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Notes for contributors are printed at the end of this volume.

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The Dorset Natural History and Archaeological Society came into existence in 1928 with the coming together of the Dorset County Museum (founded in 1845) and the Dorset Natural History and Antiquarian Field Club (founded 1875). The County Museum was Dorset's first conservation body, coming into existence as it did in opposition to a plan of Kingdom Isambard Brunel to drive the line of his railway through Poundbury hillfort west of Dorchester and Maumbury Rings to the east.

The Collection had several homes in Dorchester and Sherborne until the early 1880s when a public subscription headed by the Prince of Wales raised the money to buy the site of the George Inn and employ G.R. Crickmay to design the first part of the present building in High West Street. The Museum was opened by the 'father' of British Archaeology, General Augustus Henry Lane Fox Pitt-Rivers on 7 January 1884. In 1938–9, Handel (now Williams) House was added to the property through the generosity of Sir Robert Williams.

Between 1963 and 1978 the Society launched a successful public appeal and the fabric was put in order, heating installed and an extension designed by Michael Brawne was built to provide a multi-purpose gallery for temporary exhibitions, lectures and conferences as well as a new archaeological gallery and schoolroom. All Saints' Church in High East Street, redundant in 1972, was converted to accommodate the largest archaeological reserve collection in the south-west and more property has since been bought in Colliton Street for future expansion.

The Society exists to collect, conserve, record and publish the geology, palaeontology, natural history, archaeology, architecture, local history, fine and applied arts, textiles and literature as they pertain to the County of Dorset. And these are promoted through displays and exhibitions, lectures, field meetings and the many events that comprise the annual programme. Dorset has a well-deserved reputation for its archaeology and geology and for its literary figures. The Society's collections are of international importance.

The Society also exists to promote research in these many Dorset-related fields. It publishes an annual *Proceedings* of academic papers and shorter contributions, reports from archaeological units working in the county and natural history reports. The well-regarded Dorset Monograph occasional series supplements the *Proceedings*, which allows for the publication of much longer reports. The Society also publishes books, pamphlets and postcards.

Over many years the Society has built up an important library housing a comprehensive collection of books, papers, articles, prints and drawings related to Dorset and a number of rare sources available for research. The Society subscribes to a number of leading archaeology, geology, and natural history journals. The whole library is currently undergoing a complete re-cataloguing project to improve access. Anyone interested is invited to contact the Hon. Librarian.

The Society has two websites:

the Museum site is
http://www.dorsetcountymuseum.org/

the Research site is
http://www.dorsetcountymuseum.org/research/

The Research site presents a calendar of forthcoming events organised by the Society and its specialist interest groups, information about membership including an application form, and details of the Society's publications including a cumulative Index to the *Proceedings* from Volume 1 to the present. An on-line form is provided for ordering copies of publications and offprints.

Articles intended for publication should be sent to the Hon. Editor c/o the Society. Please see Notes for Contributors.

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'Egyptians' in Early-Modern Dorset

JUDITH FORD

There are sporadic references, in Dorset records, to people described as 'Egyptians'. This was the name by which the Romany people were known when they first arrived in England (from Europe) in the early years of the 16th century, and from which the word 'Gypsy' is derived. These references appear in a variety of records, including parish registers, churchwardens' accounts, the proceedings of various courts and in non-documentary sources such as monumental inscriptions. Since the late 18th century there has been much interest in the history and culture of this people and numerous books have been published on the subject.[1] A broad and balanced view of the history of the Gypsies may, however, be difficult to achieve, because Gypsies have 'a non-literate tradition' and thus (it has been asserted) information about this people's past is 'found fragmented in documents of the dominant, non-Gypsy . . . society'.[2] This paper will discuss references to 'Egyptians' (and Gypsies) in Dorset records (and, where appropriate, records from elsewhere) dating from *c.* 1550–1800, in an attempt to further illuminate the early history of the Romanies[3] in England, and to consider the utility of these sources for that purpose.

It is not known why this people (who are now thought to have originated in India[4]) were known as (and may have called themselves) 'Egyptians'. The name might reflect places or areas, such as 'Little Egypt' (the old name for Epirus on the Greek-Albanian coast), that were visited, or for a time settled in, by the Romani during their westward migrations.[5] Or, the name may have been used simply to denote individuals who were not English or European. As Ian Hancock has observed 'Because [this people] arrived from the East they were thought by Europeans to be from Turkey or Nubia or Egypt or any number of vaguely-acknowledged non- European places'.[6] In 15th century France the 'Egyptians' were described as being 'very dark . . . with hair as black as a horses tail'[7] and, when they first arrived in Britain, their physical appearance might have been regarded as 'foreign'. In Scotland this people may sometimes have been referred to as 'Saracens' or 'Moors'[8] and such generalised terms could have been used in England to describe (amongst others) individuals who, at a later stage, were known as 'Gypsies'.

Even in the early years after their arrival in England Egyptians may not always have been described by reference to ethnicity. Aspects of the Egyptians' culture, particularly their wandering habit, were probably used by local officials, at times, to describe this people. For example, 'one Nicholas Smith a walking man' whose 'last abyding' was recorded as being 'Moncton Deverell in Willsheere',[9] and whose daughter, Anne, was baptised at Long Burton in 1594, may have been an 'Egyptian'. Although early 16th-century legislation accused Egyptians of having 'no craft or feat of merchandise' many of the Egyptians who came to Britain in the 16th century travelled here to work in the metal trades – particularly as tin smiths (and others came to trade or to entertain for a living).[10] Thus, 'Smith' quickly became a familiar surname for Egyptians in England, as well as being a common surname in the general population.[11] Until about the middle of the 19th century most Egyptians travelled on foot[12] and 'one Father Leves' another 'walkinge man' who was buried at Winfrith Newburgh in September 1586 might also have been an Egyptian who was described by his walking habit.[13] Their skills in metal work also led to some Egyptians being described as 'Tinkers', an occupational term (and name) that existed in Dorset from at least the 15th century[14] and which could also be used to describe, amongst others, Irish travellers.[15]

Some 'Egyptians' may have been described by other skills and talents; an unnamed 'fiddler' brought into Puddletown in 1619 by members of the sedentary population, and who had earlier been sent on his way by the constables of that parish, may or may not have been an Egyptian musician.[16] The early-modern authorities could not themselves always distinguish an Egyptian from those 'wandering and pretending themselves to be Egipcyans, or wandering in the habit, form or attire of counterfeit Egipcians'.[17] Amid the diverse company of wayfarers mentioned in early-modern Dorset records, the people who later became known as Gypsies may be difficult to identify with certainty.

When they first arrived in England some of the skills of the Egyptians attracted much positive interest. Writing in 1612, Samuel Rid observed that

> This kind of people, about a hundred years ago, beganne to gather a head, as the first here, about the southerne parts . . . who for quaint tricks and devices, not known here at that time among us, were esteemed and had in great admiration . . . These people continuing about the country got much by palmistry and telling of fortunes..[18]

But as the number of Egyptians coming into the country grew, the authorities became increasingly concerned about this nomadic people and it is claimed that 'the apparent acceptance [of Egyptians] gave way to both popular and official intolerance'.[19] From the middle of the 16th century until 1824 Egyptians (or Gypsies) were classified in law together with groups such as 'rogues' and 'vagabonds' and were perceived by the authorities to be part of the general and (in Tudor England) growing problem of poverty and vagrancy.[20] 'Vagabonds', or wayfaring people (further defined in the early 16th century as being able-bodied men or women who had neither land, master nor lawful merchandise or craft by which to earn a living),[21] were perceived to be a threat to the stability of the country. From the late 16th century the authorities sought to control the related problems of poverty and vagrancy by making a place of legal settlement (based usually on place of birth, marriage or settled employment) the overriding principle of poor relief, and this principle prevailed until 1834.[22]

In 1528 it was estimated that there were 10,000 Egyptians in England[23] and two years later the first 'anti-gypsy' act was passed, which stated that 'hensforth no such persone be suffered to come within the Kynge's Realme'. This act described the Egyptians as

> diverse and many outlandish [foreign] people ... [who] using no Craft nor feat of Merchandise had come into this Realme and gone from Shire to Shire and Place to place in great Company [and persuaded people] that they by Palmistry could tell Menn and Women Fortunes[24]

Anyone who disobeyed this act would have his or her property confiscated and be ordered to leave the country within two weeks. How effective the 1530 act was in reducing the size of the Egyptian community in the short-term is unknown, but increasingly harsh legislation, enacted against Egyptians (and, sometimes, other 'vagabonds') indicates that this people were not put off for long from arriving in, or re-entering, England. In 1547 an act was passed that required Egyptians (and all able-bodied vagabonds) to be

> seized ... and branded with a V [for vagabond] on their breast, and then enslaved for two years. Such slaves could be legally chained and be given only the worst food; they could be driven to work by whips. If no master could be found, they were to be made slaves of the borough or hundred or employed in road work or other public service ... if the criminals ran away and were caught, they were to be branded with an S and made slaves for life[25]

This act was repealed after only two years, it is said because English people had little desire to enslave their fellow men.[26] The failure of the act of 1547 did not deter the authorities from attempting to impose further draconian penalties on Egyptians. In 1554 legislation was passed which imposed a fine of £40 on any person knowingly bringing an Egyptian into the country. The Egyptians who were already in England had to leave within forty days or be executed as felons.[27] Hancock has observed that, in England, it became 'illegal even to be *born* a Romani [this people were] breaking the law simply by existing.'[28] The 1554 act was primarily concerned with Egyptians who had 'enterprised to come over again into this Realme' but was not very clear in its intentions regarding the increasing number of this people who were native born.[29]

The earliest known prosecution of Egyptians under this act took place in 1559, at the Dorchester Assizes, when a large band was put on trial charged with felony; that is, they were accused of being Egyptians who had 'come ... again into this realm', and of not leaving the country within the specified time. The Lord Lieutenant of Dorset was advised that the Queen thought it 'very convenient that some sharp example and execution should be made upon a good number of [this group]' and that the rest should be deported. Despite this advice, all these Egyptians were acquitted on the grounds that the 1554 act was concerned with people coming to or brought into the country and lawyers successfully argued that the group facing trial at the Dorchester Assizes had come into England from Scotland and not from across the sea.[30] This case reveals the unwillingness of common lawyers simply to yield to royal instructions over the matter of Egyptians (and also provides an interesting insight into English attitudes to Scotland at that time).

Early in the same year that this trial took place the baptism was recorded, in the Lyme Regis parish register, of 'Joan the daughter of an Egiptian'. The full entry records that 'Joan the daughter of an Egiptian borne at Charmouth (the rector there lyeing sick) was baptised in the Parish Church of Lime Regis'.[31] This baptism was clearly a matter of some urgency and Joan's parents, or possibly someone in authority in Charmouth, had decided not to wait until the rector of Charmouth had recovered his health for the ceremony to take place. The prosecution of the Egyptians at the Dorchester Assizes may well have prompted Joan (her age is not known), or those responsible for her, to ensure that her native birth was placed on record in the hope that she would not be counted as one of those who had 'enterprised to come again' into England, and might, therefore, escape punishment under the terms of the 1554 act. Joan's baptism might also reflect another aspect of that act. In an early attempt to persuade Egyptians to conform to the way of life of the general population, this people could avoid punishment if they abandoned their 'naughty, idle and ungodly Life and Company, and be placed in the service of some honest and able Inhabitant'. It may have been an 'honest and able inhabitant' of the county who ensured that the baptism took place and Joan's nomadic existence may, at least temporarily, have ceased. Whether Joan was directly connected to the group of Egyptians put on trial at Dorchester, and what became of her, is unknown. In 1562 Elizabeth I confirmed the principles of the act of 1554 and extended the punishments therein to people who were found in the company of Egyptians.[32] Individuals who had been born in England could no longer be compelled to leave, although they had to give up their 'ungodly life and company' in order to escape punishment.[33] This legislation remained on the statute book until the late 18th century.

It has been asserted that, had all the 'anti-Gypsy' laws been enforced uncompromisingly, the Egyptians/Gypsies would have been eradicated, and that the reason for the Egyptians' survival was that 'even the most rigorous penal laws were often not carried into effect, perhaps owing to silent opposition on the part of some of the population, or venality among minor officials'.[34] As early as 1569 the Privy Council had sent out a letter admonishing mayors, constables and justices of the peace for 'a universal negligent and wilful permission of vagabonds and sundry beggars commonly called rogues and in some parts Egyptians'.[35] And it is known that in the 17th century, in many areas, churchwardens, tything-men and other parish officials were content to bribe bands of Egyptians and other travelling people to avoid their parishes. A churchwardens' account for Uplyme, for the year 1650, records a payment of 1s 6d 'unto 12 Egyeptiones which the tithing man Brought.'[36] This payment may have been an example of the practice of quietly moving Egyptians on to another parish.

Egyptians and other 'vagabonds' were, however, sometimes subjected to the full force of the law in early-modern Dorset. In 1635 'Elizabeth Johnson alias Stevens' was hanged at Bridport for being a 'vagrant and an incorrigible vagabond'.[37] It is not certain that this woman was an Egyptian, but Egyptians with the family name of 'Stevens' or 'Stephen' are known to have been in England from as early as the 1530s.[38] If she was an Egyptian, Elizabeth Stevens may have thought it sensible to keep her ethnicity, or cultural background, to herself. It was asserted in the early 17th century that this people 'now . . . dare no more be knowne by the name of Egiptians, nor take any other name upon them [than] poore people'.[39] Elizabeth Stevens may have travelled to Dorset from Cornwall; a woman of that name is recorded as having been branded at Sherborne (with an 'R' for rogue) and sent back, by pass, to Penzance, in 1633. At that time Stevens was in the company of three other women (who were also branded), including one called 'Rose Smyth', who is described as being 'the wife of Robert Smyth'. Smyth and Stevens did not restrict their wandering to the south-west of England. Rose Smyth claimed, under examination that, together with her husband and children, she had left Penzance and with various others had gone to Essex, there intending to 'get a ship for France' (the reason behind this intention is unclear). In Essex the group had met with eight other Cornish people and the company of 18 went on to Suffolk, where they were apprehended and sent on their way back to Cornwall (before being apprehended again in Dorset).[40] Whether Elizabeth Stevens, Rose Smyth, or any of the company they travelled with were Egyptians cannot be known for certain, but a Robert and Rose Smith are noted in the Calendar of Essex Assize Records as having appeared at the Chelmsford Assizes in 1627, and the couple are described as having been members of a group of seven 'Egiptians' accused of having 'for a long tyme . . . wandred and cheated his Majesties people'. The Smiths were two of only three survivors of the group but it is not clear how the other four 'Egiptians' had died.[41] It is thought that the last executions for the 'felony' of being a wandering Egyptian took place in Suffolk (as noted above, one of the counties visited by Elizabeth Stevens) in 1658.[42] But it was not until 1783 that Elizabeth I's act of 1562 was repealed. From that date, individuals could no longer be deported, imprisoned or executed simply for being 'Egyptians',[43] although, as David Mayall has observed, 'the early laws intended to control migrants, vagrants and nomads continued [to be used against this people] into the nineteenth century'.[44]

The history of the Egyptians in early-modern England cannot be fully told in terms of legislation. It is clear that 'popular intolerance' of Egyptians, if indeed it existed in the early-modern period, did not prevent the people of Dorset from enjoying, or at least experiencing, elements of their culture. The Egyptians' skills of using charms and telling fortunes, noted in the Act of 1530 (and in subsequent legislation) were not only contrary to the laws of the land but were also considered to be to the dishonour of God. Despite official disapproval of this aspect of Egyptian culture, records show that some inhabitants of Wimborne Minster decided to have their fortunes told by Egyptians who were camped near to the town in the early 17th century. In 1622–3 a defamation case was heard by the church courts which centred on one of the townspeople, a woman named Elizabeth Rivers, whose fortune had been told.[45] This case provides a rare glimpse of interaction between the Egyptian and sedentary communities in early 17th century Dorset.

It was alleged that the woman accused of defamation, Avice Kneller, had repeated in the hearing of others that Elizabeth Rivers had been told by the Egyptians that she already had one bastard child and was 'in possibilitie of another'. The witness statements, apparently taken months after the event, differ slightly in the details of what was uttered by Avice Kneller. One witness remembered hearing Kneller having an argument with Cecily Clarke, the sister of Elizabeth Rivers, and recalled that, after 'many words in anger' passed between the two women, Avice Kneller had declared that her own sister 'had never had a Bastard as the Egyptians did say that Cecily Clarke's sister had'. Cecily Clarke thought that Kneller had said that she 'would not give 2d to the Egyptians to tell her fortune that she had a Bastard and was in possibilitie of another . . .'. Another woman, Julian Gurde, recalled that she herself had given money to the Egyptians to tell her fortune and that 'because the Egiptians did not tell her her fortune to her mind [satisfaction] she took away her money agayne'. It is clear that Egyptians were not simply telling their 'customers' what they thought they wanted to hear, and that some customers were not willing to part with their money unless they approved of what had been said. The theme of the words uttered by the Egyptian fortune-tellers at Wimborne was part of a long-established tradition. In Paris, in 1427, it was recorded that Egyptians told fortunes which tended to sow discord in households, and which focused on such themes as 'your wife has made you cuckold' or 'your husband has deceived you'.[46] The ripples caused in Wimborne by what was probably a fleeting visit from this people did not fade quickly and may indicate that the people of that town did not have much experience of having their fortunes told. Avice Kneller was the daughter of a church court official[47] but what she is alleged to have said appears to have been part of a quarrel between neighbours rather than primarily an expression of her disapproval of fortune-telling. It is not entirely clear how Avice knew what Elizabeth Rivers had been told by the Egyptians, but it is possible that she had been present at the event. Palmistry and fortune-telling might, at that time, have drawn accusations of sorcery or witchcraft, and it has been suggested that Egyptians 'got away' with practices that could be considered as witchcraft (or which might have attracted accusations of lesser offences such as defamation) simply because they could move on quickly from the communities they camped near.[48]

The records discussed so far indicate a sometimes troubled, and possibly transient, relationship between Egyptians and the sedentary population of Dorset in the 16th and 17th centuries (although official records cannot provide a full picture of contacts between the travelling and settled communities). Where the 18th century is concerned, the character of the Egyptian community remains a subject of debate among historians,[49] as does the nature of that community's relationship with the general population. The use of the name 'Egyptian' had, apparently, largely died out in Dorset by the beginning of the 18th century (at least where written records were concerned) and had been replaced by the term 'Gypsy'. If the name 'Egyptian' had been used by the general population, in the 16th and 17th centuries, to describe a community perceived to be non-European, Dorset records indicate that the diminishing use of that name did not necessarily mean that Gypsies had ceased to be regarded as ethnically or culturally distinctive. In 1790, for example, the Criminal Process Register recorded the conviction of James Boswell alias Clarke (of Corfe Castle) for horse stealing. A fairly full description of Boswell is given in the register; his trade was described as 'Tinker' and he was recorded as being 5′ 4″ in height, his hair and eyes are described as being black, and his complexion is described as 'Gypsy' (this description may have been the result of pre-conceived ideas about a distinctive 'Gypsy' complexion on the part of the gaol officials).[50] And in 1817 the baptism was recorded in the Lyme Regis registers of 'Caroline daughter of Edward and Phillis Boswell of the people called Gypsies'.[51]

The cessation of the most draconian punishments for travelling Gypsies (simply for being Gypsies) may have encouraged greater contacts between this people and the sedentary community. There are, from the early decades of the 18th century, an increasing number of entries in Dorset parish registers that appear to relate to Gypsies and other travelling people. But local officials may still have disapproved of the Gypsies' lifestyle. It has been asserted that, very often, church officials 'saw little contradiction in both keeping [Gypsies] at a distance and condemning them as irreligious'[52] and an ambivalent attitude on the part of officialdom may be apparent in some Dorset records. In 1781, for example, the baptism took place, in Winterborne Whitechurch, of William the son of an individual described as 'a travelling woman' whose family name was Stanley.[53] No first name is given for William's mother and that may have been because she had not been baptised; furthermore, her family name was added in brackets to the entry, perhaps as an afterthought. Compared with entries relating to the general population this baptism is recorded in an apparently careless manner. And in 1800 the burial was recorded at Milton Abbas of 'Cooper aged 10 years, a Gipsy', and the words 'small Pox' complete the entry.[54] Either parish officials could not be bothered to establish and record the first name of this child, or, their failure to do so indicated (as perhaps was the case with William Stanley's mother), that he had not been baptised, and the officials were not willing to record his given Gypsy name. It is known that some churchwardens in England would refuse to allow an Egyptian/Gypsy to be buried in their churchyard if he or she had not been baptised, although such a decision was sometimes overruled by the incumbent of the parish.[55]

Church officials were, apparently, sometimes perplexed (possibly because of concerns about settlement laws and future claims for poor relief) by the comparatively flexible attitude of the Gypsy community regarding the 'appropriate' location for the baptism of their offspring. On November 20th 1803 the baptisms took place, in Combe Keynes, of Gentilia and Jane the daughters of Thomas and Sabra Whittle who are described in the parish register as 'travelling Gypsies'.[56] The entry recording these baptisms includes the observation that '[these] children cannot belong to the parish of Coomb as their father was a parishioner of Knole' (Thomas Whittle had been baptised at Church Knowle in 1777).[57] The use of the past tense for Thomas Whittle's status as a parishioner of 'Knole' is interesting; perhaps his nomadic life was considered to have undermined that status. It is unclear what the apparently increasing number of records relating to the baptisms, marriages and burials of Gypsies and other travelling people indicates about their own attitudes towards the culture of the sedentary population. The urgent motives that had, almost certainly, prompted the baptism of Joan of Charmouth in 1559 had probably been replaced by a mixture of pious and cultural considerations.

The sometimes complex and independent attitudes of Gypsies towards the Church and towards the ceremonies of baptism, marriage and burial, may be indicated by records relating to Peter Stanley, who is described on his headstone in Puddletown churchyard as 'the king of the Gypsies'.The full inscription on this headstone reads

In memory of Peter Standley, king of the Gypsies
who died 23rd November, 1802, aged 70 years.
Farewell my dear and faithful wife
My sons and daughters too
Tho' never in this mortal life
Again you must me view
Close in our Saviour's footsteps tread
Of love divine possessed
And when you're numbered with the dead
Your souls will be at rest[58]

Despite the fact that these family-orientated sentiments were expressed in pious terms (it is not clear who composed the inscription), Peter Stanley did not, apparently, chose a church as the venue for his marriage. In 1792 the overseers of the parish of Corfe Castle recorded a 'settlement examination' of a Peter Stanley, who was then described as a 'razor grinder and tinker'.[59] The examination was conducted in order to establish the legal place of settlement of Peter Stanley's son Aaron. This record, and other settlement examinations concerning Aaron Stanley (dated 1801), provide a valuable insight into the lives of Gypsies in the 18th century. During his examination in 1792 Peter Stanley stated that he was 62 or 63 years old, and that he had been born in the parish of Upton Grey in Hampshire. He said (presumably in response to the questions put to him by officials) that he had been married to 'his present wife Sarah' at about the age of 21, by 'a Clergyman of the Church of England' and he recalled that the marriage had taken place at the sign of the 'Hand and Pen in Fleet, London'. In the 18th century (prior to the Marriage Act of 1753) several inns in the Fleet area were 'marrying houses' that provided chapels and chaplains and in which marriages were solemnized 'on every day and night of the year'.[60] For itinerant people who frequently camped in the 'natural amphitheatre of the Fleet valley' and who may have taken part in, or observed, the then popular pursuits of bear-baiting, cock-fighting and bear-knuckle contests that took place in that district, the 'marrying houses' provided a quick, relatively informal and inexpensive means of being married (as they did for many individuals from the sedentary community).[61]

Peter Stanley further declared that he had seven children, some of whom had been born in the Dorset parish of Morden. His son Aaron had been born before his parents' marriage and Peter Stanley assured the overseers that, since his son's birth, he had not done 'any Act matter or thing thereby' to gain settlement for him. In February 1801 Peter Stanley, then 'of Langton in the Isle of Purbeck', made a further statement, to the Corfe Castle overseers, confirming his son's birth at Morden.[62] At the time of his own examination by the overseers, in March 1801, Aaron Stanley (who was also described as a 'razor grinder and tinker' and as 'residing in the parish of Corfe Castle') recalled that he had 'generally travelled about the country with his father Peter Stanley till within a few years past'.[63] Whether this statement indicates that Aaron Stanley had stopped travelling altogether, or just that he had stopped travelling with his father, who was by then elderly, is unclear. The overseers noted that Aaron had stated that he 'now receives relief from Parish Officers of Corfe Castle' which suggests that he was not, in 1801, a fleeting visitor.

Aaron had married his wife, Mary Day, at Corfe Castle on 11th May 1792 (the day after the first settlement examination had taken place of Peter Stanley, an event which had probably been prompted by the impending nuptials of his son) and this may have been a marriage between two travelling families. The 1841 census for Pimperne records the presence in that parish of a Mary Day and her husband Robert Day, who are described as 'travelling pedlars', and who might have been related to Aaron's wife.[64] Some members of the Stanley family may have married outside the Gypsy and travelling communities. In 1801(despite the fact that Aaron Stanley was already in receipt of relief from their parish) the overseers of Corfe issued a removal order for Aaron and his family, naming Morden as their place of settlement.[65] But the family's links with Corfe Castle remained strong. In March 1819 Aaron's daughter Mary Ann (who had been baptised at Corfe in 1798)[66] was married, in that parish, to Joseph Salisbury (of Kingston) who is described simply as a labourer.[67] Whether Joseph Salisbury was a member of the non-Gypsy, sedentary (or travelling) community, or was a 'settled' Gypsy is unclear. Salisbury continued to be described as a labourer in the records of the baptisms of his and Mary Ann's children (at Corfe Castle), during the 1820s and 30s.

The information given about their lives by Peter and Aaron Stanley might indicate that for this family at least, a way of life centred on travelling had begun to change to a more settled, or at least intermittently settled, existence by the end of the 18th century. It is unclear whether and to what extent their travelling days had been interspersed with periods of settlement, or what 'settled' might have meant to this family. They were not just summer visitors to Dorset (when they might have undertaken seasonal farm work); Peter Stanley's daughter Sabra was baptised at Winterborne Kingston in December 1764.[68] The difficulty of positively identifying Gypsies in Dorset records means that it is impossible to establish when the Stanley family first came to the county. Peter Stanley's birthplace (Upton Grey) is not far from Basingstoke and he may therefore have been born while his parents were travelling a long-established route between London and the west country.[69] The nuncupative (spoken) will of a John

Standly of East Stoke near Wareham, dated 1675, may represent an early record of this family on the isle of Purbeck.[70] The document is brief and records that the testator, who was described as being 'sicke' in body (and whose occupation and cultural background are not stated), had declared his wish that his possessions would pass to his wife. The name of the testator and the location of East Stoke in an area clearly associated with the Gypsy community are suggestive. Historians may sometimes be a little too ready to assert, or assume, that the history of this people is to be found exclusively in 'official' records. The last wishes of an individual are personal, however they are expressed or recorded.

It is said that until the early years of the 19th century 'imperfect supply and demand conditions' meant that many Gypsies 'could serve a very useful function touring the largely inaccessible rural areas . . . they supplemented the economic and social life of the village by offering their goods and services to a population which . . . was not otherwise catered for.[71] An example of Gypsies selling products in Dorset villages is provided by the records relating to a famous Old Bailey court case from the 1750s. A Gypsy named Mary Squires was put on trial accused of assault and felony on the person of a young woman called Elizabeth Cannings, a crime that was alleged to have taken place on New Years' Day 1753, at Enfield Wash on the outskirts of London.[72] Despite being at first found guilty, Mrs Squires was saved and eventually acquitted by proving that she had been in Dorset at the time of the assault. She had claimed during her trial that she knew many people in the county and that some of these people could vouch for her presence in Dorset on New Year's Day. Although her claims were at first dismissed, they were later later followed up and found to be true; 36 inhabitants of the county came forward as witnesses.[73] One of those who testified to Mrs Squires' presence in Dorset at the time in question was John Gibbon, landlord of the Old Ship Inn at Abbotsbury, who travelled to London in person to give evidence. Gibbon recalled that on the 1st of January 1753, Mrs Squires had come into his house, with George her son and Lucy her daughter. Gibbon stated that the Squires family 'came with handkerchiefs, lawns, muslins, and checks, to sell about town' and that they stayed at his inn 'from the first to the ninth day of the month'. Evidence given during the trial by George Squires reveals the family's itinerary over Christmas and New Year, 1752/3. Squires recalled that he and his mother and sister had been in South Perrot on December 29th; they had travelled to Litton Cheyney on the 30th and had moved on to Abbotsbury the next day, where they stayed until the 9th January. On that date they had travelled to Portesham (presumably with the merchandise mentioned by John Gibbon) thence to 'Ridgway' and had arrived in Dorchester on the 11th. They had walked almost all the ensuing night to reach another (unnamed) Dorset village and had then walked on to Morton, where they stayed in a barn. From Morton they went on to Combe Bissett and travelled to London (where George Squires had goods and a debt to collect) via Basingstoke, before eventually returning to South Perrot.

The records relating to the Stanley family, discussed above, may indicate that by the end of the 18th century changes in the social and economic life of rural Dorset had begun to erode the Gypsies traditional role of supplying wares and services to villages and households. During the second half of the 18th century there were 'strains and stresses on [the] rural economy' of Dorset (and elsewhere in England) which were 'largely due to rising grain prices' and expanding overseas trade and improving farming conditions 'brightened the prospects of all classes save the agricultural labourer'.[74] These changes may have reduced the number of customers for the services provided by the Stanley family, the Squires, and other travelling people. Developments such as the enclosure of open land which destroyed traditional Gypsy camp sites,[75] and the development of the turnpike system (it has been asserted that Dorset 'experienced profound changes in its road systems' between 1750–1780), may also have begun to erode the traditional Gypsy way of life and their role in what had previously been the less accessible areas of the county. The relatively numerous references to itinerant people, and to individuals with common Gypsy surnames in records from the isle of Purbeck in the 18th century may be because that locality continued to offer opportunities for employment. The skills of Peter and Aaron Stanley, amongst others, may at times have been in demand for mending and sharpening the tools used by quarrymen. A Militia List for (an unnamed) tything of Purbeck, for the year 1759, includes the names of 'Bernard Dunford' and 'William Andelum' who are both described as basket makers, an occupation often associated with Gypsies and travelling people.[76] All the other listed men were involved in quarrying. Other tasks connected with stone-quarrying, including labouring, as well as work within the labour-intensive ball clay industry (the principal workings of which were situated between Corfe Castle and Wareham), might also have attracted itinerant people to Purbeck. The kind of labouring carried out by Aaron Stanley's son-in-law, Joseph Salisbury, is not specified in the records but Joseph and Mary Ann's son William, born at Corfe Castle in 1831, is listed in the 1871 census for Church Knowle as a 'clay labourer'.[77]

A wide range of sources attests to the long history of the Gypsies in Dorset. These records reflect the survival, despite terrible persecution in the 16th and 17th centuries, of this people's nomadic lifestyle and indicate the longevity of 'Egyptian' traditions such as the theme and content of fortunes told to the non-Gypsy population. As well as these elements of continuity, the records suggest a gradual move from 'outlandish' Egyptians and 'walking men' (and of possibly transient contacts between this people and the settled population), to the 'Gypsies', 'razor-grinder's', 'tinkers', 'travellers' (and sometimes parishioners) of the county who were an established part of Dorset life. This was a far- from-straightforward process, and increasing familiarity with the general population did not necessarily mean that the the Gypsy community became less distinctive. The difficulty of positively identifying Gypsies in some records means that aspects of their history remain unclear, but Gypsy history is, arguably, no more 'fragmented' than that of many other minority groups, or of many individuals within the general population. Although the information on this people is (largely but not exclusively) to be found in official documents, such records can contain the testimony of Gypsies concerning their own lives. The information provided by the Stanley family, and the testimony of Mary Squires, indicate that, by the 18th century, associations between this people and Dorset could be strong and enduring.

NOTES

1 For example, J. Hoyland, *A Historical survey of the customs, habits and present state of the Gypsies* (1816); C.G. Leland, *The English Gypsies and their Language* (1873); A. M'Cormick, *The Tinker-Gypsies* (1907); A. Fraser, *The Gypsies* (1992); D. Mayall, *Gypsy Identities 1500–2000: From Egipcyans and Moon-men to the Ethnic Romany* (2003); M. Levinson and A. Silk, *Dreams of the Road: Gypsy Life in the West Country* (2007).

2 J. Okely, *The Traveller-Gypsies* (1983), 1.

3 The name Romany (or Romani) is derived from the Sanskrit word 'dom', meaning 'man'. This paper will use the terms 'Egyptian' or 'Gypsy' because they appear in the records under discussion.

4 See, for example, Fraser, *The Gypsies*, Chapter 1.

5 Fraser, *The Gypsies*, 53–6; I. Hancock, S. Dowd and R. Djuric, *A PEN Anthology of Gypsy Writers (PEN American Center's Threatened Literature Series)*, (1998), 13.

6 Hancock et al, *A PEN Anthology*, 13.

7 Quoted in J-P. Liegelois, *Gypsies: An illustrated History*, (2005), 42.

8 Fraser, *The Gypsies*, 111.

9 DHC/PE/LOB/ RE 1/1.

10 Fraser, *The Gypsies*, 125, notes begging, fortune-telling, horse-dealing, metal-working, healing, music and dancing as common 'Gypsy livelihoods'.

11 Some common family names of English Romani Gypsies are listed in C.Clark and M. Greenfield, *Here to stay: The Gypsies and Travellers of Britain* (2006), 15.

12 www.journeyfolki.org.uk. The 'Gypsy wagon' or 'vardo' probably did not come into general use until about the middle of the 19th century. For much of the period under study Egyptians travelled on foot or horseback and made camp in 'bender' tents or slept in barns; D. Hawes and B. Perez, *The Gypsies and the State* (1995), 13.

13 DHC/PE/WFN/RE 1/1.

14 For example, the Lay Subsidy Rolls for Bridport, for the year 1475, include the name 'Thomas Tynker'. DHC/BTB/M39.

15 Fraser, *The Gypsies*, 171.

16 J.H. Bettey (ed.), *The Casebook of Sir Francis Ashley JP, Recorder of Dorchester 1614–35*, Dorset Record Society, vol. 7, (1981), 59.

17 39 Elizabeth I, *c.* 4; Hawes and Perez, *The Gypsy and the State*, 12.

18 S. Rid, *The Art of Jugling or Legerdemaine* (1612). www.gutenberg.org/etext/12343

19 Mayall, *Gypsy Identities*, 57.

20 Fraser, *The Gypsies*, 115–6.

21 Mayall, *Gypsy Identities*, 61.

22 www.en.wikipedia.org/wiki/Poor_Law

23 This figure has been disputed by historians. It is thought, however, that numbers of Egyptians may have 'increased significantly in the late 1520s'. Fraser, *The Gypsies*, 113.

24 22 Henry VIII, *c.* 10.

25 I. Hancock and K. Lee, *We are the Romani People* (2002), 27. 1 Edward VI, *c.* 3.

26 William Blackstone observed that 'the spirit of the nation could not endure this condition [of slavery], even in the most abandoned rogues'. *Commentaries on the Laws of England* (1765), 1: 411–3.

27 1 and 2 Philip and Mary, *c.* 4.

28 Hancock and Lee, *We are the Romani People*, 32.

29 Fraser, *The Gypsies*, 131.

30 Fraser, *The Gypsies*, 131.

31 DHC/PE/LR/RE1; L. Parker, J. Ford and J. Draper, *Ethnic Minorities in Lyme Regis and West Dorset Past and Present*, Lyme Regis Museum (2004), 39.

32 5 Elizabeth I, *c.* 20.

33 Fraser, *The Gypsies*, 132.

34 Fraser, *The Gypsies*, 130.

35 HMC 6729/11/52.

36 Transcription of extracts from Churchwardens' Accounts for Uplyme (with notes by John Fowles), Lyme Regis Museum, 6.

37 T. Hearing and S. Bridges (eds) *Dorset Quarter Sessions Order Book 1625–1638: A Calendar*, Dorset Record Society, 14 (2006), 315.

38 Fraser, *The Gypsies*, 113.

39 Rid, *The Art of Jugling*, e-text.

40 Bettey, *The Casebook of Sir Francis Ashley*, 105–6.

41 Essex Record Office, T/A 418/101/113.

42 Fraser, *The Gypsies*, 133.

43 Mayall, *English Gypsies and State Policies* (1995), 27.

44 Mayall, *English Gypsies and State Policies*, 28.

45 DHC/PE/WM:CP 2/11 (116). D.C. Reeve, 'Wimborne Minster, Dorset: a Study of a Small Town 1620–1690', University of Exeter PhD thesis (2000), chapter 6, 217. I am grateful to Dr Reeve for alerting me to this record.

46 J-P. Liegelois, *Gypsies: An Illustrated History* (2005), 42.

47 Her father, Roger Kneller, was the church court apparator.

48 O. Davies, *Witchcraft, Magic and Culture 1736–1951* (1999), 196; H.C.E. Midelfort, *Witch Hunting in Southwestern Germany: The Social and Intellectual Foundations, 1562–1684* (1972), 190.

49 The Proceedings of the Old Bailey: www.oldbaileyonline.org/history/communities/gypsy-traveller.html

50 Criminal Process Register, 1782–1800. DHC/NG/PR/1 D1/1. Boswell was 19 years of age and married. He was sentenced to death, but was reprieved and sentenced to be transported for seven years.

51 DHC/PE/LR: RE 6.

52 Fraser, *The Gypsies*, 185.

53 DHC/PE/WWH/RE 1/4.

54 DHC/PE/MIL/RE 1/2.

55 See, for example, the Wikipedia entry for South Luffenham, Rutland: www.en.wikipedia.org/wiki/South_Luffenham

56 DHC/PE/WOO/RE 1/1.

57 DHC/PE/CKL/RE1/2.

58 A. Helps, *St Mary's Church Puddletown*, 1994, 18–19. The inscription is now very difficult to read.

59 DHC/PE/COC/OV188/100. This appears to be the same Peter Stanley, king of the Gypsies, who was buried in Puddletown in 1802. In 1821 Sarah Stanley 'of Wareham' was buried in Puddletown, aged 100 years.

60 British History Online, www.british-history.ac.uk chapter xlix

61 No banns or licence were required for these 'clandestine' or 'irregular' marriages which, although they breached canon law, could still be valid. www.familyrecords.gov.uk/frc/pdfs/TTU_fleet_registers.pdf

62 DHC/PE/COC/OV188/138.

63 DHC/PE/COC/OV188/139.

64 1841 Census for Pimperne, fo. 8, 9. DHC/MIC/R/758.

65 DHC/PE/COC/OV186/30.

66 DHC/PE/COC/RE2/3. Aaron Stanley may not have been entirely sedentary after his marriage; the baptism of his son, John, described in 1801 as being 'aged about six years', is not recorded in the Corfe Castle registers.

67 DHC/PE/COC/RE3/5.

68 Dorset Online Parish Clerk, Winterborne Kingston baptisms (Bishop's Transcripts) transcribed by Tony Higgins. Another child of Peter Stanley, his son Henry, was baptised at Winterborne Kingston in May 1778. DHC/PE/WKN/RE1/2.

69 There is thought to have been a Gypsy encampment at an area near Upton Grey called Five Lanes which was described by a magistrates' clerk in 1922 as being located on an 'old cattle road'. www.hants.gov.uk

70 DHC/DA /W. 1675/ 28.

71 Fraser, *The Gyspies*, 217.

72 An attempt was made to bring charges of perjury against John Gibbon and other Dorset witnesses, but the case was dismissed through lack of evidence. www.oldbaileyonline.org

73 J. Paget, *Judicial Puzzles Gathered From the State Trials*, 1876, 34.

74 B. Kerr, *Bound to the Soil: A Social History of Dorset* (1968), 95–6.

75 Fraser, *The Gypsies*, 213.

76 Dorset Online Parish Clerk, Corfe Castle page, transcription of Purbeck Militia List, 1759.

77 1871 census for Church Knowle, fo. 50, 7. DHC/MIC/R/785; Clay extraction had been carried on at Church Knowle from at least the early 18th century. See, for example, E. Hyde East, *Reports of Cases Argued and Determined in the Court of the King's Bench: with Tables of the Names of the Cases and Principal Matters*, vol. 4 (1845), 528. For information on the stone quarries of Purbeck see, for example, P. Stanier, *The Industrial Past*, The Dovecote Press (1998), 11–17.

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Re-introduction of Atlantic salmon, *Salmo salar* L., to the Tadnoll Brook, Dorset

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Summary

Atlantic salmon were extinct in Tadnoll Brook, Dorset, a tributary of the River Frome. Fry were reared from River Frome native stock and introduced to Tadnoll Brook. Dispersal downstream of the introduction site was high initially, through at least 1km; despite dispersal a density of salmon parr of 8 per 100m² was achieved in the introduction reach. Survival was 71% egg – fry in egg boxes, 4.1% fry – smolt and 2.9% egg – smolt. There were two smolt migratory periods, in the autumn following the introduction, and in the following spring. Approximately 45% of the surviving population remained in Tadnoll Brook for a second summer. Observed patterns were consistent with suggestions that fry and parr distribution is constrained by habitat limitation.

Introduction

Fish stocking programmes are widely used in the management of inland recreational fisheries, to replenish populations or to restore extinct stocks. Many rivers in the UK have suffered declines in natural stocks of Atlantic salmon (*Salmo salar* L.) in recent years (Mills *et al.* 2005). This includes the chalk rivers of the south of England (Welton *et al.* 1999), in line with a wider trend of decline across the north Atlantic range of this species (Parrish *et al.* 1998). Hence, Atlantic salmon stocking programmes are likely to become more widespread across the UK, with fewer river systems possessing self-sustaining natural populations (EA and CEFAS 2005). The endpoint of stocking practices is assessed from the number of mature fish returning to the river to spawn; however, there are few data available on the short term growth and survival of stocked fish. Furthermore, the wider impacts of stocking on the stream community structure, recipient food web and associated ecosystem processes are unclear. As part of a wider study of the structure and functioning of stream food webs, an experimental re-introduction of salmon fry was carried out in a Dorset stream. The objectives of this paper are not associated with the food web manipulation, rather to detail how the stocking of salmon fry was carried out, and to present data on their dispersal, growth and survival through to the smolting stage.

Methods

Site description

The Tadnoll Brook is a second order tributary of the River Frome (Dorset, UK); its ecology and the human impacts affecting it, have been described previously (Armitage *et al.* 2005). The catchment is 48km² and the river drains an area of chalk bedrock overlain by tertiary deposits of clay and sand. Although groundwater fed, the resultant water chemistry is circumneutral as a result of the acidic heathland surface run-off. Our experimental reach (4–6m wide, 250m long, 1,175m²) was situated 5.6km downstream of the source, 1.7km upstream of Tadnoll Mill (see below) and 5.2km from the confluence with the Frome (Figure 1). The reach is heavily shaded by bank-side vegetation. As a consequence there is little in-stream macrophyte growth and the stream bed is predominantly gravel covered with a thin film of attached diatoms, green algae, fungi and bacteria. The fish community is dominated by trout (*Salmo trutta* L.) and bullhead (*Cottus gobio* L.) with brook lamprey (*Lampetra planeri* Bloch) and eel (*Anguilla anguilla* L.) present at low densities.

Tadnoll Brook can be divided into two sections separated by a water mill, Tadnoll Mill. In the past, Atlantic salmon were present in Tadnoll Brook both upstream and downstream of Tadnoll Mill (Ibbotson *et al.* 2006). The section above the mill provides most of the suitable spawning grounds and has the highest proportion of nursery habitats (Ibbotson *et al.* 2008). However, salmon became extinct above the mill in the mid 1990s, probably because a shallow step weir near Tadnoll Mill created a partial barrier to upstream migration when

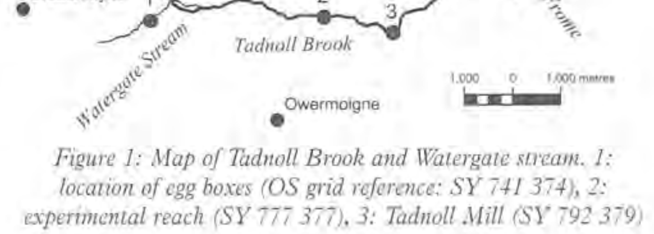

Figure 1: Map of Tadnoll Brook and Watergate stream. 1: location of egg boxes (OS grid reference: SY 741 374), 2: experimental reach (SY 777 377), 3: Tadnoll Mill (SY 792 379)

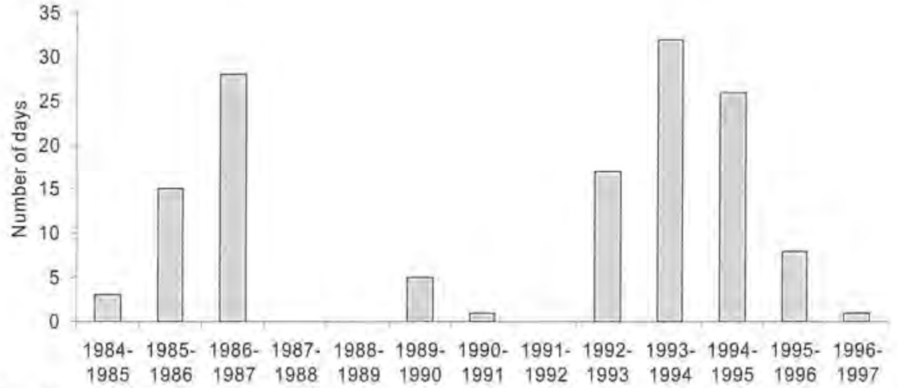

Figure 2: Number of days from November to Mid January with discharge greater than 10 cumecs (approximately twice the typical winter base flow of 4–5 cumecs), measured at East Stoke Gauging station on the River Frome, 1984–1997

flow conditions were low. Indeed, the extinction coincided with consecutive years of dry winters, from 1988–1992 (Figure 2) Salmon depend heavily on flood events for upstream migration (Mitchell and Cunjak 2007). As salmon from the River Frome spend at most 3 years at sea (Welton *et al.* 1999), 4 or 5 consecutive years of low winter discharge would have prevented adult fish from passing the weir, resulting in the extinction of the Tadnoll Brook population. Over the course of 2006, the Environment Agency modified the step weir so that the water on each step is deeper, even when the flow is low; thus, the weir should no longer be an obstruction to migratory fish. With the improved fish passage near Tadnoll Mill, a successful re-introduction of salmon to Tadnoll Brook was possible.

Egg Boxes and adult brood stock

Because the River Frome still has a natural salmon population, it was possible to obtain local brood stock, under the assumption this would be the closest genetic strain to that previously populating Tadnoll Brook, and that any diseases or parasites carried by the brood stock were already present in the catchment. Adult sea run salmon were captured in the River Frome over a two week period from the 28th December 2005 to the 9th January 2006 using electrofishing. In total, six pairs were captured, with both male and female from each pair captured and stripped on the same day. The number of eggs stripped from each female was estimated using a volumetric method, after measuring the mean diameter of 20 eggs. Eggs were fertilised on the day of capture, just prior to placement in boxes.

Six egg incubation boxes were located at Watergates Fisheries (Broadmayne, Dorset) a fish farm, located approximately 4.3km upstream of the introduction site. The fish farm is fed by pumped groundwater, which drains into the Watergates Stream, a first order tributary of Tadnoll Brook. The fibreglass egg boxes were of rectangular shape, 110cm long × 39cm wide × 44cm deep. Filtered water was taken from a fishless pond at a rate of 12 $l{\cdot}min^{-1}$, through a pipe which entered at the bottom of the boxes. The main compartment (78cm × 30cm × 36cm; $0.84m^3$) was divided into two chambers. Water first flowed upwards through a main chamber, used to house eggs and gravel, and overflowed into a second chamber where fry accumulated after emergence. This last chamber (22cm × 30cm × 23cm, $0.15m^3$) was emptied separately using a hatch. The boxes were sealed with a removable clear plastic lid, which allowed in natural daylight. The bottoms of the boxes were lined with a 2.5cm layer of pea gravel (10–20mm). Fertilised eggs were placed in the incubation boxes in layers, with alternate 10cm layers of 40mm gravel. A temperature logger was placed in the first box, and was assumed to be representative of water temperature in all boxes. The same process was repeated each time a pair was captured until all 6 boxes were filled. In total *c.* 30,000 eggs were housed in the 6 incubation boxes, with numbers of eggs per box ranging from 2,300–12,600 (Table 1). The stock introduced to Tadnoll Brook was thus a mixture of six different known genetic pairings.

Once fry started to emerge from a box, the collection chamber was emptied daily and the fry counted. Twenty fry from each box were measured to the nearest 1mm and weighed to the nearest 0.1mg to provide an estimate of length and weight at introduction. Fish were transported to the introduction site in buckets. Every day, the available fry were spread out along the length of the experimental reach and two 30m 'buffer' zones, immediately upstream and downstream of the reach. Fry were released in marginal habitats where flow was less and large fish were absent. Woody debris and marginal macrophytes provided refugia. This process was repeated daily until the required number of fry was introduced (*c.* 7,000; target density of 5 per m^2). The introduction phase took 2 weeks, from when fry first emerged on the 24th of March 2006 to the 8th of April 2006.

Longitudinal survey (excluding experimental reach)

In late July 2006, Tadnoll Brook was electrofished in an upstream direction from 1,000m downstream to 600m upstream of the experimental reach, using an Electracatch WFC4 with pulsed DC output at a

Table 1: For each egg incubation box: Fork length of female parent, egg size, number of eggs, egg density in incubation box (thousands of eggs per m³), number of degree days (dd) to first emergence of fry and peak swim-up numbers, percentage survival to the swim up stage, mean (± 1SE) fork length and wet weight of emerging fry

								Fork length (mm)		Wet weight (g)	
Box	Female length (cm)	Egg size (mm)	Egg number	Density $(1000m^{-3})$	dd (first)	dd (peak)	% survival	Mean	SE	Mean	SE
1	71.5	1.65	2340	2.78	775	852	83.6	30.4	0.18	0.26	0.005
2	77	1.84	6935	8.23	709	862	62.1	28.0	0.21	0.20	0.005
3	58.5	2.00	1880	2.23	700	842	68.6	27.5	0.25	0.19	0.006
4	80.5	1.95	12584	14.94	700	917	56.8	27.2	0.30	0.18	0.006
5	61	1.96	2640	3.13	724	833	78.9	27.5	0.29	0.19	0.006
6	62	2.06	2820	3.35	664	828	81.1	26.6	0.29	0.17	0.006

frequency of 50Hz, 200V and 1.25Amps. Reaches of approximately 100m were fished once and the numbers and sizes of salmon and trout recorded. The fishing efficiency value for salmon ($p = 0.63 \pm 0.098$) from our monitoring of the experimental reach in July 2006 (see below) was used to derive a population estimate. Stream width was measured in the middle of each reach to estimate reach area and salmon density.

Experimental reach

The experimental reach of Tadnoll Brook was electrofished for the first time after the fry introduction in May 2006, then every two months thereafter until the end of our monitoring programme in May 2007 (the reach had also been fished every two months since May 2005, confirming the absence of salmon before the introduction). Population estimates and electrofishing efficiency values were derived using the Le Cren method (Le Cren 1969). On each sample occasion all fish were measured and weighed. Water temperature in the experimental reach was measured continuously using data loggers (HOBO pendant UA-002-XX). Growth was calculated as the difference in mean weight of the sample population between two successive occasions, and corrected for the number of degree days (dd). Growth between sample occasions was expressed as a percentage of the initial mean weight of the fish.

All salmon parr captured were fitted with individually coded peritoneal passive integrated transponder (PIT) tags. Data on migration of the salmon parr were collected continuously using in-river PIT tag readers, located at Tadnoll Mill and also on the River Frome at East Stoke (NGR: SY870867), 4km above the tidal limit (Ibbotson *et al.* 2004). Part of the salmon population in the River Frome catchment is known to migrate downstream in autumn, with a larger migration in the following spring (Pinder *et al.* 2007). The condition factor (weight divided by the length cubed) was compared between fish that migrated to the main river in autumn 2006 and fish that migrated in spring 2007. Finally, we compared the condition, in March 2007, of known migrants and the parr which remained in the experimental reach of Tadnoll Brook for a second summer. Statistical comparisons were performed using the General Linear Model (GLM) procedure in Minitab 15®.

Results

Egg incubation boxes

Egg incubation time ranged from 664–775 degree days to the appearance of the first swim up fry in a box, and from 828–917 degree days to peak fry emergence (Table 1). Incubation time was strongly correlated with the numbers of eggs in the box (for peak swim-up, $r = 0.943$, $p = 0.005$). Overall mean (± 1 SE) survival of eggs to the swim-up stage, across the 6 incubation boxes, was 71.8% (± 4.5). Egg survival through to the swim up stage was negatively correlated with egg density in the boxes ($r = -0.825$, $p = 0.043$). Egg density in the 3 boxes with more than 78% survival ranged from 2,780–3,350 eggs per m³. The mean fork length of swim-up fry across all egg boxes ± 1 SE was 27.6mm (± 0.58) and mean weight 0.16g (± 0.013). Wet weight at emergence was not correlated with either the numbers of eggs per box ($r = -0.244$, $p = 0.641$) or percentage survival in a box ($r = 0.364$, $p = 0.478$). However, wet weight was positively correlated with incubation time ($r = 0.937$, $p = 0.006$). Egg size was not correlated with first emergence time, peak emergence time or survival to swim up stage, and furthermore no consistent relationship was found between mean egg size and mean fry size/weight.

Longitudinal survey

The longitudinal survey of Tadnoll Brook in July 2006 showed that salmon had dispersed through, at least, the 1km downstream of the experimental introduction site (Figure 3), where the density varied from 2–18 fish per 100m². The first 100m upstream of the experimental reach (which includes the upstream buffer) had a density of 3 individuals per 100m². However, the next 500m upstream of the introduction site, had very low

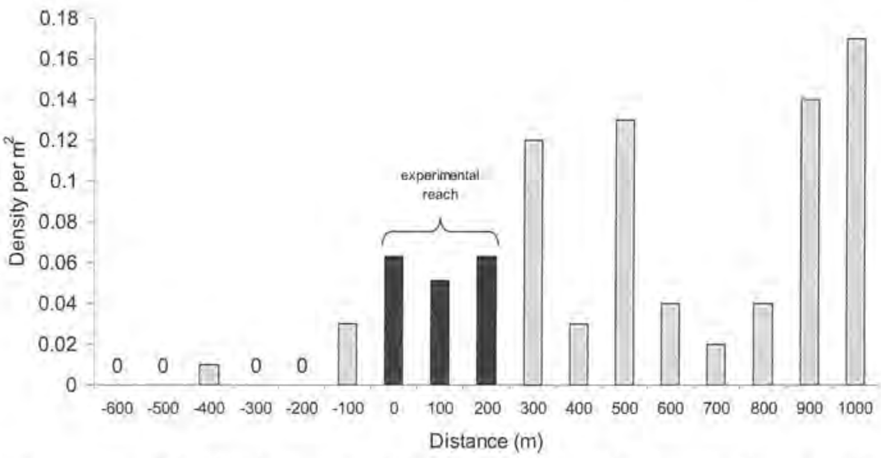

Figure 3: Density of salmon parr in July 2006 in successive 100m reaches for the 600m upstream through to 1km downstream of the experimental reach. Top of experimental reach starts at 0m. Dark bars represent the experimental reach itself, which was fished twice, from which fishing efficiency was derived and used to calculate population and density estimates of all other reaches, which were fished once

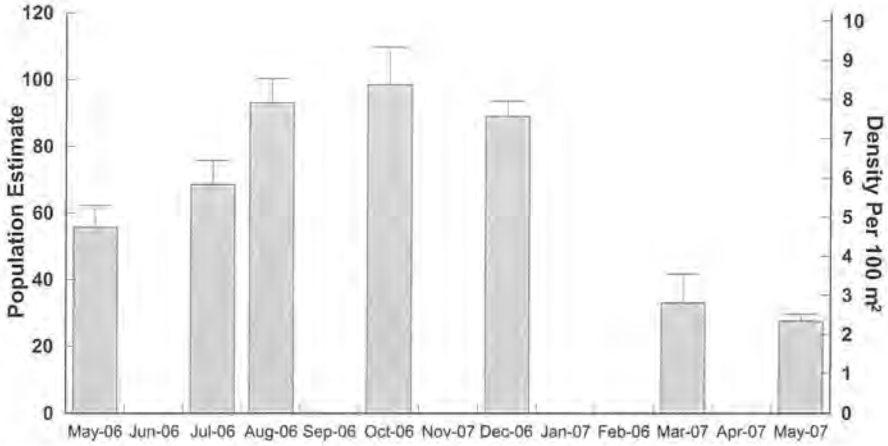

Figure 4: Population estimate (± 1 SE) and density per 100m² (± 1 SE) of Atlantic salmon in the experimental reach from May 2006 to May 2007

salmon densities (<1 fish per 100m²); only one individual in total was captured in these reaches. The total salmon population estimate derived from this longitudinal survey (experimental reach and buffers, plus 1km downstream, plus 600m upstream) was 374 ± 23. This represented 5.3 ± 0.33% of the 7000 salmon fry introduced, i.e. 94.7% of the introduced fry had either died or dispersed more than 1km downstream. Of the remaining 374 salmon, 76.2% occurred in the 1km downstream of the introduction site, 18.2% occurred in the experimental reach itself and 5.6% occurred in the 600m upstream. Correlation analysis indicated a strong positive correlation between salmon parr and trout parr density ($r = 0.562$, $p = 0.019$) but there was no correlation between large trout and salmon parr density ($r = -0.079$, $p = 0.764$).

Experimental reach

The salmon population and density (Figure 4) estimated for the experimental reach in the bimonthly surveys increased on each sampling occasion from May to August 2006, then stabilised at around 8 individuals per 100m², once fish were large enough to be accurately sampled by electrofishing (Peterson *et al.* 2004). Population size in the experimental reach at the end of the first growing season in October 2006 was estimated as 1.72% of the initial number introduced (corrected for the number of fish known to have dispersed upstream and downstream of the experimental reach). Salmon density remained relatively stable until the last two fishing occasions in March and May 2007, when it dropped to approximately 3 fish per 100m². Most of the salmon observed in March 2007 appeared to be in migrating condition, displaying the silver coloration of smolts. The data recorded on PIT tag readers located at Tadnoll Mill and East Stoke were examined in June 2007, and contained records for 32 individual salmon tagged in the experimental reach. Ten of these fish had migrated between 20th October 2006 and 17th December 2007, and the remainder migrated between the 5th April 2007 and the 9th May 2007. These represented, respectively, 31.2% and 68.8% of the tagged fish known to have migrated out of the reach. Twelve of these 32 fish were recorded passing Tadnoll Mill

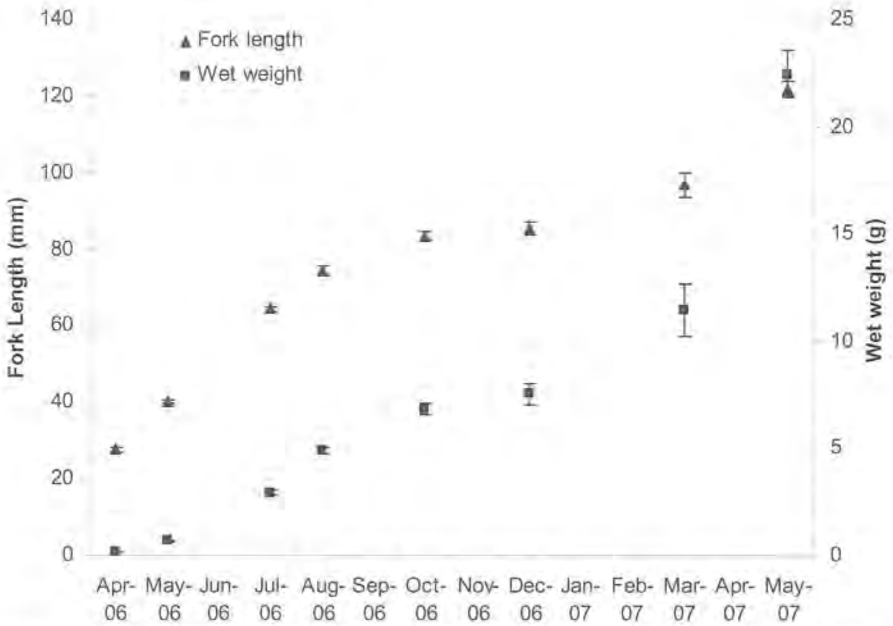

Figure 5: Mean wet weight in g (squares) and mean fork length in mm (triangles) of Atlantic salmon (± 1 SE) from the experimental reach for the year following introduction

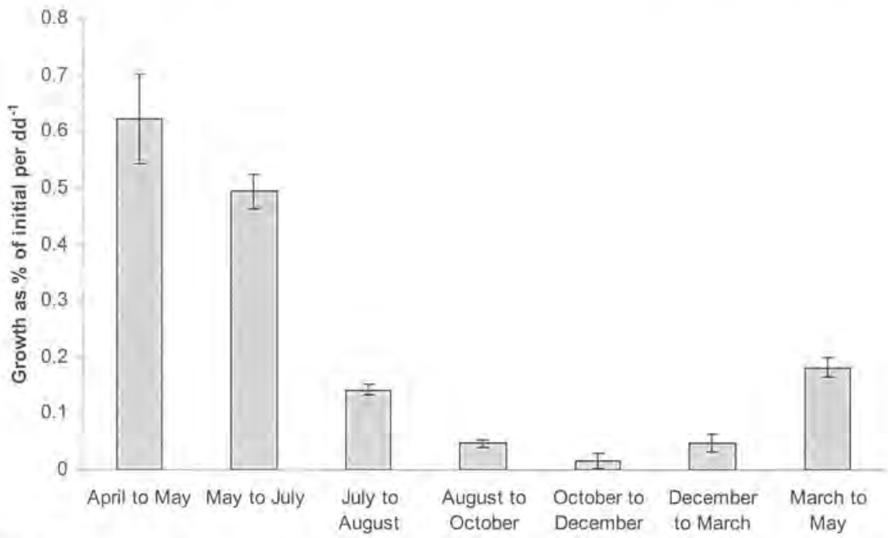

Figure 6: Growth rate of juvenile salmon between sample occasions from April 2006 to May 2007 expressed as a percentage of mean initial weight, and corrected for degree days ± 1 S.E

readers but not the readers further downstream at East Stoke. The efficiency of the PIT tag reading systems was 79%, thus up to 40 PIT-tagged smolts migrated from the experimental reach. Adding the salmon remaining in the reach in May 2007 and the estimated number of salmon that migrated, the approximate annual 'survival' rate in the experimental reach was 1.2%. We also extrapolated the survival rate from July 2006 to May 2007 in the reach (72%) to the population estimates from July 2006 upstream and downstream of the reach. Thus, when these sections of Tadnoll Brook were considered, the overall annual survival rate of stocked fish was estimated to be 4.1 ± 0.23%. Of the population remaining in May 2007, 45% stayed in Tadnoll Brook for a second summer, in stark contrast to the River Frome population where only 2% of the population remains for a second growing season (W. Riley, pers. comm.).

Salmon growth

The biggest step increases in fork length of the parr were from May to July 2006 and from March 2007 to May 2007 (Figure 5). Mean fork length on each sample occasion was always significantly higher than the previous occasion, except from October to December 2006 (ANOVA and Tukey's pairwise comparisons). Mean wet weight showed an identical pattern to mean fork length (Figure 5). Growth rate, relative to initial weight, was fastest at the fry stage (0.6% per dd^{-1}), then decreased throughout the year to a minimum in October/December of < 0.1% per dd^{-1} (Figure 6). Growth then increased in spring of 2007, reaching 0.2% per dd^{-1} just prior to smolting in March/May 2007.

There was no significant difference in mean condition in October 2006 (based on weight and length data of PIT-tagged fish) between the parr that migrated to the main river that Autumn and the parr that remained until spring 2007 (GLM; df = 1, 19; F = 1.97; p = 0.176). Similarly, there was no difference in mean condition at time of migration, based on October 2006 and March 2007 weight-length data respectively, of the fish that migrated in autumn and spring (GLM; df = 1, 14; F = 1.06; p = 0.320). However, the condition (in March 2007) of the fish that migrated was significantly greater than the condition of the fish that remained in Tadnoll Brook for a second summer (GLM; df = 1, 18; F = 4.69; p = 0.045).

Discussion

Survival

The use of incubation boxes produced high egg survival (*c.* 72%), similar to rates described for hatcheries of 70%, (Aprahamian *et al.* 2004), and in-stream incubators of 80% (Dumas and Marty 2006), and in excess of survival in natural redds of 2–35% (MacKenzie and Moring 1988; Pauwels and Haines 1994; Dumas and Darolles 1999). However, it was clear that incubation time and survival to emergence were dependant on the initial density of eggs in the boxes, implying that the boxes had a maximum carrying capacity, either in terms of initial number of eggs or pre-emergent fry. This may be due to oxygen limitation at higher egg densities (Rombough 2007). Although the experiment was not designed to test the effects of egg density, there was higher survival (boxes with > 78% survival from egg to swim up fry) at an egg density of approximately 3000 per m^3.

Within three months of the introduction, the salmon parr had dispersed throughout at least 1km downstream of the introduction site; there was practically no upstream dispersal. Salmon parr density was highest downstream of the experimental reach, in contrast to some studies where salmon densities remained highest in the introduction zone (Egglishaw and Shackley 1980; Letcher *et al.* 2004). We could not isolate the process by which parr distribution was determined, though predation by older trout, and competition with conspecifics and first year (0+) trout can be important factors (Mills 1989). There was no evidence, at the reach scale, of a negative relationship between 0+ salmon parr and larger trout. This may have been because predation would have occurred immediately after the introduction. The salmon parr would have rapidly attained sufficient size to protect them from the larger trout, enabling the two species to co-exist. At the patch scale, larger brown trout have a propensity to hold station in deeper pools (Fausch and White 1981), whereas salmon parr prefer faster flowing habitats. This partitioning of the stream environment may have limited the loss of salmon fry and parr to predation by trout. The strong positive correlation at the reach scale between 0+ trout and salmon parr may indicate that they have similar habitat requirements and that habitat availability, rather than predation, was the main determinant of salmon parr distribution in Tadnoll Brook, where trout density is very high.

It was difficult to separate mortality and emigration, thus our 'survival' rates integrate the two processes. It was clear that, as more salmon were found in the 1km downstream than in the experimental reach in July 2006, dispersal was high and may have accounted for most of the loss from the experimental reach. In this study, the annual fry survival was estimated at 1.2% in the experimental reach and 4.1% overall for the stocked fish. Combined with the mean egg survival in the egg boxes, the egg to smolt survival was estimated as approximately 2.9%, higher than the assumed survival from egg to smolt in the wild of 1% (Harris 1995; Mills *et al.* 2005), and within the range (0.2–3.2%) cited in a review of 275 population studies (Hutchings and Jones 1998). Historical records of salmon parr density in Tadnoll Brook above Tadnoll Mill are lower than the density achieved in the experimental reach of this study, with the exception of a high density recorded in 1976. This indicates that the carrying capacity of this section of Tadnoll Brook could be naturally low in terms of salmon. Studies have consistently identified fast flowing and shallow riffle areas as the preferred habitat of salmon parr (Heggenes *et al.* 1999), including the chalk streams of south west England (Prenda *et al.* 1997) where they can be associated with beds of *Ranunculus* (Riley *et al.* 2006). These habitats are under-represented in the experimental reach of the Tadnoll Brook.

Growth

In the year following introduction, the salmon parr grew over two main periods: from introduction until autumn 2006 and then again in the spring of 2007. The largest accrual of biomass was before smolting, in part supported by the increasing productivity of the river at that time of year. This is a crucial stage in the life cycle of salmon, as body size can be an important determinant of the physical ability to smolt, and affects the age at which salmon migrate (Hutchings and Jones 1998) and their vulnerability to predators at sea (Koed *et al.* 2006). However, when growth was standardised by the initial size of the fish, the fastest period of growth was at the fry stage, at the beginning of the first growing season. A rapid gain in body size at this life stage is important as it affects vulnerability to predation by larger fish, and the ability to compete for space and resources with other parr (i.e. bigger is better). The mean weight of the salmon parr after the first growing season was high compared with other salmon stocking studies, approximately 1.5g greater than the maximum weights cited by other studies for similar growth periods (Egglishaw and

Shackley 1980, Letcher *et al.* 2004). This is probably due to the productive nature of chalk streams (Wright *et al.* 1992), and is comparable with data for a natural salmon population in the nearby Bere Stream (Mann 1971).

Two migratory periods were identified one in autumn 2006 and one in spring 2007. Autumn downstream migration has been identified in the River Frome catchment with some evidence that these fish remain in the main river and estuary until smolting occurs in spring (Pinder *et al.* 2007). Possible explanations for early partial migration of the population are subdominance, lack of overwintering habitats (Armstrong and Griffiths 2001) or differences in growth and fitness (Cunjak 1992). There was no difference in the condition of the fish that migrated downstream in autumn and the ones that remained in the experimental reach until the spring. This could indicate that the decision to migrate early is linked to the availability of good quality habitat rather than body size, i.e. fish with a well established territory will choose to exploit it for as long as possible, but those without territories will have to migrate. The autumn partial migration of the population fits the theory of a carrying capacity set by habitat limitation, which should intensify as the fish and their individual territories grow, in effect creating a need for a population reduction after the first growing season. At the spring migration, however, the condition of migrants was higher than the non-migrants, indicating that the autumn and spring migrations are separate processes: the former possibly related to habitat limitation, the latter related to condition and physiology. The proportion of salmon parr remaining in Tadnoll Brook for a second growing season was high in comparison to the River Frome, and though the smaller fish remained for a second growing season, these will ultimately produce larger smolts after two growing seasons in freshwater.

Our experimental introduction of salmon allowed us an insight into the dispersal, survival and growth of stocked fish. The primary aim of this experiment, which was to achieve a stable density of parr in a discrete experimental reach, was achieved successfully. This has enabled us to study changes at all levels of the food web in great detail, and alterations in ecosystem functioning, pre- and post-introduction (unpublished, in preparation). When the adult salmon return to spawn in Tadnoll Brook, the implanted PIT tags, will be identified by the permanent in-river tag readers. This will provide us with individual life history data, which will be linked to the feeding and growth of individual parr in future work.

Acknowledgements

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The Macroinvertebrate Fauna and Environmental Quality of the Oakers Stream, a small tributary of the River Frome (Dorset)

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Summary

The Oakers Stream is a small, acidic tributary of the River Frome. The stream rises in Oakers Bog SSSI and flows through Oakers Wood before entering farmland in its lower reaches. The stream is characterised by a variety of habitats, ranging from 'natural' shady pools and woodland sites, to channelized and re-sectioned lower reaches. Macroinvertebrate surveys were carried out in summer 2007, autumn 2007 and spring 2008, recording a total of 108 taxa in 6 sites. The list included the beetle Agabus brunneus, *which is a Red Data Book species with a 'vulnerable' status. The environmental quality, as determined by RIVPACS, varied from 'fairly good' to 'poor'. However, the relatively high species richness for an acidic stream in the River Frome catchment may be a reflection of the contrasting habitats and land uses that occur over the stream's short length.*

Introduction

The Oakers Stream, a tributary of the River Frome, flows through two Sites of Special Scientific Interest: Oakers Wood and Oakers Bog. In the lower reaches, the stream flows through farmland and the channels have been extensively modified. The stream is of particular interest because of its acidic water, spatey discharge pattern and a tendency for the upper reaches to cease flowing in dry weather periods. The contrast in land use within a short length of stream, may be reflected in changes in the faunal communities. Such small streams are frequently neglected in national surveys but may support rare and endangered species. The aims of this paper are to describe the macroinvertebrate communities found at 6 sites along the Oakers Stream and to use these data to assess environmental quality, based on seasonal samples. The sites' characteristics can be catalogued to provide data for comparisons with other such small, acidic streams in the future.

Study Area

Oakers Stream rises at an altitude of 46m OD and flows for 3.5km before joining the River Frome. The upper catchment consists of wet heathland with characteristic valley mire vegetation (http://www.english-nature.org.uk/special/sssi/). The source of the stream consists of interconnecting pools which then drain through bog for about 0.5km, before collecting as a smaller pool where a track crosses a culvert on the stream at site 1. The water flows through a bog once more before creating a stream channel in Oakers Wood. The stream meanders through oak (*Quercus* spp.), *Rhododendron* and birch (*Betula pendula*) and is characterised by the presence of numerous woody debris dams which impound water in elongated pools during dry weather. In the lower reaches the stream flows though agricultural land (mainly maize fields and cattle pasture) and the channel has been re-sectioned and straightened.

Recent and historical management that may have affected the area and influenced the stream include: the removal of conifers from Oakers Bog five years previously; the clearing of extensive *Rhododendron* thickets between sites 2 and 3; and the removal of Turkey oaks (*Quercus cerris*) and holly (*Ilex aquifoluim*) to protect lichen communities (http://www.english-nature.org.uk/special/sssi/). In addition, upstream of site 3, a track crosses where a culvert was constructed and plastic pipes have been placed in the stream in association with the renovation of Oakers Cottage.

Site locations

Site 0 was located by the roadside at the source of the Oakers Stream. It consisted of interconnecting channels joining shallow boggy pools, with variable widths of 0.2m to 5.0m. In the summer, the site was heavily shaded by willows (*Salix* spp.) and birch (*Betula* spp.). The substratum was composed of anoxic, organic, peaty soil. Only during spring sampling was there any significant water flow.

Site 1 was an unshaded reach situated immediately downstream of a culverted section over which a track passes. Flow velocity was low, except during spates when the peaty substratum overlying the sandy bottom may be moved downstream. The site was characterised by pools with some growth of *Potamogeton* spp.

Site 2 was located within the dense shaded area of Oakers Wood. The channel was narrow and the substratum covered in flocculent iron precipitate during periods of stable flow. The physical characteristics (width and depth) of this site were highly variable with the benthic habitat consisting of a soft, mobile, sandy bottom.

Site 3 was also heavily shaded (mainly birch and oak) but the stream was faster flowing due to inputs nearby from small tributaries. The dominant substratum was gravel, with accumulations of leaf litter and occasional bricks and larger stones originating from a damaged culvert about 6m upstream.

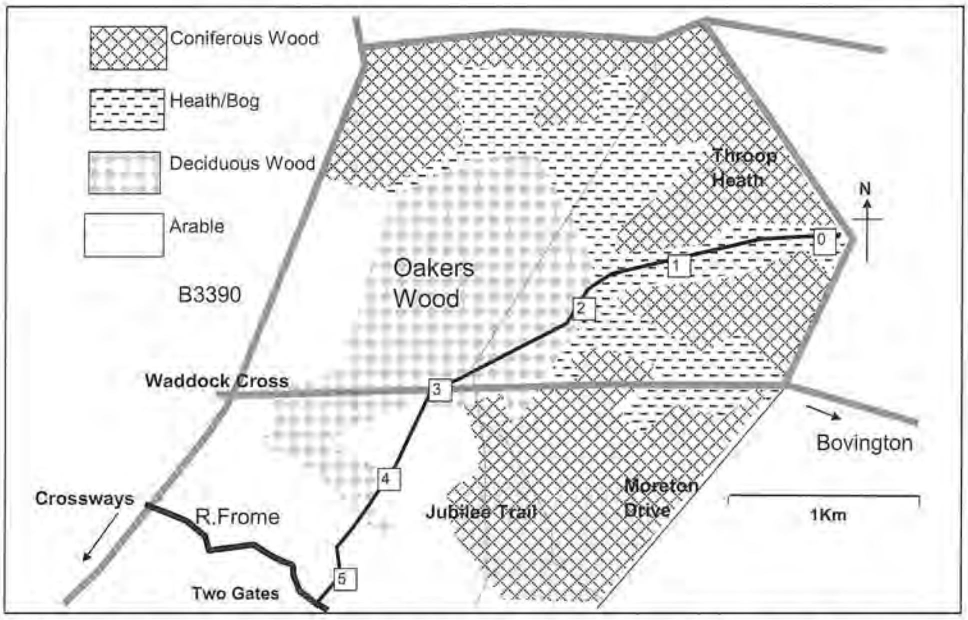

Figure 1: Sketch map showing the position of the 6 sites (numbered) on the Oakers Stream and surrounding land use

Sites 4 and 5 were set within an agricultural and flatter landscape where the stream has been resectioned and has steep banks. At site 4 there was very little organic matter and the pebbles were tinged with iron ochreous deposits. At site 5 there was clear evidence of iron richness and the substratum was very soft and loose, consisting of silt/clay and partially decomposed leaves over a base of sandy gravel.

Physical and Chemical Characteristics

Background physical data were collected for each site using standard RIVPACS methodology (River Invertebrate Prediction And Classification System; Murray-Bligh 1999). Spot water samples were collected and a proportion filtered through a 0.45μm membrane before analysis. The filtered water samples were used to

Table 1: The physical and chemical characteristics of the 6 sites on the Oakers Stream, based on the combined mean values from summer 2007, autumn 2007 and spring 2008

Site	0	1	2	3	4	5
Physical						
Grid Reference	SY 8215917	SY 817916	SY 812914	SY 8075911	SY 80559082	SY 80259035
Altitude (m OD)	46	42	35	32	28	26
Distance from source (km)	0.00	0.50	1.07	1.64	2.11	3.58
Slope (m/km)	13.30	11.10	9.76	4.00	6.90	6.90
Water Width (m)	2.00	1.70	1.00	1.90	1.20	1.20
Mean Depth (cm)	17.22	39.22	22.22	10.67	17.00	44.44
Surface Velocity categories	0–1	1–2	2–4	3	3	2
Substratum Cover (%)						
Boulders and Cobbles	0	0	0	1	0	0
Pebbles and Gravel	0	35	70	71	66	23
Sand	73	5	28	25	32	42
Silt and Clay	27	0	2	3	2	35
Chemical						
pH	–	5.03	6.4	5.73	–	6.45
Alkalinity	–	–	12.6	–	–	13.7
Silica (mg/l Si)	–	2.25	0.00	0.18	–	2.55
Phosphate (μg/l P)	–	20	98	18.5	–	43
Nitrate (mg/l N)	–	<0.3	n/d	<0.2	–	n/d–4.2

Velocity categories 1: <10, 2: >10–25, 3: >25–50, 4: >50–100 (cms^{-1})

determine soluble reactive phosphorus (SRP) and total oxidisable nitrate (TON) concentration. Unfiltered water samples were analysed for total phosphorus (TP) concentration using the colorometric method of Eisenreich *et al.* (1975) (see Bowes *et al.* 2005 for details of the chemical methods).

Methods

Faunal Sampling

Samples for the three seasons were taken using a standard 3 minute kick/sweep technique (Wright *et al.* 1993; Murray-Bligh 1999) with a pond net of 900μm mesh. Samples were fixed in 5% formaldehyde solution and sorted into 70% alcohol. Identifications were made to species level wherever keys and life history stage allowed. An exception was Oligochaeta, identified as such. Relative abundance was recorded at the family level.

Environmental quality

RIVPACS (Wright *et al.* 1993; Cox *et al.* 1995) was employed to assess the Oakers Stream. This system is based on a large database of information on macroinvertebrate communities of unstressed sites throughout the UK. It provides a method of setting a standard against which to assess the fauna of new sites and also places the site in a national context. The technique has been adopted on a national basis by the Environment Agency in their surveys of river quality. The output from the program includes predictions of numbers of taxa, Biological Monitoring Working Party (BMWP) biotic score and Average Score Per Taxon (ASPT) (Armitage *et al.* 1983).

In the BMWP score system, taxa that are intolerant to pollution are given high scores and tolerant taxa are given low scores. A summation of the scores of all taxa present in a sample gives an indication of the level of environmental stress that the site has experienced. If this sum is divided by the number of taxa comprising it (ASPT), the average pollution tolerance of these taxa is indicated.

Expected target values for BMWP score, number of scoring taxa and ASPT were obtained for each site based on data from the three seasons. These results are compared with observed values based on combined seasons' data to give an observed/expected index or Ecological Quality Index (EQI). A warning message is shown on screen and printout if, on the basis of the physical and chemical data, the site is unlike any in the original database.

The EQIs are banded into classes (Murray-Bligh 1999) and the Environment Agency recognizes 6 classes where 'a' is very good and 'f' is bad. These bands now apply only to number of scoring taxa and ASPT.

Results

The Fauna

Based on the three seasons' collections, a total of 108 taxa were found at the 6 sites (Table 2). Five taxa, *Pisidium casertanum*, Oligochaeta, *Asellus meridianus*, *Simulium vernum* and *Macropelopia* sp. were found at every site, but 59 taxa were found at only 1 site. Taxon richness was highest at site 0 (54 taxa) and lowest at site 2 (21 taxa).

The distribution of all taxa amongst major groups is shown in Table 3. Diptera, Coleoptera and Trichoptera contributed the majority of the taxa to the total found at the sites (45, 15 and 10 taxa respectively). Coleoptera were absent from sites 2 and 3 and Trichoptera were absent from site 1.

Gammarus was not recorded at any of the sites but *Crangonyx pseudogracilis* was found at sites 4 and 5. Only three mayfly species (*Centroptilum luteolum, Cloeon dipterum* and *Ephemera danica*) were found, each occurring at one site only. Of the stoneflies, Nemouridae were found at all sites and were abundant in sites 2–5. Leuctridae showed a similar pattern of abundance but were absent from sites 0 and 1. Odonata, mainly *Pyrrhosoma nymphula* and *Cordulegaster boltonii*, were found at all sites, with diversity lowest at sites 0 and 4. Coleoptera were richest at site 0 with 10 different species/taxa recorded. No beetle taxa were present at sites 2 and 3. A Red Data Book beetle species *Agabus brunneus* was found at site 4. The Trichoptera community was richest at site 4 with 6 different species/taxa present from the three sampling seasons. The polycentropodid, *Plectrocnemia conspersa*, was the most abundant and widespread species in this Order occurring at 4 of the 6 sites and absent from sites 0 and 1 only. Table 3 shows the high taxon richness in Diptera, site 0 being the most diverse and sites 1 and 2 being the least. *Macropelopia* sp. was the most commonly occurring chironomid taxon, whilst Simuliidae were widespread (Table 2).

The community composition in terms of major faunal groups and total abundances (based on the three seasons' collections) is illustrated in Figure 2. Compositional variability is high between sites, as is the range of abundance. Bivalves (*Pisidium* spp.), Crustacea (*Asellus* spp.), Oligochaeta and Chironomidae dominated the top 2 sites numerically. Site 2 was characterised by low numbers of all groups. Plecoptera were most abundant at site 3. Site 4 was dominated numerically by Oligochaetes, Plecoptera, Simuliidae and Chironomidae and site 5 by Mollusca and Chironomidae.

Comparison with other local acidic streams

The faunal communities at sites on three other acidic water courses in the area, the Holy (Armitage *et al.* 1996), Luckford (Blackburn *et al.* 1997) and Furzebrook streams (Armitage *et al.* 1996) were compared with that

Table 2: The log category abundance of species/taxa in samples taken at the 6 sites on the Oakers Stream based on 3 minute kick/sweep samples taken in summer, autumn and spring. (Log abundance categories: 1, 1–9; 2, 10–99; 3, 100–999. occ, occurence)

	0	1	2	3	4	5	Occ.
Microturbellaria	0	0	0	0	1	0	**1**
Polycelis nigra group	3	2	1	0	0	0	**6**
Potamopyrgus antipodarum (J.E.Gray)	0	0	0	0	1	2	**3**
Radix balthica (L.)	0	0	0	0	0	3	**3**
Galba truncatulata (Muller)	0	0	0	0	1	0	**1**
Planorbis planorbis (L.)	0	0	0	0	0	1	**1**
Anisus leucostoma (Millet)	1	0	0	0	1	1	**3**
Pisidium casertanum (Poli)	2	2	2	2	1	2	**11**
Pisidium personatum Malm	2	1	0	0	0	1	**4**
Pisidium subtruncatum Malm	0	1	0	0	0	0	**1**
Oligochaeta	3	3	3	3	3	3	**18**
Helobdella stagnalis (L.)	0	0	0	0	2	0	**2**
Trocheta subviridis Dutrochet	0	0	0	1	0	0	**1**
Ostracoda	2	0	0	0	1	2	**5**
Cladocera	1	0	0	0	0	0	**1**
Copepoda	1	0	0	0	0	0	**1**
Asellus meridianus Racovitza	3	3	2	3	3	3	**17**
Crangonyx pseudogracilis Bousfield	0	0	0	0	2	3	**5**
Centroptilum luteolum (Muller)	0	0	0	0	0	1	**1**
Cloeon dipterum (L.)	1	0	0	0	0	0	**1**
Ephemera danica Muller	0	0	0	0	1	0	**1**
Nemoura avicularis Morton	0	1	3	3	3	3	**13**
Nemoura cambrica gp	0	1	0	0	1	0	**2**
Nemoura cinerea (Retzius)	1	0	1	1	1	1	**5**
Nemurella picteti Klapalek	0	1	1	1	0	1	**4**
Leuctra fusca (L.)	0	0	0	0	1	0	**1**
Leuctra hippopus (Kempny)	0	0	0	3	2	1	**6**
Leuctra nigra (Olivier)	0	0	2	2	2	2	**8**
Pyrrhosoma nymphula (Sulzer)	3	3	1	1	0	1	**9**
Cordulegaster boltonii (Donovan)	0	0	2	2	3	3	**10**
Aeshna cyanea (Muller)	0	0	0	0	0	1	**1**
Libellula depressa L.	0	1	0	0	0	0	**1**
Gerris gibbifer Schummel	0	2	0	0	0	0	**2**
Gerris lacustris (L.)	1	0	0	0	0	0	**1**
Sigara (Pseudovermicorixa) nigrolineata (Fieber)	0	1	0	0	0	0	**1**
Hesperocorixa sahlbergi (Fieber)	3	2	0	0	0	0	**5**
Agabus sp.	2	0	0	0	1	2	**5**
Agabus brunneus (Fabricius)	0	0	0	0	1	0	**1**
Agabus bipustulatus (L.)	1	0	0	0	0	0	**1**
Ilybius sp.	2	0	0	0	1	1	**4**
Dytiscus sp.	1	0	0	0	0	0	**1**
Hydroporus palustris (L.)	1	1	0	0	0	0	**2**
Hydroporus nigrita (Fabricius)	1	0	0	0	0	0	**1**
Hydroporus gyllenhalii Schiodte	1	0	0	0	0	0	**1**
Hydroglyphus geminus (Fabricius)	0	1	0	0	0	0	**1**
Stictotarsus duodecimpustulatus (Fabricius)	0	0	0	0	0	1	**1**
Gyrinus sp.	1	1	0	0	0	1	**3**
Gyrinus substriatus Stephens	1	0	0	0	0	0	**1**
Helophorus brevipalpis Bedel	0	0	0	0	1	0	**1**
Chaetarthia seminulum (Herbst)	1	0	0	0	0	0	**1**
Limnius volckmari (Panzer)	0	0	0	0	2	0	**2**
Sialis lutaria (L.)	2	0	0	0	1	2	**5**
Plectrocnemia conspersa (Curtis)	0	0	2	3	1	1	**7**
Trichostegia minor (Curtis)	1	0	0	0	0	0	**1**

Table 2: *(cont'd)*

	0	1	2	3	4	5	Occ.
Limnephilidae Indet	0	0	0	1	2	1	4
Limnephilus centralis Curtis	2	0	0	0	0	0	2
Halesus radiatus (Curtis)	0	0	0	0	0	1	1
Glyphotaelius pellucidus (Retzius)	1	0	0	0	0	0	1
Micropterna sequax McLachlan	0	0	0	0	2	0	2
Silo nigricornis (Pictet)	0	0	0	0	1	0	1
Sericostoma personatum (Spence)	0	0	0	0	1	0	1
Mystacides azurea (L.)	0	0	0	0	1	0	1
Elophila nymphaeta (L.)	1	0	0	0	0	0	1
Pilaria sp.	0	0	0	0	1	0	1
Elocophila sp.	0	0	1	2	2	1	6
Dicranota sp.	0	0	0	2	3	0	5
Cecidomyiidae sp.	1	0	1	0	0	0	2
Pericoma trivialis Eaton	0	0	1	0	0	1	2
Pericoma diversa Tonnoir	0	0	0	0	1	0	1
Dixella filicornis (Edwards)	0	0	0	0	0	1	1
Chaorborus crystallinus (DeGeer)	3	0	0	0	0	0	3
Culiseta (culiseta) group	1	0	0	0	0	0	1
Culiseta morsitans (Theobald)	2	0	0	0	0	0	2
Ceratopogonidae	0	0	2	1	0	0	3
Atrichopogon sp.	0	0	0	0	1	0	1
Forcipomyiinae	1	0	0	0	0	0	1
Simulium aureum group	1	1	2	1	1	0	6
Simulium latipes (Meigen)	1	0	0	0	0	0	1
Simulium ornatum group	1	0	0	1	1	0	3
Simulium vernum Macquart	1	1	1	2	1	1	7
Larsia atrocincta (Goetghebuer)	1	0	0	0	0	0	1
Macropelopia sp.	2	3	2	1	2	3	13
Macropelopia adaucta Kieffer	0	0	0	1	0	0	1
Procladius choreus (Meigen)	2	1	0	0	0	1	4
Psectrotanypus varius (Fabricius)	3	2	0	0	0	0	5
Thienemannimyia group	1	0	0	1	1	3	6
Trissopelopia longimana (Staeger)	1	0	0	0	2	2	5
Zavrelimyia sp.	2	0	1	0	1	2	6
Prodiamesa olivacea (Meigen)	0	0	0	2	3	3	8
Brillia bifida (=modesta) (Kieffer)	0	0	0	0	3	1	4
Eukiefferiella brevicalcar (Kieffer)	0	0	0	2	1	1	4
Heterotrissocladius marcidus (Walker)	1	0	0	0	1	0	2
Limnophyes sp.	0	0	0	0	1	0	1
Psectrocladius obvius (Walker)	1	0	0	0	0	0	1
Smittia sp.	0	0	1	0	0	0	1
Chironomus sp.	2	1	0	0	0	1	4
Phaenopsectra sp.	0	0	0	0	1	0	1
Polypedilum sp.	1	0	1	2	3	3	10
Stictochironomus sp.	0	0	0	0	1	1	2
Micropsectra fusca (Meigen)	1	1	0	0	0	0	2
Micropsectra sp.	3	2	0	0	0	0	5
Stempellinella sp.	0	0	0	0	0	1	1
Tanytarsus sp.	1	2	0	1	1	1	6
Rhagionidae	0	0	0	1	0	0	1
Tabanidae	1	0	0	0	0	0	1
Clinocera group	0	0	0	0	1	0	1
Chelifera sp.	1	0	0	0	0	0	1
Ephydridae	0	0	0	0	0	2	2
Total number of taxa	54	26	21	27	52	45	108

The Oakers Stream provides a good example of anthropogenic effects on faunal communities. Without the channel modifications in the lower reaches, the list of taxa for the stream could have been much lower. Thirty-two taxa in total were recorded from the relatively unmodified sites 2 and 3, whereas 68 were recorded from sites 4 and 5, 48 of these having been found only in the lower reaches. The Oakers Stream exhibits a high degree of habitat variability from the pools of site 0 and 1, through the 'semi-natural' sites 2 and 3, to the modified reaches in sites 4 and 5. It is this variability (largely anthropogenic) which accounts for the relatively high species richnesss for a stream of this type.

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APPENDIX I

Collections at Oakers Stream – May 7 2008 by Dr David Bilton

Oakers Bog

Oakers 0 Pools – 7/May/2008 SY822917

Stictonectes lepidus
Hydroporus gyllenhalii
Hydroporus incognitus
Hydroporus memnonius
Hydroporus nigrita
Hydroporus pubescens
Agabus bipustulatus
Ilybius montanus
Dytiscus marginalis
Gyrinus substriatus
Hydrochus angustatus
Anacaena globulus
Anacaena lutescens
Hydrobius fuscipes

Oakers Wood SY807912

Hydroporus tesselatus (stream, 6m upstream of site 3)
Acilius sulcatus (pool adjacent to stream)

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The Odonata of a created lake at Squirrel Cottage, East Holme, Dorset

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Summary

A 1.0ha lake was created during 1994 within a heathland restoration plan at a worked out ball clay pit at Squirrel Cottage. Since 2001 observations have been made on the colonizing Odonata fauna of the lake. A total of 19 species have been recorded but only nine are known to have bred, two others probably breed and eight have occurred as occasional visitors.

Introduction

I first visited Squirrel Cottage Lake in 2003 and, knowing that the lake was only ten years old, I was interested to discover the species of Odonata that had colonized this water body. On the initial visit, it was noted that one species, *Enallagma cyathigerum* (Common Blue Damselfly) was very common, being more numerous than at any other site known to me in Purbeck. Over the following six summers I visited the Lake regularly to record the species of Odonata present and paying particular attention to the *E. cyathigerum* population. This report records the species recorded and summarises my observations made during 2003–2008.

Details are given of the origin of the Lake, its configuration and structure. Descriptions are given of the vegetation of the area surrounding the Lake, together with the marginal and submergent vegetation of the Lake.

Description of Lake

The Squirrel Cottage Lake was created during 1994 by Imerys Minerals Ltd within a restoration programme of returning this general area of worked-out ball clay pit to its former habitat of lowland heath. The lake created is roughly triangular and covers an area of about 1.0ha, including in the middle a raised oblong island (<15% of total Lake site area). The northern end of the Lake lies at (SY98 9051/8549) and the southern base is at approximately (SY98 9053/8527). The eastern and southern shores are almost straight, with the western shore forming a shallow arc. The Lake lies in a hollow on the west side of the re-establishing lowland heath site and is generally protected from the impact of strong wind.

The Lake has shallow, gently sloping edges and a firm clayey sandy bed with some organic detritus. Its underwater contours are saucer shaped between lakeside and island. At its deepest, it would appear to be seldom more than 2m and over most of the lake it is less than 1m. The maximum water level of the Lake is controlled by an outlet pipe on the west side of Lake. It is probable that most of the water is derived from surface runoff from the surrounding heathland but it is not known whether there are any aquifers feeding the lake. The water is clear and light reaches the whole floor of the Lake. With the surrounding land being heath, the water would expect to be quite acidic. It therefore came as a surprise that water samples taken on the 14th August, 2006 from both north and south ends of the lake, showed very much higher pH than expected of pH 7.3 and pH 7.2 respectively. Further sampling would be desirable to establish whether the lake is becoming more acidic or maintaining its neutral level.

The Vegetation

Origins of the vegetation

Most of the vegetation surrounding the Lake has been as a result of deliberate introduction of a foraged heathland mulch of principally *Calluna vulgaris* (Ling) and *Erica cinerea* (Bell Heath) collected from Arne Nature Reserve during the autumn of 1994. The origin of *Ulex europaeus* (Gorse) and in places some areas of acid grassland, is not known. To my knowledge other than for the appearance in 2005 of two plants of a pale pink flowered water lily, probably a cultivar of *Nymphaea 'alba'* no other plants, except trees, have been deliberately introduced to the general area. The most probable origins of the aquatic vegetation are by way of seeds probably brought by visiting waterfowl.

Vegetation bordering the Lake

The lake edge by 2008 is well vegetated with rushes, mostly *Juncus effusus* (Soft Rush) but there are areas of *Juncus acutiflorus* (Jointed Rush) and two small establishing areas of *Phragmites australis* (Common Reed) and *Equisetum palustris* (Marsh Horsetail). Bordering the southern and western sides is ericaceous vegetation, mostly *Calluna* with a little *Erica cinerea* and, in the damper areas, *Erica tetralix* (Cross-leaved Heath). At about, or just above, the high winter lake water level there are several typical heathland bog species that have become established, including *Sphagnum* sp., *Anagallis tenella* (Bog Pimpernel), *Drosera rotundifolia* (Round-leaved Sundew), *Hypericum elodes* (Bog St John's-wort) and particularly at the south end, *Molinia caerulea* (Purple Moor-grass). The eastern side of the Lake behind its *Juncus* fringe for most of its length is now a dense line of *Rubus* sp. (Bramble).

The island has a dense under story of *Ulex europaeus*. Distributed around the edge of the island are four well established trees of *Alnus glutinosa* (Alder) (to 7m) and eight *Salix fragilis* (Crack Willow) (to 10m), all probably planted at time of island construction. Additionally, there are two *Betula pendula* (Silver Birch) (<6m) and three bushes of *Salix* sp. (Sallow) (<3m) which are likely to have arrived naturally. Were the shoreline remains exposed, there are scattered small patches of *Juncus* sp. and *Typha* sp. (Reed Mace).

Aquatic Vegetation

Almost all of the emergent vegetation is restricted to the edge of the lake and is dominated by rushes, with a little colonizing Common Reed and Marsh Horsetail. There is very little emergent aquatic vegetation resulting from plants rooted on the lake bed except for the occasional patch of *Eleogiton fluitans* (Floating Club-rush) and an area of *Nymphoides peltata* (Fringed Water-lily), whose pads cover an area of 6m long by 4m wide at (SY98 9050/8545).

Submerged vegetation, which appears to cover almost all of the floor of the lake is probably dominated by *Elodea canadensis* (Canadian Pondweed), some of which is dislodged by feeding Canada Geese (*Branta canadensis*) and Coot (*Fulica atra*). Among the resulting floating debris the occasional pieces of *Potamogeton lucens* (Shinning Pondweed) has also been noted. In the shallower waters around the edge of the lake both *Chara virgata* (a stonewort) and the grass like *Potamogeton berchtoldii* (Small Pondweed) are widespread.

Non-invertebrate Odonata predators

The lake, fortunately, has not been stocked with fish, although *Anguilla anguilla* (eels) are possibly present. A pair of Little Grebe (*Tachybaptus ruficollis*) bred each year and it is probable that their major food source is Odonata larvae. The number of Odonata larvae needed to be taken to raise two or three chicks gives an indication as to the probable abundance of Odonata larvae. Emerging adults are probably taken by the breeding pairs of Moorhen (*Gallinula chloropus*) and Coot. Adults are probably regularly taken by Hobby (*Falco subbuteo*), as they are seen over the area.

The Odonata of Squirrel Cottage Lake

As the lake was established during the winter of 1994/1995, it is probable that the rising water levels would not have attracted Odonata until spring 1995. Abbott (2002) gives an indication of the Odonata breeding and visiting the Lake during 2001. Although these records are based on only three visits spaced over the summer, it would suggest that seven species had already established breeding populations and possibly two others, with a further five recorded as visitors.

I first visited the Squirrel Cottage Lake on 20/07/2003, followed by a second visit on 10/08/2003. During the following five years (2004–2008) I have visited the lake regularly; with the period of my visits spread between May-November and two were also made in April. I have made 68 visits, usually each lasting about one hour, the time taken to slowly walk round the Lake. The date of the visits was random, being selected when optimum weather conditions prevailed of fine warm and usually windless days and undertaken either in late morning or early afternoon. Table 1 gives the years, the months and the number of visits made each year, including those made by Andy Abbott during 2001.

During my six year study (2003–08), I have recorded 18 species (seven Zygoptera and eleven Anisoptera), of which nine species are known to be breeding (four Zygoptera and five Anisoptera). Confirmation of breeding has only been accepted if either *exuviae* or presence of newly hatched insects has been recorded. Although egg-laying has been noted by three other species (two Zygoptera and one Anisoptera), no *exuviae* or newly emerged insects have been seen, so their successful breeding remains unsubstantiated. Table 2 lists the species recorded since 2001, together with the number of occasions each species was recorded annually.

Table 1: The year, month and number of visits to Squirrel Cottage Lake (2001–2008) to record the presence of Odonata

Year / Month	2001	2003	2004	2005	2006	2007	2008	Total
April	–	–	–	–	–	2	–	2
May	1	–	–	2	1	–	1	5
June	1	–	2	2	3	1	1	10
July	–	1	2	2	3	2	1	11
Aug	–	1	1	4	4	1	2	13
Sept	1	–	1	1	4	3	2	12
Oct	–	–	–	5	5	2	4	16
Nov	–	–	–	1	1	–	–	2
Total No. visits	3	2	6	17	21	11	11	71

Table 2: The species of Odonata recorded at Squirrel Cottage Lake (2002–2008) and the number of visits each year when a species has been recorded

	2001	2003	2004	2005	2006	2007	2008	Total	
Total Number of visits 2001–2008	3	2	6	17	21	11	11	71	
No. of visits when species recorded									**Status**
Calopteryx splendens	–	–	–	2	4	–	–	6	Visitor
Lestes sponsa	2	2	4	8	12	5	1	34	Breeding
Ceriagrion tenellum	1	2	2	5	9	4	3	26	Breeding
Enallagma cyathigerum	2	2	6	17	21	9	10	67	Breeding
Erythromma najas	–	–	–	5	12	1	1	19	Probably breeding
Ischnura elegans	1	1	5	10	14	3	3	37	Breeding
Pyrrhosoma nymphula	1	–	–	–	2		1	4	Possibly breeding
Brachytron pratense	–	–	–	–	–	–	1	1	Visitor
Aeshna cyanea	–	–	–	1	–	–	–	1	Visitor
A. grandis	–	–	–	1	–	–	–	1	Visitor
A. juncea	1	–	–	–	–	–	–	1	Visitor
A. mixta	1	1	1	5	5	–	8	21	Breeding
Anax imperator	1	2	2	6	9	3	1	24	Breeding
Cordulia aenea	1	–	–	–	–	–	1	2	Visitor
Orthetrum cancellatum	1	2	5	8	9	3	2	30	Breeding
O. coerulescens	2	2	2	6	7	4	3	26	Breeding
Libellula quadrimaculata	1	–	–	–	1	–	1	3	Visitor
Sympetrum danae	1	1	–	–	–	–	–	2	Visitor
S. striolatum	2	2	3	12	17	7	9	60	Breeding
No. species recorded each year	14	10	9	13	13	9	14	–	

All the species recorded since 2001 are summarised, giving national status, first and last dates recorded during the survey, the numbers recorded and dates of occurrence, where relevant. The current status in Britain and Ireland of the species recorded is taken from Smallshire and Swash (2004).

Breeding Species

Lestes sponsa (Emerald Damselfly) – *Status in Britain and Ireland; Widespread and fairly common*

First and last date recorded: 21st June and 21st October.

Abbott in 2001 recorded 'many' on 14/09.

In 2003, over 200 were recorded (including some newly emerged) on 20/7 and a 100+ (including >10 pairs and <10 newly emerged) were noted on 10/8. In the following three years 2004–2006 numbers have declined. In 2004 and 2005 peak counts were only of 25+ and seldom reached >10 during 2006. A further drop occurred in 2007, when never more than 2 ♂♂ seen on a visit. The downward trend appears to have continued in 2008 with only one very late record on 21/10 but the species could have been affected by the very poor summer.

Ceriagrion tenellum (Small Red Damselfly) – *Status in Britain and Ireland; Nationally scarce and local*

First and last date recorded: – 21st June and 14th September.

Abbott in 2001 recorded 'several' on 14/9.

Although in 2003 over 100 were noted on 20/7, such a large number has not been recorded subsequently and counts now rarely reached 10 individuals. The species appears to be confined to the western edge of the Lake which is mainly associated with the fringe of boggy heathland plants.

Enallagma cyathigerum (Common Blue Damselfly) – *Status in Britain and Ireland; Common and widespread*

First and last date recorded: 16th April and 1st November.

Abbott in 2001 recorded it as 'many' and commented that over a 10m section of lake edge he collected 262 *exuviae* on 26/6.

This is the most numerous Zygoptera present. During the peak emergence period of mid-June to mid-August, tentative minimum counts can frequently be made of between 1000–2500, of which usually over 95%

are males. These counts give an indication of the population size of this species, it is large.

In the past the species was generally considered to be over by mid-September (Miller 1997) but on a visit in 2005 on 4/10 I was surprised to note that there were still >40 ♂♂ and 2 pairs present around the Lake. This discovery prompted me to continue my October visits. In 2005 the last ♂ was recorded on 1/11; in 2006 on 29/10; in 2007 none found after 19/10 and 2008 at least 5 ♂♂ on 21/10.

Ischnura elegans (Blue-tailed Damselfly) – *Status in Britain and Ireland; Common and widespread*

First and last date recorded: 17th May and 8th October.

Abbott in 2001 recorded it as 'many' on 22/6.

During the peak emergence months of June and July, a walk round the Lake can locate upwards of 50 individuals and it is most abundant along the western shore.

The species is usually over by early September but in 2008 a ♂ was noted on 8/10.

Aeshna mixta (Migrant Hawker) – *Status in Britain and Ireland; Common in the south; regular migrant*

First and last date recorded: 20th July and 1st November.

Abbott in 2001 recorded a ♂ on 14/9.

Mostly noted in September and October but never more than a single ♂ present over the Lake. Egg-laying noted and *exuvia* found.

Anax imperator *(Emperor Dragonfly) – Status in Britain and Ireland; Common and widespread in southern Britain; scarcer in north*

First and last date recorded: 12th June and 30th August.

Abbott in 2001 recorded at least 5 ♂♂ on 22/6.

On visits during the flight period up to 3 ♂♂ have been noted holding territory but the overall numbers visiting the Lake will be larger. Egg-laying noted from June to August and *exuvia* found.

Orthetrum cancellatum (Black-tailed Skimmer) – *Status in Britain and Ireland; Locally common; increasing*

First and last date recorded: 8th June and 2nd September.

Abbott in 2001 recorded 'several', including a pair and a ♀ egg-laying on 22/6.

During the peak emergence period of June to early August up to 40 ♂♂ have been noted over the Lake. Egg-laying, newly emerged insects and *exuvia* regularly noted at the Lake.

Orthetrum coerulescens (Keeled Skimmer) – *Status in Britain and Ireland; Scarce and local*

First and last date recorded: 13th June and 14th September.

Abbott in 2001 recorded 'several', including newly emerged, mating pairs and a ♀ egg-laying on 22/6 and 'several' on 14/9.

Records suggest that it is most numerous during July when as many as 20 ♂♂ may be noted. Newly emerged insects and *exuvia* regularly noted but have never witnessed egg-laying here. Unlike *O. cancellatum,* which can be noted over the whole Lake, this species tends to be more associated with the southern and western sides of the Lake.

Sympetrum striolatum (Common Darter) – *Status in Britain and Ireland; Common and widespread; regular migrant*

First and last date recorded: 13th June and 1st November.

Abbott in 2001 recorded a newly emerged insect on 22/6 and 'several', including a pair egg-laying on 14/9.

The most numerous species of Anisoptera. Newly emerged, teneral insects and *exuviae*, have been encountered up to the end of August, with adults in some years probably occurring after the 1/11. Since 2006 there appears to have been a decline in numbers, from the peaks of 2004 and 2005 when upwards of a 100 insects, mostly newly emerged, might be encountered around the Lake during July and August. In August 2006 the maxima was 40 but subsequently visits have rarely reached double figures. The reason for this apparent decline is uncertain.

Probably Breeding

Erythromma najas (Red-eyed Damselfly) – *Status in Britain and Ireland; Locally common*

First and last date recorded: 7th June and 9th September.

2001 – Not recorded by Abbott

In 2005 a ♂ was noted on floating debris at the N end of the Lake on 13/7. The nearest known breeding location is at Breach Pond, Creech, which is nearly 2.5km to the S of the Lake. One/two ♂♂ were noted on four further dates to 21/8 and a probable ♀ was seen on 15/8. All of these sightings were on or around the patch of *N. peltata* off the west shore.

In 2006 up to 10 ♂♂ were noted between 15/6 and 9/9. Egg-laying was recorded by four pairs on 15/6 into the *N peltata* pads and single pairs seen on 29/6 and 4/9. None were seen in 2007 but in 2008 on 7/6 at least a pair and 3 ♂♂ were seen around the *N. peltata* pads but none noted on subsequent visits.

Pyrrhosoma nymphula (Large Red Damselfly) – *Status in Britain and Ireland; Common and widespread*

Being the first species to emerge in the spring and with few visits undertaken to the Lake until June, it is possible the species could have a small breeding population present. The few following records could suggest that there is a small breeding population.

Abbott in 2001 noted 'several' around Lake on 4/5.

Not recorded until 2006, with a pair on 2/6 and a ♀ on 6/7 and in 2008, a pair noted on 7/6.

Non-Breeding Visitors

Calopteryx splendens (Banded Demoiselle) – *Status in Britain and Ireland; Common and widespread in the lowlands*

2001 – Not recorded by Abbott

Noted in 2005 with 2 ♂♂ on 21/6 and a ♂ and 2 ♀♀ on 21/8. In 2006 single ♂ on 17/7, 29/7, 8/8 and 9/8.

Probably a regular wanderer from the Frome Valley.

Aeshna cyanea (Southern Hawker) – *Status in Britain and Ireland; Common in the south; local elsewhere*

2001 – Not recorded by Abbott

Only a single record in 2005 of a ♀ on 19/7.

Aeshna grandis (Brown Hawker) – *Status in Britain and Ireland; Common and widespread in the lowlands; absent from western and south-western Britain*

2001 – Not recorded by Abbott

Only record once in 2005, when a ♀ was watched at close range egg-laying under debris along west edge of the lake.

Until very recently, this species had been a rare visitor to Purbeck but sighting are becoming more numerous since 2000, suggesting that the species is expanding its range (B.P. Pickess, pers. obs.)

Aeshna juncea (Common Hawker) – *Status in Britain and Ireland; Common and widespread in the north and west; local elsewhere*

Only recorded by Abbott in 2001, when 2 ♂♂ seen 14/9.

Brachytron pratense (Hairy Dragonfly) – *Status in Britain and Ireland; Scarce and local but increasing*

2001 – Not recorded by Abbott

Only record is of 2 ♂♂ quartering the west side of the Lake on 7/6.

Cordulia aenea (Downy Emerald) – *Status in Britain and Ireland; Scarce and local*

Abbott in 2001 noted a single insect on 7/6.

Only other record is in 2008 when a ♂ was along west side of the Lake, also on 7/6.

Libellula quadrimaculata (Four-spotted Chaser) – *Status in Britain and Ireland; Common and widespread; irregular migrant*

Abbott in 2001 noted one on 22/6.

A single seen in 2006 over the Lake on 15/6 and in 2008 three present on 7/6.

Sympetrum danae (Black Darter) – *Status in Britain and Ireland; Locally common; irregular migrant*

Abbott in 2001 noted a ♂ on 14/9.

The only other record is in 2003 when 3 ♂♂ were present on 10/8.

Conclusions

The Lake, even after 15 years, still has virtually no emergent aquatic vegetation and the amount of the marginal *Juncus* that is emergent, is dependent upon the seasonal water level of the Lake.

The observations of the past six years suggest that the composition of the breeding species is little altered since 2001 but their population sizes probably are changing. The limited number of visits that this report represents can only be indicative of how the populations of the different species are fairing, especially as some are semivoltine (Merritt *et al.* 1996)

Of the Zygoptera one thing is certain, the population of the principal breeding species *E. cyathigerum* would appear to have little changed between 2001 and 2008, it is still abundant. At this site it would appear to have an extremely long period over which it may be encountered and depending on the year, insects could be present for over 200 days. This species probably benefits because of the lack of predation by fish and it is therefore a little surprising that the population of *L. sponsa* is apparently declining. However, the poor showing was reflected also at other sites in Purbeck and is possibly a reflection of the inclement summer weather experienced during 2008 (B.P. Pickess, pers. obs.).

The southern and western side of the Lake is favoured by the nationally scarce *C. tenellum* where it generally keeps to the ranker vegetation beside the Lake. Numbers are small, often under 10 encountered on a visit and, like *I. elegans,* they appear to have small but stable populations.

E. najas appears to be establishing a small population in the bed of *N. peltata* along the west side of the Lake. As to where these colonists originated is not known but in the past three years males have been noted at other sites in Purbeck where previously they were not recorded (B.P. Pickess, pers. obs.). Possibly this is a species expanding its range.

The status at the Lake of the widespread Purbeck species *Pyrrhosoma nymphula* is a little puzzling but could be in part due to the limited number of visits made during its main emergence period (April to early June). However, if it does have a small established breeding population, observations should be more numerous.

It is somewhat surprising that no observations have been made of one of the most widespread Zygoptera in Purbeck *Coenagrion puella* (Azure Damselfly). The reason for its absence is possibly explained by the species preference for smaller sites that have an abundance of emergent vegetation around the shore edge such as *Potamogeton natans* (Broad-leaved Pondweed), *Eleocharis multicaulis* (Many-stalked Spike-rush), *Sparganium erectum* (Branched Bur-reed), *Juncus bulbosus* (Bulbous Rush). At present these are absent from Squirrel Cottage Lake. For similar reasons this might explain the absence of *Sympetrum sanguineum* (Ruddy Darter), another widespread species in Purbeck.

Even after 15 years the Lake is still very open and with only limited emergent vegetation which might explain why there are only five species of Anisoptera breeding. Not surprisingly both *O. cancellatum* and *S. striolatum* are the principal breeding species and currently have large populations. The population of *O. coerulescens* appears be stable but possibly slowly increasing. This insect is usually to be found along the western edge of the Lake, where it is becoming swampy and *Sphagnum* is increasing.

A. imperator is a very obvious territory-holding species, at times at least three males are present over the Lake and females are seen egg-laying along the edges. The other breeding species, *A. mixta*, is not an obvious insect, males or pairs suddenly appear, then females may be seen egg-laying for a brief while before disappearing. The population is thought to be small.

The absence of fish is certainly beneficial, for a number of species and populations could be affected should they be introduced to the Lake.

The species of breeding Odonata will probably increase as the vegetation matures, especially if more emergent species establish. Dragonflies are very mobile insects and eight species have been recorded as visitors, several of which are potential colonists.

This report gives an indication of the current status after 15 years of the breeding and visiting species, and a baseline for comparisons in the future.

Acknowledgements

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East Stoke: The Old Church of St Mary

IAIN HEWITT, BRONWEN RUSSELL and HARRY MANLEY

Background

The 'Old Church' project has been a shared initiative between and the School of Conservation Sciences at Bournemouth University and the East Stoke Heritage and Archaeological Group led by Barry Quinn. Financial support for the project has been derived from a Heritage Lottery Initiative.

Interest in the now-ruined parish church of St Mary in East Stoke parish was first prompted by Sara Grayson in 2000 and the site was visited by Iain Hewitt (Bournemouth University) the following year. The Old Church of St Mary has thus been named in order to distinguish it from the nearby nineteenth-century church of St Mary the Virgin just a short distance away in the same parish (Figure 1). This report records a programme of assessment and re-evaluation of the site of the Old Church that focuses upon its history and the steps taken to record important elements of the standing remains. A simultaneous programme of non-intrusive archaeological work has also taken place and a report upon the results of this will be made available in 2010.

Location

East Stoke (as it is now known) is a dispersed settlement that is situated towards the south-west of the Civil Parish of East Stoke in the Purbeck District of Dorset. Henceforth, in the interests of clarity, the prefix 'East' will be used only with reference to the parish. For reasons stated below, the settlement name will be given as 'Stoke'. In cases where a quoted source is ambivalent, parentheses will be applied thus: (East) Stoke.

Stoke is approximately 2.6km west of Wareham and 1.2km east of Wool. In recent times Stoke has become synonymous with the associated settlement of Stokeford

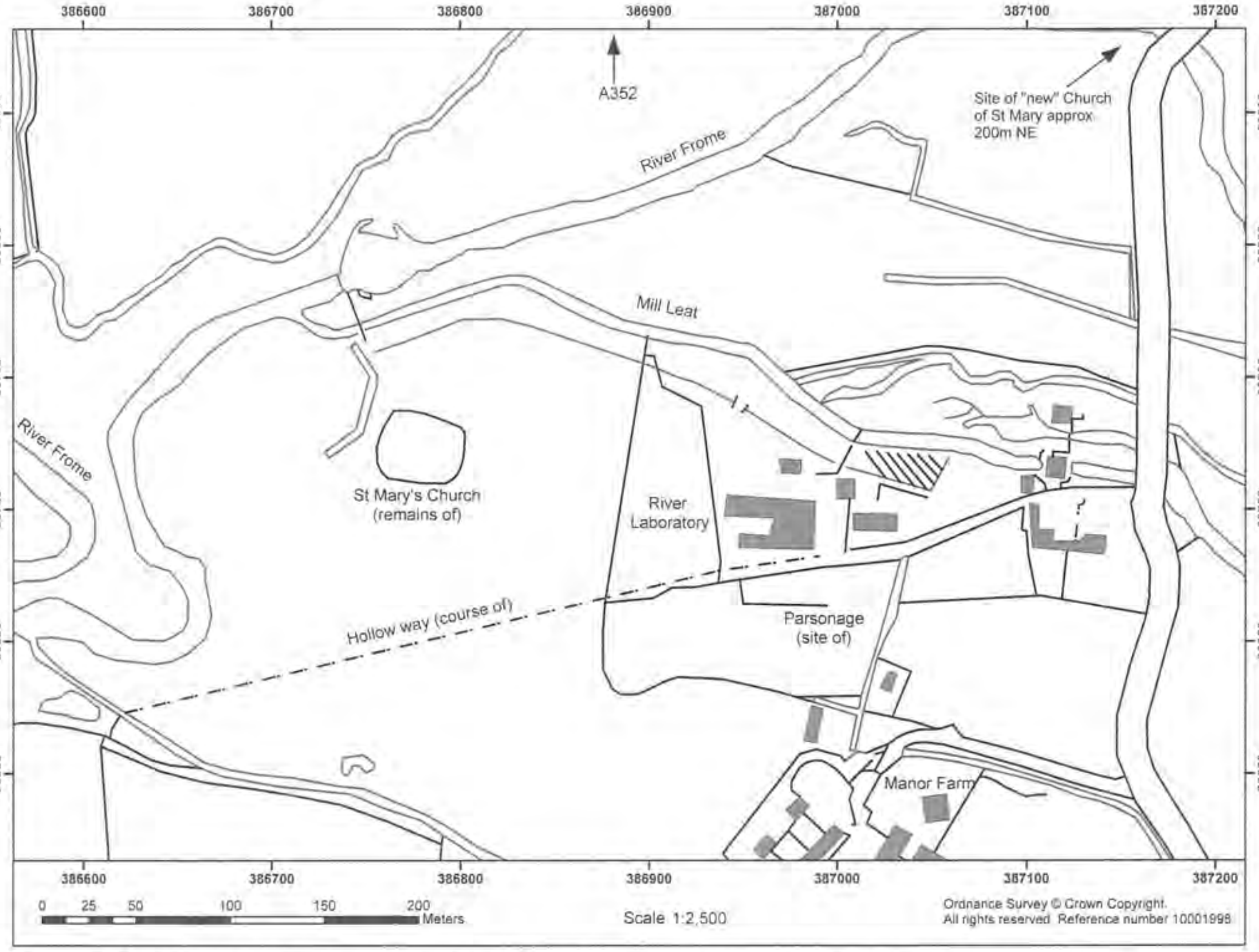


Figure 1: Map showing the location of the Old Church of St Mary in relation to the principal buildings of Stoke. The course of the medieval hollow way is shown as a dashed line

which straggles along the A352 (see Figure 3). At Stokeford, on the south side of the A352 (NGR 387250 087100), stands the early nineteenth-century church of St Mary the Virgin, immediately beyond which a minor road crosses the Poole to Weymouth railway, and bridges the River Frome (Figure 1). It is at this point that one enters the forgotten settlement of Stoke where the site of the Old Church can be found, 300m north-west of Manor Farm.

Geology and Land Use

The remains of the Old Church are in Stoke Meadow the soils of which are alluvial by reason of it being adjacent to the south bank of the River Frome. However, the underlying geology is Bagshot Beds and Heathstone, sometimes known as Carstone (Royal Commission on Historical Monuments, England (RCHME) 1970, 274), a material that is frequently used as a local building material and one which is evident in the remaining structure of the Old Church. Within living memory the meadow has not been ploughed but it has been maintained as grassland for cattle grazing. To the south and north patches of residual heathland are in evidence.

Status

The Old Church and churchyard together comprise Scheduled Ancient Monument 29087, Batch no. 10748, 1999 (County no. 580). The surviving church fabric and gravestones are Listed Grade II. In addition, the graveyard is a common registered as CL 266 (Legg 1995, 20). A number of important references to the Old Church are contained within the Dorset County Council Sites and Monuments Record 6011 (now the Historic Environment Record). These sources and others were re-examined by Whittle (2003), a process that revealed a number of inconsistencies and ambiguities in the written record.

Place-name

The Place-name element *'stoke'* has been explained by Mills as deriving from the Old English *stoc* meaning 'outlying farm building, or secondary settlement' (1998,137). The prefix 'east' is first recorded in 1316 as *'Estok'* and Mills suggests that this might have been a reference to the relative location of the settlement to Bindon Abbey. This hypothesis is plausible but strained. Mills notes that *'East Stoak'* was applied in 1664 (*ibid.*) but the cartographer John Speed used just *'Stoke'* alongside a settlement symbol on his map of Dorset dated 1610 (Nicolson and Hawkyard 1995, 71). It was still *'Stoke'* to Thomas Gerard in the 1620s (Legg 1980, 70) and also to William Seale in 1732 on his *Map of Dorsetshire* (Beaton 2001, 40–41). Furthermore, the Ordnance Survey Second Edition map of 1890–91 has the principle buildings of the settlement as Stoke Farm (now Manor Farm), and Stoke Mill and there is a Stoke Common (southsouth-east), Stokeford Farm (north), and Stokeford Cottage (north-west). The tithe map of 1844 confirms that the Old Church stands in Stoke Meadow (Dorset County Council, D1/LX33/2).

From this brief survey it is obvious that the settlement place-name had not been fixed as 'East Stoke' as late as 1732, or even 1890. It is conceivable that the names 'Stoke' and 'East Stoke' were interchangeable, but one should also consider that they represent an important distinction between parish and settlement in a similar way to 'Sixpenny Handley' and 'Handley' in the District of East Dorset. Hinton and Webster's proposed model for medieval parishes in southeast Dorset has a detached portion of East Stoke immediately to the *east* of Wareham that included Bestwall and Swineham Farm (1988, 52; Keen 1984, 220). If Hinton and Webster's proposal is accepted then the place-name 'East Stoke' might refer to the portion of the parish east of Wareham but which, by virtue of association, also came to be applied to the larger parcel of the parish on the west side of the town. Hinton and Webster argue that the combined portions of East Stoke could have constituted part of the *parochia* of the Saxon minster of St Mary's, Wareham (1988, 50–53). Assuming an early date of origin for the Old Church it is perhaps for this reason that it shares the dedication of its mother church.

The settlement of Stoke

In relatively close proximity to the Old Church were Manor (Stoke) Farm (387000 086600), Stoke Mill (387000 086700) and the Old Parsonage (387000 086670). The fate of the Old Church will be discussed in detail below. Of the others, Manor Farmhouse has been replaced on the same site by a post–1945 successor. According to RCHME the earlier building was of eighteenth-century date (1970, 276). The mill has gone too, and now a river laboratory occupies part of the site. Fortunately, Her Majesty's Commissioners visited the mill prior to demolition and produced a ground floor plan (RCHME 1970, 276). The mill seems to have been a popular subject for artists and a number of perspectives have survived in various forms, including a postcard.

The Old Parsonage has been demolished and the plot, once glebe land, remains empty. The history of this building is of particular interest because of its close spatial and functional relationship with the Old Church. According to Taggart (*c.* 1939, 9–10) the Parsonage was formerly the Rectory or Glebe House, and he indicates that a scrap of paper found in one of the Parish Registers records that its last clerical occupant was Rev. Benjamin Moyse, curate-in-charge of the Parish in 1808. RCHME (1970, 276) suggests that the Parsonage was built in the seventeenth century. A relatively poor photograph of the house survives as a single page from a sale catalogue that shows features that are similar to, but not entirely consistent with the plans of the building as depicted by the Ordnance Survey 1:2500 County map of 1889. In the sale catalogue the Old Parsonage is described as two cottages ideal for conversion into a weekend or country residence (Dorset County Council, Ph 915).

Medieval records

(East) Stoke is mentioned in the Domesday Book (*c.* 1086). It is listed under the holdings of Count Robert of Mortain, half brother of William I (Tillyard 2002, 40–2). The entry is worth quoting in full:

> *Stoke. Edmer held it before 1066. It paid tax for 2 hides. Land for 2 ploughs, which are there, in lordship; 2 slaves; 2 villagers and 3 smallholders with 1 plough. A mill which pays 15 shillings; meadow, 20 acres; pasture 5 furlongs long as wide. The value was and is 50 shillings* (Morris, 1983).

It should be stressed that the Domesday Book was primarily a tax assessment document and its entries have limited value as an indicator of settlement location and topographical detail. In fact, Domesday describes eleventh-century estates and land holdings rather than individual settlements and there can be no guarantee that these in any way equate to the modern settlement landscape. Nevertheless, the Domesday details for (East) Stoke do have a familiar ring. One can imagine the eleventh-century plough lands of the estate on the alluvial soils of the Frome valley but set back from the river to avoid flooding. The meadow, and perhaps the pasture, would have occupied riverside locations. The mill must have been situated on the River Frome, perhaps on or close to the site of its post-medieval successor (but see reservations to this notion below). Overall, the Domesday Book portrays a landscape that has dispersed characteristics and there is no topographical evidence to suggest that Stoke ever developed into a formal village thereafter.

Architectural evidence

No church is mentioned in Domesday Book but this cannot be taken as evidence that there was not one at Stoke in 1086; a chapel dependent on a mother church could have escaped the attention of the Domesday commissioners. The removal of stone from the Old Church after 1828 has left little in the way of worked architectural fragments and this makes it difficult to date the development of the building with certainty. The standing remains, notably the south porch, suggest a date range of 15th to 16th centuries (RCHME 1970, 274) but the foundations of the nave and chancel could be earlier, and it is possible that later modifications have obscured the true date of origin. The medieval font has survived but it is now in St Brendan's Episcopal Church, Franklin's Park, Pennsylvania, USA (Figure 2). A brass plaque is attached to the base of the font which reads:

Figure 2: The thirteenth-century font from St Mary's Old Church as seen at St Brendan's Episcopal Church, Franklin's Park, Pennsylvania, USA (Sara Grayson)

TO THE GLORY OF GOD
THIS ANCIENT FONT BOWL FROM THE OLD CHURCH
WAS RESTORED AND THE NEW SHAFT CARVED
AND PRESENTED TO THIS CHURCH OF ST MARY
BY O.A. HODGSON, M.A. RECTOR. 1885

It is not clear whether the font was transferred immediately from the Old Church to the new church of St Mary the Virgin upon the deconsecration of the former in 1828, but it seems probable that it was in a poor state of repair by 1885 when it was 'restored'. It is this font that was described as thirteenth-century by Her Majesty's Commissioners in 1970 (274; see also Newman and Pevsner 1972, 197). The date of the font may indicate that the original construction of the Old Church can be pushed back to the thirteenth-century, although caution must be exercised because fonts are portable items and this one might have been introduced to St Mary's Old Church from another church of earlier date. The recent history of the Old Church font is a reminder of the transferability of these fittings. However, the date of the font is consistent with the date that the Old Church was first recorded: in the Sarum Registers of 1306 (Hutchins 1861, 422).

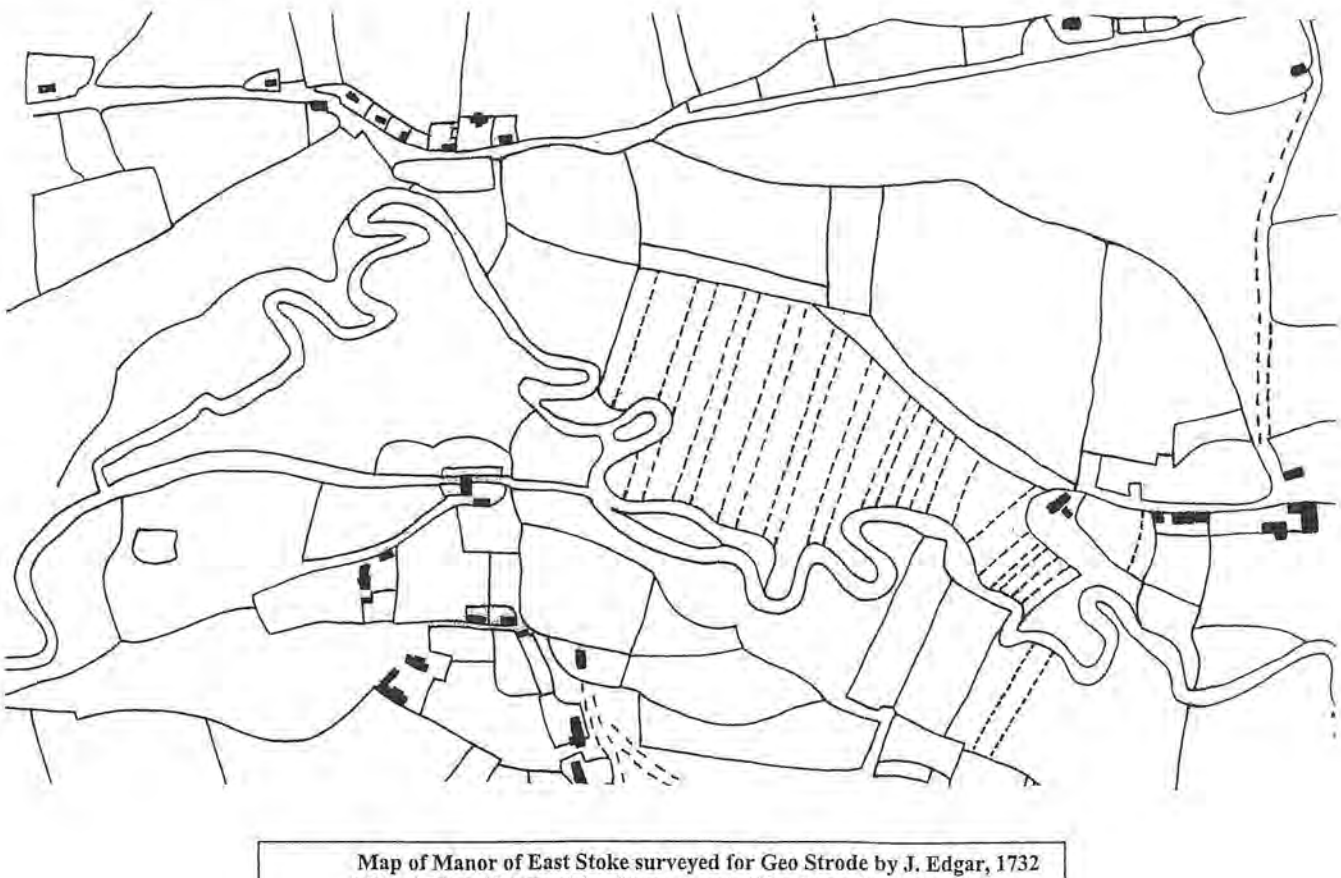
The decision to replace St Mary's Old Church

The story of the demise and replacement of the Old Church of St Mary can be traced to 1825 when the Churchwardens' accounts record a decision to build a new church on the north side of the River Frome (Dorset County Council PE/ESK: CW 1/1 MIC/R/1543). This represented a dramatic change in arrangements because the Old Church stood on the south side of the river. In correspondence dated March 1828 (Dorset County Council, D/BOH: E49) the Rector, Charles Fox, gave four reasons for this break in tradition:

- i The church stood in water meadows (Stoke Meadow) that were low and damp. When, occasionally, these meadows were flooded, it made the church inaccessible to persons on foot without considerable inconvenience.
- ii The fabric of the church stood in need of considerable repairs.
- iii The church was too small, being capable of accommodating only 140 persons out of a population of 500, and increasing.
- vi It would be more convenient if the church was located on the north side of the river near the high road (i.e. the Wareham Trust Turnpike road now known as the A352).

All of these claims can be substantiated, but it is worth examining the evidence in greater detail.

The landscape around Stoke is a palimpsest of dry and flooded water courses, drains, cuts and water meadows that are visible from the air and detectable on the ground. Successive episodes of water management must have had a considerable impact upon settlement buildings including the Old Church. The now demolished Stoke Mill was built *c.* 1820 but the channel that delivered water to the undershot wheel was cut at an earlier date (RCHME 1970, 276) since it is shown as being extant on Edgar's map of (East) Stoke dated 1732 (Dorset County Council, D/KAT/: P3; see above). This artificial channel begins as a spur off the River Frome at a point *c.* 150m north-west of the Old Church, and extends eastwards to the mill, eventually to rejoin the natural course of the River (Figure 3). Schemes such as this would have changed the character of Stoke Meadow. A site that had been suitable for a church in the thirteenth century or earlier was transformed into a watery landscape when the meadows were drowned. It is very probable that dampness was responsible for



Map of Manor of East Stoke surveyed for Geo Strode by J. Edgar, 1732
DRO ref: D/KAT/:P3. Copyright of Dorset Records Office, Dorset County Council

Figure 3: A tracing from a map of 1732 by J. Edgar on behalf of George Strode (Dorset County Council, D/KAT:/P3). The arrow marks the course of the mill leat in 1732. The position of the old churchyard is marked by a cross

some of the necessary repairs to the church fabric as alluded to by Fox.

Rev. Charles Fox had been rector of East Stoke since 1819 (Taggart *c.* 1939, 15) and was resident at Mapperton, near Bridport (Dorset County Council, D/BOH: E49). The replacement of the Old Church was certainly planned by the sixth year of his office, but preliminary discussions with the grandees of the community and the Church are likely to have originated earlier than 1825. Probably, it was a pet personal project and it is interesting to note that the start of Fox's incumbency closely coincided with the passing of an *Act for Building and Promoting the Building of Additional Churches in Populous Parishes, 1818* (Port 2006, 37–43) which established the Church Building Commission. The same year saw the formation of the Incorporated Society for Promoting the Enlargement and Building of Churches and Chapels, known as the Church Building Society. As a result of these developments, the building or re-building of parish churches rose from 57 between 1816–20, to 178 in the period 1826–30 (Gilbert 1976, 130). The early nineteenth-century census returns for East Stoke confirm the population growth alleged by Fox, there having been 318 recorded individuals in the parish in 1801 rising to 519 by 1821 (Page 1975, 267). In part at least, the increased population of East Stoke can be attributed to developments in agriculture. One indicator of this trend is evidence for the enclosure of Stokeford Heath between 1792 and 1813 (Dorset County Council, D/BOH: E43). More land was being brought into production providing new opportunities for settlement and employment.

Settlement drift

Settlement drift away from the traditional centre of Stoke, as represented by the Old Church, Manor Farm, Parsonage and Stoke Mill, must have been triggered by changes to the network of principal road routes in the parish. According to Good (1966, 139) the ancient road from Wareham (westwards) to Stoke (and onwards to Wool) would have been via Rushton (388000 086500). A large section of this road is represented by a public bridleway that follows the north bank of the River Frome and it is unlikely that it provided convenient access to Stoke, which lies on the south side of the river. A better route would have been the one that runs south of the Frome from Stoborough via East Holme and West Holme. Today it is a minor road that is variously known as Holme Lane (east) or Bindon Lane (west), connecting the sites of the former religious houses of Holme Priory and Bindon Abbey. However, even this road did not pass directly through Stoke and in order to solve this problem, a spur route existed that ran from Stoke Mill to a point on Bindon Lane at 386100 088400. This is still a public footpath that is represented by a hollow way approximately 100m south of the Old Church (Figure 1).

This arrangement of traditional routes was disrupted when the Wareham Turnpike Trust was established in 1765–6 (Good 1966, 138). Amongst its projects the Trust upgraded a new stretch of road from the market cross in Wareham through Stokeford and on to Wool (*ibid.* 139). This new route did not pass through Stoke but it is probable that the scheme included bridging the Frome at Stokeford in order to provide access to the church and settlement. The convenience of the new turnpike road (now the A352) is self-evident because it provided a more direct route to markets at Wareham and Woolbridge (Owen 1756, 29). For travellers, Stokeford became an important point of convergence and it is not surprising that it was the location of choice for a new church once the decision had been made to replace the old one.

Overall the case for replacing the Old Church must have been compelling. It was too small, too damp, expensive to maintain and, by the 1760s, off the beaten track.

The process of replacement

Once the decision had been made to replace the Old Church, steps had to be taken to identify a new site, secure the necessary funds, obtain the blessing of the Diocese of Bristol, and to appoint an architect. The Churchwardens' Accounts provide a useful insight into the development and eventual fulfilment of the project but they probably disguise much of the wrangling that went on in the background (Dorset County Council PE/ESK: CW 1/1 MIC/R/1543). The Accounts record the establishment, in 1827, of a project committee that comprised Rev. Charles Fox, Rev. William Bullen (curate), Nathaniel Bond Esq., and four parishioners: J. Garland, S. White, G. Smith and J. Seymour (*ibid*).

In order to qualify for a grant, it was required that the parish should provide the site (Port 2006, 232) and this was identified at Stokeford on the south side of the turnpike road on a plot of land owned by Nathaniel Bond (Whittle 2003, 68). There was clearly some urgency to get the new church up and running because the Faculty obtained from the Diocese in 1828 allowed for the taking down of the Old Church so that the materials might be used in the building of the new church, that was to be commenced without delay (Dorset County Council PE/ESK: CW 1/1 MIC/R/1543). In the interim, Mr Smith offered the use of the storeroom adjoining Stoke Mill as a place of worship, subject to the grant of Faculty (Taggart *c.* 1939, 7). Funds had been obtained for the building project, largely from the pockets of private individuals, but including a Parish Rate and a grant from the Incorporated Society for the Enlargement of Churches (Dorset County Council D/BOH: E49).

The project brief allowed for a building that was not to exceed £1,400 in cost and stipulated that the new church was to accommodate 450 persons, three times the capacity of the Old Church, the whole to be completed within nine months of the undertaking. T.E. Owen of Portsmouth was appointed as architect and builder (Taggart *c.* 1939, 6; Lambeth Palace Library 2009). Apparently, the new church of St Mary the Virgin was opened for worship by Special Licence in January 1829 (*ibid*, 7). Taggart (*ibid*, 8) indicates that the new church did not include a chancel in the first instance. The best explanation for this omission would have been an urgent need to cut costs within a tight budget and completion schedule. However, the architect's plan indicates that a chancel was to have been present at the outset, albeit in diminutive form (Lambeth Palace Library 2009). The apparent haste to demolish the Old Church in order to provide material for the building of its successor may be a further indicator of financial constraint. Eventually, a new larger chancel was built in 1885, the same year in which the medieval font was restored at the expense of Rector Hodgson (see above).

The demolition and abandonment of the Old Church

The grant of Faculty to demolish and replace the Old Church (Dorset County Council PE/ESK: CW 1/1 MIC/R/1543) was a broad statement of intent. The extent to which materials were re-used in the fabric of the new church was not recorded and no thorough building survey of the Church of St Mary the Virgin has been carried out to date. Such a survey might now prove difficult because St Mary the Virgin itself became redundant in 1985 (Whittle 2003, 2) and it has been converted into residential units.

Evidence from some former medieval parish churches (e.g. Otterbourne, Hampshire) demonstrates that the use of their churchyards continued for some years after the demise of the church. In such cases, the chancel frequently continued in use as a cemetery chapel after the rest of the building had been reduced to ground level (Hinton 1991, 73–89). The thorough destruction of the East Stoke chancel argues that the use of the graveyard ceased with the de-consecration of the church in 1828, an assertion that is supported by evidence from the graveyard itself (see below).

Fixtures and fittings

The medieval font aside, RCHME (1970, 274) identified four other fixtures and fittings that had been transferred from the Old Church to the new:

- 2 × eighteenth-century coffin stools; and
- Monument to Sarah (Reynolds), wife of Thomas Witt of Woolbridge, 1814, and Thomas Witt, 1824.

The fourth item was one of two bells mounted in the tower of the new church. It was inscribed *William Lockier church warden Clement Tosiear cast me in the year 1698*. According to Dalton (2000, 262), who inspected it when *in situ* in the the 'new' church of St Mary the Virgin, this was a strange-sounding tenor bell. The tombstone of a William *Lockyer* (deceased 1699) is one of those that have survived in the graveyard of the Old Church near to the south porch amongst those of the worthies of East Stoke (Feature 5). It is virtually certain that both inscriptions refer to the same individual (Table 1). After 1985, the Lockier/Tosiear bell was put in storage at Salisbury, where it still awaited a new home in 1998 (*ibid*, 262).

Architectural fragments and building plan

In 1861 Hutchins described the medieval church of St Mary as '. . . a small building which included a nave, chancel and tower' (422). The surviving ruins of the Old Church of St Mary stand off-centre (north-west) within a sub-rectangular churchyard that measures *c.* 40m east/west by 20m. The approximate dimensions of the church were 20m east/west by 10m. The standing fabric amounts to a section of the south wall that stands to *c.* 2.5m in height and a substantial portion of the south porch to a maximum of *c.* 1.5m tall. A drawing in Taggart shows the arch of the fifteenth-century porch as complete and standing (*c.* 1939, 6). Likewise, a Gothic window aperture is visible in the section of the south wall adjacent to the porch, though apparently with no vestige of tracery. RCHME (1970, 274) claims that both the porch arch and the remaining south window fell between 1948 and 1963. The RCHME site description (*ibid*, 274–5) also identifies a small quatrefoil window (now lost) and a stoup on the internal east wall of the porch (present). The same source mentions a scratch (or mass) dial on the southeast external wall surface of the porch. The mass dial has survived (Figure 4) although as a consequence of the density of the vegetation, Le Pard (1998) failed to find it (or indeed the porch) during his survey of Dorset medieval 'sundials'.

The nave, tower and chancel of the Old Church are collectively represented by a shallow scoop along their combined length and width. First impressions are that this is a quarry ditch from which flooring materials have been removed during demolition in 1828–9. However, this is unlikely to be the case because the whole of the churchyard appears to be situated upon a low knoll, an artificial feature that has been created by successive generations of burial. According to a model proposed by Morris, as burials accumulated the level of a churchyard rose whilst the floor of the church remained relatively constant and therefore at a lower level to that of the ground outside (1989, 241 Figure 65 and 320). If the church was suffering from dampness by the 1820s then here was another contributory cause. Alternatively, and at an unknown date, the floor level might have been lowered deliberately in order to enhance the impression of height and space within the church. Whatever the case, it should be noted that the floor of the south porch seems to be level with the surface of the graveyard, which would have made it necessary to step down from the porch when entering the nave. There is no evidence to indicate that the level of the porch floor was ever raised to make good any difference with the progressive rise in the level of the churchyard. This curious drop in levels between porch and nave fuels the suspicion that the porch is a relatively late addition, since it merely abuts the surviving section of south wall rather than being 'bonded in' as one might expect.

Another feature of the porch is that it is constructed of limestone ashlar blocks that would be worthy of a higher status building than a small rural parish church (Figure 4). Given their quality, it is equally strange that the building materials from the porch were not incorporated into the new church of St Mary the Virgin. Child (2007, 96) describes the parish church porch as 'the heart of village life'. It was the place where the first part of the marriage ceremony was carried out, it was linked to the service of baptism and a place where promises or deals were solemnised. The presence of the stoup within the porch at of the Old Church underlines the pivotal role of the porch within the community. Perhaps it was for this reason that it remained substantially intact, including its mass dial, when the rest of the church was demolished in 1828.

The churchyard

The Old Church group of headstones contains some fine examples of late seventeenth-century and early eighteenth-century work. These are concentrated to the south-west of the churchyard, apparently lining a path that led to the porch. Being the earliest examples of marked graves at the site, they occupy the coveted space on the south side of the church. Of particular note is the 1730 headstone to Spicer (Feature 1). At the other end of the scale, but also on the south side of the church, is a simple stone to WN 1675. If the date is correct, then it is the earliest visible member of the group. The latest burial to be commemorated is dated 1822 to Chisman of East Holme Farm and this is in the unfavoured area to the north of the church. East Holme, a separate parish, had no church of its own from 1715 until 1866 (RCHME 1970, 132) and conceivably this north side of the Old Church graveyard was set aside for East Holme parishioners. If so, then this would have added to the crowding of burial space which must have been at a premium. There is no record of graveyard crowding being given as a reason to relocate the church.

There are three graves that are marked by chest tombs (Lees 2000, 55–72). One of these is close to the entrance to the porch, the other two are on the north side of the church close to the stone of Chisman. They are all in such a state of disrepair that the subject of their dedications is a matter for speculation. However, one of the northern chest tombs was constructed of brick which is relatively rare (Lees 2000, 132).

Conservation issues

The present state of the churchyard and the remaining fabric of the Old Church give cause for considerable concern. Clearly there is a desperate need for a management plan for the site that must include the preservation and conservation of the surviving church and churchyard features in addition to appropriate interpretation of the monument. No less important is the imperative need to protect the delicate ecology of the site and to secure its future as a haven for biodiversity (Greenoak 1985). Selective clearance of encroaching tree saplings was undertaken by Dorset County Council's Conservation Ranger team and this has enhanced the biodiversity of the site. However, photographs of the site taken over the past fifty years by members of the East Stoke community have demonstrated that the graveyard monuments have succumbed to much wear and tear. It was therefore thought fit to make these a priority for attention by recording their form and inscriptions as a future historical resource. Manual transcription, photography and laser scanning have been applied and it is the last of these that is explained and illustrated below.

Laser scanning methodology

Laser scanning required that the gravestones were as close to vertical as possible. However, in a number of cases, such as the three headstones of the Burden family on the west side of the churchyard, these memorials were in various states of disarray. It was therefore necessary to apply for Scheduled Monument Consent in order to correct the alignments prior to commencing the scanning process.

Scanning of the gravestones was undertaken using a Konica-Minolta VI 900 laser scanner fitted with an 8mm wide angle lens. The scanner was positioned vertically at ground level approximately 0.5m from the gravestone face. A series of overlapping scans were then collected until the entire gravestone surface had been had been recorded. To control ambient light levels, all scanning was undertaken beneath a temporary shelter.

The individual scans were post-processed using *Polygon Editing Tool v2.02*. Extraneous data was removed and small holes in the data were filled manually. This usually occurred when moss on the gravestones detracted the laser, thus creating areas of 'no-data'. Individual scans were then registered and merged into one complete composite scan for the entire gravestones. The typical error average and Sigma was 0.08–0.11 and 0.10–0.14 respectively. The composite scans were then exported into *Paintshop Pro v7* for final minor editing and cropping.

Results

The results of the scanning technique are illustrated overleaf. Each monument appears in Site Feature order

Features: Scanned images (all copyright of Bournemouth University)

Feature 1

Feature 2

Feature 3

Feature 4

Feature 5

Features: Scanned images (all copyright of Bournemouth University)

Feature 25

Feature 26

Feature 27

Feature 34

Feature 36

Table 1: East Stoke Graveyard Survey

Feature	Details	Laser scan image
1	Headstone at west end of churchyard. Leans to the west. Inscription reads: August 16 1728 then/Died Joan Spicer wife of/William Spicer being aged 83/November 10 1730 then/Died William Spicer the/Elder being aged 73 yr	Yes
2	Headstone at south-west end of churchyard. Inscription reads: Here/lieth the b/ody of Jane/the wife of/Alexander Lumber who/ Dyed March/4th An. Do 1711	Yes
3	Headstone at south-west end of churchyard. Inscription reads: Here lieth/the body of/ Richard Smith/Son of Richard/Smith who dyed/the 23 day of Sep/1698	Yes
4	Headstone at south-west end of churchyard. Inscription reads: Here lyeth the Body/of Sturton Dawe/Gent of this parish/who dyed June the/7th day An. D. (1704)	Yes
5	Headstone at south-west end of churchyard. Inscription reads: William Lockyer/I am (was) as thov art/(T)how shalt be as I am/In Adam we shall/All die in Christ/We shall all be/Made alive/1699	Yes
25	Headstone situated on the east side of the churchyard. Corrected to perpendicular 21.5.2008. Inscription reads: In memory of/William Burden Junr/Who died the 12th October/1768/In the 52nd year of his age/also/Jean the wife of William/Burden Junr who Depar/ted this life the 26th of/November 1773/In the 57th year of her age	Yes
26	Headstone situated on the east side of the churchyard. Inscription indistinct but the scanning process has revealed: In Memory/of Charles Burden/who Departed this/Life 13th January 1788/Aged 50 years.	Yes
27	Headstone situated on the east side of the churchyard. Corrected to perpendicular 21.5.2008. Inscription reads: Here Lieth Buried ye/Body of William Burden/Senior of Woolbridge. He/Died ye 5th October 1747 Agd 72 Here also Lieth the Body of/Mary the Wife of William/Burden senior of Woolbridge/Who died ye 28th July 1757/Aged 79(ne) years	Yes
34	Headstone situated immediately to the north of F32 and F33. Inscription reads: To the Memory of/Robert Chisman/Good Carter and faithful Servant/and an honest Man/He served as a Carter on/East Holme Farm thirty six years/under five successive Masters/to the entire satisfaction of each/died July 21/In the Year of our Lord 1822	Yes
36	Headstone situated to the east of the churchyard. Inscription reads: In memory of/Mary Plowman widow/who died 26 of Jan 1758/Aged 78 years/A pious Christian lieth here/A virtuous wife and mother dear/Who patiently affliction bore/But now is blest for evermore/ All you my friends as you pass by/As you are now [so] once was I/As I am now . . . fo(r ever?) . . .	Yes

and these can be cross-referenced to the Feature numbers and transcription data in Table 1.

Conclusions

The need to correct the alignment of a number of the gravestones prior to scanning revealed that these were not set at a depth exceeding 0.4m, usually less. This made the stones vulnerable to toppling and it is possible that some lie buried. The slabs of the three known chest tombs have all been removed from their bases since the 1960s. Three broken slabs have been identified but at present their original position cannot be ascertained. They were not included in the present scanning process. Also omitted were the small standing gravestone to WN 1675 and a monument to Charles Batten (buried 1689) for both had become lost within the reasserting undergrowth.

In a number of instances, the scanned images have helped to clarify gravestone inscriptions, and in particular that of Mary Plowman (Feature 36) which is of poor quality limestone and therefore vulnerable to weathering near to the base.

All of the recorded images now can be used for exhibitions and replicas. This has provided a focus for the project as a whole, which has attracted a strong local following and reawakened interest in the remains of the Old Church and in the history of the community as a whole. The funded project concludes in 2009 but the potential for further work is considerable.

Acknowledgements

The authors would like to acknowledge the support of the landowner, Malcolm Barnes whose co-operation

Figure 4: The south-east corner of the porch of the Old Church. The ashlar blocks of this section have been cut in a curious fashion that suggests that the porch was re-assembled here after being removed from a previous site. The mass dial is 'scratched' upon the uppermost surviving stone (Iain Hewitt)

is much appreciated. Imperative to the success of the project was the contribution of Barry Quinn and Sara Grayson of the East Stoke Heritage and Archaeological Group who have inspired and organised throughout. Steven Wallis (Senior Archaeologist, Dorset County Council) and Duncan Coe (formerly of English Heritage) gave much valuable support in the initial stages of the project. Danny Alder, Paul Jones and Will Holland facilitated the initial management of the churchyard vegetation. Many others at Bournemouth University have contributed too, including Dr Kate Welham and former students Leila Whittle, David Stewart and Fiona Jackson.

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*Contextual evidence indicates that this volume was written in 1939 or soon afterwards.

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'Deviant' burials from a late Romano-British Cemetery at Little Keep, Dorchester

JACQUELINE I. McKINLEY and KIRSTEN EGGING DINWIDDY

Summary

Excavations on land adjacent to Little Keep on the west side of Dorchester recovered part of a late Romano-British cemetery including 29 inhumation graves and a mortuary enclosure. The well preserved human remains were accompanied by a small assemblage of grave goods and coffin furniture. The 'deviant' mortuary rites of decapitation and pronation of the body were recorded with unusually high frequency within a cemetery population showing distinct demographic differences from that seen in the contemporaneous neighbouring Poundbury cemetery.

Modern usage of, and connotations attached to, the word 'deviant' deflect from the basic meaning of the word which is simply ' . . . departing from normal standards' (OED 2006). By the late Romano-British period burial practices in the southern half of Britain were relatively standardised, the corpse generally being laid extended and supine, often within a wooden coffin and frequently on an east–west alignment (Philpott 1991, 53 and 226). Variations from this 'norm' may be referred as 'atypical', 'non-normative', 'anomalous' or 'abnormal', but the meaning remains the same (Tsaliki 2008). Such unusual burials may involve a range of what may be considered greater or lesser variations. The latter could include slight differences in arm or leg position and orientation of the grave or the burial within it. It is generally the more striking departures from the norm, however, which are labelled as 'deviant'; decapitation, prone burial or the presence of items which may have comprised some form of restraint (*ibid.*; Aspöck 2008). It has been argued that, given the regularity if not frequency with which such variations in the 'normal' mortuary rite occur, 'deviant burials' actually form part of the normal burial practice (Aspöck 2008).

The proportion of burials at Little Keep which conform with the normal burial attitude is unusually low (41%), and the cemetery is notable for the high frequency of deviant burial positions and other mortuary treatments. The remains of only three wooden coffins were identified (*c.* 10% burials), a considerably lower proportion than seen at the other cemeteries serving the town (see below) where the majority (over 67%) were coffined. Of the individuals buried in the cemetery 17% had been decapitated and 41% had been laid prone. This report focuses on aspects of these deviant mortuary rites, the interpretation of which requires the cemetery and the data pertaining to the individuals recovered from it to first be set in its local and wider context. The form and nature of the population burying their dead here will have been of major importance within the mortuary rite, but gaining access to the significant factors affecting the adopted burial form, even in individual cases, is far from simple.

A more detailed report on all the findings from the site (Egging Dinwiddy 2009) is available as a Wessex Archaeology internet publication (www.wessexarch.co.uk).

The Cemetery

The cemetery lay within a *c.* 0.4 hectare area of land (centred on NGR 368600 090800) about 200m west of the known line of the west wall of Roman Dorchester (*Durnovaria*) and to the south of the route of the Roman road (now Poundbury Road) leading to the north-west (Figure 1). The origin of the town, founded around AD 60–65, is uncertain though various potential foci for development have been postulated including a military base or camp (e.g. Frere 1974, 74; Wacher 1978, 316; Field 1992, 125–34; Putnam 1998, 94), a pre-existing shrine (Woodward *et al.* 1993, 367; Trevarthen 2008) and its position at the junction between roads to Exeter, Ilchester and Weymouth (Hinton 1998; Trevarthen 2008). It formed an important regional administrative centre until the later 4th–early 5th century (for a recent summary see Trevarthen 2008).

The Little Keep grave group formed one of several contemporaneous cemeteries around Dorchester, the largest of which, Poundbury, lay only *c.* 300m to the north (Figure 1: RCHM(E) 1970, 582–5; Green *et al.* 1981; Hughes 1989; Farwell and Molleson 1993; Davies *et al.* 2002; Wessex Archaeology 2008). The excavated area revealed an unquantifiable portion of a cemetery which could have formed the northern 'liminal zone' of a large grave group, perhaps delineated by the steep slope down to the Poundbury Road (Figure 1); such liminal areas often being associated with disparate burial attitudes (Farwell and Molleson 1993; Philpott 1991). The various singletons and small grave groups discovered in the triangular parcel of land between the Poundbury and Bridport Roads since the 19th century (RCHM(E) 1970; Figure 1) – including an unspecified number on the southern part of the excavated area in the 1930–40s during drain laying and air-raid trench excavation – may all form part of the same cemetery together with Little Keep, or they could represent a series of smaller cemeteries.

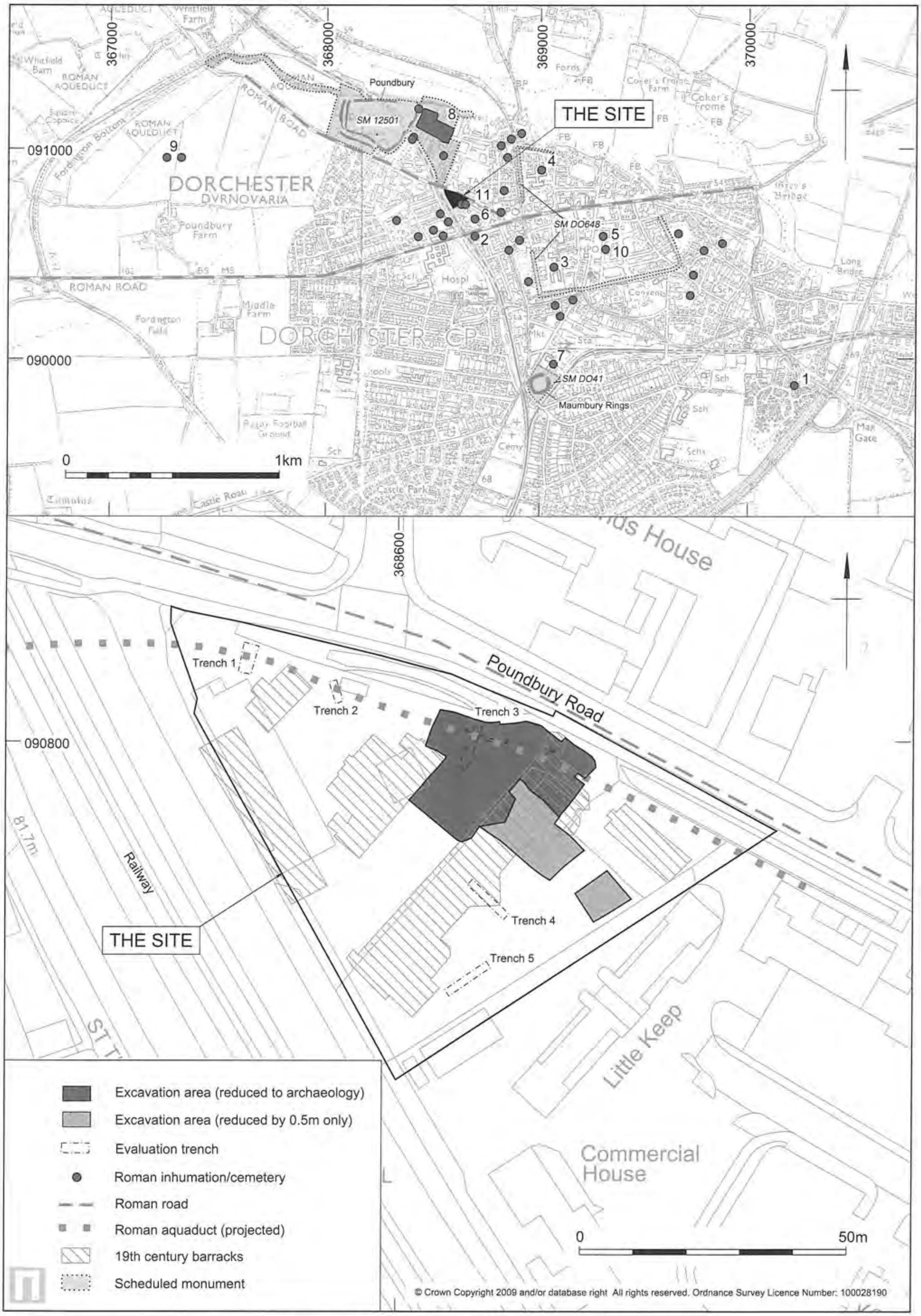

Figure 1: Site location (see Gazetteer Table 10)

Cemetery Features and Grave Goods

The 29 graves and six features believed to represent the remains of truncated graves (Figure 2; Table 1) all cut into the chalk bedrock through the heavily truncated remnants of the Romano-British land surface. The rectangular or sub-rectangular grave cuts were mostly aligned east–west (probably under the influence of the road alignment), with a few northwest–southeast and north–south, the latter located close to the mortuary enclosure (1126). The graves formed five roughly north-south rows with a concentration between ditch 1124 and the mortuary enclosure (Figure 2); two sets of two intercutting graves were situated within the concentration. The adult graves averaged 1.94m in length (range 1.55–2.25m) and 0.66m in width (range 0.42–0.91m), with a mean depth of 0.40m (range 0.15–0.66m); the infant and juvenile graves were consistently shallower at 0.15m. Large flint nodules were noted in the majority of grave fills (silty clay with chalk rubble) and in three cases (1087, 1108 and 1111) may have been placed to help keep the body in position.

Most (75.8%) of the burials had been made east–west, with four (13.7%) west–east, two south–north and one north–south. Most bodies (48%) were laid extended and supine, but a high proportion (*c.* 44%) were laid prone, and in two graves they were flexed (Table 1). Coffin nails were recovered from three graves (Table 1: all Poundbury type 1a; Mills 1993, 115) but the majority (90%) of the burials had not been made coffined, and the tight position of the limbs suggests that the most corpses were shrouded.

Few graves contained goods of any form (Table 1). Hobnails (1–58 per grave) were recovered from five graves; in three instances (1025, 1053, and 1056) the individual had been buried wearing the boots/shoes (probably *caliga* type; Rhodes 1980, 113–114) and in a fourth case (grave 1117) the footwear was placed within the coffin but to either side of the knees. Grave 1009 contained 4th century AD copper alloy coins, possibly originally placed in the mouth (Figure 3); it is relatively unusual for such late coins to appear as grave goods and their presence suggests a continuation or resurgence of the pagan burial rite where coins were provided to pay the ferryman on the journey over the river Styx. Copper alloy staining on the skull and mandible from grave 1069 also indicates the presence of grave goods, probably coins, but none was found.

Five other graves contained single nails which may have had apotropaic significance. Those from graves 1009 and 1039 were found under the chin and immediately in front of the face while those from graves 1048 and 1117 had been placed on the right hip. In grave 1108, a nail was situated at the top of the neck in place of the skull which had been removed and placed by the feet. The use of nails in ritual or magical contexts, to ward-off evil spirits or to 'fix' the dead for example, has been discussed elsewhere (Black 1986, 223; Dungworth 1998, 153; Tsaliki 2008) and may provide a possible explanation for the positioning of these nails. All were found with adult males, three of which had evidence for healed violent trauma although there was nothing to link the position of the nails with this or any other of the observed pathological lesions.

Five features (1059, 1061, 1094, two not numbered; Figure 2) of similar size, shape and form but with poorly defined edges, appeared as 'stains' in the

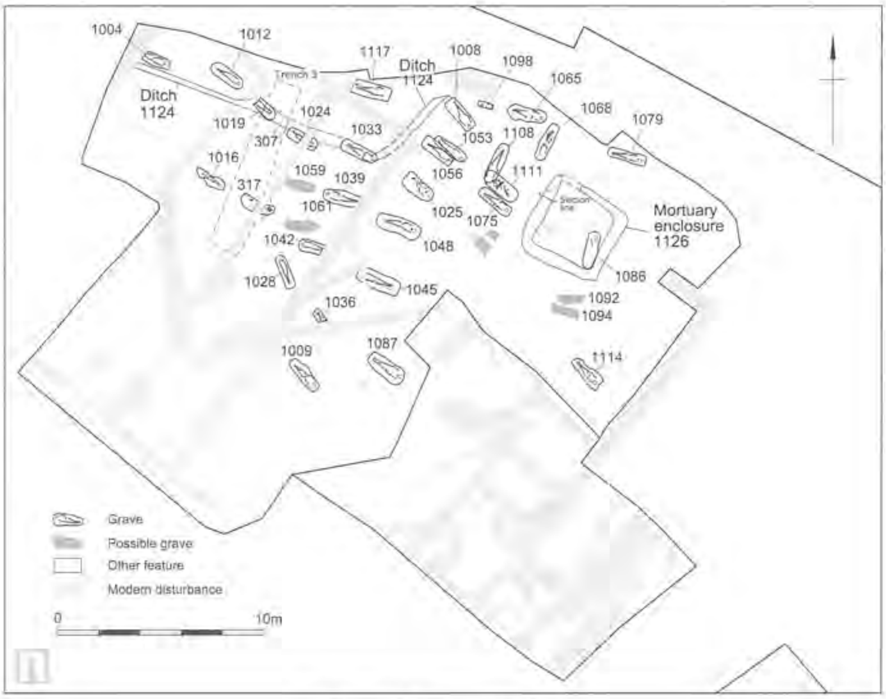

Figure 2: Cemetery plan

Table 1: Summary grave catalogue

grave	dimensions	burial type	human remains	grave goods/coffin furniture
317	1.57 × 0.65m, 0.25m deep	prone (313)	*c.* 20%; adult *c.* 50–60 yr F	
1004	1.40 × 0.55m, 0.31m deep	supine (1005)	*c.* 78%; adult *c.* 40–50 yr M	
1008	1.78 × 0.67m, 0.50m deep	supine (1015)	*c.* 92%; adult *c.* 50–70 yr M	
1009	1.85 × 0.60m, 0.42m deep	supine (1011A) + redep. bone (1011B)	*c.* 95%; adult *c.* 35–45 yr M + 1 bone (u.) adult *c.* 35–50 yr M	ONs 10, 22 and 23 – Cu-alloy coins (*nummus* inc. two House of Theodosius); ON 24 – Fe nail shank (apotropaic?)
1012	1.78 × 0.63m, 0.36m deep	supine (1013)	*c.* 90%; adult *c.* 30–40 yr F	
1016	1.82 × 0.42m, 0.20m deep	prone (1017)	*c.* 40% a.u.l.; adult *c.* 45–60 yr ??M	
1019	1.20 × 0.65m, 0.50m deep	supine (1020)	*c.* 40% a.u.l.; adult *c.* 30–35 yr M	
1024	1.58 × 0.60m, 0.45m deep	prone (1023)	*c.* 55%; adult *c.* 35–45 yr F	
1025	1.55 × 0.60m, 0.40m deep	coffined, flexed (1026)	*c.* 80%; subadult *c.* 12–14 yr ??F	ONs 11–16, 18–21, 25–28, 51 and 123 (18 coffin nails); ONs 17, 30, 31, 52, 122 and 124 (58 hobnails)
1028	1.74 × 0.49m, 0.31m deep	supine (1029)	*c.* 75%; adult *c.* 50–60 yr F	
1033	1.83 × 0.62m, 0.15m deep	prone (1032)	*c.* 60%; adult *c.* 40–45 yr M	
1036	0.70 × 0.40m, 0.15m deep	supine (1038)	*c.* 40% a.u.l.; infant/juvenile *c.* 4–6 yr	
1039	1.90 × 0.73m, 0.48m deep	prone (1040)	*c.* 100%; adult *c.* 23–26 yr M	ON 29 – Fe nail (apotropaic?)
1042	1.17 × 0.61m, 0.45m deep	prone (1043)	*c.* 75%; adult *c.* 60–70 yr F	
1045	2.21 × 0.75m, 0.34m deep	coffined, supine (1047) decapitated	*c.* 95%; adult *c.* 50–60 yr M	ONs 32–50, 53–62, 64–93, 96–102, and 129 (65) Fe coffin nails with preserved wood
1048	2.25 × 0.80m, 0.33m deep	supine (1049)	*c.* 98%; adult *c.* 35–40 yr M	ON 63 – Fe nail (?apotropaic); ON 125 – hobnail
1053	1.79 × 0.53m, 0.48m deep	prone (1052)	*c.* 85%; adult *c.* 40–45 yr M	ONs 94, 120 and 126 (70 hobnails), 1 small cleat
1056	1.77 × 0.66m, 0.44m deep	prone (1055) + redep.	*c.* 95%; adult *c.* 40–50 yr F + 26 frags. a.u.; min. 1 adult *c.* 25–50 yr	ON 95 (24 hobnails)
1065	1.84 × 0.58m, 0.40m deep	prone (1066A) + redep. (1066B)	*c.* 99%; adult *c.* 50–60 yr M + 1 tooth; adult *c.* 20–30 yr	
1068	1.97 × 0.60m, 0.53m deep	supine (1069) decapitated	*c.* 99%; adult *c.* 35–45 yr F	
1075	1.85 × 0.55m, 0.30m	prone (1076)	*c.* 90%; adult *c.* 40–50 yr M	
1079	1.90 × 0.53m, 0.32m	prone (1080)	*c.* 90%; adult *c.* 40–45 yr F	
1086	1.84 × 0.63m, 0.25m	supine (1085)	*c.* 30% s.a.u.; adult *c.* 35–45 yr M	

grave	dimensions	burial type	human remains	grave goods/coffin furniture
1087	2.05 × 0.91m, 0.30m deep	supine (1089)	*c.* 99%; adult *c.* 35–45 yr M	?stone bead
1092	1.23 × 0.50m, 0.17m deep	no bone (previous excavation)		
1098	0.76 × 0.29m, 0.15m deep	supine (1097)	*c.* 35%; infant *c.* 6–9 mth	
1108	1.90 × 0.55m, 0.57m deep	prone (1109) decapitated	*c.* 99%; adult *c.* 60–70 yr M	ON 103 – Fe nail (?apotropaic)
1111	1.90 × 0.78m, 0.66m deep	on right side (1112) decapitated	*c.* 95%; adult *c.* 50–60 yr F	
1114	1.75 × 0.79m, 0.23m deep	supine (1115)	*c.* 95%; adult *c.* 30–40 yr M	
1117	1.88 × 0.73m, 0.53m deep	coffined, supine (1118) decapitated	*c.* 90%; adult *c.* 40–50 yr M	ONs 107–8, 113 and 127 (6 hobnails); ON 118 – Fe nail (?apotropaic); ONs 104–6, 109–112 and 114–7 (11 Fe coffin nails)
		redep. (1121) service trench 1120	*c.* 10% a.u.l.; adult *c.* 35–45 yr F (?=1023) + 1 frag. a.; adult *c.* 40–45 yr ?F (?=313)	
		u/s redep.	2 frags. l.; adult > 18 yr	
		redep. (300/308)	1 bone. l.; = 313	

key: redep. – redeposited; s. – skull, a. – axial skeleton, u. – upper limb, l. – lower limb (skeletal areas recovered where all not represented)

natural chalk and are likely to represent the severely truncated remains of graves. One other possible grave (1092) devoid of human remains, situated to the south-east of the mortuary enclosure, could be one of those excavated in the 1930s.

The ditched mortuary enclosure (1126) in the north-east corner of the site described an area *c.* 16m² (Figure 2). The contiguous ditch had a shallow (0.06–0.13m), concave profile with naturally deposited fills similar in nature to those of the graves; the only associated grave cut through the upper fill of the ditch and was clearly not an original integral feature. Parallels can be found both locally and nationally, and within Continental Europe. British examples vary in terms of size and form (McKinley 2008, 188), and feature R4 at Poundbury represents the closest parallel to the Little Keep example (Farwell and Molleson 1993, 49–50, 235), but various other enclosures devoid of associated burials have been found at St Stephens cemetery in St. Albans, Winchester and Wederath, Belgium (McKinley 2008, 188–9; Cordie-Hackenberg and Haffner 1997; Haffner 1989; Cordie 2006). An area of rooty disturbance in the Little Keep enclosure suggests there may have been shrubs or a tree planted within it; at least one of the enclosures at Ryknield Street, Wall contained a contemporaneous tree-hollow which, it was suggested, may have been an extant part of the enclosed area (McKinley 2008, 188; Booth 2008, 529). Farwell and Molleson (1993, 235) suggested that these enclosures formed bedding trenches for bushes, flowers or an enclosing hedge. In France 'empty' enclosures have been interpreted as miniature gardens, possibly associated with banqueting and the Roman traditions of holding commemorative and religious feasts at cemeteries in memory of the dead e.g. *paternalia* (McKinley 2008, 189; Alcock 1980; Toynbee 1996). The Little Keep enclosure may have followed this tradition.

The People

Analytical methods

Age and sex were assessed using standard methods (van Beek 1983; Bass 1987; Buikstra and Ubelaker 1994; Scheuer and Black 2000). Measurements were taken (Brothwell and Zakrzewski 2004) and skeletal indices calculated where possible (Trotter and Gleser 1952, 1958; Bass 1987). Non-metric traits were recorded in accordance with Berry and Berry (1967) and Finnegan (1978). A summary of the results is presented in Table 1; further details can be found in the internet publication (Egging Dinwiddy 2009) and full details are held in the archive.

Taphonomy

Some level of disturbance to the burial remains was fairly common (*c.* 34%). Intercutting between graves

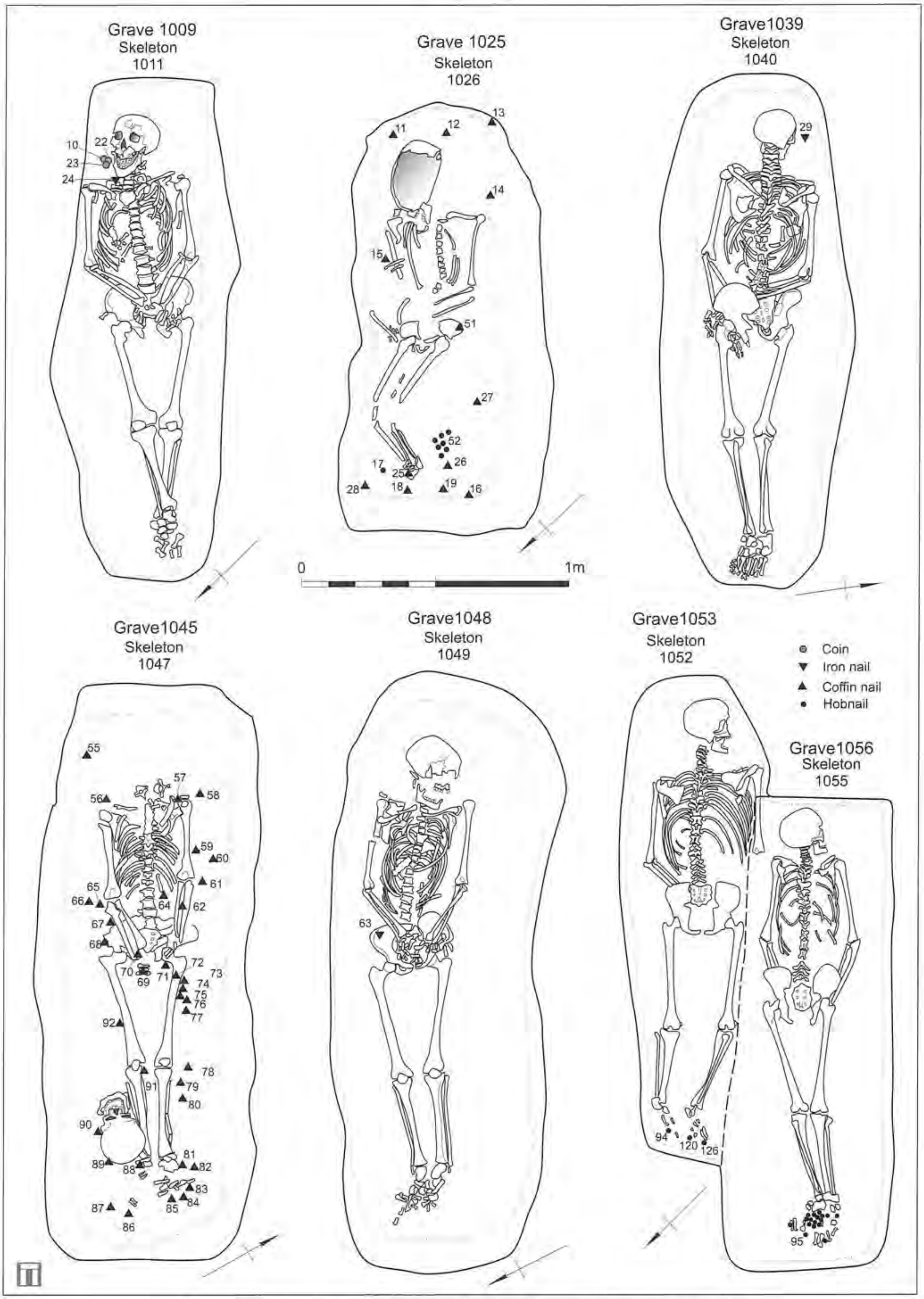

Figure 3: Graves 1009, 1025, 1039, 1045, 1048 and grave 1056 cutting grave 1053

Table 2: Summary of age/sex of identified individuals

	unsexed	female	male	total
infant 0.5–5 yr	1			1
infant/juvenile 4–6 yr	1			1
subadult 13–18 yr				1
c. 20–30 yr			1	1
c. 30–40 yr		1	3	4
c. 35–45 yr		3	5	8
c. 40–50 yr		1	3	4
> 45 yr				1
50–60 yr		3	2	5
50–70 yr			1	1
60–70 yr		1	1	2
totals	2	9	16	29

occurred in only two cases, with minimal disturbance to the remains of the burial. Modern service and foundation trenches had cut through parts of six graves and two appear to have been partially or completely excavated during the previous redevelopments (Figure 2). The percentage of skeletal recovery from the *in situ* remains averaged 77% with over 70% of the graves containing more than 75% of the skeleton (Table 1). Bone preservation is generally good, with more than half the skeletal remains scored at grades 0–2 (McKinley 2004, Figure 7.1–7).

Demographic data

A minimum of 29 individuals was identified, one from each of the excavated graves (excluding those seen only as shadows/stains). Most of the small quantity of redeposited bone recovered probably derived from the disturbed *in situ* burials and could be accommodated within the minimum number counts (MNI). The only possible exception could be 1011B which, on the basis of contextual data and distribution of the remains, may represent the remains of an additional adult male *c.* 30–50 years (NB. not included in subsequent calculations).

The assemblage includes the remains of three (*c.* 10%) immature individuals and 26 adults (*c.* 90%; Table 2). All except one of the adults (possible male) were securely sexed, showing a much higher proportion of males (61.5% adults) than females (35% adults); the subadult was tentatively sexed as female. The median age range for all adults is 35–45 years, there being little variation between the sexes. Only one adult, a male, was less than 30 years of age and a substantial proportion (35% adults) were over 45 years. A much higher proportion of the female adults (44%) fell into the older adult group than did the males (25%).

The excavated graves form an unquantifiable sample of the cemetery population and there are various other extrinsic factors which could create a biased view of the cemetery population. For example, the graves of the younger immature individuals were substantially shallower than the average for those of adults and it is possible that some of the former could have been obliterated by later disturbances. The common absence of neonatal (0–6 months) remains from Romano-British cemeteries is a well recognised part of the mortuary rite (Philpott 1991, 97–102; Struck 1993; Scott 1999, 115; McKinley forthcoming) and such remains have been recovered from various locations within Dorchester including Greyhound Yard (Rogers 1993), County Hall (McKinley 1993a) and Wollaston House (McKinley 2005).

On the basis of the currently available evidence, however, the proportion of immature individuals is low compared with the 25% from the late Romano-British cemetery at Alington Avenue, Dorchester (Figure 1; Davies *et al.* 2002, 129), 30% from Lankhills, Winchester, Hampshire (Gowland 2002) and 33% (including 5.8% neonates) from Poundbury (Molleson 1993, table 62). The poor representation of immature individuals within the assemblage could be related to the similarly low percentage of young adults (3.8% compared with 7.8% and 28% from Poundbury and Lankhills respectively), which could be a reflection of a preponderance of older adults within the general population using the cemetery, resulting in a low fertility rate.

The higher ratio of male to female adults has been observed within some other contemporaneous inhumation cemeteries, the close to 2:1 ratio at Little Keep being similar to that from Cirencester, Gloucestershire (57% males, 26% females; Wells 1982) and the late Romano-British cemetery at Alington Avenue (59% male, 27% female; Davies *et al.* 2002, 129). This trend was not, however, echoed at Lankhills (37% female and 35% male; Gowland 2002) or at Poundbury where almost equal proportions of male (29%) and female (31%) adults were identified. The population burying their dead at Little Keep appears in strong contrast to that using the contemporaneous cemetery *c.* 300m to the north, with far fewer children and a much greater proportion of males, though in the latter characteristic it has strong similarities with the cemetery at Alington Avenue on the other side of the town. Both Little Keep and Alington Avenue (MNI 109: Waldron 2002, 151) represent substantially smaller cemetery groups than that from Poundbury (MNI 1126; Molleson 1993, table 62), and it may be that the statistically larger group gives a more representative picture of the population at large. It could, however, reflect the use of the larger cemetery by the general population of the town and that of the smaller cemeteries by specific groups. Both of the latter have a major imbalance between the sexes, perhaps indicating that they were favoured by unmarried males, male immigrants or migrant workers gravitating to the town, possibly from an extended rural hinterland.

Skeletal indices and non-metric traits

It was possible to estimate the stature of the majority (*c.* 88%) of the adults (Table 3). The male mean is just above the average of 1.69m recorded by Roberts and Cox for the Romano-British period (2003, 163), being noticeably greater than that of 1.66m recorded at Poundbury and Alington Avenue (Molleson 1993, table 28; Waldron 2002, table 29a). In contrast, the mean for the females is slightly below that of 1.59m given by Roberts and Cox for the period (2003, 163), and means of 1.61m and 1.57m from Poundbury and Alington Avenue respectively (Molleson 1993, table 28; Waldron 2002, table 29a). The noticeably greater sexual dimorphism in mean estimated stature at Little Keep (0.14m) compared with the town's other two cemeteries (0.05m at Poundbury and 0.09m at Alington Avenue) further highlights the potential differences already suggested by the demographic data between both the two smaller cemeteries and the major cemetery at Poundbury, and between the two smaller cemeteries themselves.

Cranial index (Table 3) exhibited a slightly shorter range than that observed at Poundbury implying slightly greater homogeneity within the group. Little Keep appears to have closer similarities with Alington Avenue (female mean dolichocranial, male mean even split mesocranial and dolichocranial; Waldron 2002, 151) than with its nearer neighbour at Poundbury (mean in mesocranial range; Molleson 1993, 167).

Variations in skeletal morphology may indicate population diversity or homogeneity. The potential interpretative possibilities for individual traits is complex and most are not yet readily definable, particularly on a 'local' archaeological level (Tyrrell 2000). Some traits have been attributed to developmental abnormalities or mechanical modification (*ibid.* 292) e.g. *os acromialie* (non-fusion of the tip of the acromion process of the scapula), which was observed in four individuals from Little Keep, two males and two females (true prevalence rate (TPR) 15.6%). The variant is generally observed in *c.* 3–6% of individuals, though in some cases there are indications that activity-related stress may be a factor in its occurrence (Stirland 1984; 2000, 120–22; Knüsel 2000, 115–6). The comparatively high rate from Little Keep and mix of sexes suggests a familial link between these individuals (two of whom were buried in adjacent graves, the others being on the southern and western margins of the cemetery). Several other common and less frequently occurring non-metric traits were observed and recorded in analysis and some of these data (see McKinley 2009) could be taken to suggest a level of homogeneity between the Little Keep and Poundbury populations, which, although perhaps inevitable given the geographic and temporal proximity, is slightly at odds with some of the other data reviewed above. Additional articular facets were observed in tarsals and metatarsals from six skeletons, four of which formed a tight group, possibly familial, to the north-west of the mortuary enclosure.

Pathology

Pathological changes were observed in the remains of 27 individuals, i.e. all except the infant and the juvenile. Comparison of the prevalence rates for the various pathological conditions with those from the town's other cemeteries and those collated for the period in general, assists in assessing the cemetery population's potential socio-economic context.

Various forms of dental disease were observed in many of the 25 erupted permanent dentitions recovered (all 10 females and 15 of the adult males), the rates being summarised in Table 4. Dental calculus (calcified plaque/tartar) was observed in all except two of

Table 3: Main skeletal indices

	number	range	mean
		estimated stature	
male	15 (94% males)	1.62–1.79m (*c.* 5' 4¼"–5' 11")	1.70m (*c.* 5' 6¾"; SD 0.05)
female	8 (89% females)	1.48–1.62m (*c.* 4' 10¾"–5' 4¼")	1.56m (*c.* 5' 1¼"; SD 0.05)
		cranial index	
male	13 (81% males)	70.6–85.1 (dolichocranial – hyperbrachycraial)	76.7 (SD 4.10) (mesocranial)
female	8 (89% females)	68.9–81.9 (dolichocranial – brachycranial)	73.6 (SD 4.44) (dolichocranial)

Table 4: Summary of permanent erupted dentitions by sex

	teeth	socket positions	*ante mortem* tooth loss	caries	abscesses
male	330	425	39 (9.2%)	37 (11.2%)	22 (5.2%)
female	248	286	32 (11.2%)	36 (14.5%)	15 (5.2%)
total (inc. unsexed dentition)	584	713	71 (10.0%)	73 (12.5%)	36 (5.2%)

the permanent dentitions, most deposits (52%) being mild-moderate in severity (Brothwell 1972, Figure 58b). Periodontal disease (gingivitis) had affected the alveolar margin around one or more tooth sockets (never all) in 80% of the female and 66.7% of the male dentitions. In most cases (*c.* 44%) the lesions were slight but heavy lesions were recorded in 33% of the dentitions affected (Ogden 2005). The *ante mortem* loss of between one and 15 teeth was recorded in 16 dentitions including 90% of the female and 43.7% of the male. The overall rate (Table 4) is below that of 14.1% given by Roberts and Cox for their Romano-British sample (2003, table 3.12) and the 13.4% from Alington Avenue (Waldron 2002, 152). Dental caries were recorded in between one and 12 teeth in 19 dentitions, including 90% of the female and 66.7% of the male. The rate (Table 4) is higher than the 7.5% given by Roberts and Cox for the Romano-British period (2003, table 3.10) and the 2.2% from Alington Avenue (Waldron 2002, 152), but below that of 15.8% for Poundbury (Molleson 1993, 183). Between one and six lesions indicative of dental abscesses were recorded in 13 dentitions including 50% of females and 54% of males. In the case of one older adult male (burial 1015), bi-lateral maxillary abscesses had tracked superiorly into the sinuses resulting in secondary sinusitis. The abscess rate (Table 4) is greater than the mean of 3.9% given by Roberts and Cox for the period (2003, table 3.13), and the very low 0.8% from Alington Avenue (Waldron 2002, 152).

Evidence for fractures was recorded in the remains of 11 individuals (CPR 37.9%), including 10 males (62.5%) and one female (10%). Comparative data is largely in the form of crude prevalence rates (CPR i.e. number of individuals affected), Roberts and Cox giving an overall rate of 10.7% for the period (2003, 151), which is close to the 9.2% from Alington Avenue (Waldron 2002, 152) but below that of 16.7% from Poundbury (Molleson 1993, table 47). Males commonly show greater involvement than females; at Poundbury, for example, Molleson recorded a male CPR of 37.4% and female 18.5% (1993, table 47). Most individuals at Little Keep exhibited single lesions and, as usual, ribs represent the most common fracture site with a CPR of 17.2%, which is close to that of 13% noted by Molleson at Poundbury (*ibid.*). There were single cases of fractures to other parts of the skeleton including; the proximal humerus (burial 1047), proximal tibia (burial 1089) and a proximal foot phalanx (burial 1049). Two, possibly three adult males had healed fractures at two/three sites. A fracture to the 1st metacarpal from burial 1118 had indications of soft tissue damage as well as fracture to the bone; such fractures are often the result of longitudinal violence applied by a blow, as, for example, in boxing (Adams 1987, 186). There is also a possible fracture to a tarsal bone, resulting from a direct blow or a fall, and a well-healed lesion in the right frontal, probably the result of a sharp weapon-trauma skimming part of the outer-plate off the skull. One other possible old, healed, weapon trauma was recorded in the

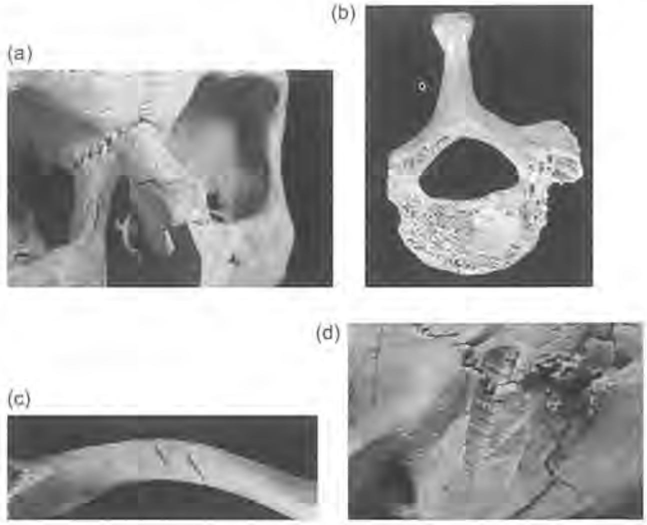

Plate 1: (a) Skeleton 1109: Healed nasal fracture; (b) Skeleton 1112: Cuts to 7th cervical vertebra (decapitation); (c) Skeleton 1112: Right clavicle, cut marks associated with decapitation; (d) Skeleton 1118: Sharp-weapon trauma to left mastoid portion of skull (post-depositional missing flake)

left superior frontal of another older adult male (1066). The other recidivists included skeleton 1015, with healed fractures to the thoracic and sacral vertebrae, and 1109 which had a healed fracture to the inferior end of the nasal bone (TPR 5.3%). The changes suggest a blow down onto the nose from directly in front of the individual, possibly accidental but more likely deliberate using a blunt implement (Plate 1a). The same individual had old fractures to the left mandibular canine and left maxillary 1st premolar, the lingual portions of both crowns having sheered-off, probably as a result of heavy upward or downward impact against the occlusal surfaces of the opposing teeth. Both injuries could have been sustained in the same traumatic event.

Minor infections affecting the periosteal membrane covering bone were indicated in three case, all adult males with very slight lamellar (healing) new bone forming small patches on the fibulae distal shafts; at least one case – 1052 – is likely to be associated with a soft tissue trauma and slight lesions were also observed in the adjacent tibia shaft. A possible case of poliomyelitis is represented by noticeable foreshortening of the left upper limb bones of the adult female from burial 1013. A viral infection of the central nervous system, the condition often leads to the temporary or permanent paralysis of the affected muscles and is most common in the immature individual, hence its potential affect on bone growth (Adams 1986, 147–8; Roberts and Manchester 1997, 134; Aufderheide and Rodríguez-Martín 1998, 212). There are few reported cases from the period, the potential diagnoses – as here – tentative and inconclusive in each case (Wells 1982; McKinley 1993b; Roberts and Cox 2003, 127–8).

Joint diseases represent the most commonly recorded class of conditions in archaeological skeletal material. Similar lesions – osteophytes and other forms of new

Table 5: summary of number and rates of spinal lesions (excluding infant/juvenile)

	total no. vertebrae	osteoarthritis	Schmorl's nodes	degenerative disc disease	lone osteophytes	lone pitting
male	337 65.7% total	37 (11.0%)	74 (22.0%)	53 (15.7%)	52 (15.4%)	52 (15.4%)
female	176 34.3% total	40 (22.7%)	26 (14.7%)	60 (34.1%)	82 (46.6%)	38 (21.6%)
total	513	77 (15.0%)	100 (19.5%)	113 (22.0%)	251 (48.9%)	90 (17.5%)

bone development, and micro- and macro-pitting – may form in response to one of several different disease processes, some also occurring as lone lesions largely reflective of age-related wear-and-tear. Many of the conditions increase in frequency and severity with age, though factors other than the age of the individual are frequently involved and the aetiology of some conditions is not clearly understood. All or parts of 26 spines and 1911 extra-spinal joints were recorded from all the sexed individuals, and Table 5 shows the number and prevalence rates for the spinal lesions.

Schmorl's nodes (a pressure defect resulting from a rupture in the intervertebral disc; Rogers and Waldron 1995, 27; Roberts and Manchester 1997, 107) were seen in 11 male (68.7%) and 5 female (50%) spines. The rate is slightly above the average of 17.7% for the Romano-British period given by Roberts and Cox (2003, table 3.21). Degenerative disc disease (Rogers and Waldron 1995, 27) was recorded in between 1 and 19 vertebrae in 17 spines, including 9 male (56.2%) and 8 female (80%). There is an age-related link in extent, all 4 individuals with more than 10 affected vertebrae being over 50 years of age (2 males and 2 females). Lesions indicative of osteoarthritis (Rogers and Waldron 1995, 43–44) were recorded at between 1 and 36 sites in the remains of 21 individuals, including 12 males (75%) and 9 females (90%). Spinal lesions were recorded in between 1 and 20 vertebrae in 14 spines (8 male, 6 female), the greatest prevalence being in an elderly female (burial 1112) who also had extensive lesions in her extra-spinal joints (9 sites). Extra-spinal lesions were recorded at between 1 and 23 sites in the remains of 20 individuals (11 males, 9 females). Relatively few of the lower limb joints were affected, though in both females and males the greatest prevalence of the disease was seen in the hip joint (TPR 33%). The condition was more widespread in the males, but the prevalence in the affected females joints was generally higher than in the males. In general, the rates are slightly higher for the right side than for the left. Comparative data is in the form of the less reliable CPR (number of individuals affected) rather than the number of joints affected (TPR). Roberts and Cox show a CPR of 13% for spinal joints and 11.1% for extra spinal joints for the period (2003, tables 3.19 and 3.20), the CPR for extra spinal joint involvement at Poundbury being 16.5% (Molleson 1993, table 51). All are considerably lower than the 48.3% spinal and 69% extra-spinal CPRs for osteoarthritis at Little Keep, though the rate from Alington Avenue, at 43.1%, is close (Waldron 2002, 153). As Waldron observed, the prevalence of osteoarthritis is strongly age-related, and the population at Little Keep includes few adults of less than 35 years of age (15.4%) which may largely account for the high rates of osteoarthritis and other degenerative joint diseases. The distribution of the condition at Little Keep is also of interest given the exclusion of the joints of the lower limb; a CPR of 3.1% was recorded for the knee joints at Poundbury for example (Molleson 1993, table 51).

Bi-lateral lesions in the hand and foot bones from burial 1109, an elderly male, are indicative of rheumatoid arthritis. The disease was observed in 9 individuals from Poundbury (CRP 0.8%), 6 males (1.8%) and 3 females (0.7%), and the hands and/or feet were affected in all cases; Roberts and Cox did not record the occurrence of the condition at any other contemporaneous site (2003, 150–1). There are suggestions of a genetic predisposition to the disease, though other factors, including diet and climate, are also key to its development (*ibid*. Rogers and Waldron 1995, 55–63).

Cribra orbitalia, a metabolic disorder associated with childhood iron deficiency anaemia (Molleson 1993; Roberts and Manchester 1995, 166–9), and dental hypoplasia (developmental defects in the tooth enamel reflective of periods of illness or nutritional stress in the immature individual; Hillson 1979) are both regarded as childhood stress indicators. The latter, manifest as faint horizontal lines in the dental enamel, was observed in 13 dentitions including 60% female and 47% male. The majority of cases indicate periods of stress between 4–6 years of age, with at least one at 2–3 years; 2 individuals appear to have experienced repeated periods of stress. The rate (13.2%) is above that at 9.1% given by Roberts and Cox for the period (2003, table 3.16). Both the TPR (9.1%, 14.3% males) and CPR of 6.9% for *cribra orbitalia* at Little Keep appear relatively low. Most comparative data comprises only the CPR, with a rate of 19.3% for Poundbury and an overall rate of 9.6% for the period (Roberts and Cox, 2003, table 3.17), and an overall TPR (only two sites from their sample) of 16.9%.

Although there are some suggestions of homogeneity between parts of the population at Poundbury and that at Little Keep, not unexpected in contemporaneous cemeteries serving the same town, it would be erroneous to see the smaller cemetery simply as a southern extension of the larger one. There are notable differences in the demographic structure, skeletal indices and disease rates, which suggest that specific groups of people were using the smaller cemetery. There are indications of a moderate level of homogeneity within the Little Keep assemblage, probably with some familial relationships. There is also strong evidence for an ageing population making use of this area for burial, with very few immature individuals and the preponderance of older individuals being reflected in the relatively high rates of degenerative joint diseases. The high proportion of males, while echoing data from some other Romano-British cemeteries including Alington Avenue on the east side of the town, is in marked contrast to the data from Poundbury. The high trauma rates amongst the males, together with evidence for interpersonal violence and several recidivists, may suggest a preponderance of unmarried veterans amongst those buried here, though equally they may be indicative of workers/tradesmen involved in stressful physical activities. The similarity between the males and females in terms of rates of degenerative joint diseases suggests similar stress levels affecting both sexes, but the variation between the sexes in respect to the skeletal areas affected indicates different types of stress, largely, it would appear, acting on the upper body and axial skeleton/core muscles. This could imply that there were few basic labourers and more trades-people amongst the dead at Little Keep.

Dental attrition was relatively light with no extensive exposure of dentine until an individual reached their mid-30s. Although levels of dental hygiene appear to have been fairly poor, the rates for the various dental disease, together with the greater dimorphism between the sexes in terms of height and the slightly above average height of the males, suggests those burying their dead at Little Keep generally enjoyed a more nutritious diet than those burying at Poundbury, with a higher meat protein intake and less reliance of cereal-based potages and stews (see Molleson 1993, 184). Molleson suggested that migrant workers from the rural areas were likely to have enjoyed a better diet than their urban counterparts, having had more ready and reliable access to the food products which town dwellers would have had to purchase (*ibid.* 154). Indicators of dietary stress in the immature individual are contradictory, but generally suggest that despite undoubted periods of illness/nutritional stress in the years between weaning and development of the individual's own immune system at approximately six years of age, as children those buried at Little Keep were relatively well nourished.

Mortuary Rite

Description of decapitations

There was clear archaeological evidence for the decapitation of 5 individuals (17% population); all adults over 35 years of age (*c.* 33% this age group), 3 over 50 years, and inclusive of 2 females (22%) and 3 males (19%). In each case, the skull and neck vertebrae above the point of severance had been placed at the distal end of the grave adjacent to or over the leg/ankle (Table 6), though space for the head in the correct anatomical position was maintained within the grave. Three of the graves were within the cluster of four to the north-west of the mortuary enclosure, for the occupants of which a potential familial relationship has been postulated via shared non-metric traits. The other two graves, both containing coffined burials, lay

Table 6: Summary of decapitations

burial/grave	age/sex	orientation	coffin furniture/ grave goods	skull location	position of cut
1047/1045	male *c.* 50–60 yr	supine, extended WNW-ESE	coffined	lateral to right leg; on base facing proximal	single cut; C5; ?from front
1069/1068	female *c.* 35–45 yr	supine flexed to left SSE-NNW		behind right knee; on left side facing out	min. three blows; right occipital and C3; from posterior right; head severed between C6–7
1109/1108	male *c.* 60–70 yr	prone extended SSE-NNW	?apotropaic nail	lateral to right ankle; ?on left side	two blows; C1 and C4; from left front
1112/1111	female *c.* 50–60 yr	flexed to right SE-NW		between legs, on right side, facing knees	min. three blows; C7; from ?dorsal right
1118/1117	male *c.* 40–50 yr	supine extended ESE-WNW	coffined, hobnails, ?apotropaic nail	over right foot, on left side, facing distally	?single blow; C5; from dorsal right

to the north and south in the central area of the cemetery, but not in marginal locations. There is considerable variation in the number of blows used to remove the head, the point of severance and the apparent position of both the victim and perpetrator (Table 6).

No cuts were observed to the remains from burial 1047 (grave 1045; Figure 3), parts of the 4th–6th cervical vertebrae from which are damaged as a result of taphonomic changes. The point of severance was evident, however, from the distribution of the cervical vertebrae. The C1–4 were recovered with the skull together with a small fragment of the C5 comprising the right superior articular process and a small part of the right superior body. The left half of the C5, including the articular processes and the neural arch, was recovered *in situ* together with the rest of the spine. The C5 obviously formed the point of severance. The cut appears to have clipped the very upper lateral portion of the right C6 but not to have damaged the C4. The cut appears to have been made at a *c*. 40° angle, from left to right. The lack of damage to the adjacent vertebrae, particularly the spinal and transverse processes, suggests a back-handed (or left-handed) blow was made from in front, with the head pushed back and to the right side, probably with a final push to snap any remaining un-cut bone.

There is evidence for two blows made in the removal of the head from the individual buried within grave 1068 (burial 1069; Figure 4). One cut to the skull base lies immediately dorsal-lateral to the right side of the foramen magnum border. The neck was largely severed at the level of C3 by a second blow at a similarly shallow *c*. 5° angle, extending half-way through the vertebral body, thereafter the vertebra appears to have been snapped. The blows appear to have been made from the dorsal right side. There were, however, obviously more than the two blows for which osteological evidence survives, since the C1–6 were recovered with the skull, only the C7 remaining *in situ*. So clearly the neck was severed between C6–7; no cuts were observed to the bodies of either vertebrae.

The C1 and C2 in burial 1109 (grave 1108; Figure 5) were recovered with the skull, the rest of the cervical vertebrae being found *in situ*, illustrating the point of severance between C2–3. No cuts were evident to either vertebrae, but the inferior body of C2 was damaged and incomplete (that of C3 complete and undamaged) and the point of severance was undoubtedly through the lower part of this vertebra. The slight angles evident in the bone suggests the blows were from the front and possibly from the left, the bone probably being snapped in the last instance. A *c*. 22mm long cut across the anterior of the C4 immediately inferior to the superior surface, penetrating only *c*. 2mm into the bone, supports this probable positioning.

In burial 1112 (grave 1111; Figure 5), the 1st–6th cervical vertebrae were recovered with the head, only the C7 remaining *in situ*. The C7 has a clean cut through the superior right side of the body and neural arch at a shallow, *c*. 10° angle (Plate 1b). This cut may have continued across the left side of the inferior body of the C6, which is damaged but with no clear cut marks. An almost vertical cut removed the right transverse and articular processes of the C7. A second similar cut at a slightly more obtuse angle (*c*. 30°) had passed through the right side of the 1st thoracic vertebra. Two short cuts – 11mm long, *c*. 2mm max. depth, and *c*. 6mm apart – on the superior-dorsal margins of the right clavicle shaft (Plate 1c) appear to form part of the same episode, perhaps reflecting a deflection of the blade during the downward cut made to the vertebrae rather than representing separate blows.

The 1st to 4th cervical vertebrae were recovered with the skull from burial 1118 (grave 1117; Figure 5), the C6–7 being *in situ* and the C5 missing. No cuts were evident in the C4, but a clear, sharp cut across the superior margin of the right transverse portion of the C6 illustrates the point of severance in the missing C5; the latter was probably subject to preferential post-depositional destruction due to taphonomic factors. A *c*. 35mm cut across the left mastoid portion had 'skimmed-off' a shallow (max. 0.7mm) depth of the outer-plate of the skull (Plate 1d). It is uncertain whether this lesion forms part of the decapitation process but the lack of healing suggests it is likely.

'Deviant' burials

Decapitated burial remains are a well recognised phenomenon within Romano-British cemeteries (Harman *et al.* 1981; Philpott 1991, 77–83; McKinley 1993b; 1993c; Boylston 2000, 367–8). The decapitation sometimes appears to have been carried out *peri-mortem* and under coercion but in some cases seems to have formed part of a mortuary ritual undertaken on the corpse prior to burial. The severed head could be placed either in its normal anatomical position, between or to one side of the legs, or – as in the one case from Alington Avenue – removed completely (Davies *et al.* 2002, 140). Philpott records ten Romano-British sites in Dorset with decapitations, including five sites around Dorchester (1991, Figure 23). In each case the numbers are small (total of eight from all five sites; *ibid.* 305; Davies *et al.* 2002, 140; Molleson 1993, 152), including 0.9% of the population from Alington Avenue and 0.3% of that from Poundbury; most of the latter were female. Philpott gives an average rate of 6.1% decapitations for his sample, with a maximum of 21.4% for Winterbourne Down in Wiltshire, the only other site with a higher percentage than at Little Keep being Chignall St. James, Essex (Philpott 1991, table 15). Recent work at Driffield Terrace in York, however, has revealed a group of burials, mostly of males and possibly with military associations, where >50% of the individuals had been decapitated (Taylor 2008).

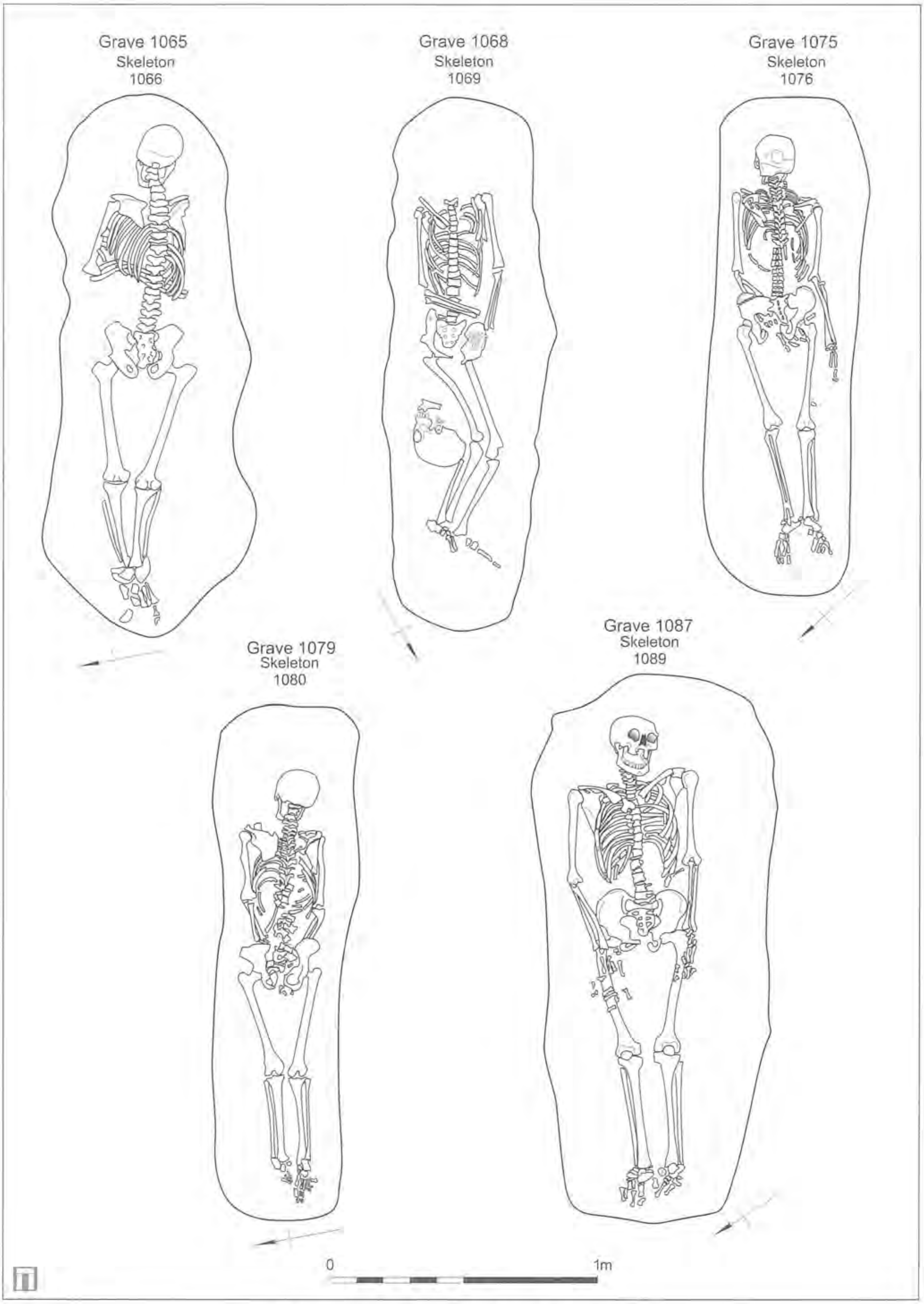

Figure 4: Graves 1065, 1068, 1075, 1079 and 1087

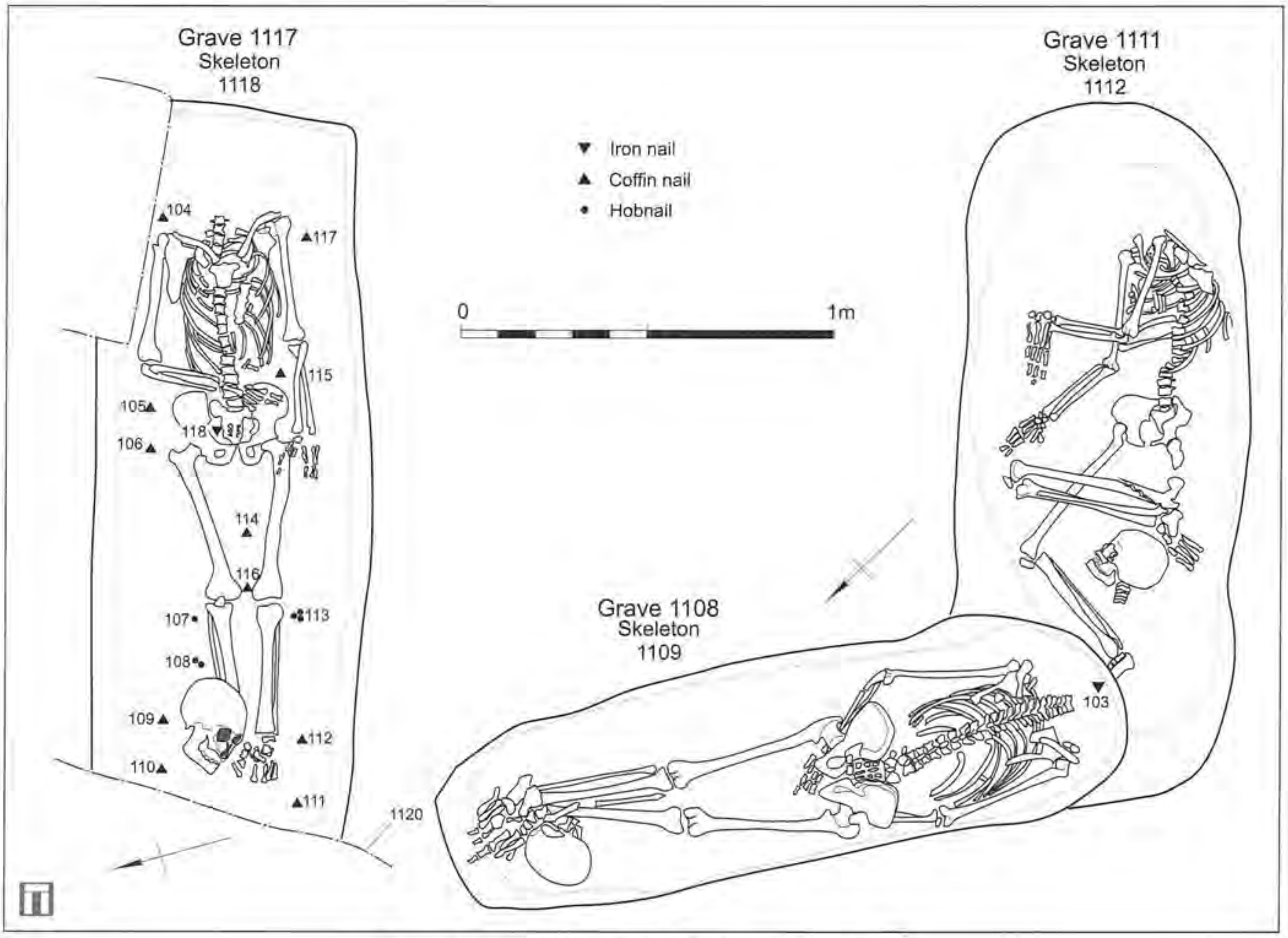

Figure 5: Graves 1117 and grave 1108 cutting grave 1111

The unusually high percentage of decapitated individuals at Little Keep (17%) is apparent from these figures. One other area of difference with Philpott's sample is in the high proportion of older adults in the Little Keep group, 33% compared with only *c.* 17% in his sample where the preferred age groups are young adults of both sexes and older females (1991, table 14, 84); this may simply be the influence of there being a relatively high proportion of older adults in general within the population at Little Keep. The number and location of cuts recorded in other assemblages, most commonly via a single blow in the mid-cervical (C3–5) region (Harman *et al.* 1981; Manchester 1983, 63), was only followed in two cases at Little Keep, with multiple blows to the upper and lower areas of the neck occurring in others (Table 6). There are few recorded decapitations where the head was severed at the level of C7 and which impinged on the T1 or the clavicle shaft as in the case of burial 1112 (Table 6; Molleson 1993, 152; Boylston *et al.* 2000). In other ways, the cases seen at Little Keep are similar to those elsewhere, including in the preponderance of females (*ibid.*) and the location of the severed heads within the graves (*ibid.* 78).

Various potential reasons for decapitation – execution, sacrifice, weapon trauma, desecration and necrophobia – have been discussed in detail elsewhere (Harman *et al.* 1981; Philpott 1991, 77–83; Boylston *et al.* 2000; Aspöck 2008; Talyor 2008; Tsaliki 2008). Clearly, it does not necessarily follow that all those decapitated and buried in any one cemetery had their heads removed for the same reason, particularly where the method of removal appears to have varied. Only one of the five decapitated individuals from Little Keep was buried in the 'standard' fashion; supine and extended on the 'normal' east–west orientation (Table 6). Amongst the three graves clustered close to the mortuary enclosure (1068, 1108 and 1111), two were distinguished by the south-north orientation of the burials, one (in grave 1108) also having been made prone, and the individual in the third grave (1111) had been laid flexed on the right side. Two of the three coffined burials from the site involved decapitated individuals; hobnails also being recovered from one. One of the possibly apotropaic nails was recovered from grave 1108, having been placed in the anatomical position of the severed head (Figure 5). It appears, therefore, that each of these decapitated individuals was further distinguished by other variations within their mortuary rite, all of which may have been associated with the factor(s) leading to the decapitation.

Table 7: Gazetteer to Figure 1

Figure 1 ref	NGR	Site	Description
1	370200 89900	Alington Avenue	(1984–87) *c.* 100 inhumation burials. 1st to 4th century AD. native and Romanised types. First Roman dwarf discovered
2	368700 90600	9 Bridport Road	(1989) 50 graves
3	369070 90455	County Hospital	(2000–1) Up to 9 *in situ* inhumation burials, all of neonates. disarticulated fragment of an adult
4	369010 90910	County Hall	(1988) All neonates or foetal/neonate, 1 adult radius from a pit
5	369300 90600	Greyhound Yard	(1993) All neonates
6	368700 90680	Crown Buildings	(1981) Cemetery including a lead coffin. Cemetery extent E and W reached. All extended and W-E. most adults, some children. No bone recovered. 2 coffined, + ?more. ?cist burial. No grave goods. Lead coffin with gypsum (adult,). and 1 ?lead lined wooden coffin
7	369070 90000	Police Station	(2005) One inhumation burial, and some likely disarticulated bone from a pit. Small watching brief
8	368500 91100	Poundbury (main)	(1966–1987) *c.* 1400 inhumations, mostly late Roman. Series of cemeteries including stone built mausolea. Stone coffins, ditched funerary enclosures etc. Recorded and published in detail
9	367250 90950	Poundbury 2007	(2007) Groups and singletons, varied positions
10	369300 90600	Wollaston Road	(2005) Neonates and redeposited
11	368630 90760 368660 90760	Depot Barracks,	(*c.* 1938) Unspecified number of inhumation burials (1940) *c.* 6 inhumation burials. skeletons 'spaced out', no objects
	Borough gardens area, Albert road	368900 90300 368880 90530 368900 90570	(1895–1942) 1895–2 inhumation burials above chalk geology. Bronze objects One apparently face down; 1921 – skull, (1942 (1951 – re-analysed, >50 burials incl children, all direction, no grave goods or coffins) (1896 and 1898) Several inhumations and ?cremations. Male with bronze ring around lower thigh, jar by skull – poss cremation? Female with armlets – another with one armlet. other objects probably grave goods
	Corporation Yard	368810 90690 368840 90780	(1931) Poundbury. 1 inhumation burial – E–W in ditch, poss aqueduct branch? armlet, coffined. a 'regular' burial (*c.* 1920 and 1965) About 30 inhumation burials. ?disturbed – skulls broken. 2 more 1965, extended W–E, either side of parallel ditches (?aqueduct?)
	St Thomas Way	368580 90660	(1962) One inhumation burial, extended NW–SE, skull dislodged
	Mountain Ash Road	368550 90690	(1866 – *c.* 1921) Unspecified number of inhumation burials. Two 'stone coffins' probably slab lined cists? close to railway cutting
	Prospect Road	368400 90700	(1910 and *c.* 1955) Several inhumation burials. some with pots near the skulls. Some coffined. Many seen in 1955 (water works)
	Bridport road	368700 90600	(1880s) Either side of Bridport Road and railway cutting
	Hawthorn Lodge	368500 90620	(1965) Inhumation burial. Extended, W–E.
	Steam Laundry	368450 90600	(*c.* 1940) Destroyed prior to observations. In a stone lined cist
	Water Works Bridport Road	368330 90620	(1943) Single inhumation burial. Flexed or 'sitting upright' with cooking vessels between the knees
	The Grove	368900 91000 368860 91060 368820 91000	(1841) 2 or more inhumation burials (1903 and 1963) 17 or more inhumation burials in different directions, all extended. 6–7ft deep. 1st–2nd century (2 × pots) (1964–5) 1 (poss 2 more) inhumation burials; *c.* S-N aligned. hobnails at feet

There is no direct indication of coercion amongst the decapitated burial remains from Little Keep. Although most of the decapitations (three of the five) appear to have been undertaken from behind and a minimum of one from in front (the latter at least suggesting *post-* rather than *peri-mortem* removal of the head, though it is difficult to prove either way for most cases at Little Keep), the interpretation of these remains as execution victims is not convincing. Whilst distinguished in various ways from others within the cemetery in their mortuary rites, the age, sex and location of these individuals within the overall group does not signal the kind of distancing one may expect to see in such cases. Mutilation of the corpse, particularly of execution victims (not necessarily those dispatched by beheading), seems to have comprised an additional form of disgrace (Taylor 2008), and what may in some cases – e.g. burial 1068 – appear an un-skilled or badly executed removal of the head could, in fact, have been a deliberate insult. It has been argued, however, that the kind of 'careful' burial afforded decapitated individuals, as seen at Little Keep and in many other cases, is no proof against execution; execution by decapitation appears to have viewed as a 'privilege' reserved for less serious offenders or elite groups (e.g. Roman citizens) and the corpse may have been returned to the family for burial after death (Taylor 2008). It has also been suggested that the occurrence of multiple cuts may indicate unwilling (presumably struggling) victims, including those being ritually dispatched in sacrifice (Harman *et al.* 1981; Philpott 1991, 77–83). A further suggestion is that such individuals would include social outcasts – outlaws, criminals and slaves – with elderly females figuring large amongst them (though it is unclear why, possibly considered the most 'disposable' individuals?). The same arguments could be made against this being the case at Little Keep as against those for execution; the similarity in location of the burials, 'formal' if not quite 'normative' mortuary treatment, and the general longevity and relatively good nutritional and health status of the individuals themselves (see above). Boylston *et al.* (2000) suggested that the one individual they had with multiple cuts (including to the lower cervical vertebrae and the clavicle) from Kempston, Bedfordshire, may have been dispatched in armed combat. There is certainly evidence for interpersonal violence at Little Keep, including healed weapon trauma, but this is amongst the males, and the individual from burial 1112, where the lesions match those seen by Boylston *et al.*, is an older adult female.

In a superstitious world, where extraordinary events (including untimely or unexplained deaths) or individuals may be seen as something to be feared (even if also revered), ensuring the dead remained with the dead and did not return to haunt the living would have been a serious consideration. Removal of the head – the seat of wisdom – and placing it out of position, may have represented one way of confusing the dead and ensuring they did not return. Burial of the body face-down may have served a similar purpose. There is extensive evidence for necrophobia in the ancient world where both these practices are regularly recorded as potential methods of warding-off unwanted ghosts (Aspöck 2008; Tsaliki 2008). Those subject to such treatment may include disabled individuals or those deformed by some unusual pathological condition and individuals subject to murder or who took their own life. In such cases there would rarely be any surviving osteological or artefactual evidence to support the interpretation. At Little Keep osteological evidence for 'unusual' physical deformities is limited to one possible case of polio (individual subject to a 'normal' burial in grave 1012) and rheumatoid arthritis where the individual's hands and feet may have appeared crippled and 'clawed' (1108). The latter is, in fact, an interesting case. This elderly male (1109 in grave 1108) had also survived several episodes of probable inter-personal violence, including sustaining a broken nose, the results of which were probably still evident at the time of his death (set skewed; Plate 1a). This male had been decapitated and buried in a prone position on a south-north orientation with an iron nail placed where his head should have been (Figure 5). The use of iron nails as 'restraints' within graves has been discussed by Tsaliki (2008); such nails are placed to 'restrict' the dead, one particular aim being to prevent reanimation of the corpse as a vampire. Three of the five graves from which possible apotropaic nails were recovered from Little Keep contained the remains of individuals who had been decapitated and or buried prone (1039, 1108, 1117); all were adult males, two of whom had experienced interpersonal violence. There are few published comparative examples of such nails from contemporaneous cemeteries, e.g. Sea Mills, Avon (Bennett 1985, 20 in Philpott 1991, 74). The inclusion of such tokens may not be as rare as it appears, however, their potential significance possibly being overlooked in earlier excavations.

The occurrence of so large a number of decapitations in one cemetery is rendered even more intriguing at Little Keep in that the practice is viewed as a predominantly rural one, rarely seen and certainly far less common in large urban centres such as Roman Dorchester (Harman *et al.* 1981; Philpott 1991, 77–83). Where they do occur in such settings they usually form groups in liminal locations within the wider cemetery context (Farwell and Molleson; Taylor 2008), and it may be that Little Keep represents one such area associated with the Poundbury cemetery. Alternatively, this may add further support to earlier observations on the osteological data suggesting that those burying their dead here may have included a number of rural migrant workers, who had carried some of their own traditions with them to the urban environment.

The 41% prone burials recovered from Little Keep included seven males (*c.* 44%) and five females (*c.* 55%). Only one of these individuals was less than 30 years of age, six were between 30–50 years, and of those five (55% of total) were over 45 years. The number of prone burials from Poundbury (0.7%; Molleson 1993, 152) and Alington Avenue (4%; Davies *et al.* 2002) were considerably lower. As with decapitation, prone burial forms a recognised feature of Romano-British cemeteries which, though not as rare as was once believed, is not common. They have often been recorded in liminal locations leading to the suggestion that the pronated dead were criminals or some other form of social outcast (Philpott 1991, 71–75). In recent years, however, a growing number of otherwise 'normal' burials have been recovered (e.g. Maddington Farm (McKinley and Heaton 1996) and Boscombe Down, Wiltshire (Wessex Archaeology in prep.), and it has been suggested that some such burials could have resulted from accidental inversion – particularly of coffined burials – (Philpott 1991, 73; McKinley and Heaton 1996) or, as has been argued for at least some cases of decapitation, have represented a ruse to confuse the dead (Harman *et al.* 1981; Taylor 2008; Tsaliki 2008). At Little Keep such burials are widely distributed across the area and generally include otherwise 'normal' burials.

Conclusion

Although there are indications of some degree of broad homogeneity between the people burying their dead at Little Keep and those burying at Poundbury, there were also significant differences. The population from Little Keep was an aging one with few young individuals. The group appears fairly homogeneous with some evidence suggestive of familial relationships. The general good health of the individuals may be due to a rural upbringing with easier access to food sources than afforded their more urban contemporaries. The preponderance of males over females is perhaps reflective of a high proportion of unmarried veterans, itinerant tradesmen or labourers; the potential occupation in trade gaining support from the relative lack of stress markers in the bones of the lower body skeleton and its relative frequency in those of the upper body.

The various forms of evidence recovered from Little Keep are generally consistent with late Roman cemeteries elsewhere (Farwell and Molleson 1993; Davies *et al.* 2002; Philpott 1991), though the cemetery is clearly unusual in terms of the high frequency of decapitated individuals and prone burials it contained. On the basis of the criteria set out by Farwell and Molleson (1993, 236–7, table 66) regarding the type and frequency of particular mortuary rites, the burials from Little Keep reflect a strong tendency towards pagan rather than Christian beliefs.

The method of decapitation, and potentially the purpose of it, was not consistent, with variations in the location of the cut(s), the direction and number of blows. Evidence from some of the graves indicates those subject to decapitation were viewed as unusual individuals who's return to the land of the living was feared and to be resisted. The frequency of prone burials was such as to almost render it the 'normal' rite within the cemetery, possibly linked to the distinctive nature of this part of the town's population.

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Excavation of an Iron Age and Roman settlement and salt production site at Shapwick Road, Hamworthy, Poole, Dorset, 2005–6

SARAH COLES and JO PINE

with contributions by John Allen, Natasha Bennett, Aidan Colyer, Lucy Cramp, Brenda Dickinson, Steve Ford, Kevin Hayward, Robert Hopkins, Claire Ingrem, Malcolm Lyne and Jane Timby

Summary

The report describes the results from eight excavation areas, integrated with findings from a previous watching brief. This work revealed evidence for late Iron Age settlement with roundhouses, pits and linear features present. Two substantial ditches of late Iron Age to early Roman date are thought to represent defensive works. There is no unambiguous evidence that the site was a trading port in this period as has previously been suggested. Salt production started towards the end of the Iron Age and continued into the early Roman period. Roman activity on the site comprised salt production without any clear evidence of occupation. There was a shift in activity in the late Roman period, salt production ceased, and evidence for occupation is slight. The site was then abandoned.

Introduction

An excavation was carried out by Thames Valley Archaeological Services, between September 2005 and January 2006, on land off Shapwick Road, Hamworthy, Poole, Dorset (SZ 0010 9020) (Figure 1). The site lies on the south side of the Hamworthy peninsula, at a height of 2.6m above Ordnance Datum on the northern shore of Poole Harbour, where the Blackwater channel enters the harbour. The site's southern boundary is formed by the railway line, which parallels the shore. The underlying geology has been mapped as Poole Formation deposits of the Bracklesham group overlain by drift, sands and second level river terrace, with Oakdale clay and man-made deposits (BGS 1991). A sand and brickearth-type deposits were revealed during the excavations.

Planning permission had been granted by Poole Borough Council for the construction of new housing, subject to a condition, requiring excavation and a watching brief, in accordance with *Archaeology and Planning* (PPG16, 1990) and the Borough's policies. The fieldwork was supervised by Sarah Coles. The site code is SHP05/91. The archive is presently held at Thames Valley Archaeological Services, Reading and will be deposited at Poole Museum in due course.

Archaeological background

Poole Harbour is one of the largest and shallowest natural harbours in the world. This area and the coastal region to the east have been significant from the later prehistoric period, facilitating trading links with northern France. One of the most significant sites in the region is at Hengistbury Head, some 10km to the east on a headland midway around the sweep of Poole Bay, regarded as one of the most important trading complexes in Iron Age Britain (Cunliffe 1978).

Numerous other occupation areas and sites have been recorded around the fringes of this harbour (Figure 1). In the southern part of the Poole basin, during the late 1980s, archaeological survey preceding the development of the Wytch Farm Oilfield located fifteen new sites with occupation from as early as the Mesolithic, Bronze Age field systems, Iron Age salt extraction sites and early Roman occupation, with small enclosures and ditched trackways such as at Cleavel Point (Cox and Hearne 1991). Investigation on Furzey Island indicated similar features, and ongoing investigations on Green Island indicate small scale industrial output including shale working and iron smelting during the Iron Age (Cunliffe 1982). This area focused on Cleavel Point and the islands is now considered the location of a major prehistoric port, the hypothesis strengthened by the discovery of an artificial Iron Age mole or jetty called the 'Green Island Causeway' (Markey *et al.* 2002).

Shapwick, in the northern part of the basin, is located in an area where piecemeal archaeological investigations over many years have indicated a late Iron Age settlement on the peninsula (Smith 1931; Farrar 1975; Jarvis 1994; Bellamy 1999a and b, Bellamy 2000a and b; Bellamy and Pearce 2001, Bellamy and Tatler 2006). The full extent of the settlement and its form remain unknown, however there is the suggestion, based on a substantial quantity of imported Iron Age pottery that this could be a trading centre, whether a subsidiary base to the port-of-trade of Hengistbury (Cunliffe 1982) or a port in its own right (Jarvis 1985). A Roman road, in operation soon after the Roman conquest, has been recorded just to the north of the site, built of a turf bank with a sand and gravel surface laid down on top. This linked the area to a legionary fortress at Wimborne (Jarvis 1983; Collins 1989). The late Iron Age occupation continued into early Roman times and this headland location, its position at the end of the road, together with the range of finds has led to the suggestion (largely conjectural but, as so often, widely assumed to be based on more substantial evidence) that the site represents a military supply base for the invasion in the AD 40s and/or to supply the early legionary fortress at Lake Farm, Wimborne (Farrar 1975; Webster 1980; Jarvis 1983).

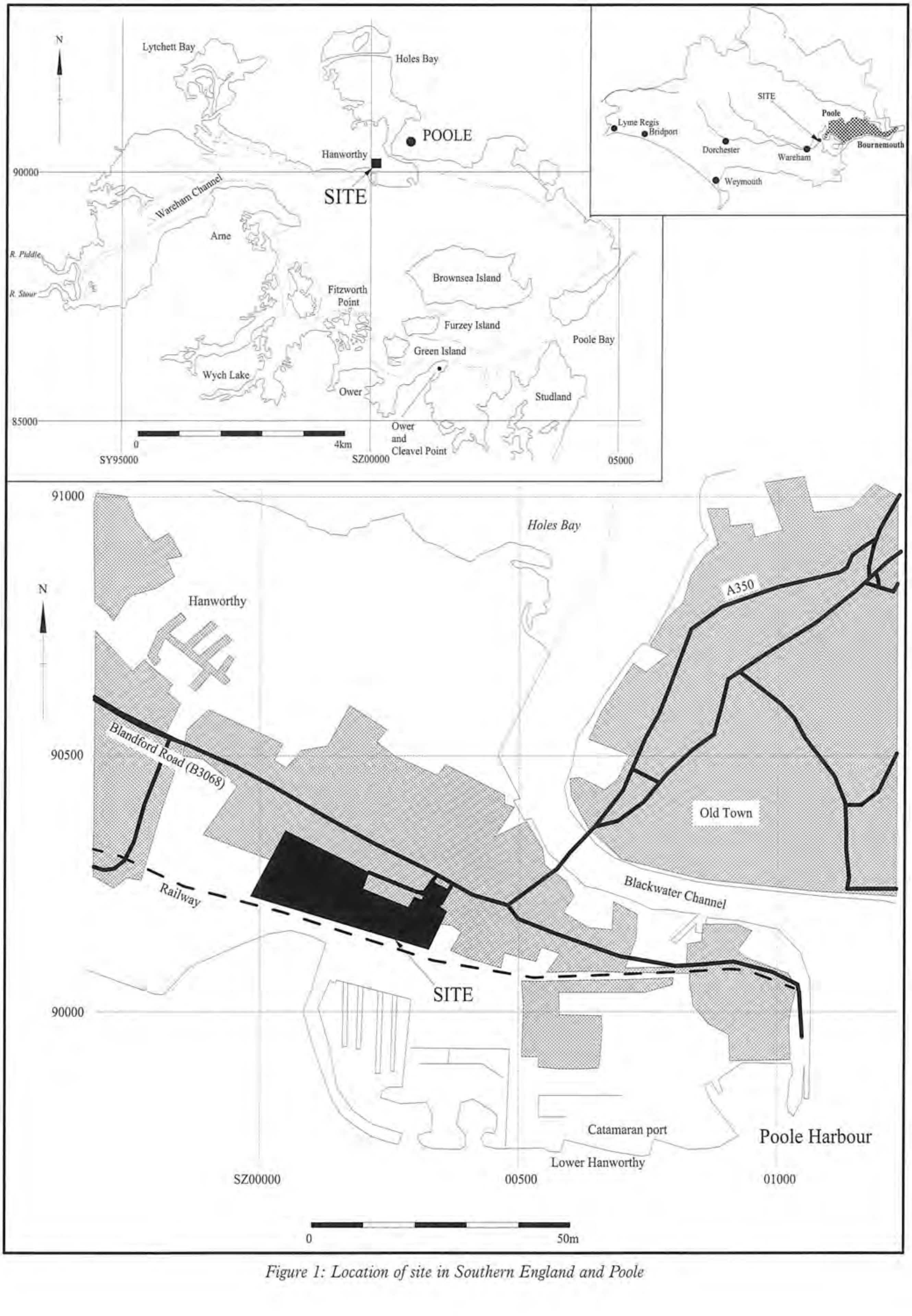

Figure 1: Location of site in Southern England and Poole

It has also been suggested that the area around Cleavel Point was abandoned as a port in the 1st century due to sea level rise, and that activity switched a better suited location on the Hamworthy Peninsula (Markey *et al.* 2002). Indeed, the peninsula was occupied extensively throughout this period and through the 2nd to 4th centuries. These later occupations appear to be civil settlements with evidence of salt making being recorded (briquetage, possible furnaces and ovens) but whether this is on an industrial scale or for local consumption is difficult to ascertain.

Early Medieval occupation is attested by the presence of substantial oyster shell middens along both Hamworthy peninsula and Poole foreshore, dated from the 12th or 13th century and believed to represent industrial exploitation of the shellfish.

Previous archaeological work on the site

The archaeological potential of the site was revealed by recent archaeological investigations in the form of a desktop study, phased field evaluations and watching briefs (Bellamy 1999a and b; 2000a and b; Bellamy and Pearce 2001; Bellamy and Tatler 2006) (Figure 2).

An initial evaluation comprised the excavation of seven trenches (Trenches 1–7), of which Trench 2 contained a substantial ditch of probable late Iron Age-early Roman date, aligned NW–SE, whilst Trenches 1 and 3 contained further linear features of similar date. A geophysical survey plotted a linear anomaly in the north-western part of the site, considered to represent a continuation of a large ditch observed in Trench 9.

Trench 9 was excavated along the line of a storm drain during a watching brief (Bellamy and Pearce 2001). It was 125m long, 6.5m wide with a 225sq m extension to south. It contained numerous Roman features including two large early Roman ditches, one of which is on the same alignment as the ditch observed in Trench 2, the other corresponding to the geophysical results. These ditches were assumed to correspond to a single structure and it was suggested they may be military, on the basis of their scale, and the evidence of early fineware pottery. A series of 1st-century rectilinear boundary ditches seems to denote small fields, and a number of hearths or kilns were recorded, together with large quantities of briquetage. The late 1st- to 2nd-century phase comprised rectangular enclosures and a well. In the later 2nd to 3rd century, linear boundaries took on a different alignment.

Trench 10 comprised a 1.5m wide, 122.7m long strip and contained a great deal of modern disturbance, together with four ditches and two pits which were poorly dated but could be of late Iron Age/Early Roman date. Trench 11 was 95m long and 1.5m wide and again revealed ditches and pits, some excavated, some preserved *in situ*. These were not well dated but again some contained late Iron Age/Early Roman pottery.

Trenches 12 and 13 were excavated in the south-east part of the site. Within these trenches a ring gully, pits and ditches of late Iron Age date were recorded together with Roman pits and ditches. A watching brief on the footing trenches for several blocks of houses (Blocks A, F, G, H and I) in the eastern part of the site, revealed a continuation of one of the large 'military' ditches previously observed, together with a low density of later Roman ditches. Trench 8, at the eastern extreme, revealed only a buried soil layer that seems to denote an absence of activity in this area.

In short, the various previous phases of evaluation and watching brief indicated that the main areas of archaeological interest were in the north-west of the site. Other areas of the site did not appear to contain archaeological deposits, either because they were never present or because the relevant levels had been disturbed by subsequent land use, with parts eroded by the sea and subsequently reclaimed. The areas selected for excavation were therefore the footprints of the eight new blocks at the western end of the site (N, O, P, Q, R, S, T and V) (Figure 2).

Results

The areas excavated are indicated on Figure 2. The pottery dating provides most of the phasing, supplemented by the few other categories of finds and the limited stratigraphic data. These indicate five main phases of site development. The scheme is presented below. A complete catalogue of all excavated features can be found in archive.

Phase 1: Prehistoric and middle Iron Age

A small collection of residual flints was recovered, and apart from a narrow flake which is possibly Mesolithic, the material is not closely datable in itself but is likely to be later of Neolithic or Bronze Age date. In Areas R and T was a narrow gully 2025/2030, aligned NW-SE (Figures 9 and 12); slot 300 through this contained 23 sherds of middle Iron Age pottery together with a fragment of Hobarrow brine boiling pan fragment. This latter material could suggest salt production in this period but, given the later concentration of this material, it could be intrusive. Other sherds of middle Iron Age pottery were all recovered as residual material in later features. These findings suggest occupation on the site in this period, but reveal little of its nature or extent.

Phase 2: Late Iron Age

A small number of features have been dated to this period, from Areas N, P, Q, S and V. This includes ditches and gullies, some of which may represent structures.

In Area S a possible ring gully house 2045/2046 was recorded, this being disturbed to both the NW

Figure 2: Detail of Excavation Area Locations

and SE by modern truncation and the full plan thus is far from complete (Figures 10 and 11). The projected internal diameter of the ring gully was *c.* 10m with a possible entrance to the south-east. Gully 2045 was between 0.40m and 0.45m wide and 0.12m and 0.20m deep. Gully 2046 comprised the terminal end of a thin stretch of gully which appears to be part of this structure. Both gullies contained pottery of middle and late Iron Age date together with fragments of furnace lining and fuel ash slag. Some 15m to the east was a small stretch of very ephemeral gully 2055, which given its shape is suggestive of a structural element for another

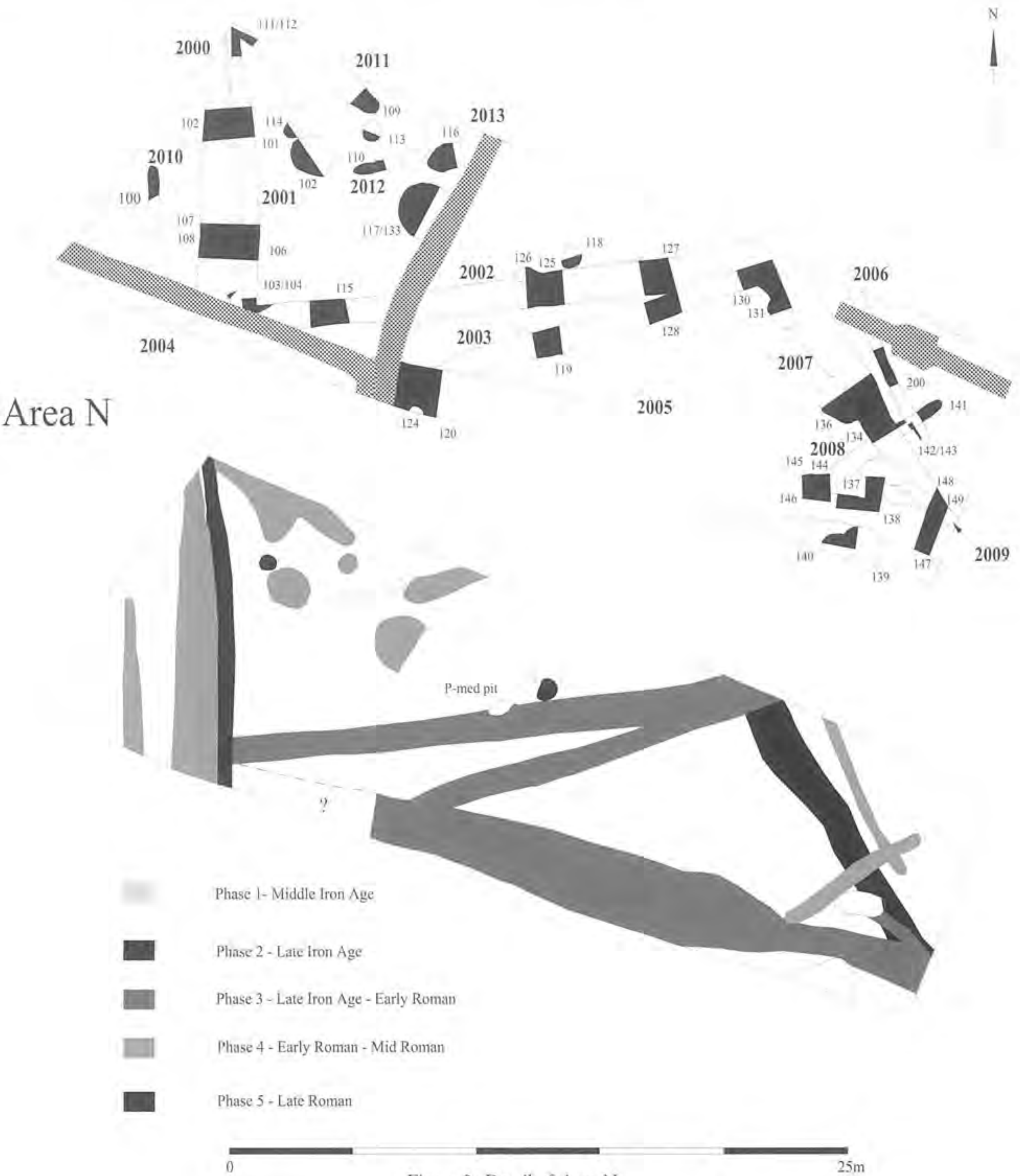

Figure 3: Detail of Area N

ring gully house, the eastern part of this gully not being present possibly due to its shallowness. This gully was 0.35–0.60m wide and 0.08–0.15m deep.

Small ditches and gullies 2041, 2051, 2053 and 2076 within Area S have also been assigned to this phase of site development and contained pottery and furnace lining fragments and iron scrap. Pit 901 may be of this date.

In Area N a small ditch (2007) aligned north-south may date to the late Iron Age, it was then truncated by later ditches 2003 and 2005 (Figures 3 and 4). Within Area P gully 2017, which curved gently round from the west to the north for 10m where it terminated, contained Late Iron Age pottery with a single sherd of late Iron Age-early Roman date which could be intrusive (Figure 6). The projected internal diameter of this feature was *c.* 15m and one small undated posthole 708 was observed within it, while it cut gully 2018 which may nonetheless also belong in this phase, as it also had a single sherd of pottery of this date (or perhaps it was dug in Phase 1 and filled early in Phase 2).

In Area Q, undated curving gully 2023 may be late Iron Age in date, together with gullies 2020, 2021 and 2022, the latter two being truncated by late Iron

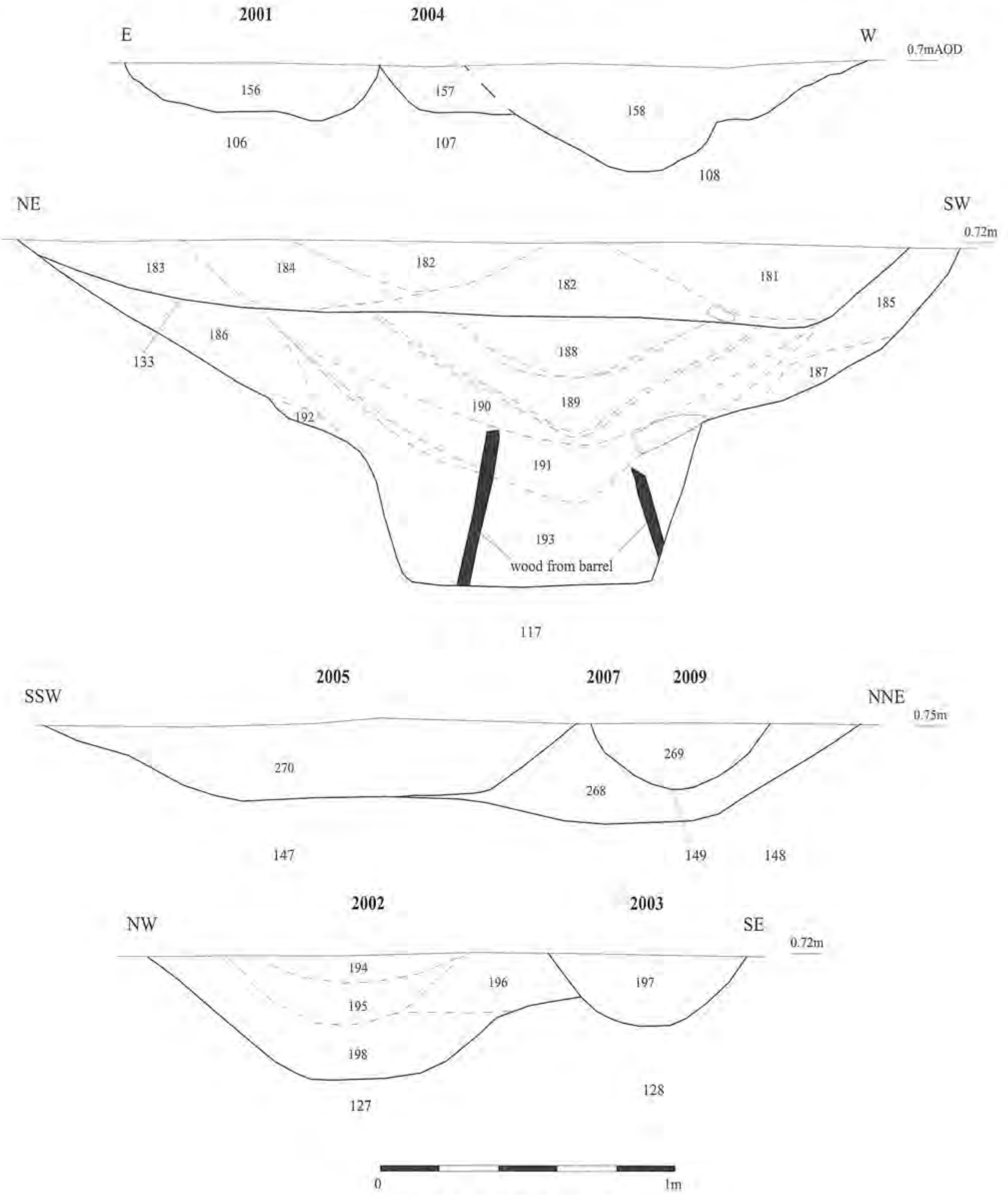

Figure 4: Sections from Area N

Age-early Roman ditch 2078 (Figures 7 and 8). It is possible these gullies continued across the site through Trench 9 and into Area N (as 2002 and/or 2003).

Residual late Iron Age pottery was found in later features. Within Area V, narrow gully 2033 aligned SW–NE terminates after 6m and contained middle and late Iron Age pottery (Figure 13). Directly opposite to the west, after a gap of 2m, another gully 2032 contained late Iron Age pottery with two sherds of amphora which could be late Iron Age or later, together with fragments of briquetage. If contemporary, as seems likely, these gullies could represent an entrance into an enclosure. It is possible that these return through Trench 13. A small circular pit 18, 0.22m deep was also assigned to this phase.

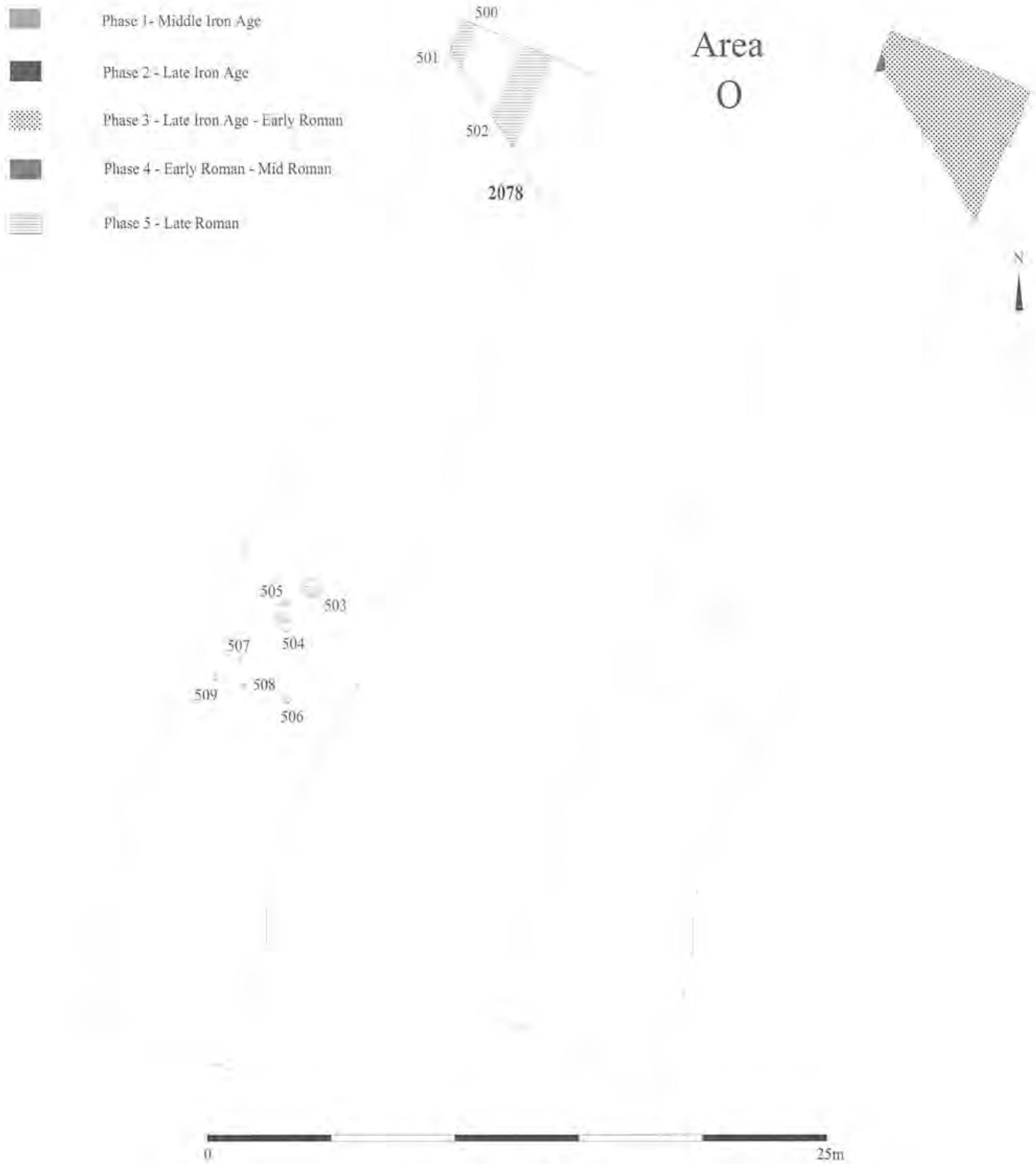

Figure 5: Detail of Area O

Phase 3: Late Iron Age-early Roman

There are probably sub-phases in this period, the earliest feature being ditch 2002 in Area N, this then being truncated by ditch 2003, it is probable they represent a parcelling up of the landscape, but due to the disjointed nature of the excavations, it is difficult to ascertain shape and size of this landscape management (Figure 3).

Two large parallel ditches 2077 and 2078 appear to be the next element in the development of the site (Figures 7 and 14). These were partially in-filled in this late Iron Age-early Roman period which suggests they were originally excavated earlier in the phase, but stratigraphically later than ditch 2003. Elements of these ditches were observed in areas O, P, Q, R, T and had been previously observed in Trenches 2 and 9 and Block G (Bellamy 1999a and b, 2000a and b; Bellamy and Pearce 2001; Bellamy and Tatler 2006) (Figures 5–9 and 12). These are substantial ditches, over 6m wide (up to 7.2m in places) and *c.* 1.60m deep and the combined fieldwork indicates they are at least 200m in length and spaced only some 13m apart. They contained multiple fills, some of the earlier fills containing pottery,

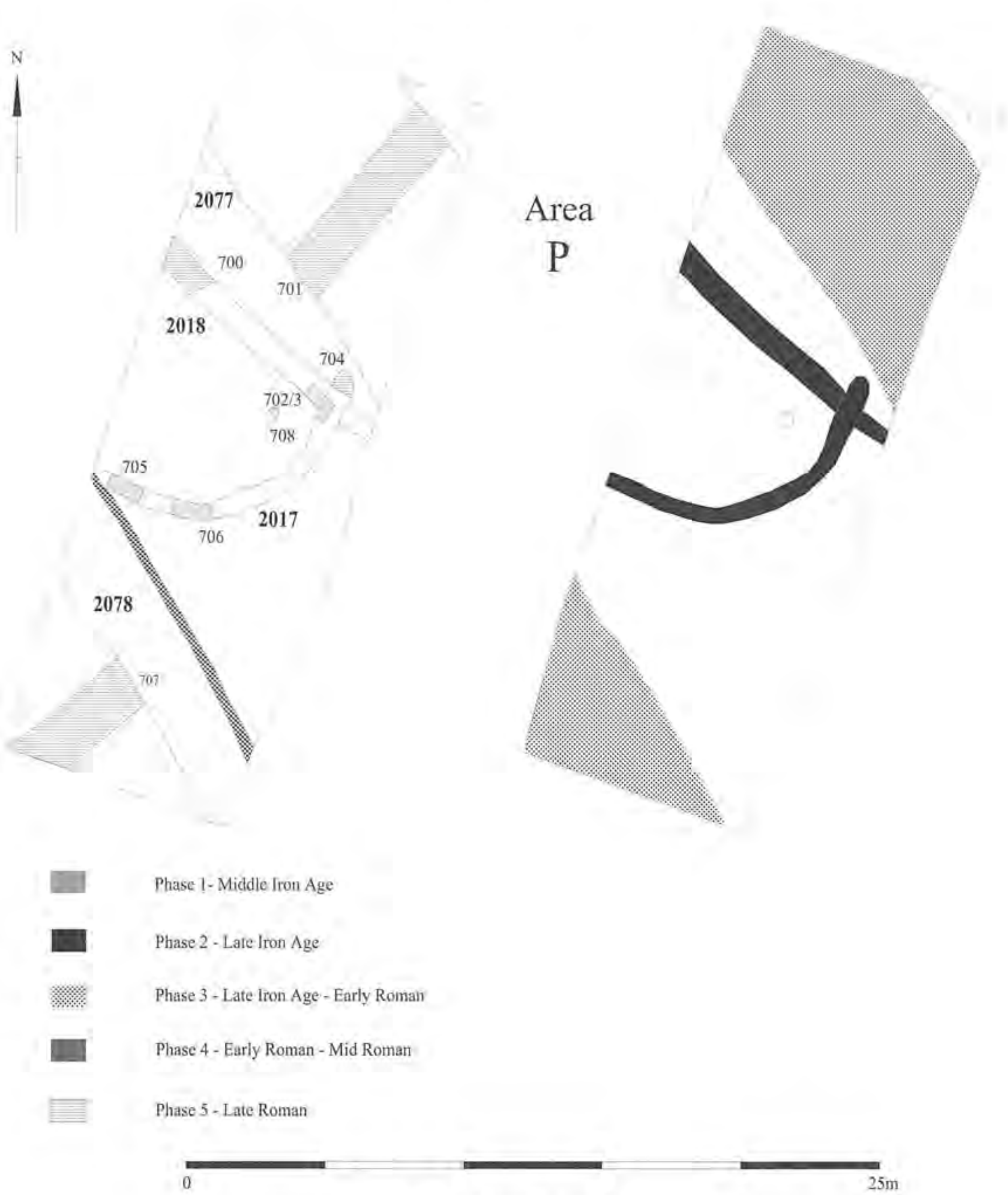

Figure 6: Detail of Area P

fine and coarsewares, briquetage in large concentrations, together with furnace lining and iron nails. No evidence for banks was recorded during this phase of fieldwork, but spatially these could have existed either side of the ditches, as few contemporary features were cut close to them, and the space between them is completely empty except for earlier features (Figure 14). It has been suggested the substantial layers of sand and gravel in a ditch slot excavated during earlier fieldwork may be the remnants of a slighted bank (Bellamy and Tatler 2006). Similar deposits were recorded in the slots excavated during this phase of works, but nothing suggests they formed bank material. In some instances these fills seal peaty/waterlogged fills, which contained seeds of water pepper, sedge, blackberry, rush and pond weed. The substantial dimensions of these ditches, the strong sign they are contemporary and represent a single structure, support a military origin as previously suggested (Bellamy 2000a and b; Bellamy and Pearce 2001; Bellamy and Tatler 2006).

Other features have been assigned to this phase but it is not possible, due to lack of stratification, to state whether they are contemporary with the large ditches or in use slightly earlier or in the later part of this phase. (For the previous work on the site, these were all seen as later than the large ditches, albeit on the basis of only one stratigraphic relationship and the plausible assumption that a series of other parallel ditches would be contemporary.) In Area N, this includes pit 114 which was 0.96m × 0.55m and 0.30m deep and ditches

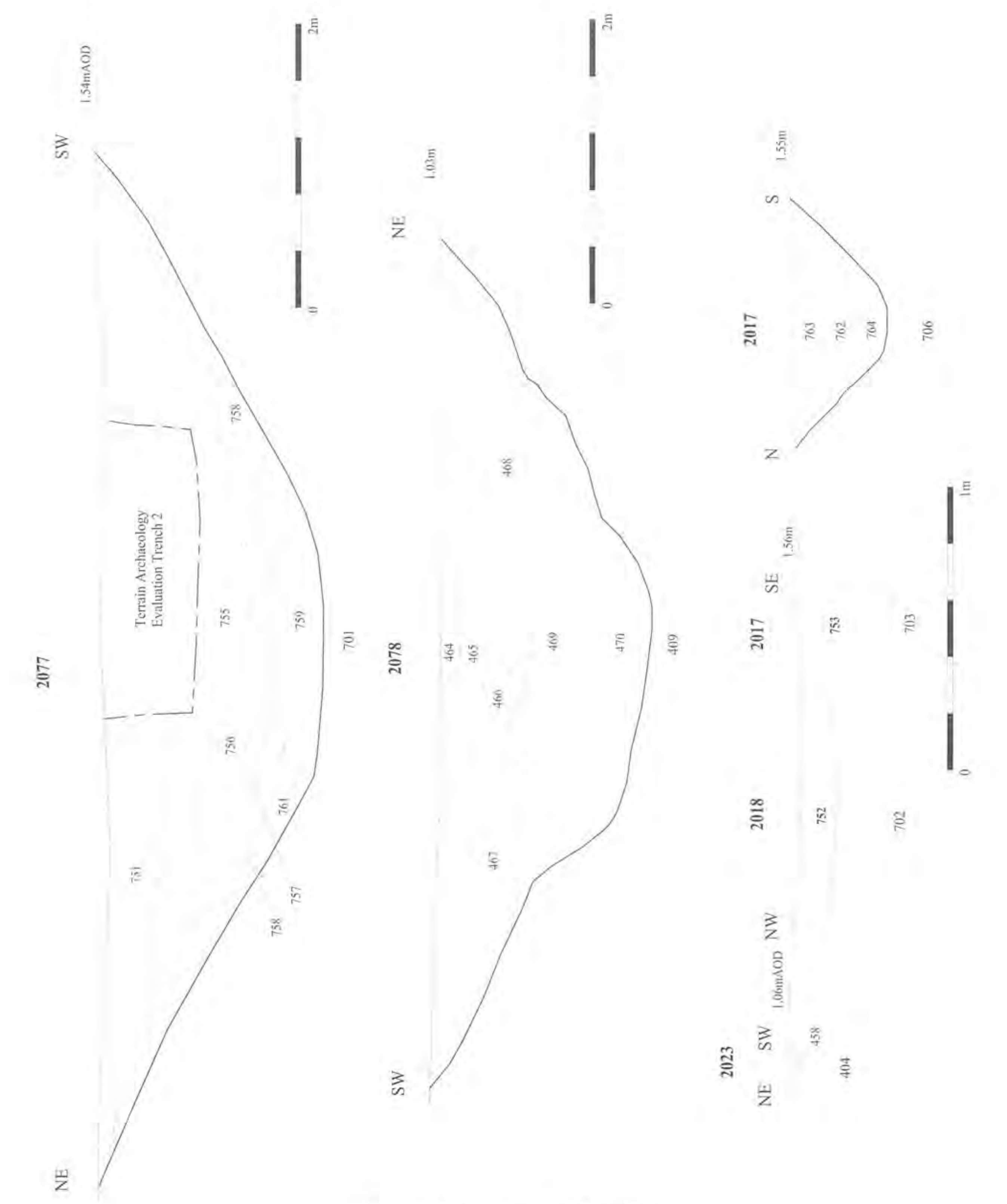

Figure 7: Sections from Area P and Q

2005, 2008, 2009 (Figure 3). Similarly in Area S are a series of narrow gullies (924, 1013, 2044, 2048, 2052–4, 2057–61, 2064–5, 2067–9, 2071–2 and 2076) which do not display any particular favoured orientation, and a number of pits (805, 811–13, 837, 908 1015, 1019, 1021–2, 2070) (Figure 10). Both types of feature contained large assemblages of Hobarrow brine boiling pan fragments and a small assemblage of furnace linings came almost entirely from the gullies. The concentration of salt-making debris and the character of the linear features indicate salt production during this period. The lower fills of the large ditches also contained

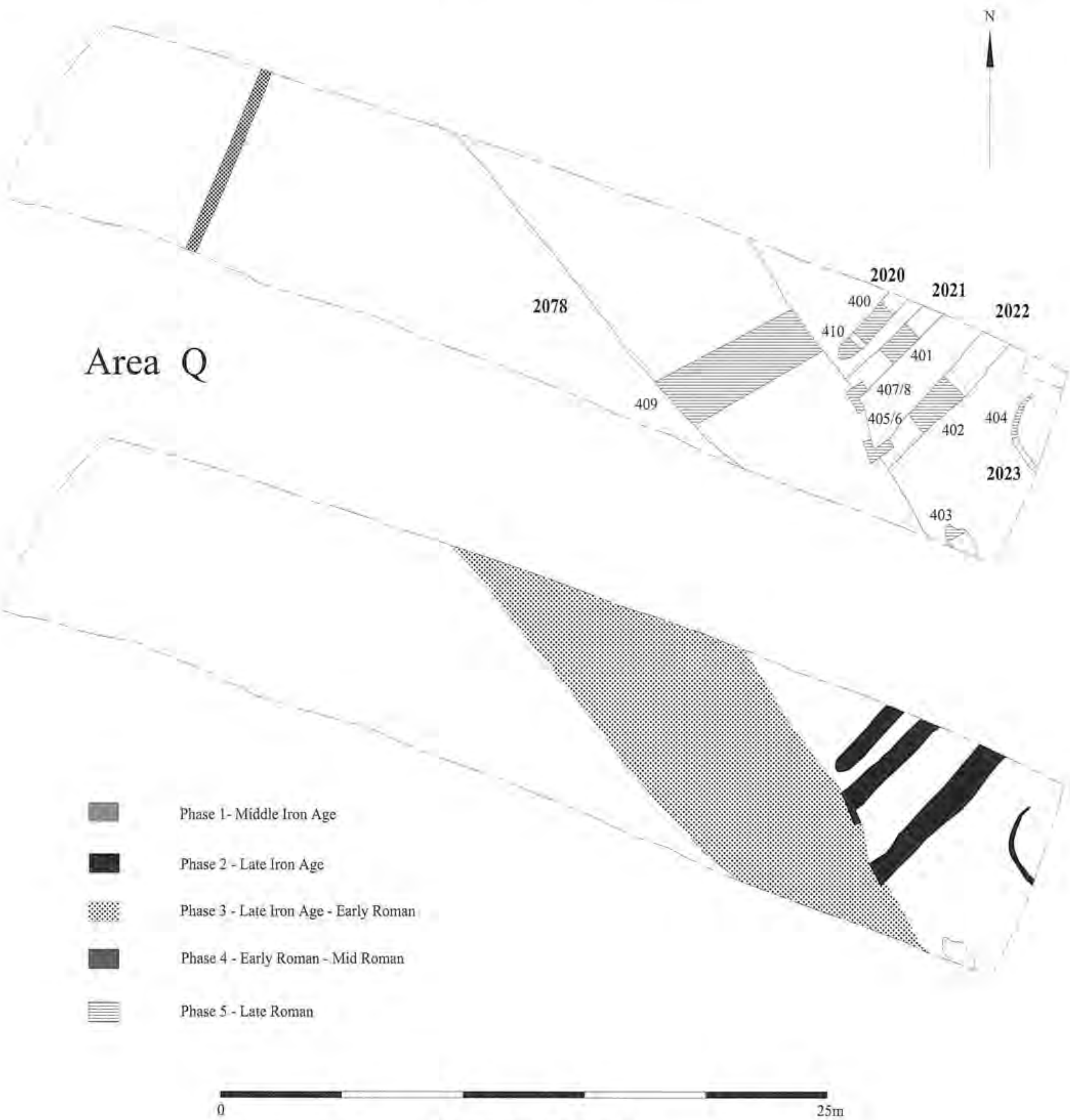

Figure 8: Detail of Area Q

briquetage in large concentrations with furnace lining and if contemporary, support the idea of salt production on the site at the same time as the early use of the ditches.

Pit 837 did not produce a single fragment of briquetage but 42 sherds of Claudio-Neronian pottery were recovered. This pit was substantial, being 2.37m by 1.70m and 2.10m deep; it was possibly a well.

In Area V a small ditch-gully 2034, aligned north-south, could be a southern extension of redefined gullies 2057–9 and again this feature contained briquetage fragments. A pit (20) and gully (35) have also been assigned to this phase together with pits 600 and 604 in Area R (Figures 9 and 13).

Phase 4: Early Roman-mid Roman

The majority of the features assigned to this phase appear in the southern part of the site in Areas N and V, straddling both sides of the large parallel ditches 2078 and 2077 (Figures 3 and 13). The upper fills of ditch 2077 have been assigned to early in this phase, suggesting this ditch and its twin were still at least partially open throughout the previous phase and into the 2nd century.

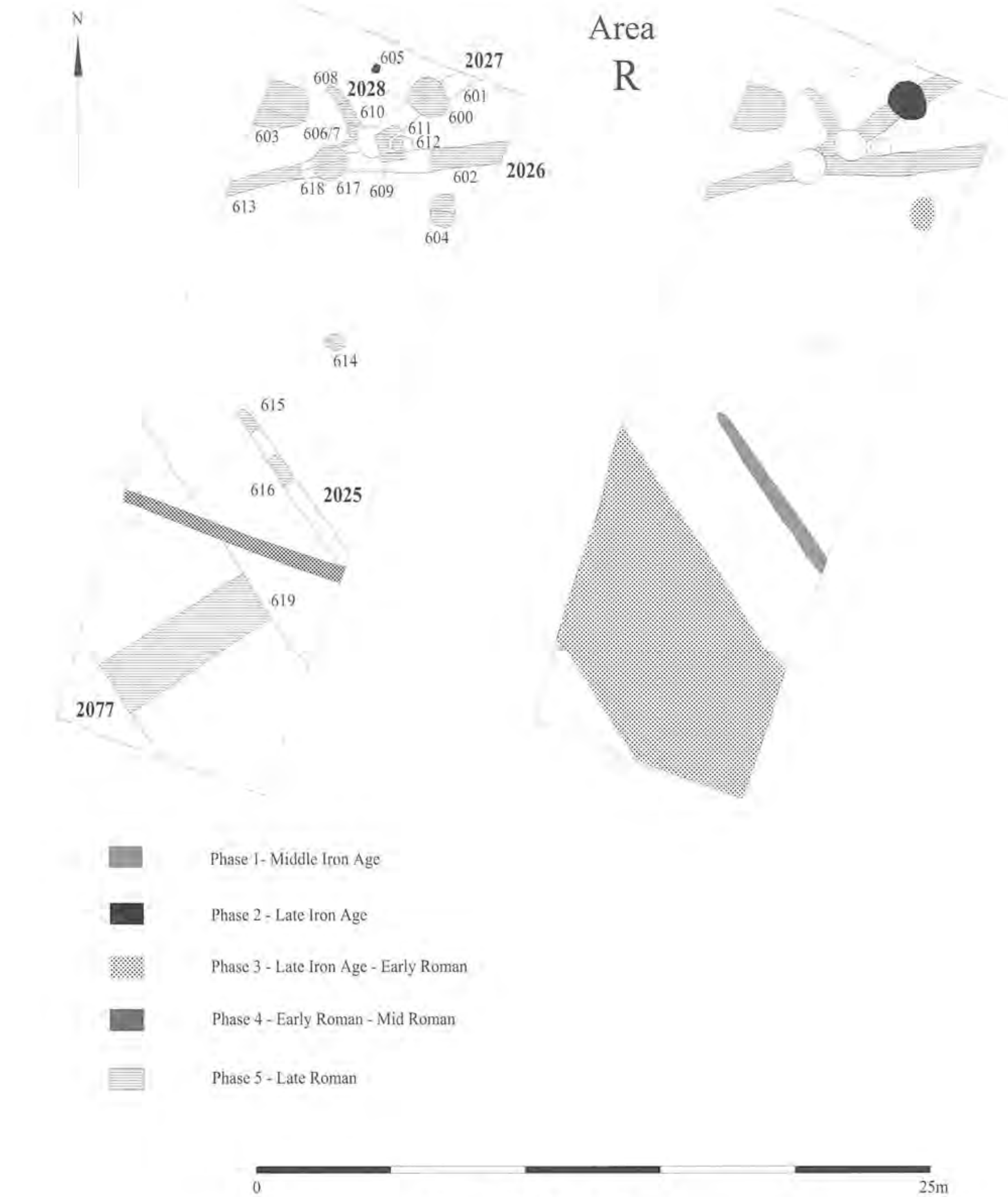

Figure 9: Detail of Area R

A well in Area N comprised a large circular cut (117), 3.20m in diameter, with a gentle lip down to a near vertical cut, excavated to a depth of 1.17m. The top had been truncated by shallow pit 133 (Figure 4). Re-used timber planks (straight cut and including dove-tailed joints) were used to line the shaft which appears circular. The well then appears to have gone out of use and the timbers collapsed in on themselves. Cut 133 may have been for the robbing of the wooden superstructure. A series of linear features were also recorded in Area N (41, 100, 2000, 2004, 2006, 2011) comprising shallow ditches and gullies, possibly again elements in salt manufacture as they too contained a large assemblage of briquetage and furnace lining remains. In Area V a similar series of linear features (2031, 2035–9) again contained salt-working briquetage and probably again represent elements in the salt making process. Ditch 2031 contained smithing debris

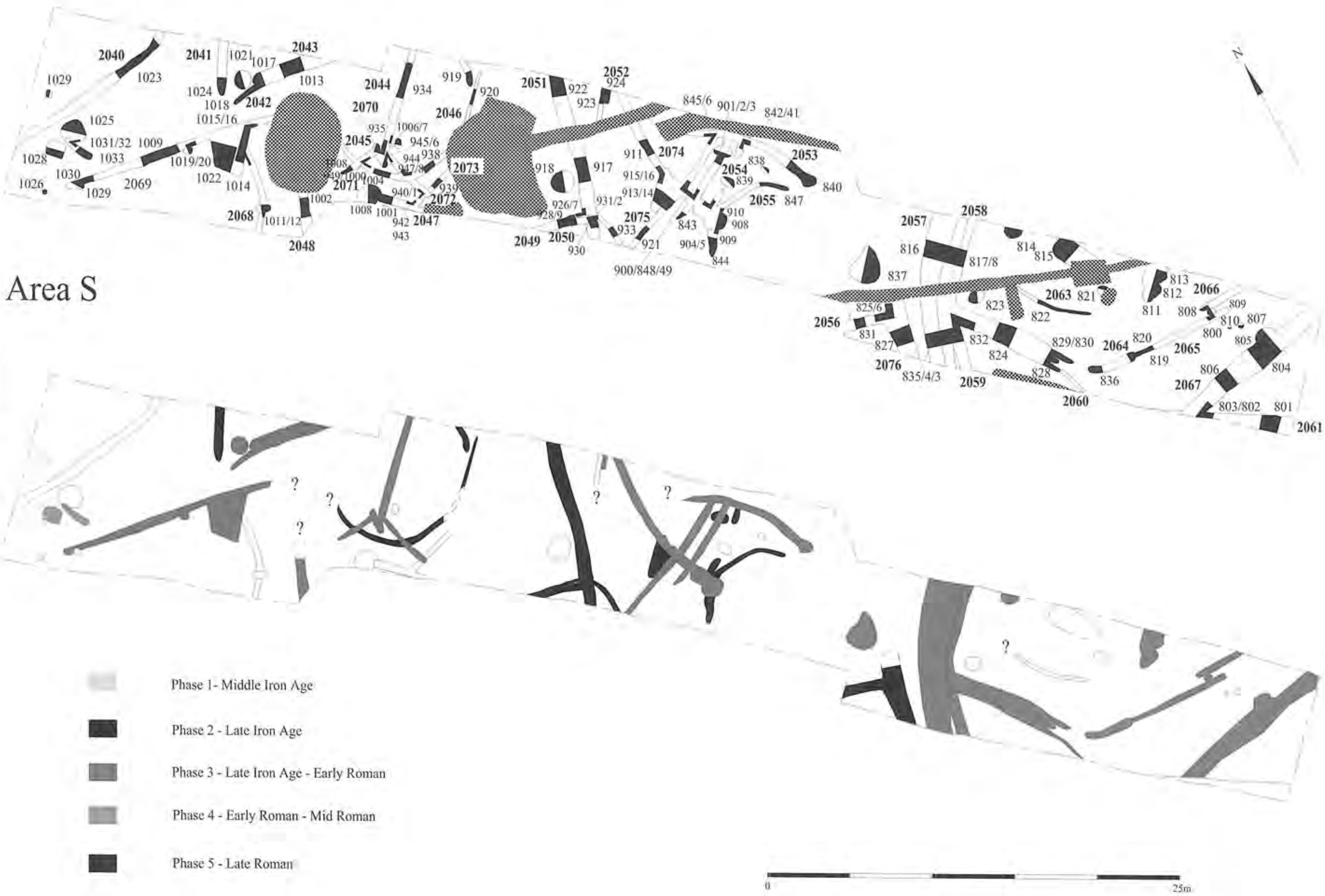

Figure 10: Detail of Area S

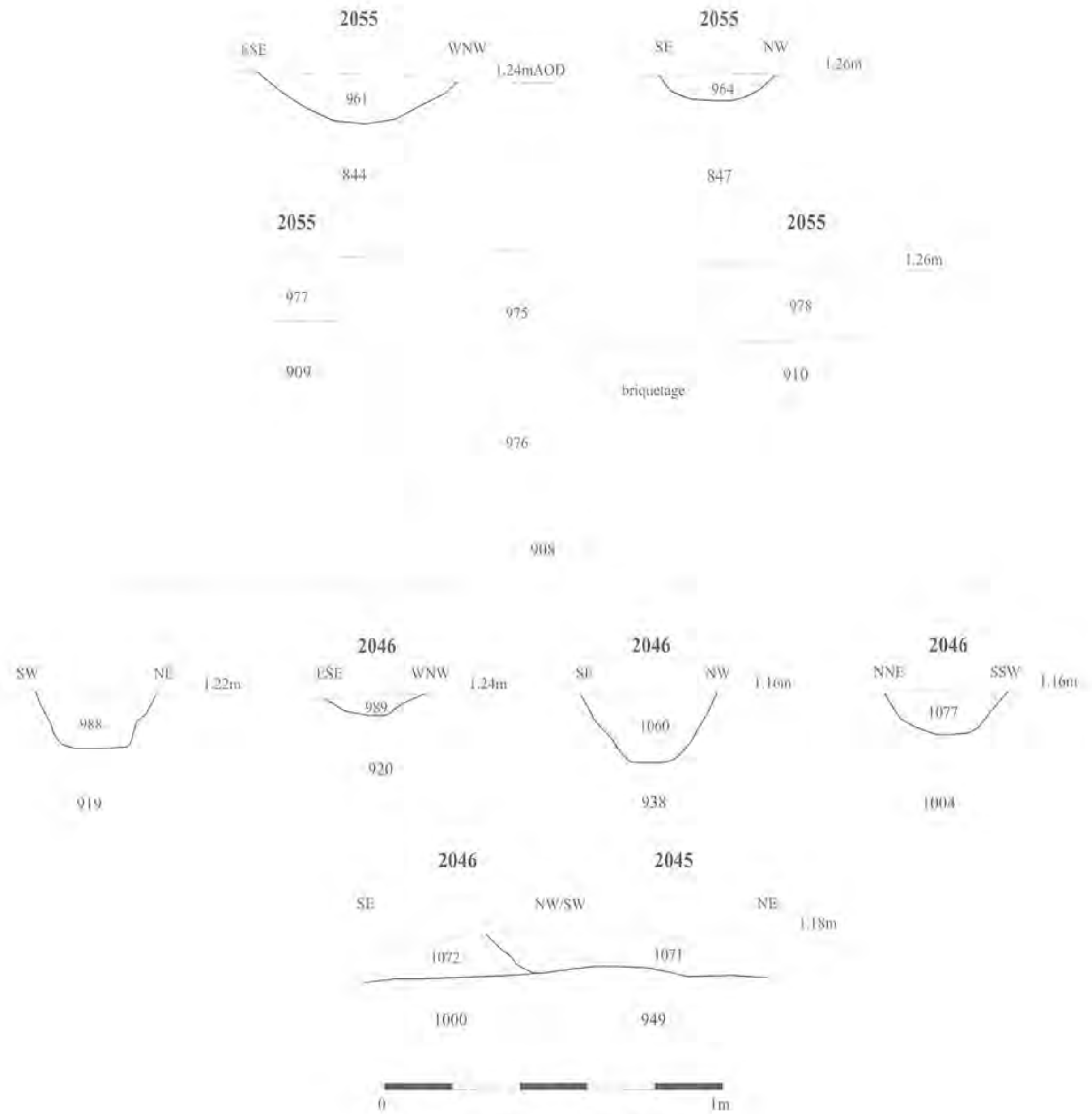

Figure 11: Sections from Area S

together with briquetage. A large circular feature 19/20, possibly an unlined well, cut into this ditch, cannot be securely phased as it only contained residual pottery. It comprised a circular cut 1.10m in diameter which steeply sloped to a deep straight sided shaft 0.60m in diameter. It was hand excavated to 1.10m then augered to its base at 1.50m. The top of the cut appeared to be lined with a clay and its lower fill (72) was waterlogged.

Area T contained a single deep pit (302), 2.65m by 1.75m and 2.20m deep, which may represent another well shaft: no timber was retrieved. Pit 1032 also dates to this period and again contained salt-working briquetage (Figure 12).

Phase 5: late Roman

There is only limited evidence for occupation on the site in this late period. This takes the form of a thin gully 2001 in Area N (Figure 3). This truncates an existing gully 2004 assigned to the early-mid Roman period. A shallow pit 105 is also dated to this phase by the presence of Bestwall pottery, this was 1.71m in diameter and 0.55m deep. In Area R three slight gullies (2026–8) contained very abraded Hobarrow fragments, perhaps residual; 2026 is of this period and the other two may also be, although they contained small amounts of abraded earlier pottery. Pit 603 also dates to this period.

The Finds

Pottery by Malcolm Lyne, Jane Timby, Robert Hopkins and Brenda Dickinson

The excavation yielded 2802 sherds (45,824g) of Late Iron Age and Roman pottery and 4629 fragments

Figure 12: Detail of Area T

(83,177g) of salt-working briquetage from 247 contexts from hand excavation and a further 4285 fragments (12,047g) of pottery and briquetage from sieved soil samples. The pottery includes fragments from Late Iron Age Armorican and Early Roman imports from western Gaul but is for the most part made up of local Durotrigian and Roman Black Burnished ware products. The briquetage is very largely made up of Hobarrow pan fragments, pan supports and furnace lining fragments from local salt production. The samian was catalogued by Robert Hopkins and Brenda Dickinson (Appendix 1) and the amphorae by Jane Timby, with the other wares and briquetage being analysed and reported on by Malcolm Lyne. A summary of the excavated pottery is given in Table 1: a full catalogue by context is available in the archive.

All of the pottery and briquetage assemblages were quantified by numbers of sherds and weights per fabric. These fabrics were classified using a ×8 magnification

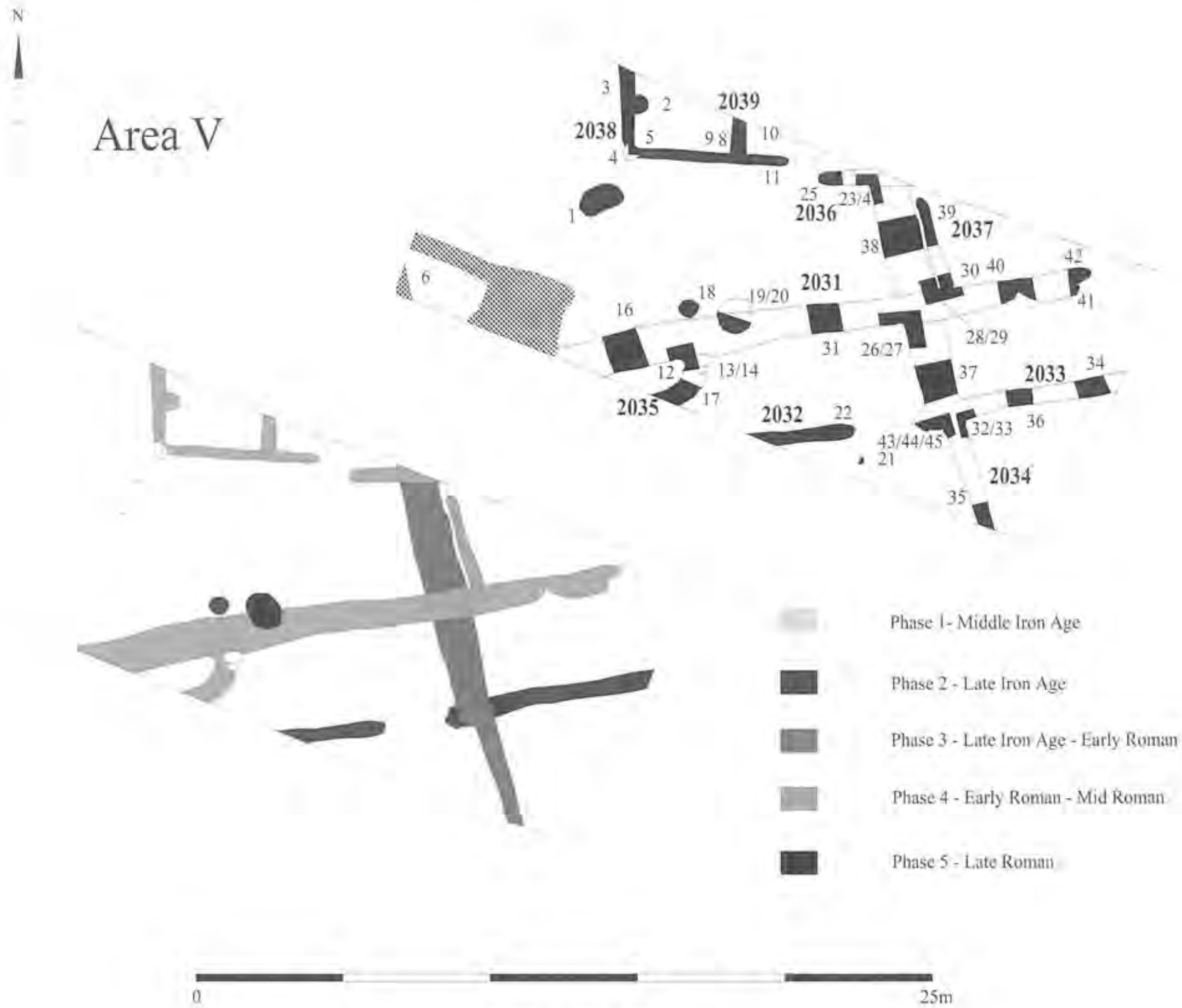

Figure 13: Detail of Area V

lens with built in metric graticule in order to identify the natures, forms, sizes and frequencies of added inclusions. Five numbered fabric series were drawn up with the prefixes C, F, M and B for Coarse wares, Fine wares, Mortaria and Briquetage respectively (for the amphorae, see Timby below). Two of the pottery assemblages (from ditches 2078 and 2077) were considered large enough for quantification by Estimated Vessel Equivalents (EVEs) based on rim sherds (Orton 1975).

Fabrics

Coarse wares

- C1. Rough buff-brown fabric with profuse up-to 2.00mm angular flint and sparse multi-coloured quartz filler (Hengistbury fabric C1a)
- C2a. Handmade orange-brown fabric with profuse up-to 2.00mm vesicles
- C2b. Soft brown fabric with chaff impressions fired polished black externally (Hengistbury fabric J)
- C3a. Soapy grog-tempered grey-black fabric with occasional surface vesicles (Hengistbury fabric D1a)
- C3b. Hard grog-tempered brown-black fabric with additional sparse up to 0.50mm quartz filler
- C4. Rough black fabric fired brown externally with profuse up-to 1.00m angular and subangular white and pink quartz filler
- C5. Coarse sandy rough brown/black crumbly fabric with profuse angular up-to 1.00mm multi-coloured angular quartz and sparse surface vesicles
- C6. Soft black to brown rough fabric with profuse 0.50–1.00mm white quartz and occasional flint (Hengistbury fabric C1b)
- C7. Coarse black fabric with profuse up-to 0.50mm white quartz filler and sparse 1.00mm soft red ferrous inclusions
- C8. Micaceous rough black fabric with profuse up-to 0.50mm angular feldspar and sparse 0.50mm rounded quartz. Breton
- C9. Micaceous black to brown fabric with profuse up-to 0.30mm feldspar and metallic graphite slip. Breton (Hengistbury fabric A3b)
- C10. Wheel-turned grey fabric with profuse 0.20mm metamorphic rock and quartz inclusions fired

Figure 14: Detail of TVAS Features with evaluation features from Trenches 9, 10 and 11

Table 1: Summary of all pottery by fabric type

Fabric	No. sherds	Wt (g)	% No.	% Wt.
CAT AM	4	152	0.1%	0.3%
CAM AM	4	384	0.1%	0.8%
GAL AM	27	834	0.8%	1.8%
BAT AM	51	3226	1.6%	6.9%
CAD AM	15	1781	0.5%	3.8%
Ax	4	327	0.1%	0.7%
Amphorae	**105**	**6704**	**3.2%**	**14.4%**
C1	22	246	0.7%	0.5%
C2	2	38	0.1%	0.1%
C3	49	421	1.5%	0.9%
C4	3	58	0.1%	0.1%
C4/5	1	38	0.0%	0.1%
C5	44	637	1.3%	1.4%
C6	229	2093	7.0%	4.5%
C7	9	31	0.3%	0.1%
C8	12	260	0.4%	0.6%
C9	9	341	0.3%	0.7%
C10	9	68	0.3%	0.1%
C11	25	250	0.8%	0.5%
C12	2459	32565	75.2%	69.7%
C13	3	175	0.1%	0.4%
C14	1	5	0.0%	0.0%
C15	1	14	0.0%	0.0%
Cx	5	42	0.2%	0.1%
Coarsewares	**2883**	**37282**	**88.2%**	**79.8%**
F1	78	786	2.4%	1.7%
F2	3	9	0.1%	0.0%
F3	11	130	0.3%	0.3%
F4	1	1	0.0%	0.0%
F5	3	28	0.1%	0.1%
F6	3	9	0.1%	0.0%
F7	12	154	0.4%	0.3%
F8	79	657	2.4%	1.4%
F9	1	18	0.0%	0.0%
F11	5	15	0.2%	0.0%
F12	21	167	0.6%	0.4%
F13	3	31	0.1%	0.1%
F14	1	2	0.0%	0.0%
F15	1	3	0.0%	0.0%
F16	2	20	0.1%	0.0%
F17	1	30	0.0%	0.1%
F18	2	12	0.1%	0.0%
F20	1	10	0.0%	0.0%
F21	4	83	0.1%	0.2%
F22	1	16	0.0%	0.0%
FX	5	50	0.2%	0.1%
Finewares	**238**	**2231**	**7.3%**	**4.8%**
M1	2	302	0.1%	0.6%
M2	1	82	0.0%	0.2%
Mortaria	3	384	0.1%	0.8%
Misc	41	103	1.3%	0.2%
China	1	3		
PMed	1	1		

smooth micaceous black with pink margins. Breton

C11. Crumbly vesicular black fabric with grog and sparse 0.50mm sub-angular white quartz filler. Breton

C12a. Coarse Durotrigian black fabric with profuse up-to 1.00mm angular and subangular white and colourless quartz filler. Occasional coarser inclusions

C12b. Durotrigian Black-Burnished ware with profuse up-to 0.50mm subangular white and colourless quartz filler with occasional shale

C12c. Finer BB1 version with profuse up-to 0.30mm white and colourless subangular quartz filler

C13. Buff-brown micaceous fabric with profuse 0.10mm multi-coloured quartz, larger angular feldspar and patchy brown external colour-coat. ?Central Gaulish

C14. Central Gaulish Fine Micaceous ware with golden mica slip

C15. Handmade black fabric with shell and sparse 1.00mm multi-coloured quartz filler

Cx. Unassigned coarsewares

Finewares

F1a. La Graufesenque samian

F1b. Martres de Veyre samian

F1c. ?Pulborough samian

F2. Micaceous pink Central Gaulish *Terra Rubra* fabric with traces of external orange colour-coat

F3. *Terra Nigra*

F4. Lyon ware

F5. Buff-brown Campanian Pompeian Red fabric with internal deep red colour-coat and profuse up-to 0.20mm quartz, feldspar and black sand (PRW1)

F6. Hard sand-free pink fabric with occasional up-to 1.00mm rounded red ironstone inclusions, matt orange colour coat and sand roughcasting. South Gaulish

F7a. Sand-free polished off/white-cream fabric

F7b. Slightly micaceous white fabric with fine red iron inclusions and orange-brown paint band on exterior. Probably Roanne

F7c. Wheel-turned pinkish cream flagon fabric with occasional up-to 0.50mm soft red ferrous inclusions and internal grey discolouration from sealant. Rigby Fabric A

F7d. Silt tempered pink fabric fired marbled reddish-brown/yellow

F8a. Sand-free to silt tempered cream Corfe Mullen fabric with brown/red ferrous inclusions

F8b. Very-fine-sanded rough cream fabric with profuse up-to 0.30mm iron-stained and colourless quartz filler

F8c. Cream Corfe Mullen fabric variant with sparse crushed 2.00–10.00mm red ironstone inclusions

F9. Silt-tempered off-white fabric with external brown/buff colour-coat

F10. Hard sand-free pale grey fabric with soft red and white inclusions, fired cream externally
F11. Silt tempered orange-buff fabric fired smooth buff
F12. Sand-free orange with sparse red up-to 0.50mm red ferrous inclusions and patchy external white slip
F13. Silt tempered pink fabric
F14. Sand-free polished grey fabric
F15. Sand-free micaceous grey fabric
F16. Rough pale buff dimpled beaker fabric with profuse up-to 0.10mm multi-coloured quartz filler and silt-sized black and red inclusions. External gilt mica wash
F17. Wheel-turned hard micaceous pink fabric fired buff-yellow with sparse up-to 0.50mm multi-coloured quartz filler
F18. Wheel-turned micaceous pinkish-brown fabric with silt-sized quartz and soft red ferrous inclusions
F19. Buff fabric with up-to 0.10mm igneous inclusions. Patchy brown external colour-coat and micaceous surfaces
F20. Buff-brown fabric with profuse silt-sized quartz and occasional black obsidian inclusions. Reddish-brown colour-coat on rim and discontinuous external cream wash
F21. Sand-free yellow-brown fabric with soft up-to 2.00mm brown and white inclusions
F22. Campanian pink cored polished black fabric with occasional quartz inclusions
Fx Unassigned finewares

Mortaria

M1. Silty buff *mortaria* fabric with ferrous inclusions and occasional large voids. (NFSE–2667 fabric)
M2. Silt-tempered greyish-white fabric with 0.50mm black ironstone trituration grits extending into body of fabric

The Pottery assemblages

Phase 2. *c.* 100–50BC

Assemblage 1. Ditch 2051 (contexts 985, 991, 992 and 1054). Cut 922 was the only section to yield significant quantities of pottery (49 sherds, 878g). This assemblage is too small for any form of meaningful quantification but includes a number of large fresh sherds from the following Armorican imports:

Figure 15(1): Necked bowl in fabric C9 fired black with profuse felspathic filler and graphite slip over its rim and neck. Ext. rim diameter 240mm. Probably from Finistere or western Morbihan (Cunliffe and Brown 1987, 314) and paralleled at Le Camp D'Artus, Finistere (Wheeler and Richardson 1957, figures 5–15 and 6–88). *c.* 75–25BC.

Figure 15(2): Cordoned jar in crumbly grog-tempered grey-black fabric C11 with sparse sub-angular white quartz up to 0.50mm and profuse up to 1.00mm rounded vesicles. Ext. rim diameter 200mm.

These two vessels account for 32 of the 49 sherds in the assemblage: other fragments of more local origin include six fresh thick-walled jar sherds in grey-black handmade fabric C5 fired rough yellow-brown externally, two in grog-tempered fabric C3a (Brown 1987, Fabric D1a) dated *c.* 100–50BC, and the following:

Figure 15(3): Bead rim jar of Hengistbury Class JC2.0 in rough black fabric C1 with sand and crushed flint filler. Ext. rim diameter 220mm. Paralleled in Phase 2 assemblages at Gussage All Saints (Wainwright 1979, figure 59–200). *c.* 400–50BC.

An abraded fragment from a Bestwall type 6/2 bowl (Lyne forthcoming, *c.* AD 210–280/90) is clearly intrusive: the same can probably be said for the three abraded Hobarrow pan fragments from context 992.

Assemblage 2. Ditch 2041. The 12 sherds from this feature comprise one fresh jar fragment in soft brown chaff tempered fabric C2b and 11 in quartz-sand and crushed-flint tempered fabric C1: these latter include sherds from the following vessels:

Figure 15(4): Bead-rim jar of Hengistbury Class JC2.0 fired rough black to brown. Ext. rim diameter 220mm. *c.* 400–50BC.

Figure 15(5): Another example in similar fabric. Ext. rim diameter 120mm.

Ten sherds in calcined-flint tempered Fabric C1 and one in grog-tempered fabric C3a were retrieved from environmental samples and include fresh fragments from the following:

Figure 15(6): Bead-rim saucepan pot in rough buff-brown fabric C1. Ext. rim diameter 200mm.

Assemblage 3. Ditches 2056 and 2076. The 11 sherds from these connecting features comprise nine in fabric C3b, and two in fabric C9: these include the following:

Figure 15(7): Lid seated necked-bowl in micaceous brown fabric C9 fired polished black with graphite slip. Paralleled at the Camp d'Artus, Finistere (Wheeler and Richardson 1957, figure 5–12). *c.* 100–50 BC.

Figure 15(8): Bead-rim jar in rough black fabric C3b with profuse up to 1.00mm grog and subangular white quartz filler. Ext. rim diameter 90mm.

Figure 15(9): Hole-mouthed jar in friable rough similar fabric fired black. Ext. rim diameter 200mm.

Phase 3. c. 50BC–AD.70

Assemblage 4. Ditch 2034. The 87 sherds (1429g) of pottery from this feature is too small an assemblage for detailed quantification but has Durotrigian Black-Burnished and BB1 fabric C12 variants making up 88% of it and has hardly any Continental imports.

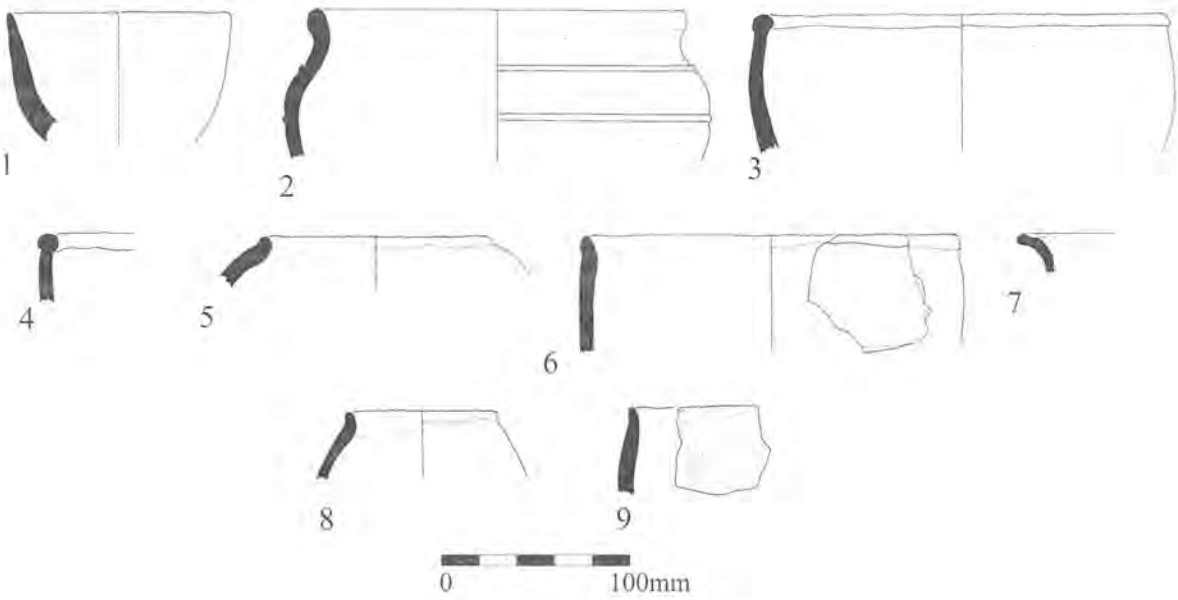

Figure 15: Pottery c. 100–50BC

Table 2: Assemblage 5, quantification by EVEs

Fabric	Jars	Bowls	Dishes	Beakers	Others		Total	%
C6	P						P	–
C12A/B Black	2.86	0.28					3.14	57.2
C12A/B Oxidized	1.14	0.05	0.25		Jug	0.16	1.60	29.1
C12c Black	0.01						0.01	0.2
C13	P						P	–
F1a		0.09			Cup	0.25	0.34	6.2
F6				0.11			0.11	2.0
F7a					flagon		P	–
F7b					flagon		P	–
F8a					flagon		P	–
F12					flagon		P	–
F21					closed		P	–
A2					Amphora	0.29	0.29	5.3
A4a					Amphora		P	–
A6					Amphora		P	–
Total	*4.01*	*0.42*	*0.25*	*0.11*		*0.70*	*5.49*	
%	73.0%	7.7%	4.6%	2.0%		12.7%		

P: Present

This and the presence of four Middle Iron Age and Late Iron Age 1 sherds in fabrics C3a and C4/5 suggest a date-range of *c.* 50BC–AD.43 for the assemblage. Durotrigian Black-Burnished wares include fragments from two everted-rim storage-jars of Hengistbury type JE4.2, four bead-rim jars, a bead-rim storage-jar of type JC4.2 and the following:

Figure 16(10): ?Crucible with diagonal wipe marks on its exterior fired black. Ext. rim diameter 120mm.

The six imported sherds comprise a jar fragment in Central Gaulish fine micaceous ware with traces of golden micaceous slip in fabric C14 (Tyers 1996, Fabric C. *c.* 15BC–AD43) and five abraded ?*Cam* 186 amphora chips in soft buff-yellow brown fabric A4b (*c.* 50BC–AD150).

Assemblage 5. From the lower fills of cuts 303, 619 and 701 across Ditch 2077 (Table 1). Eighteen fills of this massive ditch yielded 453 sherds (6397g) of pottery

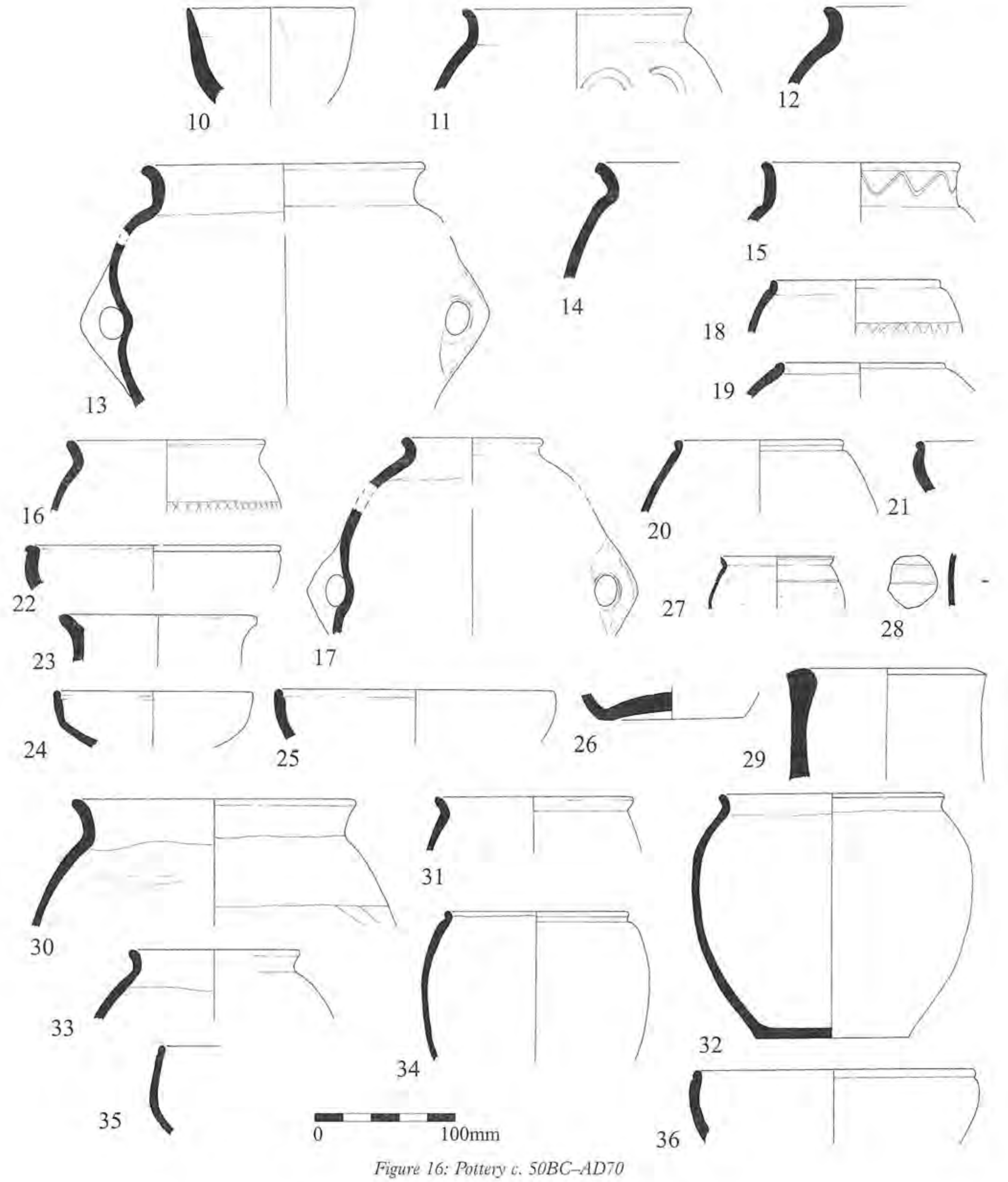

Figure 16: Pottery c. 50BC–AD70

and 597 fragments (10,741g) of briquetage; a large enough assemblage for quantification by EVEs:

The local black-burnished ware sherds in Fabric C12 variants make up an overwhelming 87% of the assemblage. Jars in this fabric can be divided between bead-rim and necked jars (23 and 77% respectively). Forms include a carinated bowl of Hengistbury type BD5.3, at least two 'war cemetery' bowls of type BC3.12 and the following:

Figure 16(11): Jar of Hengistbury type JE4.2 in patchy fired BB1 fabric C12b with impressed lunettes on its shoulder. Ext. rim diameter 160mm. Paralleled on the Late Iron Age 2 occupation site at Tollard Royal (Wainwright 1969, figure 19–77) and elsewhere but absent from the earliest Roman occupation levels in Dorchester and Exeter. The impressed decoration is far more common on bead-rim jars, suggesting that necked vessels with this type of treatment had a very short-lived currency before the Roman invasion. *c.* AD 25–43/50. Context 751 (slot 701).

Figure 16(12): Another, undecorated, example in black BB1 fabric C12b. Ext. rim diameter 280mm. Context 756 (slot 701).

Figure 16(13): Jar of Hengistbury type JD4.41 in BB1 fabric C12b with countersunk handles fired black. Ext. rim diameter 200mm. Wheeler (1943, 210–13) dated this type of jar with countersunk handles to after AD25. Context 683 (slot 619).

Figure 16(14): Jar of type JE4.2 in similar but oxidized fabric. Ext. rim diameter 240mm. Context 689 (slot 619).

Figure 16(15): Jar in coarse Durotrigian Black-Burnished ware fabric C12a fired black, of form transitional between Hengistbury type JE4.2 and Gillam type 1 (1977) with burnished chevrons on exterior of rim. Ext. rim diameter 140mm. *c.* AD43–120. Context 756 (slot 701).

Figure 16(16): Jar with weakly-everted rim in similar fabric with acute-lattice decoration on its body. Ext. rim diameter 140mm. *c.* AD.43–120. Context 683 (slot 619).

Figure 16(17): Jar with stubby everted rim of Greyhound Yard type 58 (Woodward *et al.* 1993) in coarse Durotrigian Black-Burnished fabric C12a fired black. Ext. rim diameter 100mm. *c.* 50BC–AD70. Context 686 (slot 619).

Figure 16(18): Bead-rim jar in black BB1 fabric C12b fired polished black. Ext. rim diameter 120mm. *c.* 50BC–AD100. Context 687 (slot 619).

Figure 16(19): Bead-rim jar in similar fabric. Ext. rim diameter 120mm. *c.* 50BC–AD100. Context 751.

Figure 16(20): Bead-rim jar in coarse Durotrigian Black-Burnished ware fabric C12a. Ext. rim diameter 120mm. *c.* 50BC–AD100. Context 756.

Figure 16(21): Bowl of Hengistbury type BC3.2 in similar fabric. Similar to examples from Stickland's Garden, Stoborough and Redcliff (Lyne 2003, figures 6–12 and 8–29). *c.* 50BC–AD50. Context 751 (slot 701).

Figure 16(22): Bowl of Ower type 15 with incipient flange in similar fabric. Ext. rim diameter 180mm. *c.* AD43–100. Context 756 (slot 701).

Figure 16(23): Ledge-rim jug or flagon of Exeter type 10.1 in patchy-fired BB1 fabric C12b. Ext. rim diameter 140mm. Context 751 (slot 701).

Figure 16(24): Deep lid of Ower type 18 in similar but oxidized fabric. Ext. rim diameter 140mm. *c.* AD40–100. Context 683 (slot 619).

Figure 16(25): Simple lid or convex-sided dish in similar fabric. Ext. rim diameter 200mm. Context 689 (slot 619).

The 19 sherds from imported fine and coarse wares include five South Gaulish samian sherds from forms Dr 24/25 (*c.* AD43–70), Dr 27 (*c.* AD43–110), Dr 29 (riveted, *c.* AD43–85) and Ritt 8 (*c.* AD43–70), three flagon fragments in Corfe Mullen whiteware fabric F8a, four in fabric F12, and the following:

Figure 16(26): Base of closed form with smooth underside in buff-grey fabric C13 with profuse 0.10mm quartz filler, surface mica and traces of brown colour-coat extending down its interior surface. Context 686 (slot 619).

Figure 16(27): Roughcast beaker with a cornice rim in cream fabric F6 with matt orange colour-coat applied with a brush over quartz-sand roughcasting. Ext. rim diameter 80mm. Probably South Gaulish. *c.* AD43–70. Context 683 (slot 619).

Figure 16(28): Counter trimmed from ?flagon sherd in polished white fabric F7b with orange-brown painted horizontal band. The inner surface is blackish grey with the remnants of a black residue, possibly pitch. The fabric is reminiscent of the Roanne painted bowls of which two have been documented in Britain, one at Oare, Wilts (Swan 1975, figure 5.57); the other from Cleavel Point, Ower (Timby 1987, figure 41.33). *c.* AD50–100. Context 683 (slot 619).

The 25 amphora sherds comprise eighteen Dressel 20 fragments in Baetican fabric, one from a Dressel 2–4 in Catalan fabric, four from a Gauloise 4 in micaceous cream fabric and two from the following:

Figure 16(29): Pascual 1 amphora in pink Catalan fabric with internal yellow coating. Ext. rim diameter 140mm. *c.* 50BC–AD20. Context 758 (slot 701).

Pre-Flavian Continental and other fineware imports are absent from the lowest fills of the ditch. The only non-local sherds from these contexts are two Catalan Pascual 1 fragments (including Figure 18(29), two Dressel 20 sherds and two jar fragments in ?Central Gaulish fabric C13. This suggests that the ditch was cut some time before the Roman Conquest but remained in use after AD43.

Assemblage 6. From the lower fills of Ditch 2078 (Table 3). Fifteen contexts yielded 419 sherds (7421g) of pottery and 1654 fragments (37970g) of brine-boiling briquetage. The assemblage was large enough for quantification by EVEs:

Local black-burnished wares make up 74% of this assemblage although this percentage is distorted downwards by the presence of a complete Corfe Mullen flagon top. The jars, as before, can be divided between bead-rim and necked examples (26 and 74% respectively).

Table 3: Assemblage 6: quantification by EVEs

Fabric	Jars	Bowls	Dishes	Beakers	Others		Total	%
C12a/b black	3.91	0.82	0.09		Jug	0.25	5.07	64.7
C12a/b oxidized	0.50				Jug	0.26	0.76	9.7
F1a		0.24	0.35				0.59	7.5
F2			P				P	–
F6				0.12			0.12	1.5
F7a					Flagon	1.00	1.00	12.8
F7c					Flagon	P	P	–
F8a					Flagon	P	P	–
F9					Closed	P	P	–
M1					Mortarium	0.30		3.8
A2					Amphora	P	P	–
A4a					Amphora	P	P	–
A4b					Amphora	P	P	–
A8					Amphora	P	P	–
Ax					Amphora	P	P	–
Total	*4.41*	*1.06*	*0.44*	*0.12*		*1.81*	*7.84*	
%	56.3%	13.5%	5.6%	1.5%		23.1%		

Figure 16(30): Jar of Hengistbury type JE4.2 in BB1 fabric C12b fired polished black. Ext. rim diameter 200mm. *c*. 50BC–AD70. Context 465 (slot 409).

Figure 16(31): Jar with stubby everted rim of Greyhound Yard, Dorchester form 58 (Woodward *et al.* 1993) in BB1 fabric C12b fired polished black. Ext. rim diameter 140mm. *c*. AD50–120. Contexts 464 and 465 (slot 409).

Figure 16(32): Jar with weak everted rim in similar fabric fired polished black. Ext. rim diameter 160mm. Context 466 (slot 409).

Figure 16(33): Another example in similar fabric. Ext. rim diameter 120mm. Context 468 (slot 409).

Figure 16(34): Bead-rim jar in similar fabric. Ext. rim diameter 130mm. One of five. A very common Durotrigian Late Iron Age form which continued in use until *c*. AD100 (Holbrook and Bidwell 1991, type 3). Context 466 (slot 409).

Figure 16(35): 'War Cemetery' bowl of Hengistbury type BC3.12 in polished black BB1 fabric C12b fired polished black. *c*. AD.40–150. Context 465 (slot 409).

Figure 16(36): Bowl of Hengistbury type BC3.2 in similar fabric. Ext. rim diameter 200mm. *c*. 50BC–AD50. One of four. Context 466 (slot 409).

Figure 17(37): Dish of Ower type 25 (Woodward 1987) in BB1 fabric C12b fired polished black. Ext. rim diameter 180mm. Context 465 (slot 409).

Figure 17(38): Jug in similar fabric but oxidized. Ext. rim diameter 120mm. Paralleled at Ower (Woodward 1987, figure 49–167). *c*. AD43–200. Context 468 (slot 409).

The 46 fine ware and *mortaria* sherds include 18 from South Gaulish samian forms Dr 15/17 (*c*. AD55–85), Dr 18 (*c*. AD55–90), Dr 24/25 (*c*. AD55–70), Dr 27 (*c*. AD70–100) and Dr 29 (*c*. AD40–70), 22 sherds from flagons in Corfe Mullen Whiteware fabrics F7c and F8a, one in fabric F9 and the following:

Figure 17(39): Base sherd from open form in micaceous pink Central Gaulish *Terra Rubra* fabric with grey 90 degree latticing beneath orange internal colour-coat. *c*. 20BC–AD45. Context 468 (slot 409).

Figure 17(40): Ring necked flagon in off-white fabric F7a with brown internal sealant splashing over its rim. Ext. rim diameter 70mm. *c*. AD43–70. Context 466 (slot 409).

Figure 17(41): *Mortarium* of Hartley (1985) Group III in buff fabric M1 with occasional large voids. Ext. rim diameter 220mm. *c*. AD45–60. One of two. Context 466 (slot 409).

A sherd from the same roughcast beaker as is present in Assemblage 5 from the parallel Ditch 2077 (Figure 18(26) is also present. The nine amphora sherds include two in Catalan fabric and three from Gauloise vessels in orange fabric. Imported pre-Flavian and Flavian finewares are present in all of the fills of slot 409, suggesting that this ditch was filling *c*. AD50/55.

Assemblage 7. From Ditch 2067. This ditch yielded 47 sherds (1281g) of pottery and 61 fragments (622g) of briquetage. Nearly half of the sherds (49%) are in

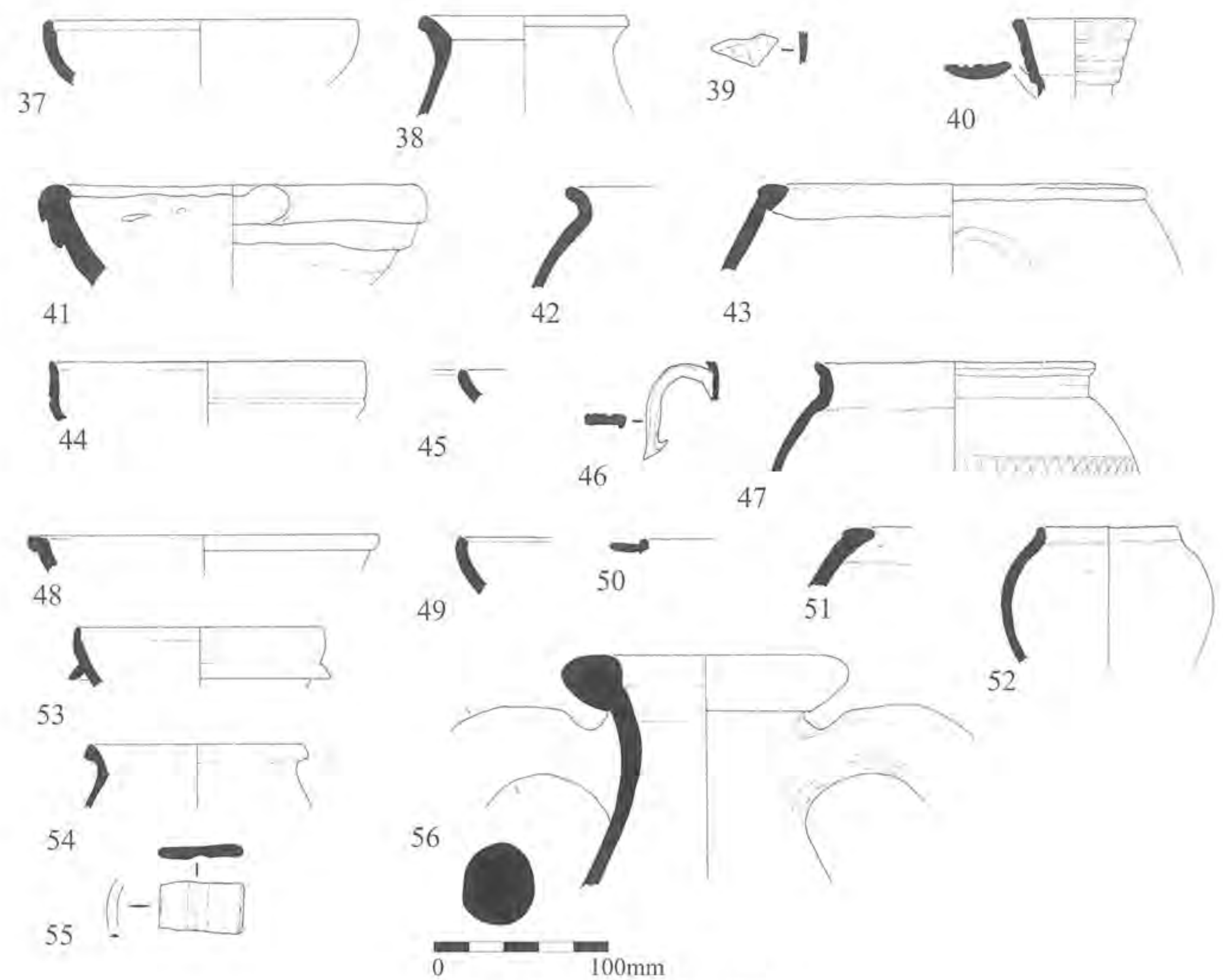

Figure 17: Pottery c. 50BC–AD70

local black-burnished ware fabric C12 variants and include fragments from bead-rim jars, a bowl similar to Figure 18(20) and the following vessels:

Figure 17(42): Everted rim jar fired polished black. A countersunk handle may belong to this vessel. Ext. rim diameter 260mm. *c*. AD25–120. Context 854 (slot 804).

Figure 17(43): Bead-rim jar of Hengistbury type JC4.2 in polished black Durotrigian fabric C12a with impressed lunettes on its shoulder. Ext. rim diameter 220mm. Paralleled at Maiden Castle (Wheeler 1943, Figure 69–142) in context dated *c*. AD1–25 and at Bestwall Quarry (Lyne forthcoming). *c*. 50BC–AD43. Context 855 (slot 804).

Figure 17(44): Unusual carinated and lid-seated bowl fired polished black. Ext. rim diameter 180mm. *c*. AD43–70. Context 853 (slot 803).

Sherds in other fabrics comprise 13 bead-rim jar sherds in Late Iron Age 1 fabric C6, a jar basal sherd in off-white fabric F16 with external gilt mica slip, two flagon sherds in Corfe Mullen whiteware fabric F8a (*c*. AD43–60), five Dressel 20 amphora sherds in Baetican fabric A6 (*c*. AD1–250) and the following:

Figure 17(45): Platter fragment in Campanian Pompeian Red fabric F5 (Peacock 1977, Fabric PRW1). *c*. 15BC–AD80. Context 855 (slot 804).

Figure 17(46): Flagon handle in hard pink fabric F17 fired buff. Context 854 (slot 804).

Assemblage 8. From Pit 805. This feature can be dated *c*. AD43–60. It yielded 91 sherds (2942g) of pottery and 135 fragments (2740g) of briquetage. Local Black-Burnished ware sherds make up 43% of the pottery assemblage but are almost entirely lacking in diagnostic fragments: a single jar sherd in Middle Iron Age/Late Iron Age 1 grog-tempered fabric C3a is probably residual. The 38 fineware sherds comprise eleven fresh fragments from a flagon in Corfe Mullen whiteware fabric F8a, four in the coarse variant F8c from the same source (*c*. AD43–60), eighteen in pink fabrics F12 and F13 of probably similar origin and date, a sherd in marbled fabric F7d, two sherds from a Pompeian Red platter in Campanian PRW1 fabric (*c*. 15BC–AD80), a sherd from an open form in black Campanian ware fabric F22 and

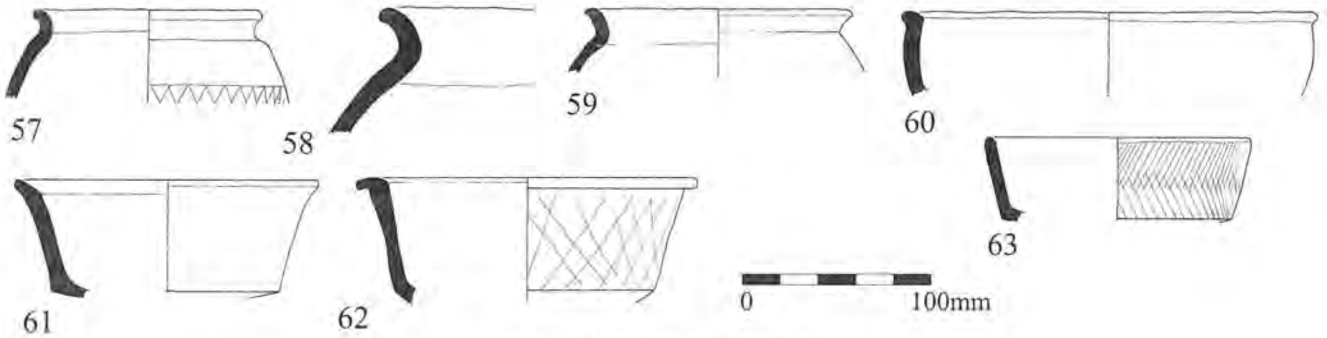

Figure 18: Pottery c. AD70–250

a 'bobble' beaker sherd in buff fabric F16 with golden mica slip. This latter is probably from a North Gaulish import. The fourteen amphora sherds comprise ten Dressel 20 sherds in Baetican fabric A6, one Rhodian *Cam* 184 neck fragment (*c.* 50BC–AD150), two Dressel 2–4 fragments in Campanian fabric (Tomber and Dore 1998, CAM AM 2) and one from a *Cam* 186 example in South Gaulish fabric GAL AM 2 (*c.* 50BC–AD150).

Assemblage 9. From Ditch 2060. The 26 sherd (293g) pottery assemblage from this feature is too small for any form of quantification but includes the following:

Figure 17(47): Everted-rim jar in BB1 fabric C12b fired black with acute lattice decoration. Ext. rim diameter 160mm. *c.* AD70–160. Context 885 (slot 824).

Figure 17(48): Rim sherd from flanged dish of Menez type 12b (1985) in micaceous Central Gaulish *Terra Nigra* fabric. Ext. rim diameter 200mm. *c.* AD30–70. Context 890 (slot 829). Joining sherd in 899 (slot 837). This vessel joins one of quite a typologically diverse group of micaceous TN platters and bowls found in Britain largely from pre-conquest levels. A vessel of similar fabric is present in the post-conquest military assemblage from Lake, Dorset.

Figure 17(49): Rim sherd from a dish of Deru (1996) type A43 in Gallo-Belgic TN fabric. *c.* AD40–70. Context 890 (slot 829).

Figure 17(50): ?Ritt 12 copy in micaceous buff sand-free *Terra Rubra* fabric F2 fired pink with external red colour-coat extending over the flange. *c.* AD30–60. Context 893 (slot 832).

This suggests that the ditch remained open until after AD70.

Assemblage 10. From Pit 837. This pit is unusual amongst the features at Shapwick Lane in that it did not produce a single fragment of briquetage. The 42 sherds (1455g) of pottery, dated *c.* AD50–70, include the following local products:

Figure 17(51): Bead-rim jar of Hengistbury type JC4.2 in rough black fabric C6. Ext. rim diameter 240mm.

Figure 17(52): Bead-rim jar in polished black fabric C12b. Ext. rim diameter 80mm. *c.* 50BC–AD70/100. One of two.

The 18 sherds from imports comprise four in South Gaulish samian from two Dr 29 bowls (*c.* AD50–65 and 55–70), three in *Terra Nigra*, 10 from Corfe Mullen Whiteware flagons and butt-beakers and a large Dressel 20 amphora fragment.

Figure 17(53): Large cup of Deru type C13.2 (Deru 1996, *Cam* 58) in Gallo-Belgic *Terra Nigra* fabric. Ext. rim diameter 140mm. *c.* AD15–70.

Figure 17(54): Butt-beaker in of *Cam* 113 type in North Gaulish Whiteware fabric F7a. Ext. rim diameter 120mm. *c.* AD30–70.

Figure 17(55): Flagon handle section in similar fabric. *c.* AD43–70.

Figure 17(56): Dressel 20 of Martin-Kilcher (1987) type 27 in Baetican fabric. Ext. rim diameter 160mm. *c.* AD30–50.

Phase 4. *c.* AD.70–250

Assemblage 11. From the upper fills of Ditch 2077. The 336 sherds (4709g) of pottery from four upper ditch fills have BB1 sherds making up 95% of the assemblage: they include fragments from a 'War Cemetery' bowl (*c.* AD40–150), a handled beaker (*c.* AD120–300) and the following vessels:

Figure 18(57): Everted rim jar in Black BB1 fabric. Ext. rim diameter 120mm. *c.* AD70–160. Context 681 (slot 619).

Figure 18(58): Everted rim jar in oxidized BB1 fabric. Ext. rim diameter 240mm. *c.* AD70–160. One of at least ten. Context 677 (slot 619).

Figure 18(59): Everted rim jar of Gillam type 1 in similar fabric. Ext. rim diameter 140mm. *c.* AD120–60. Context 677 (slot 619).

Figure 18(60): Flanged bowl of Exeter type 36.2 (Holbrook and Bidwell 1991) in oxidized BB1 fabric. Ext. rim diameter 220mm. *c.* AD43–100. One of two. Context 681 (slot 619).

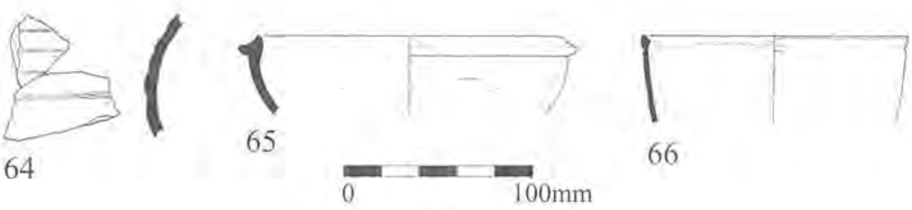

Figure 19: Other Pottery

Figure 18(61): Flanged bowl fired black with overall burnishing. Ext.rim diameter 160mm. Context 678 (slot 619).

Figure 18(62): Flanged bowl of Gillam type 58 fired black with burnished acute-latticing. Ext. rim diameter 180mm. *c*. AD120–60. Context 677 (slot 619).

Figure 18(63): Dish of Gillam type 76 fired black with acute lattice decoration. Ext. rim diameter 140mm. *c*. AD140–200. Context 677 (slot 619).

Sherds in other fabrics include one from a Dressel 20 amphora of Martin-Kilcher (1987) type 32, *c*. AD110–70, and one from a flagon in rough coarse Corfe Mullen whiteware fabric F8b. This assemblage indicates that rubbish continued being deposited in the top of the ditch well into the 2nd century. Smaller but similarly dated assemblages come from ditches 2010, 2011, 2078 and 2031, and pit 302.

Phase 5. *c*. AD250–400

Amounts of Late Roman pottery are very small: there are a few sherds from Ditch 2004, including beaded and flanged bowls of Bestwall types 6/8 (*c*. AD270/300–370) and 6/9 (*c*. AD300/350–420) and a dish of type 8/2 (*c*. AD.200–70).

Miscellaneous

Fragments of the following vessels from small, poorly-dated assemblages are of interest in their own right:

Figure 18(64): Body sherd from Breton black cordoned ware jar in smooth micaceous black fabric C10 with profuse up to 0.20mm feldspar, quartz and metamorphic rock inclusions. *c*. 75–25BC. Context 988 (gully terminus 919).

Figure 18(65): Flanged hemispherical bowl with matt black surface and post-depositional iron staining. Fine sandy fabric with sparse ill-sorted up to 3.00mm crushed grey argillaceous inclusions and occasional large round grains of quartz (up to 1mm). Probable import (not Gallo-Belgic TN). Ext. rim diameter 160mm. *c*. AD43–60/70. Context 259 (gully 2008 terminus 141).

Figure 18(66): ?Dr 33 copy in buff-brown fabric F20 with reddish-brown colour-coat over the rim and external thin discontinuous cream slip. Ext. rim diameter 140mm. Context 767 (ditch 2078, slot 707).

The Amphorae by Jane Timby

The amphora sherds were classified by fabric and form and quantified (Table 1). The fabrics present are as follows:

Baetican (BAT AM) (Tomber and Dore 1998, 84). This is the commonest fabric present in the group represented by 47 bodysherds, two rims (Figure 19(56)) one handle and one basal knob. In all cases the sherds appear to be from the Dressel 20 form made in the Guadalquivir region of Southern Spain and primarily used for transporting olive oil. The two rims typologically fall into the 1st century using the classification produced by Martin-Kilcher (1983: Peacock and Williams 1986, figure 66). Sherds were associated with 12 features (well 117, ditches 2077 (619 and 701), 2067 (804), pits 805, 837, 1028 and gullies 2060 (808, 828), 2065 (819), 924, 2044 (935).

Cadiz amphorae (CAD AM) (Tomber and Dore 1998, 87). This fabric, represented by 14 bodysherds and one handle fragment, may well be from one vessel, a *Camulodunum* type 186C (Peacock and Williams 1986, class 18). The type usually occurs in Britain from around the Neronian period through to the early 2nd century and was used to transport *garum* or other related fish products. Sherds came from just two features, ditch 2031 (slot 16) and pit 1025.

Campanian amphorae (CAM AM) (Tomber and Dore 1998, 88). Four body sherds from at least three different vessels in Campanian fabrics are most probably from Dressel 2–4 forms. One sherd from ditch 2007 (slot 134) is in the classic 'black sand' fabric; one sherd (freshly broken into two) from gully 2032 (slot 22) is in a 'black sand' and limestone fabric with a similar one from ditch 2067 (slot 804), whilst the sherd from pit 805 is in a more sandy limestone fabric. The form was used to transport wine and was imported into Britain from the later 1st century BC through to the early 2nd century AD.

Catalan amphorae (CAT AM) Dressel 1–Pascual 1 (Peacock and Williams 1986, class 6). Four sherds, one a rim (Figure 16 (29)) are all in Peacock and Williams fabric 2, a creamy white fabric with quartz and feldspar. The type was probably used to transport wine and the presence of a pitch residue on the interior of the rimsherd would support this being used to seal the vessel. The form is not common in Britain and is considered

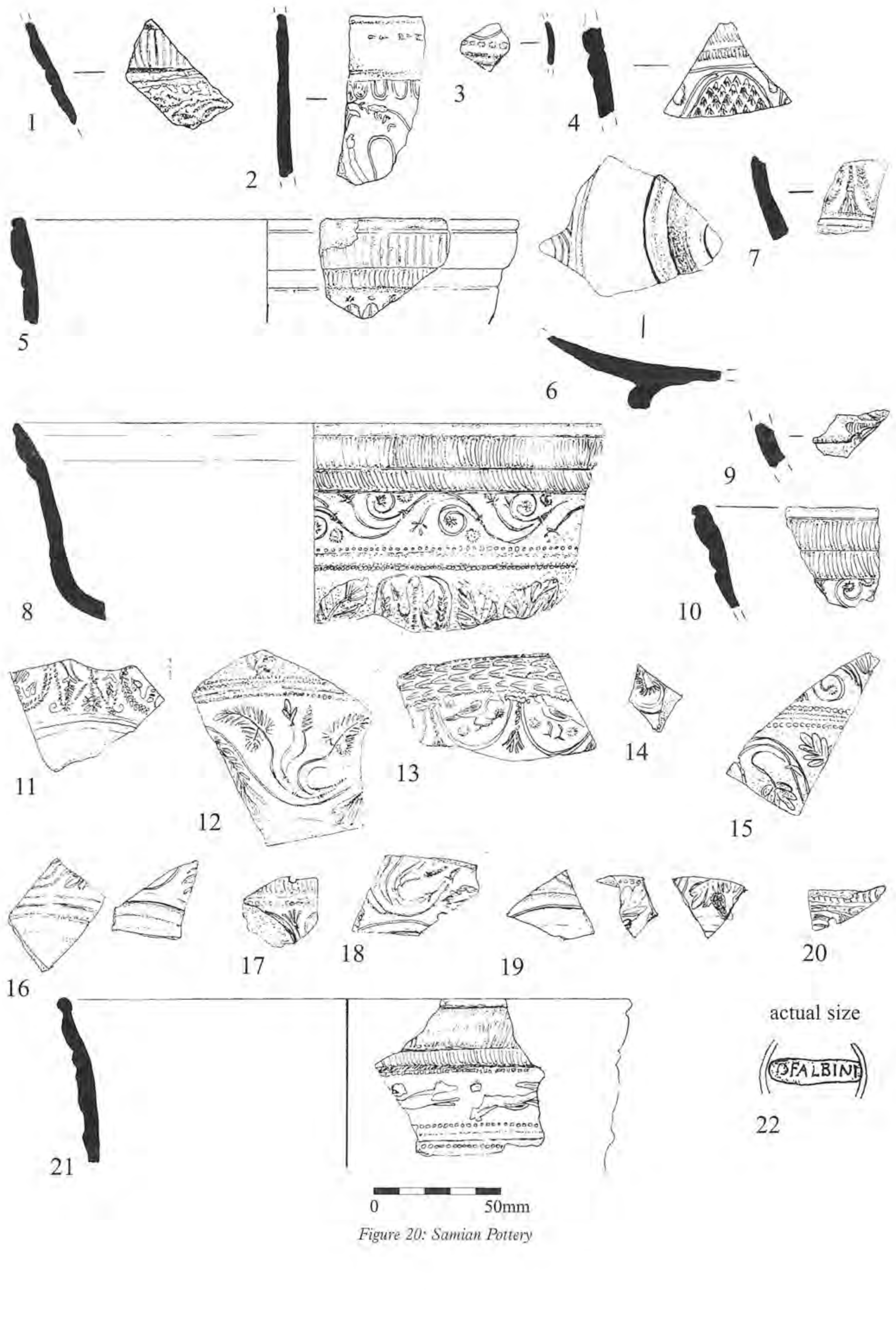

Figure 20: Samian Pottery

to have been mainly a pre-conquest import although sherds were found stratified in post-conquest levels at Ower (Williams 1987a, 79). Sherds were recovered from ditches 2077 (slots 303, 619, 701) and 2022 (405) here.

Gallic amphorae (GAL AM) (Tomber and Dore 1998, 93–5). The second commonest fabric present, represented by 25 bodysherds and one base. These are wine amphorae from southern Gaul, in particular around the mouth of the Rhone. They were imported into Britain between the later half of the 1st century AD and the beginning of the 3rd century. Sherds were recovered from ditches 2078 (slots 707 and 409), 2077 (701), 2031 (16), gully 2002 (slot 115), and pit 805.

Unassigned. Four sherds remain unassigned. Two sherds from gully 2000 (slot 102) are in a buff, slightly crumbly, powdery fabric with a moderately dense frequency of fine inclusions. Wall thickness 14mm. A sherd from ditch 2077 (slot 619) is in a harder, fine pinkish orange fabric, very slightly micaceous. Wall thickness 11mm. The third unassigned sherd, from gully 2052 (slot 849) is in an orange, very micaceous fabric with a slightly rough feel. Wall thickness 11mm.

The amphorae recovered from Shapwick Road are fairly typical of the range that might be expected from this area. All the fabrics have been previously documented from other sites in the Poole harbour areas such as Ower (Williams 1987a) and Hengistbury Head (Williams 1987b).

In addition to the sherds recovered above, previous archaeological interventions (Timby 2005, 2006) have recorded the presence of two other amphora types from the locality. One is a rim from a form generally referred to as a 'London 555' (Davies *et al.* 1994, 14). This form was made in and around Lyon in the Rhone Valley but it has also been suggested that other sources existed, notably southern Spain. The fine buff-beige fabric of the Hamworthy example suggests it is Gallic in origin. London 555 amphorae are known to have carried olives and were imported in the 1st and early 2nd centuries. The other form documented from previous work is a Dressel 1A probably from northern Campania of which both handle and rim fragments were present. Amphorae of this type were generally imported into Britain in the third quarter of the 2nd century BC and are still present on some French sites up to *c.* 50 BC. It is well documented from this area, notably from Hengistbury Head (Williams 1987b, 271).

Unlike these other sites where there is a greater proportion of pre-conquest types, the assemblage from Shapwick Road is dominated by Dressel 20, which would argue for a post-conquest date of importation, perhaps linked with supplying the (unpublished) legionary fortress at Lake Farm. The presence of some pre-conquest types at the locality might suggest some earlier occupation or use of the site.

Table 4: Briquetage

Fabric	No. sherds	Wt (g)	%No	%Wt
B1	144	3152	1.7%	3.4%
B2	123	2177	1.5%	2.3%
B3	6660	85555	79.2%	91.3%
B4	1214	1726	14.4%	1.8%
Bx	273	1098	3.2%	1.2%
Briquetage	**8414**	**93708**		

The Briquetage by Malcolm Lyne

The 4629 pieces of briquetage (Table 4) include 4227 fragments from brine boiling pans of Farrar's (1975) Hobarrow type with just 20 bar and 16 prop pieces. This assemblage is similar to that from the nearby 1974 excavation (Lyne 1993) although later 'Fitzworth' trough type brine-boiling container fragments of 2nd and 3rd century date are absent from Shapwick Lane.

Briquetage Fabrics

- B1a. Streaky sand-free pink/white clay
- B1b. Streaky sand-free orange/cream clay
- B2a. Sand-free pink clay
- B2b. Sand-free orange clay
- B2c. Sand-free cream clay
- B3. Gritty oxidized Hobarrow pan fabric with profuse up to 2.00mm angular white quartz and alluvial grit filler
- B4. Vitrified grey/black furnace lining

As with the Hobarrow pan fragments from the 1974 excavations, two fabrics were used. Nearly all such container fragments (99%) are in the coarse alluvial flint, chert and quartz tempered fabric B3 (Lyne 1993, Fabric 1), but a few (1%) were made in finer oxidized sandy fabric C6 (Lyne 1993, Fabric 2). These latter come from Durotrigian Late Iron Age contexts 687 and 688 in ditch 2077 and date from a time when the Late Iron Age fabric C6 was still being used to make some storage vessels.

Very few features on site lacked Hobarrow pan fragments: these exceptional contexts do, however, include the fills of the Pre-Durotrigian Late Iron Age ditches 2017, 2076, 2056 and 2051, suggesting that the use of Hobarrow pans in brine-boiling, and perhaps salt production itself, on the site did not start until after *c.* 50/25BC.

The largest briquetage assemblages come from the two large ditches 2077 and 2078 (806 and 2288 fragments respectively) with that from the latter ditch tending to be made up of fresher fragments.

Figure 21(1): Plain rim fragment from pan in oxidized fabric B3. Slot 707.

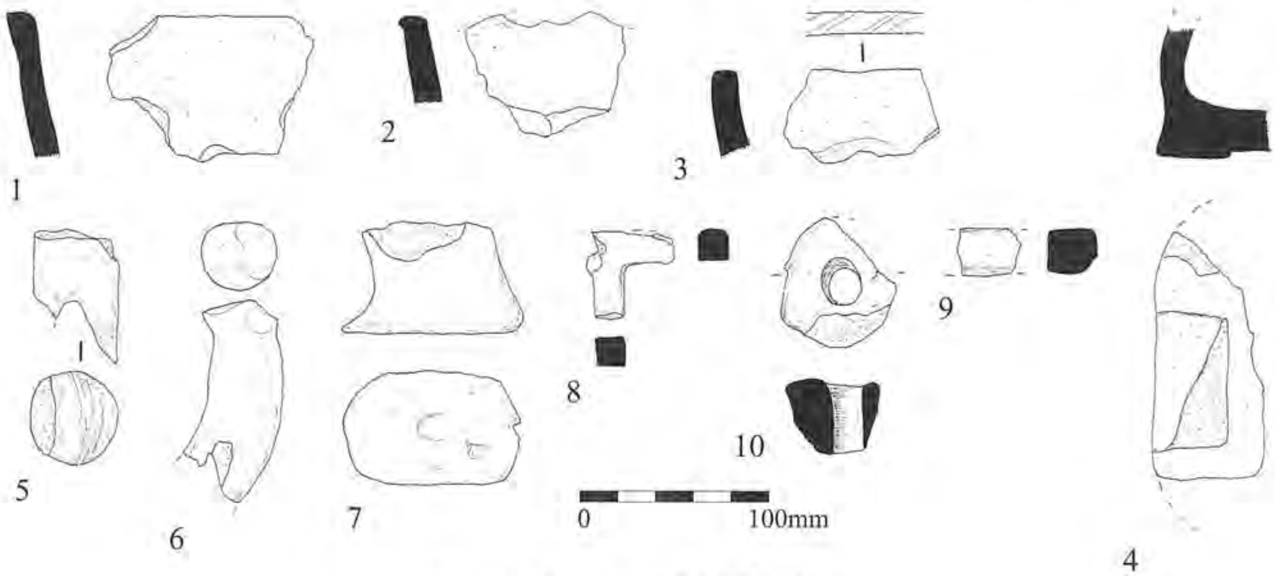

Figure 21: Briquetage and fired clay objects

Figure 21(2): Pan wall fragment in oxidized fabric B3 with scalloped edging. Slot 409.

Figure 21(3): Another such fragment but with diagonal finger rippling on its rim and in oxidized fabric C6. Paralleled in 1974 excavations (Lyne 1993, Figure 2–36). Slot 619.

Figure 21(4): Basal fragment from pan with raised rectangular area on underside in similar fabric. The important thing about this fragment is that it consitutes nearly the entire width of a pan. Farrar (1975, 18) suggests that dimensions of *c.* 0.5 by 0.3m were likely for Hobarrow pans with a depth of between 0.15 and 0.20m. These calculations were based on the difficulty in moving a loaded pan much larger and heavier and not on extant examples. This fragment suggests a somwhat smaller width of 0.18m for this particular pan. Slot 707.

There are very few pan support prop fragments compared with the 67 pieces found in the much more limited 1974 excavations a short distance to the north on the other side of the Blandford road (Lyne 1993, 108). The few fragments are, however, in similar unprepared raw Bagshot clay and include the following:

Figure 21(5): End of pan support prop with impression of Hobarrow pan rim, in streaky pink/white raw Bagshot clay fabric B1a. One of two. Slot 502.

Figure 21(6): Pan support prop fragment in raw orange clay fabric B2b. Slot 502.

Figure 21(7): Base of pan support in similar fabric. Slot 619.

Other fired clay objects include:

Figure 21(8): Grate fragment in rough black fabric C12b. Gully terminus 1033.

Figure 21(9): Fragment from ?grate or kiln bar in fired cream natural clay fabric B2c. Gully 2045 (slot 938).

Figure 21(10): ?Net weight in patchy orange/black fabric B2b. Gully 2045 (slot 938).

These last three items are unlikely to have anything to do with brine boiling: the two grate fragments may have had a domestic function and the putative net weight used in fishing.

Bone by Claire Ingrem

A total of 651 pieces of animal bone were recovered by hand collection of which 174 (27%) are identifiable to taxon or animal size category. Sieved samples produced an additional 164 fragments of which 33 are identifiable. The number of specimens assigned to individual phases is small and there were no identifiable remains from late Roman contexts. Details of methodology, quantification and the small amount of analytical data available are held in the archive.

Most of the animal bone came from ditches, gullies and pits of Late Iron Age/Early Roman date. The animal bone assemblage is too small for detailed analysis. It is only possible to be certain that the remains of horse, cattle, caprines, pig and red deer were present at the site. The presence of bones from most parts of the body suggests that sheep/goat arrived at the site as whole carcasses, probably on the hoof. There is evidence for both adult and immature animals and it is likely that some animals were bred in the vicinity of the site. The recovery of a juvenile red deer ankle joint suggests that some meat was obtained by hunting.

Of interest is a coracoid belonging to Great auk (*Pinguinus impennis*) a flightless bird that is now extinct, from ditch 2061 of late Iron Age or later date. In

Table 5: Metalworking debris

Cut	Deposit	Group	Material	Phase
115	165	2002	Hearth Lining	Late Iron Age
134	251	2007	Red Burnt Clay	Late Iron Age
922	992	2051	Hearth Lining; Iron Scrap; Ball of ferruginous sand with charcoal and bone	Late Iron Age
938	1060	2045	Elongated fragment of sandy, fuel-ash slag with a regular, semi-circular profile consistent with having chilled on a light Iron bar of circular section and then been dislodged	Late Iron Age
303	365	2029	Red Burnt Clay	Late Iron Age/Early Roman
701	751	2019	Hearth Lining; Iron Scrap	Late Iron Age/Early Roman
701	756	2019	Hearth Lining	Late Iron Age/Early Roman
707	765	2015	Hearth Lining with Chalk and Sandy Mortar	Late Iron Age/Early Roman
819	880	2065	Hearth Lining	Late Iron Age/Early Roman
12	62	2031	Iron Scrap	Early/Mid Roman
16	66	2031	Hearth Lining	Early/Mid Roman
120	69	2005	Red Burnt Clay	Early/Mid Roman
31	83	2031	Small (0.24g), thin, basin-shaped hearth bottom with large irregular voids; fragment of hearth lining	Early/Mid Roman
120	169	2005	Hearth Lining	Early/Mid Roman
1010	1081		Hearth Lining	No date
1023	1099		Hearth Lining	No date

addition, the shaft of a human radius was recovered from slot 619 (context 686) in Late Iron Age/Early Roman ditch 2077.

Struck Flint by Steve Ford

Just five prehistoric struck flints were recovered, all residual from Roman or later contexts. Apart from one narrow flake which is possibly earlier, the material is broad flake and not closely datable, but is likely to be of later Neolithic or Bronze Age date.

Shale by Jo Pine

Eleven pieces of shale were recovered. From a late Iron Age pit 118, the waste remains from making a shale blank were recovered. From ditch 2077 (slot 303), a ditch dated to the late Iron Age/early Roman period, came evidence of industrial activity in the form of a Kimmeridge shale centre of a lathe turned blank. Also from a late Iron Age/early Roman ditch 2067 (slot 804) a small fragment of a shale bracelet was found. Unidentifiable shale fragments were recovered from late Iron Age gully 2076 and from late Iron Age/early Roman features: pits 114 and 1021 and gully 2060 (slot 830). Shale products appear to have been fabricated on Green Island during the Iron Age, and the recovery of a lathe turned blank suggests production could be occurring on this site also.

Metalwork by Natasha Bennett

Thirty-nine metal fragments were recovered, weighing 535g. Almost all (36) were iron, most of these (31) being flat head nails. Two copper alloy objects were found from late Iron Age/early Roman contexts. From ditch 2067 (804), a circular fragment, weighing 2g is probably the remains of some form of jewellery. From gully 2054, terminal 843, came a fragmented head of a dolphin brooch, of 1st- to 2nd-century date. A coin collected from the spoil heap is highly corroded and not identifiable.

Metallurgical Materials by John Allen

Metal-working debris with a total weight of 1.12kg (Table 5) was examined by hand-lens, knife, magnet and acid bottle. There is no evidence for any smelting activity and the assemblage is instead fully consistent with the smithing of iron objects. It is dominated by fragments of hearth lining, in the form of lumps of baked clay (red, sand-tempered) grading to vesicular, vitrified clay, and also fragments of vesicular vitrified clay. Some fragments of lining include small pieces of chalk and one is associated with a sandy, lime mortar. There is a single, small, thin, basin-shaped hearth bottom. Three fragments of iron scrap were noted. One mass of coarse, ferruginous sand contained fragments of charcoal and bone.

Stone by Kevin Hayward

Two rotary quern fragments from late Roman pit 105, and early-mid Roman ditch 2015 (707) were examined in hand specimen using a hand lens. Both are in green/brown coarse shelly greensand (further details in archive). The site is in an area characterized by soft unconsolidated Tertiary sediments (Bagshot and Barton Beds; London Clay). None of these sediments are hard or coarse enough to be used as quernstones which means that the stone must have been acquired from further afield. To the north and west lie progressively older sediments (chalk followed by Upper Greensand and Gault and then Lower Greensand) some of which are suitable for this purpose. Older still are the sediments (Upper Jurassic) exposed by the Purbeck Anticline to the south, around the coast at Swanage from where a whole raft of materials (Kimmeridge Shale; dolostone; Purbeck Marble) were quarried and supplied for use throughout the province.

Examples of Roman rotary quernstone made from this same shelly greensand have been observed by the author at Shapwick and Badbury Rings. This material is different from the equally coarse Lodsworth Greensand (Lower Greensand of West Sussex) in that the latter does not contain large shells but instead contains black chert-filled burrows (Peacock 1987). Although it has not been possible to identify an outcrop source of this shelly greensand, its restricted distribution around the Dorset/Wiltshire area leaves little doubt that its outcrop is from this area. It seems unlikely that the source is the Isle of Purbeck as the Lower Greensand sands are unfossiliferous (Melville and Freshney 1982, 72). Inland outcrops near Shaftesbury or the Vale of Wardour seem more probable.

It is clear that these quernstones made from shelly greensand have a different distribution to the Lodsworth Greensand querns. The former are restricted to Dorset/Wiltshire whilst the latter are more widely in circulation throughout Sussex; Hampshire; Berkshire and East Anglia.

Burnt Flint

A small collection of burnt flint (123 pieces, 376g) was recovered, the majority from late Iron Age and Roman contexts. None showed any signs of working.

Shell

A small assemblage of shell was recovered, all from late Iron Age-early Roman contexts (details in archive). The assemblage is too small to come to any conclusions about economy and resource procurement. The majority of the shells are cockles, with some winkles and mussels. The absence of oyster (a staple foodstuff) need not be significant, as oyster shell was used for a variety of purposes which result in its destruction.

Charred Seeds, Waterlogged Remains and Charcoal by Lucy Cramp

Sixty-five samples of sediment, between 10 and 20 litres in volume, were taken from Iron Age and Roman gully and ditch deposits. In addition, two pieces of waterlogged wood were examined. Details of methodology and full quantification are in the archive. Twenty-seven samples contained identifiable material, but in very low concentrations. This primarily consisted of carbonized cereal grains or relatively small charcoal fragments. Three waterlogged samples contained some identifiable weed seeds or rootlets and some preserved wood.

Carbonized and waterlogged wood

Charcoal was found in the majority of samples, although it tended to be relatively fragmentary and was therefore not always identifiable. Where identifiable, all but one sample contained only oak (*Quercus* sp.) charcoal. The exception contained charcoal of the hawthorn/apple (Pomoideae) family. Two pieces of waterlogged blackthorn/cherry type wood (*Prunus* sp.) were recovered from Roman well 117 and the terminal (615) of middle Iron Age gully 2025.

Other plants

Cereal grains were recovered from nine deposits, but the highest abundance of grains was from the late Iron Age/early Roman from ditch 1021, at just 3.2 grains per litre of sediment. The identifiable cereals were wheat, including emmer or spelt wheat (*Triticum dicoccum* or *spelta*), and barley (*Hordeum* sp.), including 6-row and hulled barley. Several oat grains (*Avena* sp.) were also recovered, although these cannot be confirmed as the cultivated species. No cereal chaff was found in any of the samples.

The carbonized weed seeds that were identified include the arable weed goosegrass (*Galium aparine*) and bramble (*Rubus fruticosus* agg.). A wider range of plants was represented by seeds and rootlets recovered from the waterlogged flots deriving from late Iron Age and early Roman ditch deposits (619 and 701 in ditch 2077; 707 in 2078). With the exception of blackberry, these plants are all species that grow in or beside water, including pondweed (*Potomogeton* sp.), water grass (*Glyceria* sp.), water pepper (*Polygonum hydropiper*), water crowsfoot (*Ranunculus* s. *batrachium* sp.), sedges (Cyperaceae) and rushes (*Juncus* sp.).

The samples demonstrate the presence of typical Iron Age/Roman crops, including wheat and barley. Oats may also have been a cereal crop, although it is also possible that these merely represent crop contaminants. There is no evidence from cereal chaff to indicate the processing or storage of ears/spikelets or uncleaned grain.

Additional waterlogged wood by Aidan Colyer and Jo Pine

A small number of wood samples were examined from waterlogged deposits. The majority came from well 117 (191). These comprised four stake fragments together with 17 wooden planks (the majority broken, two complete). The planks varied from 329mm to 703mm in length, 14mm–74mm wide and 16mm–26mm in thickness. They are probably oak (*Quercus*) and are straight planks apart from some post-depositional warping. Some of the ends are diagonally shaped and others dove-tailed, the majority showed chamfering and saw marks with two planks having roughly square holes at one end. These timbers were probably used for a square wooden well shaft and appear to have been reused from elsewhere.

A small plank fragment from ditch 2077 (701) was 100mm by 20mm by 50mm is probably oak. From ditch 2078 (409, 470) a thin stake fragment with broken tip 220mm long, shaped, *Quercus;* from ditch 2078 (619, 686) a twig fragment, *Quercus*; from ditch 2031 (42, 94) wood fragments, *Quercus;* from ditch 2077 (303, 364) thin plank fragments highly fragmented, again all *Quercus.*

Conclusions

The fieldwork at Shapwick has revealed further evidence for the complex settlement history of the Hamworthy Peninsula. On the site there is the suggestion of sporadic early prehistoric activity, in the form of flint work, but no firm settlement evidence. There is also the possibility of middle Iron Age activity, a single gully 2025/2030 has been assigned to this period, although this is not well dated. A small assemblage of middle Iron Age pottery was also recovered as residual material in later features.

It is in the late Iron Age that the site appears to be more substantially occupied. The TVAS excavations revealed probable roundhouse structures together with pits and potential land division features, ditches and gullies. Evidence for the economy was limited as detailed analysis of faunal remains was not possible though horse, cattle, sheep/goat, pig and red deer were all utilized. Evidence for salt making was partial: hearth/furnace lining fragments were recovered, however these are not definitive proof of salt production and there is the strong indication that these remains were by-products of smithing. Briquetage fragments were only recovered from gully 2032 which may be of late Iron Age or early Roman date. Indeed within the Poole harbour area evidence for Iron Age saltworking has been dogged by dating problems (Farrar 1975) and the chronological evidence from the Hamworthy peninsula and Poole town is particularly poor. Recent work in the southern part of the Poole basin has suggested the re-occupation of this area in the middle Iron Age was in part drawn by salt production, although again evidence is sparse. However, by the late Iron Age salt production evidence is a good deal better dated (Cox and Hearne 1991). The working of shale may have occurred on the site but again the evidence is somewhat limited and it would probably be on a small domestic scale if at all. It is likely these materials came from elsewhere in the region, such as Green Island to the south, where there is evidence of more intense, possibly industrial, shale working.

The Iron Age evidence from this phase of excavations can be added to that from earlier work on the site which revealed another possible roundhouse and other settlement features in the form of pits and ditches in the east of the site (Bellamy and Tatler 2006).

This site at Shapwick is important as it was excavated using modern methods and techniques and revealed definite cut features of late Iron Age date, whilst other investigations in the local vicinity were either carried out in the first half of the 20th century or have been limited in scope or poorly dated. There is no unambiguous evidence that the site was a trading port in this period as previously suggested. The pottery assemblage did contain Armorican imports, however, it was dominated by local Durotrigian wares and the assemblage was small overall, more suggestive of a consumption site than a trading port. This material could have been brought in via the late Iron Age port of Hengistbury Head to the east. However, with certainty, it can be stated there was a settlement on the peninsula in the late Iron Age, with roundhouse structures together with management of the landscape indicated by the parcelling up/enclosing of the land.

Probably in the very late Iron Age or at the very start of the Roman period, two substantial ditches were dug. These have now been mapped for over 230m on a NW–SE alignment. No traces of SW–NE ditch returns were observed, but this area of the site had been heavily disturbed and truncated by modern development. It is suggested these ditches were excavated by the Roman military to defend the headland, and from this hypothesis derives the further suggestion that they may be elements of a military supply base founded for the invasion of southern Britain in the AD 40s, linked to the hinterland by the Roman road, which appears to head directly to this point (Farrar 1975; Webster 1980; Jarvis 1985; Bellamy and Tatler 2006). Evidence supporting this was the dimension of the ditches, the headland location of the Hamworthy sites, its position at the end of the Roman road, together with the range of finds.

Evidence from the excavation described above does not supply unambiguous answers to the question of whether this was a military site. The substantial double ditches, 6m wide and 1.6m deep, set 13m apart, certainly appear to support a defensive function (especially assuming accompanying banks), however the pottery assemblage recorded is not so clear. There were low percentages of fine ware (7% by count) and samian wares (2%), and while higher proportions of these (for example, 5–15% samian) are expected on military sites, especially early ones (Evans 2001; Willis 1999), this is not always the case; equally, 2% samian would be unusually high on an average rural farm, but not without precendent. The percentage of amphora is 3.3% in terms of sherd count but 14.7% by weight, these figures are likely to lie on the cusp between non-military/military sites. However the amphora assemblage from Shapwick Road is dominated by Dressel 20, which would argue for a post-conquest date of importation, perhaps linked with supplying the (unpublished) legionary fortress at Lake Farm (Timby above). There was only a single coin (unidentified and unstratified), which even allowing for the vagaries of survival and recovery, would be extraordinary in either a commercial port or a fort; and there was no military metalwork (albeit, survival conditions may be a contributory factor here too). If the ditches were indeed defensive, right-angled returns should be expected on the north side of Blandford road, to complete the defence of the headland: future work might yet provide answers.

Due to poor site stratification and the nature of the excavations in separate blocks, it is not possible to establish whether the features to the east represent contemporary internal features or are slightly later than the ditches; this problem also arose during the previous works on the site where similar features were recorded to the east of the large ditches. However, no structural remains were recovered.

The ditches might equally be suggested to have acted as channels relating to the control of a supply of salt water and could thus also relate to salt production. The large quantities of briquetage from the lower fills in particular, accumulating while the ditches were still open, support this view.

Another suggestion for this area is that that the Hamworthy Peninsula may have been the location of a new port, developed in the 1st century, due to the rise in sea level leading to the abandonment of the port suggested at Cleavel Point (Markey *et al.* 2002). It is interesting that the ditches and some of the other features do date to this period, however, again the evidence is ambiguous.

The features discussed above, channels and gullies full of briquetage, show that salt making began in earnest in the 1st century AD. A hearth/furnace associated with large quantities of briquetage excavated during previous investigations in Trench 9 dates to this period (Bellamy and Pearce 2001). Whether this salt production was industrial or domestic (or military) in organization is impossible to state yet given the extent of salt working evidence across the Hamworthy peninsula in the Roman period (Farrar 1975; Jarvis 1985, 1994; Bellamy 1999b) an organized exploitation of this resource is likely. There is no evidence for buildings either for industrial purposes or habitation during the Roman period.

In the early/mid Roman period the archaeological evidence indicates salt production continued on the site with numerous channels and gullies recorded, the majority containing briquetage. No hearths/furnaces were recorded within this phase of work but furnace lining elements were recovered as debris within these channels (as noted above, these may have been for smithing). Two groups of brine boiling hearths were recorded during earlier work (Bellamy and Tatler 2006), one of these overlying the backfill of one of the large 'military' ditches suggesting a mid-late Roman date.

In the late Roman period the site appears to have seen less activity, but this may be the result of excavation area layout rather than a reality. Interestingly the late features recorded both in this excavation and earlier fieldwork on the site contained little in the way of salt making evidence and this intimates that salt winning may have ceased by the mid 3rd century or even slightly earlier. The site was then abandoned. There is an impression that this reflects a province wide trend, with little evidence for late Roman salt production at coastal sites; but more secure dating will be required to check whether it is not just that the late sites are in different locations. Sealey's (1995) warning that late Roman occupation on earlier salt winning sites need not indicate late salt winning should also be heeded.

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Appendix 1: The Samian by Robert Hopkins, with a stamp report by B. Dickinson

Gully 2010, terminus 100 Fill 150: 1 sherd, Dr 18, South Gaulish. Late Neronian – early Flavian

Ditch 2001, slot 101 Fill 151: 1 sherd Dr 27g, South Gaulish. Early Flavian

Ditch 2001, slot 106 Fill 156: 1 sherd, Dr 24/25, South Gaulish. Neronian

Pit 114 Fill 164: 1 sherd, dish base, South Gaulish. Neronian

Gully 2002, slot 115 Fill 165: 1 fragment, dish base, South Gaulish. ?Neronian

Well 117 Fill 188: 1 sherd, Dr 29, South Gaulish. Neronian (Figure 20(1) Upper zone, the decoration is a trifid leaf wreath. cf a Vitalis Dr 29 from La Graufesenque for a similar wreath, but used in the centre band of the lower Zone (Dannell *et al.* 2003, no: 0991). *c.* AD 60–85

1 sherd, Dr 18, South Gaulish. Late Neronian – early Flavian

Gully 2003, slot 119 Fill 168: 1 sherd Dr 30, South Gaulish. (Figure 20(2) The soil condition has eroded the surface somewhat, not helped by overzealous cleaning whilst still wet. The ovolo appears to be 'FD', attributed to Albinus, Martialis, Masclinus and Masclus (Dannell *et al.* 1998). The decoration appears to be a bifid leaf winding scroll, cf. a Dr 30 from La Graufesenque signed by Albinus ALBINI retro. (Samian.Net No:1001328). Within the upper facing scroll, an eagle O.2165A.

1 sherd Dr 27, South Gaulish. Neronian

Gully 2008, slot 135 Fill 252: 1 sherd Dr 29, South Gaulish, with eroded slip. (Figure 20(3) The upper part of the lower zone has the upper part of a scroll visible below the division band. The fabric and large horizontal beads suggest a Neronian date.

Gully 2008, slot 144 Fill 264: 1 sherd Dr 29, South Gaulish. (Figure 20(4) Upper zone, consisting of a winding scroll, arrowheads fill the raised lobe. The depressed lobe on the left has a partial leaf, possibly the same one as on an upper zone on a Licinus bowl from Mancetter (Dannell *et al.* 2003, no:0655). In the depressed lobe on the right is part of a heart shaped leaf cf. a Licinus bowl from La Graufesenque (Dannell *et al.* 2003, no:0637).

Pit 302 Fill 352: 1 sherd Dr 29, South Gaulish. (Figure 20(5) Upper zone, with what appears to be a series of ovoid leaves topped by a rosette over the apex.

Ditch 2077, slot 303 Fill 353: 1 sherd Dr 29, South Gaulish. (Figure 20(6) Footring with a small part of a scroll surviving. ?Neronian – early Flavian

Ditch 2077, slot 303 Fill 364: 1 sherd Dr 15/17, South Gaulish, slightly overfired. ?Flavian

Ditch 2078, slot 409 Fill 4656: 1 sherd, Dr 18 rim, South Gaulish. Neronian

1 sherd, Dr 18 rim, South Gaulish. Neronian or possibly early Flavian

Ditch 2078, slot 409 Fill 466: 1 sherd, Dr 18 rim, South Gaulish. Neronian

1 sherd, Dr 18 base, South Gaulish. Neronian

Ditch 2078, slot 409 Fill 468: 1 sherd, Dr 29, South Gaulish. (Figure 20(7) Base of the lower zone; all that survives of the decoration is a 5 fingered pendant leaf suspended between 2 chevron wreathed festoons. The decoration can be paralleled on a Dr 29 in the Museum of London attributed to Murranus (Dannell *et al.* 2003, No:0770), and a stamped Murranus bowl from Castelnaudary (Dannell *et al.* 2003 No:2385)

1 basal sherd, Dr 29, South Gaulish. Vestige of a straight gadroon, not rubbed. Neronian-early Flavian

1 sherd Dr 29, South Gaulish. ?Neronian

1 sherd Dr 29, South Gaulish. Neronian

1 sherd Dr 15/17, South Gaulish. Flavian

1 sherd Dr 15/17, South Gaulish. Neronian

1 sherd Dr 18R, South Gaulish. Flavian

2 sherds, Dr 18, South Gaulish. Flavian

1 sherd Dr 24/25, South gaulish. Neronian

1 sherd Dr 27, South Gaulish. Flavian

1 sherd, bowl, South Gaulish. Neronian

Ditch 2078, slot 409 Fill 469: 1 sherd, dish, South Gaulish. Neronian

1 sherd Dr 29, South Gaulish. (Figure 20(8) The upper zone consists of a winding scroll, with bifid leaved tendril bindings and astragals; tendrils terminate in tassels and rosettes. Different rosettes are used as 'fillers'. The Lower zone decoration consists of large chevron festoons, within which are two large leaves used by Aquitanus (Dannell *et al.* 2003, no:0106). Between the festoons, columns of astragali (cf. Aquitanus, Dannell *et al.* 2003, No:0060), topped by a rosette; emanating from the rosette, tendrils ending in small heart shaped leaves. *c.* AD 40–65. Same vessel as No. (10)

Ditch 2077, slot 619 Fill 677: 1 sherd overfired ?Dr 36, South Gaulish. ?Flavian

Ditch 2077, slot 619 Fill 681 1 rim flake, Dr 30 or 37, South Gaulish. Flavian

1 sherd, Dr 37, South Gaulish. (Figure 20(9) Small scrap, with what appears to be a boar to the left; in

the upper right, a trifid leaf, with a striated central leaf. Flavian

Ditch 2077, slot 619 Fill 682: 2 sherds, probably from the same vessel, Ritterling 8, South Gaulish. Neronian

1 sherd Dr 24/25, South Gaulish. Neronian

1 sherd Dr 27, South Gaulish. Neronian

Ditch 2077, slot 619 Fill 683: 1 sherd Dr 29 rim, South Gaulish, with a rivet hole for a repair. The fabric and the coarse rouletting on the rim suggests a date of *c*. AD 70–85

Ditch 2077, slot 701 Fill 751: 1 sherd Dr 29, South Gaulish. (Figure 20: 10) Upper zone, scroll decoration, see (8)

Ditch 2078, slot 707 Fill 765: 1 sherd dish, South Gaulish. Late Neronian – early Flavian

Ditch 2078, slot 707 Fill 766: 1 sherd Ritterling 8, early Lezoux. Fairly soft fabric. Neronian

Ditch 2078, slot 707 Fill 767: 1 sherd Dr 29, South Gaulish (Figure 20: 11) Lower part of the lower zone; the decoration has chevron medallions to the left and right with a centre panel demarcated with wavy line verticals terminating in rosettes. At the junction there are spirals to the left and right. The centre panel is based on a saltire of wavy lines coming from the rosettes, two tendrils end in inverted lanceolate leaves with bifid leaf bases, cf. an Aquitanus Dr 29 from Aislingen (Dannell *et al*. 2003, No:0060). A small rosette in placed in the centre of the cross, a large pendant rosette fills the bottom triangle. The large rosette appears on a Labio Dr 29 from La Graufesenque (Dannell *et al.* 2003, no:1564). The medallions could be that on a Modestus bowl in the Museum of London (Dannell *et al*. 2003, No:0715); within, a column of astragali, and tendrils terminating in a small heart shaped leaf, and a ?trifid leaf. *c*. AD 50–70

1 sherd Dr 18, South Gaulish. Neronian

1 sherd dish base, South Gaulish. Neronian

1 sherd Ritterling 8, South Gaulish, unworn footring. Neronian

Ditch 2078, slot 707 Fill 768: 1 sherd, Dr 24/25, South Gaulish. Neronian

Ditch 2061, slot 801 Fill 851: 1 sherd, Dr 15/17, South Gaulish, Neronian

Pit 805 Fill 856: 1 sherd, Dr 18, South Gaulish. Neronian

Pit 811 Fill 872: 1 sherd ?Dr 18, South Gaulish. Neronian

Gully 2020, slot 829 Fill 890: 1 sherd, dish base, South Gaulish. Neronian

1 sherd, small cup, South Gaulish. Neronian

Pit 837 Fill 899: 2 sherds, joining, Dr 29, South Gaulish. (Figure 20(12) In the upper zone, part of an inverted stirrup leaf. The lower zone scheme is of a large winding scroll; in the downward lobes, tendrils terminating in opposed curved leaves, which are on an unstamped Dr 29 from Colchester (Hawkes and Hull 1947, pl. XXXIV, 8); a small trifid leaf and a serrated bud, Astragali are placed on the tendrils. In the upper facing lobes, arcades composed of the small trifid leaf, terminating in a large trifid leaf. The large trifid leaf appears on a Gallicanus bowl (Dannell *et al*. 2003, No:1936b); the small trifid leaf wreath appears on an Ardacus Dr 29 in the Hermet Collection (Dannell *et al*. 2003, No:1568)

1 sherd Dr 29, South Gaulish. (Figure 20(13) Lower Zone only; at the top, a horizontal leaf wreath, which appears on a bowl by Primus from Canterbury (Dannell *et al*. 2003, No:2813), although the spacings between the leaves are slightly wider. Horizontal wavy line below. The bottom register is a series of double bordered festoons tied by horizontal astragali. Suspended from the astragali, pendant six pointed leaves on wavy line stalks. This arrangement can be seen on a Passienus bowl from Oberwinterthur (Dannell *et al*. 2003, No:0824). Within each festoon a bird, alternating between left and right facing. They appear to be slightly larger versions of a pair in an upper zone of a Licinus bowl from Mainz (Dannell *et al*. 2003, No:0640)

1 sherd Dr 29, South Gaulish. (Figure 20(14) Portion of a frilly heart shaped leaf cf. a Rufinus bowl from London for similar (Dannell *et al*. 2003, No:0910)

Gully 2044, slot 935 Fill 1057: 1 sherd Dr 29, South Gaulish. (Figure 20(15) In the upper zone, a scroll design, terminals end in a serrated rosette and a tassel bud used by several Neronian potters eg Celadus (Dannell *et al*. 2003, No:3380). In the lower zone, a large scroll, two poinçons are extant, a bifid leaf tendril binding, and large, slightly pointed lobate leaf, similar to, but smaller than one on a bowl in the Museum of London stamped by Felix I, signed Mod retro. in the decoration (Dannell *et al*. 2003, No:0416). The design is typically Neronian, note the drawing in Hermet (1934, pl.118: 12). *c*. AD 50–70 Sherds from the same bowl Nos 16, 17 and 19

Pit 944 Fill 1066: 2 sherds from the same bowl, Dr 29, South Gaulish. (Figure 20(16) Lower zone, same bowl as No. 15. Neronian

1 sherd Dr 29, South Gaulish. (Figure 20(17) Upper zone; scroll with a bud terminal used by a number of Neronian potters e.g., Celadus (Dannell *et al*. 2003, No:3380). Probably the same bowl as No:15 etc. Neronian

1 sherd Dr 29, South Gaulish. (Figure 20(18) Lower zone, showing a scroll design. Emanating from biffid leaves are multiple stalks. One tendril ends in a striated bud, in the bottom right, the vestige of a serrated leaf. Neronian or possibly early Flavian

Gully 2044, slot 945 Fill 1067: 3 sherds, Dr 29 South Gaulish. (Figure 20(19) Probably from the same bowl as 16 1 sherd drilled for a rivet, a second has the rivet in place. Neronian

1 sherd, Dr 29, South Gaulish with rivet hole. (Figure 20(20) Upper zone, rim and part of a vine scroll. Neronian-early Flavian

Pit 1015 Fill 1090: 1 sherd, Ritterling 8, South Gaulish. (Figure 20(22) Stamped Albinus iii die 4a.

2 joining sherds, Dr 18, South Gaulish; also join the 2 sherds from Feature 1022 Fill 1098. ?Neronian or early Flavian

1 sherd Dr 27, South Gaulish, with a flat top. Neronian

1 sherd dish base, South Gaulish. Early Flavian

Pit 1021 Fill 1097: 1 sherd Dr 29, South Gaulish. (Figure 20(21) Upper Zone, with a hunting scene of an emaciated dog chasing a hare, two rosettes 'in the field' The dog appears on an upper zone of a Dr 29 of Ardacus from La Graufesenque (Dannell *et al.* 2003, No:2058

Pit 1022 Fill 1098: 2 joining sherds, Dr 18, South Gaulish; also join the 2 sherds from Feature 1015 Fill 1090. ?Neronian or early Flavian

1 sherd, Dr 18, South Gaulish. ?Neronian

Stamp Report by B. Dickinson

Pit 1015 Fill 1090 (Figure 20(22): Albinus iii die 4a. Ritterling 8. The die has been recorded from La Graufesenque. There are two examples from the Second Pottery Shop at Colchester (1971 excavations) and nine from Narbonne, La Nautique (Fiches *et al.* 1978, Figures 4,6). The stamp was used on cups (Ritterling 8, Ritterling 9 and Dr 27g) and dishes (Dr 15/17 and 18).

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The Inferior Oolite at Coombe Quarry, near Mapperton, Dorset, and a new Middle Jurassic ammonite faunal horizon, Aa-3b, *Leioceras comptocostosum* n.biosp. in the Scissum Zone of the Lower Aalenian

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Summary

The biostratigraphy of Coombe Quarry at Mapperton, Dorset is described. Its special significance lies in the presence of an ammonite faunal horizon Aa-3b (hitherto not recognized elsewhere in the English Inferior Oolite) lying in the upper part of the Scissum Zone. Its exceptionally abundant and well-preserved ammonite assemblage characterizes a new species, Leioceras comptocostosum *sp.nov., giving an unusually clear insight into the structure of a natural, genetic, true ammonite species – a palaeobiospecies – as expressed in the intraspecific variability of its fossils. It typifies the evolution of the genus* Leioceras, *regarded as a phylogenetic segment of the evolutionary lineage of the family Graphoceratidae, as an isochronous slice – a transient – through the trunk of that lineage.*

The formal taxonomic relationships of the new (bio)species to existing nominal Linnean (morpho)species, with which some of its variants have in the past been associated in European continental descriptions, are briefly reviewed. Leading among these are Leioceras comptum *(Reinecke, 1818) and* Leioceras costosum *(Quenstedt, 1886), both of which have been used as zonal indices and both of which are in need of serious revision.*

Coombe Quarry (Mp-CQ – a locality-code used for brevity), Mapperton, Dorset is situated at the end of a narrow cart track at SY 496 998. The face runs NW-SE. The site is that of an old quarry described by Bomford (1949, 148–9) and known then as Coombe Quarry, a repeat of which is given by the Geological Survey (Wilson *et al.* 1958). It lies near to, but is not the same as, Coombe Down Quarry (Richardson 1929, 177). An account by the Dorset Environmental Records Centre (Geology), September 1983, by G. Madgwick (unpublished) names the site as Coombe Sheepwash Mapperton, which is also how it is marked on the OS map at 1:25k. The quarry lies within an area of sedimentation that has become known as the 'Dorset Swell' (Penn 1982 and adapted in Callomon and Cope 1995, previously sometimes referred to as the 'Bath Axis', e.g. in Wilson *et al.* 1958), a region running south-west to north-east that maintained a positive relative sea floor elevation at the western margins of the Hampshire Basin during the Aalenian and Bajocian of the Middle Jurassic. Sedimentation was slow, episodic, almost free of coarse siliciclastic input, yet rarely if ever at levels above storm wave-base. Syn-sedimentary faulting, sometimes rapid enough to produce neptunian dykes (Jenkyns and Senior 1991), and differential penecontemporaneous erosion on a very localized scale then controlled the successions that have been preserved. The results have been to produce very marked local differences in the succession at neighbouring localities, for example at Horn Park (Be-HP, ST 458 022: Chandler 1997) and Cockroad Farm, Beaminster (Be-CF, ST 470 081: Sandoval and Chandler 2000), and at Waddon Hill (Be-WH, ST 447 015: Callomon and Chandler 1990). The successions at these localities and others nearby have been the subject of previous accounts by Buckman (1887–1907, 1910); Richardson (1915, 1928); Wilson *et al.* (1958) and were revised more recently by Senior *et al.* (1970), Parsons (1974, 1976; Cope 1980), Callomon and Chandler (1990) and Callomon and Cope (1995).

At Coombe Quarry, as elsewhere, the section shows a highly incomplete succession of lenticular, impersistent sedimentary bodies separated by major non-sequences, frequently reflected in marked erosion-planes separating units of distinguishable lithologies that can wedge out in a single quarry-face. Whicher and Chandler (2009) provide further details on the discontinuities in the stratigraphic succession at Mp-CQ. These units yield distinct, characteristic ammonite assemblages which, from their compositions, states of preservation and sedimentary taphonomy, indicate relatively short *durations* of time for their accumulations. They can moreover be widely recognized further afield – in some examples ranging from Skye via Dorset to Portugal and Franconia – without further biostratigraphical differentiation, indicating time-correlations within the uncertainties inherent in their durations. As these durations are unknown, but not further subdivisible by means of the fossils, they must be regarded as effectively instantaneous and their ammonites assemblages as isochronous. Successive assemblages of this kind that can be morphologically differentiated reflect therefore steps in the genetic evolution of the lineages of which they are members. Successions of such distinguishable assemblages arranged in time-ordered sequences can thus be made the basis of a chronostratigraphical classification of the succession in terms of (assemblage) biozones termed *biohorizons*, the rock-equivalents of Buckman's 'hemerae' (1893; Callomon 1995). They are therefore, by definition, at the finest limits of achievable time-resolution by means of guide-fossils in an incomplete geological record. The succession is nowhere complete and has to be built up piece by piece, by correlations from place to place. The ladder

AALENIAN		Zone	Subzone
Aa-16	*Sonninia (Euhoploceras) acanthodes*	Concavum	Formosum
Aa-15	*Graphoceras formosum*		
Aa-14	*Graphoceras concavum*		Concavum
Aa-13	*Graphoceras cavatum*		
Aa-12	*Brasilia decipiens*	Bradfordensis	Gigantea
Aa-11	*Brasilia gigantea*		
Aa-10	*Brasilia bradfordensis, similis*		Bradfordensis
Aa-9	*Brasilia bradfordensis, baylii*		
Aa-8	*Brasilia bradfordensis, subcornuta*		
Aa-7	*Ludwigia murchisonae*	Murchisonae	Murchisonae
Aa-6	*Ludwigia patellaria*		
Aa-5	*Ludwigia obtusiformis*		Obtusiformis
Aa-4	*Leioceras opalinoides*		Haugi
Aa-3b	*Leioceras comptocostatum* n.biosp.	Scissum	
Aa-3a	*Leioceras bifidatum*		
Aa-2	*Leioceras lineatum*		
Aa-1b	*Leioceras opaliniforme*	Opalinum	
Aa-1a	*Leioceras opalinum*		

Figure 1: Chronostratigraphical classification of the English Aalenian. The standard chronozonation of the Middle Jurassic Aalenian Stage into Zones and Subzones is shown on the right. The successon of ammonite biohorizons that have been recognised so far is shown on the left. The labelling of some of them with a letter as suffix, e.g. Aa-3a,b reflects the insertion of new discoveries following those reconigzed at the time of the original numbering, in 1990, and implies no difference in status. Thus, Aa-3b is the new biohorizon described in the present work that lies between those labelled Aa-3 and Aa-4 in 1990

of known horizons as a whole is thus always also still incomplete and its members are themselves separated by biostratigraphical non-sequences representing time-*intervals* of unknown durations: gaps into which new discoveries can always be inserted. These time-intervals between distinguishable biohorizons are a measure of the *temporal resolving-power* of their assemblages used as guide-fossils, which, conversely, depends on the rates of their genetic evolution. And, for reasons still not understood, the ammonite shells evolved at rates far exceeding those of other contemporary marine organisms, giving them their pre-eminence as tools in the chronostratigraphic classification of the Jurassic. Ammonite biohorizons provide us with the most precise time-correlations we can achieve in the regional stratigraphical classification of the Jurassic.

Conversely, the absence in a marine succession of sediments in which the ammonites of a particular biohorizon would be expected to occur can be taken to indicate a stratigraphical non-sequence. These principles were first worked out in the Inferior Oolite of Dorset by Buckman a century ago (1893) and are all clearly demonstrated at Mapperton. A nomenclature for the succession was introduced for the Inferior Oolite by Callomon and Chandler (1990) in an ascending numerical order within the Aalenian (Aa) and Bajocian (Bj) Stages. As new horizons were discovered and inserted, additional indices a, b, . . . had to be introduced, but it should be emphasised that such subdivisions do not indicate any inferiority of quality, only differences in the times of their discoveries. The current state of knowledge of the ammonite bio-horizons of the Aalenian Stage in England is shown in Figure 1.

The succession at Mp-CQ and its biostratigraphy described here reveals the presence of an Aalenian ammonite assemblage hitherto scarcely known in this country but closely similar to some previously well recognized in parts of continental Europe, particularly in France: Jura, Franche-Comté (Contini 1969), the lower Rhône valley Lyonnais (Rulleau 1995) and Germany: Lower Saxony (Hoffmann 1913), Swabia (Horn 1909; Rieber 1963) and Franconia (Dorn 1935). Further descriptions of specimens probably of similar age have come from many other localities in Europe, but are based on samples either too small to date precisely or lacking sufficiently precise stratigraphical information – often found in successions vastly thicker than those in Dorset. The emphasis in what follows will therefore be on this new assemblage, which characterises a new faunal horizon, Aa-3b, shown in Figure 1. Conversely, the enormous quantity of superbly preserved ammonites recovered provides yet another test-case in which to study the variability of a dimorphic ammonite palaeobiospecies: *Leioceras comptocostosum* biosp.nov. The formal taxonomic relationships of the new (bio)species to existing nominal Linnéan (morpho) species, with which some of its variants have in the past been associated, particularly in European continental descriptions, are briefly reviewed. Leading among these are *Leioceras comptum* (Reinecke, 1818) from Franconia and *Leioceras costosum* (Quenstedt, 1886) from Swabia, both of which have been used as zonal indices and both of which are in need of serious revision.

The names of ammonites listed bed by bed are, unless otherwise indicated, those of conventional nominal (morpho-) species. The exception is the assemblage of *Leioceras* from the Comptocostosum Bed. Only works by authors of taxa given with a year-date are cited in the bibliography. The ammonites and associated fossils have been registered as part of the Sedgwick Museum collection (prefix: SM X), Cambridge, and are at present with R.B. Chandler (RBC). The zonal scheme used in Figure 1 is that of Callomon and Cope (1995), adopted also by Cox and Sumbler (2002).

Abbrevations:

SM X Sedgwick Museum, Cambridge
MCZ Museum of Comparative Zoology, Harvard University
Mp-CQ Mapperton, Coombe Quarry
(c) common, (o) occurs, (r) rare.
* Type species of a genus
juv. juvenile
[M] macroconch
[m] microconch
HT holotype
PT paratype
AT allotype (type of antidimorph of the holotype)
Mon. Buckman, S.S., 1887–1907 A *Monograph of the ammonites of the Inferior Oolite Series*.
ICZN *International Code of Zoological Nomenclature* (1999).

The section

The section is shown diagrammatically in Figure 2. Bed-numbers in square brackets are those of Bomford (1949).

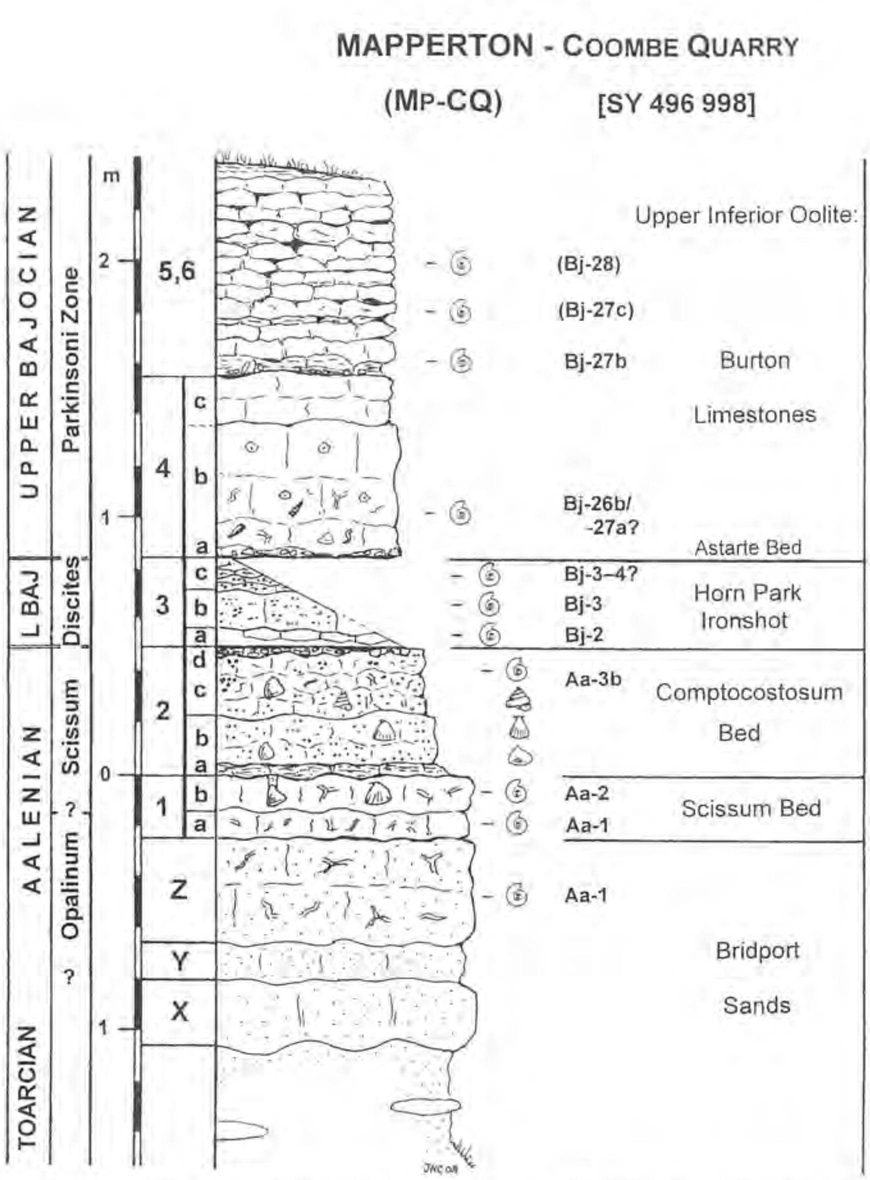

Figure 2: Diagrammatic representation of the section at Coombe Quarry in weathering-profile. The main numbering of beds goes back to the description by Bomford (1949), extended downwards into lower levels not seen by him. The bed providing the major topic of discussion here is bed 2c. The two major erosion-planes lie at the bases of beds 3 and 4, marking non-sequences spanning three and six whole Zones respectively. The non-sequence at the base of bed 3 is discomformable over the extent of the quarry. That at the base of bed 4, marking the so-called Vesulian regional transgression, is highly unconformable even over the length of the quarry. Recent extensions of the working face have brought in yet higher levels above bed 3c, indicating remains of biohorizons as high as Bj-7 or 8. '0' on the scale bar indicates present level of quarry floor

From above:

Topsoil

Burton Limestones: *Upper Bajocian, ?Garantiana – Parkinsoni Zones*

5 [5,6]: bioclastic limestones, in several courses, separated by undulating marly partings, with much ferruginous staining and clay pockets from superficial weathering; heavily burrowed at some levels, the burrows with marly infill; some beds richly fossiliferous, with large but disarticulated bivalves, sparse brachiopods. Not examined further in detail, but spoil-heaps point to the presence of at least one major erosion-plane. 5a: the basal bed, shelly; together . . . . *c.* 0.8m

Occasional ammonites, but not found in situ:

Parkinsonia bomfordi Arkell	[M] and [m](o)	**Bj-28**
– *pseudoferruginea* Nicolesco	[M] (o)	**Bj-27c**
– *parkinsoni* s.s. (Sowerby)	[m] (o)	**Bj-27b**
– *dorsetensis* (Wright)	[M] (o)	**Bj-27b**
Vermisphinctes meseres Buckman and spp.	[M] (o)	
Bigotites petri Nicolesco	[M] (r)	
Oxycerites cf. *aspidoides* (Oppel)	[M] (o)	
Strigoceras truellei (Sowerby)	[M] (o)	**Bj-27b**

– undulating parting –

4 [4] Limestones, biodetrital, mainly biosparitic packstones, fairly well sorted, the clasts largely echinodermal; hard, massive, white, separating into a few courses (b and c) when weathered but without clay partings; scattered large cream ooliths and some limontic pockets in the lowest 0.2m, a few pebbles at the base; the top 0.2m rather softer, more marly, perhaps separable as a subdivision 4b, the base perhaps a residue of the otherwise widespread Astarte Bed (4a) . . . . *c.* 0.7m

Very sparsely fossiliferous:

Parkinsonia parkinsoni and sp., fine-ribbed		**Bj-27a?**
Parkinsonia cf. *rarecostata* (Buckman)	[M] (r) (at +0.2m)	
(= *bradstockensis* Dietze)		**Bj-26b/27a?**
Garantiana sp. [juv.] (at +0.15m)		**Bj-26b**
Lissoceras sp.	[M]	
Oxycerites cf. *aspidoides*	[M]	
Oppelia cf. *subradiata* (Waagen)	[M]	
Neocrassina modiolaris (Lamarck) (o, at base) (= *Astarte obliqua* auctt.)		

– sharp, flat, erosion-plane, the regional 'Vesulian' transgression –

Horn Park Ironshot: *Lower Bajocian, Discites and ?Ovale Zones*

3 [3] Limestones, marly, densely ironshot, in lenticular development, wedging out across the quarry, thickening from a barely divisible 0.10m at the western end to 0.30–0.35m at the eastern end, where it is divisible into three courses:

3c: limestone, locally biosparitic, ferruginous, marly to argillaceous, strongly burrowed, much limonitic crust, occasional snuff-boxes; medium- to coarse-grained ironshot, in cloudy distribution, with pockets of very coarse, light brown ooliths in grey matrix, as in the snuff-box bed at Burton Bradstock. . . . . *c.* 0.12m

Sonninia (Euhoploceras) sp., fragments	[M] (c)	
Hyperlioceras sp., fragments	[M] (r)	
Fissilobiceras cf. *ovale* (Waagen)	[M] (r)	
Docidoceras sp. trans. *Emileia* sp.nov.	[M] (r)	**[Bj-3–4]**

– undulating parting –

3b: limestone, very fine-grained, harder, dark grey weathering cream; densely ironshot, the ooliths uniform, small to medium-sized, dark brown . . . . *c.* 0.15m

Scattered well-preserved macrofossils:

Hyperlioceras cf. *discites* (Waagen)	[M] (r)	
– cf. *deflexum* Buckman	[M] (o)	
– cf. *subsectum* (Buckman)	[M] (o)	
– *cuneatum* (Buckman)	[M] (o)	
– *liodiscites* Buckman	[M] (o)	
– *subdiscoideum* Buckman	[M] (o)	
– *politum* (Buckman)	[M] (r)	
Sonninia modesta Buckman	[M] (o)	
– cf. *dominans* Buckman	[M] (o)	
– *costata* Buckman	[M] (o)	
– *spinigera* Buckman	[M] (o)	
– *crassicostata* Buckman	[M] (o)	
– *dominans* Buckman	[M] (o)	
– cf. *acanthodes* Buckman	[M] (r)	
*Docidoceras** *cylindroides* Buckman	[M] (r)	
Bradfordia costata Buckman	[M] (r)	**Bj-3**
Camptonectes cf. *giganteus* Arkell, 1926	(c)	

(Note – all the species of *Sonninia* are often assigned to the genus *Euhoploceras*)

– undulating parting –

3a: limestone, dark grey, marly, indurated in lenticles, somewhat fissile, much limonitic weathering with clay lenticles; densely ironshot, the ooliths coarse, poorly sorted, in clouds through burrowing 0.03–0.06m

Hyperlioceras discitiforme Buckman	[M] (c)	
H. (Darellia) semicostatum (Buckman)	[M] (c)	
– sp.	[M] (c)	
H. (*Braunsina*) sp.	[m], (c)	**Bj-2**

– (Note – no true *Graphoceras* found!)

– major flat erosion-plane, stromatolitic encrustation; in places clusters of 'snuff boxes' in rotted limonite matrix –

[*Murchisonae* and *Bradfordensis Zones* – present as thin lenses in some parts of the quarry:]

– Limestone, khaki, fine grained and stained by limonite.

Ludwigia murchisonae(Sowerby)	[M] (r)	
Brasilia aff. *bradfordensis* (Buckman)	[M] (r)	**Aa-7** or **8**]

Comptocostosum Bed: *Lower Aalenian, Scissum Zone, upper part*

2 [2] Limestones, ironshot oolitic, intensely burrowed, shelly, divisible into four courses:

2d[d]: conglomerate, a mass of pebbles, crusts, limonitic pockets in a matrix of dense ironshot, highly ferruginous, weathering dark brown; let down into the undulating top of the bed below, lifting off in slabs, most prominent at West end, fading and absent at East end, cut out by the overlying erosion-plane 0–0.07m

2c[c]: shell-bed: limestone, fine-grained, hard, dark grey ironshot oosparite, small to medium-sized ooliths, poorly sorted, in clouds, intensely and coarsely burrowed. Highly fossiliferous, ammonites, large bivalves and gastropods with shells preserved, complete and intact, with additionally much shell debris; flat-lying ammonites concentrated particularly near the top of the bed, elsewhere much smaller specimens, sparser and at all angles 0.25–0.30m

The ammonite fauna of this bed is in Britain so far unique to this locality. The most abundant component of the rich ammonite fauna consists of an assemblage of morphologically highly diverse forms, ranging from compressed, entirely smooth to stout and coarsely ribbed, whose intergradation shows them to be merely variants of a single, dimorphic palaeobiospecies of the genus *Leioceras*:

Leioceras comptocostosum sp. nov.
[M] and [m] **Aa-3b** [new]

Individual variants have in the past been described under the names of a plethora of more than 20 conventional nominal (morpho-)species. These are listed more fully below in the taxonomic description of the new species.

Other elements:

Pachylytoceras wrighti (Buckman) [M] (very large) forming a noticeable layer at 0.35m below the erosion surface at the top of bed 2.

Planammatoceras planinsigne (Vacek) and sp. aff. [M] (r)
Hammatoceras lorteti (Dumortier) [M] (r)
Bredyia sp. [M] (r)
Erycites barodiscus (Gemmellaro) (Pl.11, Figure 2a,b) [M] (r)
(= *exulatus* Callomon and Chandler 1994)
Tmetoceras scissum (Benecke) and sp. aff. (very fine-ribbed) [M] (r)
Vacekia stephensi (Buckman) [M] (r)

Non-ammonites include:

bivalves: *Gresslya abducta*, *Gervillella* sp. (entire), *Pleuromya* sp., *Trigonia costata* Sowerby, *Ctenostreon pectiniforme* (Schlotheim);
gastropoda: *Pyrgotrochus punctatus* (Sowerby), *Pseudomelania cf. procera* Morris and Lycett;
solitary corals

– undulating parting –

2b[b]: limestone, oosparitic, massive but coarsely burrowed, very hard, densely and finely ironshot; very few fossils, mainly large bivalves 0.15–0.20m

Ceratomya bajociana (d'Orbigny), *Ctenostreon pectiniforme* (Schlotheim), *Gresslya* sp., *Plagiostoma* sp,

2a: limestone, grey, marly, non-oolitic, softer than the bed above 0.03–0.05m

– undulating surface and parting, floor of quarry –

Scissum Bed: *Scissum Zone, lower part; boundary with Opalinum Zone not clearly determinable*

1 Limestone, light grey to white, marly, somewhat nodular, divisible into two courses:

1b[2a]: limestone, fine-grained to saccharoidal, grey, weathering cream, hard, burrowed, with clouds of fine cream pellets, forming the working base of the quarry 0.15m

Very few ammonites:

Leioceras cf. *opalinum* (Reinecke)
– cf. *capillare* (Buckman)
– *plicatellum* Buckman
– *lineatum* Buckman
– *grave* Buckman
Tmetoceras scissum (Benecke) **Aa-2**

Large thick-shelled bivalves form a layer at the top surface:

Camptonectes giganteus Arkell
Ctenostreon pectiniforme (Schlotheim)
Liostrea sp., large
Plagiostoma sp.
and burrowing bivalves *in situ* include *Pholadomya* sp.

– parting –

Opalinum Zone

1a [1]: limestone, mid-grey, marly, heavily burrowed, no pellets 0.10m

Few fossils: small *Leioceras* cf. *opalinum* [**Aa-1**?]

– wavy parting –

Z Limestone, pale grey (fresh), hard, slightly sandy, no pellets 0.4m

Leioceras opaliniforme Buckman [M],
abundant fragments of *L.* aff. *opalinum* **Aa-1**

– wavy parting –

Bridport Sands – boundary somewhat arbitrary

Y Limestone, very sandy, or calcareous very fine-grained sandstone, with numerous small brown grains; no fossils seen 0.15m

– wavy parting –

X Limestone, very sandy, similar, no fossils seen 0.25–0.30m

– undulating, gradational boundary –

– Bridport Sands, typical, loose fine-grained sands locally indurated into small to medium-sized lenticular 'burs', seen to 0.3m
Lower beds covered, forming steep valley slope down to Coombe.

Palaeontology: the classification of ammonites

The profusion of nominal taxa and their names that have been created to describe the ammonites of the Inferior Oolite is legendary. It presents a historical burden that is daunting in any attempts at modern revision. How and why has it arisen; to what extent does it bear any relation to natural reality; and what goal should guide the direction of modern revision? As the cradle of much of this development lay in our own county of Dorset, a brief historical review is pertinent. The story has evolved in four stages.

In the first stage, going back to the earliest days, beginning with the genus *Ammonites* Bruguière, 1789, descriptions were cast in conventional terms of Linnéan binominal classification and nomenclature – genus and species. The criteria were purely morphological: "a species is what a taxonomist says it is". The emphasis was on the description of *differences*, to bring out the diversity of forms. It marked what has been aptly described as the *analytical* phase of taxonomy (Wright 1981, 167), and continues to be the first step even today, in for instance the description of new discoveries in parts of the world so far barely explored, such as Tibet or Antarctica. The ammonites revealed a diversity of forms that generated an abundance of species unmatched by any other group of contemporary molluscs. The number of Jurassic nominal species as listed by Sherborn in the *Index Animalium* (1902–33) had risen to over a thousand by 1850, including the 16 from our Inferior Oolite alone. That these forms also changed rapidly over geological time was also soon recognized. This was then exploited in their use in the Jurassic as the guide-fossils of choice for time-correlations of distant rocks, giving us the standard chronostratigraphical scales of Stages (d'Orbigny 1850) and Zones (Oppel 1956–58) we still use today. But what the causes behind all these observations might have been was wholly unknown.

The second stage goes back to Darwin's *Origin of Species* of 1859, which proposed a mechanism – evolution – to explain the observed changes of form in living organisms with geological time and hence their derivation from common ancestors. It was not long, therefore, before the ammonites, in their exceptional diversity of forms and their rapid and closely documented changes with time, suggested themselves as particularly favourable subjects for attempts to provide tests and demonstrations, in the Darwinian spirit, of evolving lineages. The first attempt was by Waagen (1869), who chose as his lineage ('Formenreihe') a group that is part of today's family of the Oppeliidae, beginning with the species *Oppelia subradiata* (Sowerby), first defined in our own Inferior Oolite, and following its successors upwards into the Upper Jurassic. Attempts in the Lias soon followed, culminating in perhaps the most famous, Hyatt's *Genesis of the Arietidae* (1889). The time-dependent element in such classifications now began to add an extra function to the next taxonomic category in rank above that of the species, that of the genus, besides that of being merely a convenient bin for species that looked similar. This provided a huge impetus to the creation of new nominal genera and these proliferated from the 1860s onwards in a way resembling that of species half a century earlier. Genera became increasingly regarded as groups of successive species. But the fundamental question remained: what was a species? Forms found side by side seemed to differ among themselves more than some of them did with those in successive assemblages. Morphological species seemed to have vertical ranges. Conversely, diversity of form in a contemporary assemblage suggested multiplicity of co-existing, parallel lineages that came and went, implying phylogenetic splitting. So, in attempting to identify lineages, what do you join vertically to what? Taking morphological characters as criteria, you have a choice: which do you take as the reliable arrow of evolutionary direction? The septal suture? Presence or absence of a keel? Involution of coiling? Style of ribbing?

It was at this point that Buckman took up the story ('Classification by descent', *Mon.* 1889, 125). He had begun the description of the ammonites of the Inferior Oolite of Dorset from a position of unusual strength in the enormous richness of the material available to him, particularly of the Graphoceratidae, much of it collected by himself; and the high precision of the stratigraphical basis on which it could be dated, most of it also created by him (Buckman 1893). Alas, the view he adopted of the evolving species became ever narrower, defined in ever finer details of morphology. The number of species living naturally side by side that this implied seemed not to worry him – although in another group, the Sonniniidae, similarly split by him into over 60 species, doubts seem briefly to have assailed him (*Mon.* 1892, 288). And as we all know, the evolutionary picture that emerged has been disastrous. Instead of the wood of well-spaced family-trees hoped for in the post-Darwinian era, what grew was an impenetrable thicket of family-bushes. The legacy of its taxonomic nomenclature remains with us today.

The third stage came with the advent after the first world war of semi-quantitative Mendelian genetics in the study of the 'laws of inheritance' in neontology, in the so-called New Systematics (Huxley 1940). The leading concepts were the determinants at the level of the prokaryotic cell, of polymorphic genes arranged in fixed patterns at loci on a genome, itself partitioned into replicating chromosomes. A metazoan species had now to be redefined not in terms of its morphology alone but also on the ability of its members to propagate, leading to the famous definition by Mayr (1942, with subsequent refinements) of a *genetic* species as consisting of all the members of a population actually or potentially able to propagate by interbreeding, and reproductively isolated from other such populations. (Ironically, an almost identical definition had already been cited by Quenstedt in 1845, in a discussion of the taxonomy of ammonites! See Callomon *et al.* 2004, 1072: a definition then ignored, or overlooked, by most ammonite workers ever since). The definition of a species was now elevated to the properties of an assemblage – a population – rather than to those of an individual.

The fourth stage came with the attempts to introduce the New Systematics into palaeontology (Sylvester-Bradley 1956). Once again, the fundamental problem centres on the question: what constitutes a palaeobiospecies in fossils? All we have are more or less isochronous fossil assemblages and the tests of reproduction, on the time-scale of a few generations, a few years, are ruled out. To what extent, however, may our fossil assemblages, properly chosen, approximate sufficiently closely to those of neontological biospecies for our purpose, which is that of plotting evolutionary lineages on a time-scale of steps of 10,000–100,000 years? The answer is optimistic: perfectly adequately – if properly chosen. What are the requirements and what is the criterion? For the former, the assembly of a palaeobiospecies, it is in the first place the collection of an assemblage that is as close to isochronous as is stratigraphically possible – here, as that from a single biohorizon. For the latter, the recognition of such a species, the criterion is the observation of increasingly seamless morphological intergradation in all characters between specimens as their number grows. The emphasis is now on the interrelationships between members of an assemblage, rather than on the differences between them. Biospecific taxonomy represents the final, *synthetic* stage of classification in palaeontology. (In neontology there is a further, fifth stage, that of molecular genetics – a stage that, in our extinct ammonites, we are mercifully spared).

In the special case of the ammonites that concern us here, there is one additional important requirement. The assemblages to be tested for morphological intergradation must be of adults. Ammonites grew to a final stage of ontogeny at which growth stopped. Maturity is usually easily discernible as the adult bodychamber usually underwent morphological modifications that distinguish it in form from the earlier whorls. The onset of the change usually coincides more or less closely with the position of the final septum of the chambered phragmocone. The form of the adult bodychamber is an important character in ammonite classification, as is the diameter of the fully-grown shell. These points are all well illustrated in the present work. No ammonite should ever be described without an indication of its ontogenetic status, for instance by marking on illustrations the onset of the bodychamber where preserved. Buckman, in his later years, was exemplary in his adherence to this principle. Many authors, even today, totally ignore it. One of the early triumphs of this biospecific approach to ammonite taxonomy was to make immediately obvious the existence in adult assemblages of a strong dimorphism, presumed to have been sexual. Nowhere is it more obvious than in the Graphoceratidae, and why Buckman failed to recognize it – even rejecting it (Buckman and Bather 1894) – remains a mystery.

The outcomes of applying the New Systematics to ammonite taxonomy are threefold. Firstly, those simple, clean family-trees hoped for at the beginning do emerge. The main stem of the Graphoceratidae, the Graphoceratinae, represents a monophyletic lineage from its origins in the Late Toarcian to its demise in the Early Bajocian. Its members were endemically restricted to the shelf-seas around the western margins of the Tethys. They are at every biohorizon monospecific and hence one biospecific name for every transient suffices: for the Aalenian part, Figure 1 says it all.

Secondly, this raises technical problems of nomenclature. A re-classification of a jungle of 'vertical' morphospecies having stratigraphical ranges into a simple, monophyletic succession of 'horizontal' isochronous biospecies must still conform to the Linnéan ICZN (International Code of Zoological Nomenclature) (1999), observing the principles of priority and homonymy at binominal level. Although, praise be, most of the enormous litany of specific names in the literature is redundant, it regrettably cannot just be ignored. Next higher, the genus becomes now merely a segment of an evolving lineage; and as gaps in the succession have increasingly been filled, the boundaries between successive 'genera' become more and more blurred through overlap: hence, if retained, arbitrary. Of the 46 nominal genera that have been created for the main stem of the Aalenian-Bajocian Graphoceratidae – 30 with type-species based on macroconchs, 16 on microconchs – of which 43 were created by Buckman himself, just five seem worth retaining on grounds of convenience: the four shown in Figure 1 and *Hyperlioceras* for the survivors in the Lower Bajocian, horizons Bj-1–Bj-3. But it should be stressed that this is purely a matter of convention: there are no sharp boundaries between them. A revised generic classification, with lists of taxa and synonyms, was detailed by one of us some years ago (Chandler 1997).

Thirdly, there then arises the question of how to name the morphologically diverse variants within a biospecies. To create yet more names would be counterproductive. One way that has been followed (see below) is to retain the specific epithets, the adjectival parts of Linnéan binomina previously used to label morphospecies, but to demote them to infrasubspecific, varietal status, to continue to convey the morphological features for which they were invented. But as infrasubspecific units they are freed from the constraints of priority imposed by the *Code* on names in the species-group. Their varietal status can be formally indicated by giving their names the prefix 'var.'.

This way is followed here. The assemblages of the younger transients of the Graphoceratinae were comprehensively described in this form in the earlier account of the fauna at Horn Park (Chandler 1997; Table 1), in which details of the species, their authors and years, their types and stratigraphical ranges are listed, together with the nominal genera in which they were founded and of which, conversely, some of them may be the type species.

A full account of this method of classification has also been given by Dietze *et al.* (2005), where it was applied to a segment of the Sonniniidae. Being a very strongly sculptured group involving various styles of ribbing and tuberculation, the number of morphospecies to be digested was, if anything, even greater in this group than in the Graphoceratidae. The most recent example of biospecific reclassification lies in the genus *Morrisiceras*, the index and principal guide-fossil of the Morrisi Zone of the Middle Bathonian (Zatoń 2008). In contrast to the compressed, planulate Graphoceratinae, this member of the Tulitidae consists of involute, inflated spheroconic macroconchs. The dimorphism is extreme. The variability is again very high and the reclassification saw five morphogenera and 17 morphospecies boiled down into a single biospecies of the single genus *Morrisiceras*. The first application of biospecific classification to a whole lineage was to the family Cardioceratidae (Callomon 1985), ranging from the Upper Bajocian to the Kimmeridgian, sampled at levels of over a hundred transients representing a duration of perhaps 20 Ma.

The reasons and requirements for biospecific taxonomy in ammonites were explained quite fully already many years ago (Callomon 1963) but have been slow to catch on. The main obstacle continues to be incredulity at the astonishingly wide morphological diversity that members of a biospecies could maintain. The shape of shell seems to have had little functional significance and hence not to have been a character on which Darwinian selection-pressure could guide evolution. Why this should have been so remains a mystery but the facts seem incontrovertible.

Systematic palaeontology

Suborder AMMONITINA Hyatt, 1889
Superfamily Hildoceratoidea, Hyatt, 1867
Family Graphoceratidae Buckman, 1905

The Graphoceratidae have been divided into a number of subfamilies (Arkell 1957, L262–3): the Graphoceratinae Buckman, 1905, the Leioceratinae Spath, 1936 and the Staufeniinae Maubeuge, 1950. As explained above, the separation of the first two is arbitrary, as they are merely two successive intergrading stages in the development of a single monphyletic lineage. The Leioceratinae as nominal taxon can therefore be abandoned. The Staufeniinae were created for what appears to be a distinct branch within the Graphoceratidae, a separate short lineage running in parallel with the Graphoceratinae in about the Bradfordensis – Concavum Zones and seemingly endemic in central Europe. It is represented by the genus *Staufenia*, which developed septal sutures of almost ceratitic simplicity. Except possibly for some rare early forms, the genus in its typical development is not found in Britain and needs not here be considered further.

The family ranges from the Aalenian (Opalinum Zone) to Lower Bajocian (Discites or lowest Ovale Zones). Its ancestors lie in the Upper Toarcian genus *Pleydellia* Buckman, 1899 of the Grammoceratinae Buckman, 1904, and the transition from *Leioceras* downwards is as seamless as that within the Graphoceratinae upwards (see e.g. Ohmert and Rolf 1994). The boundary between the families, drawn to coincide with the boundary between the Toarcian and Aalenian Stages, is purely conventional and is based entirely on historical roots. A generic organization within the Graphoceratidae was suggested by one of us recently (Chandler 1997). Historically we recognize *Leioceras*, *Ludwigia*, *Brasilia*, *Graphoceras* and *Hyperlioceras* but, as already stated above, in reality these names are morpho-labels denoting stages in the continuous development of the family, a chronocline, its members the evolving transients of a single lineage. Here we are concerned with a single transient of that lineage and, because of the unusual quality and quantity of the material, we examine the characteristics of the lowest member of the genetic hierarchy, the palaeobiospecies.

The family is markedly dimorphic, with well-developed, slim, medio-lateral lappets on adult microconchs. Macroconchs are larger and possess plain sigmoid mouth borders.

Subfamily Graphoceratinae Buckman, 1905
(including Leioceratinae)

Genus **Leioceras** Hyatt, 1867
(= *Lioceras* Bayle, 1878, invalid emendation of *Leioceras*)

Type species. *Nautilus opalinus* Reinecke, 1818; subsequent designation by Buckman, 1887, p.12, 21, as *Lioceras opalinum* (Reinecke), [M]. In common with those of most of the other species created by Reinecke, the type specimen was long regarded as lost (Zeiss in Heller *et al.* 1972). Reinecke's types were rediscovered in Coburg on arrival of Dr E. Mönnig as curator of the Naturkunde-Museum in the 1990s. The type of *N. opalinus* was figured by Ohmert (in Ohmert and Rolf 1994, 42, pl.4, Figure 11) and, in rather better definition, by Schulbert (2001). Fortunately, Reinecke's figure clearly indicated a species that was readily and widely recognisable, so that later interpretations were substantially correct. The type is septate to 42mm, which makes it a macroconch. It is abundantly represented in Britain and marks the horizon Aa–1a. On the Dorset coast it lies in the Foxy Bed of Bridport, bed 5 in the current descriptions of the section there (Callomon and Cope 1995), formerly the Rusty Bed of Richardson (1928, 63, bed 8a) and bed 7 in Parsons' account of the Stony Head cutting on the A35 trunk road, east of Bridport (1975). Comprehensive new collections from Hyde Quarry at Walditch (Richardson 1929, 156) will be described elsewhere.

Other nominal genera included. As already mentioned, the number of nominal genera that have been coined in the Graphoceratidae is immense. Which of these should be formally included in *Leioceras* is a highly subjective matter and need not be gone into here in any detail. Various of them appear below in the names attached to some of the specimens shown in the plates. A fuller review is to be found in Chandler (1997).

Leioceras comptocostosum biosp. nov. [M and m] Chandler and Callomon here [Plates 1–12, Tables 1, 2]

Material: 248 specimens [M] and 46 [m]

Type series. HT [M], pl.1, Figure 1a,b (SM X 40269) and five paratypes: PT-1 [M], pl.1, Figure 2a,b (X40364); PT-2 [M], pl.2, Figure 2a,b (X 40285); PT-3 [M], pl.2, Figure 1a,b (X40286);. PT-4 [m], allotype, pl.1, Figure 3a,b (X27939); PT-5 [m], pl.1, Figure 4a,b (X40367); all currently with RBC.

Type locality and horizon. Coombe Quarry, Mapperton (Mp-CQ), near Beaminster, Dorset, bed 2c, faunal horizon Aa-3b, Lower Aalenian, Scissum Zone.

Nomenclature and synonymies. Most of the variants of this new biospecies as now described find close matches in the types of already existing nominal morphospecies. The names of some of those that match the variants illustrated here in the plates are collected together in Table 1. But 'match' is a subjective judgement and the list, its members treated as variants and as such their names freed from the constraints of priority, is to some degree arbitrary and by no means complete.

But what name should be given to the new biospecies? Could, or should, one of the existing morphospecies serve also as the name-giving type of the new biospecies? In principle yes, but the application of the same name to two separate taxa implies also biological identity of the two taxa. In the case of biospecies, this implies identity not only of type specimens but also of the whole assemblages to which the names are being applied. And in the case of biospecies that are transients of a lineage, their identity must also imply precisely identical ages, location in the same biohorizons. In the Inferior Oolite of Dorset, in which beds in sections can change very rapidly with distance between sections, the age of the type of an older species can often be narrowed down only if the locality from which it came is known. In the present case even that does not suffice to be quite certain.

Under these constraints, there are among the many existing species that could give their names to the new species only three British candidates for consideration. They share only their origins, which have been given simply as 'Mapperton':

(a) *Geyeria? evertens* S. Buckman, 1899, Suppl. p.l, HT(mon), Suppl. pl.11, Figures 10–12 (MCZ 107471); "Dorset: Mapperton . . . in a whitish stone, near base of limestone bed. *Scissi* or *Murchisonae* hemera". – Dia. 57mm, [M], onset of bodychamber not shown, but text draws attention to 'gerontic character'. Matched here by pl.8, Figures 3a,b. Range given in Chandler (1997) as Aa-2–Aa-4. Could not have come from the present section as that did not yet exist in Buckman's time. A probable source may have been Mythe Hill quarry, Richardson's no. 52 (1929, 175, at SY 496_5988_0, 1km S of Mp-CQ). But his description of the section differs from that of Coombe Quarry so strongly that it cannot be assumed that horizon Aa-3b is present. The most striking feature of bed 2c at Coombe Quarry is the abundance of its ammonites. Richardson mentions none. Similar remarks apply to all other former sections in the area described by him.
(b) *Ancolioceras cariniferum* S. Buckman, 1899, *id.*, p.xlvii. HT(mon), Suppl. pl.11, Figures 10–12 (present location not known), "Dorset: Mapperton . . . evidently from near the base of the Inferior Oolite limestone. *Murchisonae* hemera."– Dia. 27mm, no indications of ontogenetic stage, possibly merely a nucleus of an [M]; effectively not closely determinable. No matching specimen is figured here.
(c) *Strophogyria *cosmia* S. Buckman, 1899, p.lxii, LT (designated here), Suppl. text-Figure 20 (MCZ 107502). "Dorset: Mapperton . . . from a white stone; *Murchisonae* hemera." Recorded in Chandler, 1997, as common in horizons Aa-4, 5. Dia. 55mm, bodychamber not indicated, but clearly a largely complete adult [m]. A well-defined morphospecies but, as with most microconchs, long ranging, its type-horizon lying higher.

Derivation of name. The present assemblage bears a close overall resemblance to some faunas that have been characterised from quite closely-defined faunal horizons widely recognized in continental Europe, from NW Germany to Franconia, Swabia and the French Jura. They have been described there under two historical names, *Leioceras comptum* (Reinecke, 1818; Franconia) and *Leioceras costosum* (Quenstedt, 1886; Swabia), names that were then also adopted as labels for standard chronostratigraphical Zones or Subzones (see below). However, neither of these names is suitable for the new assemblage from Dorset. The type of

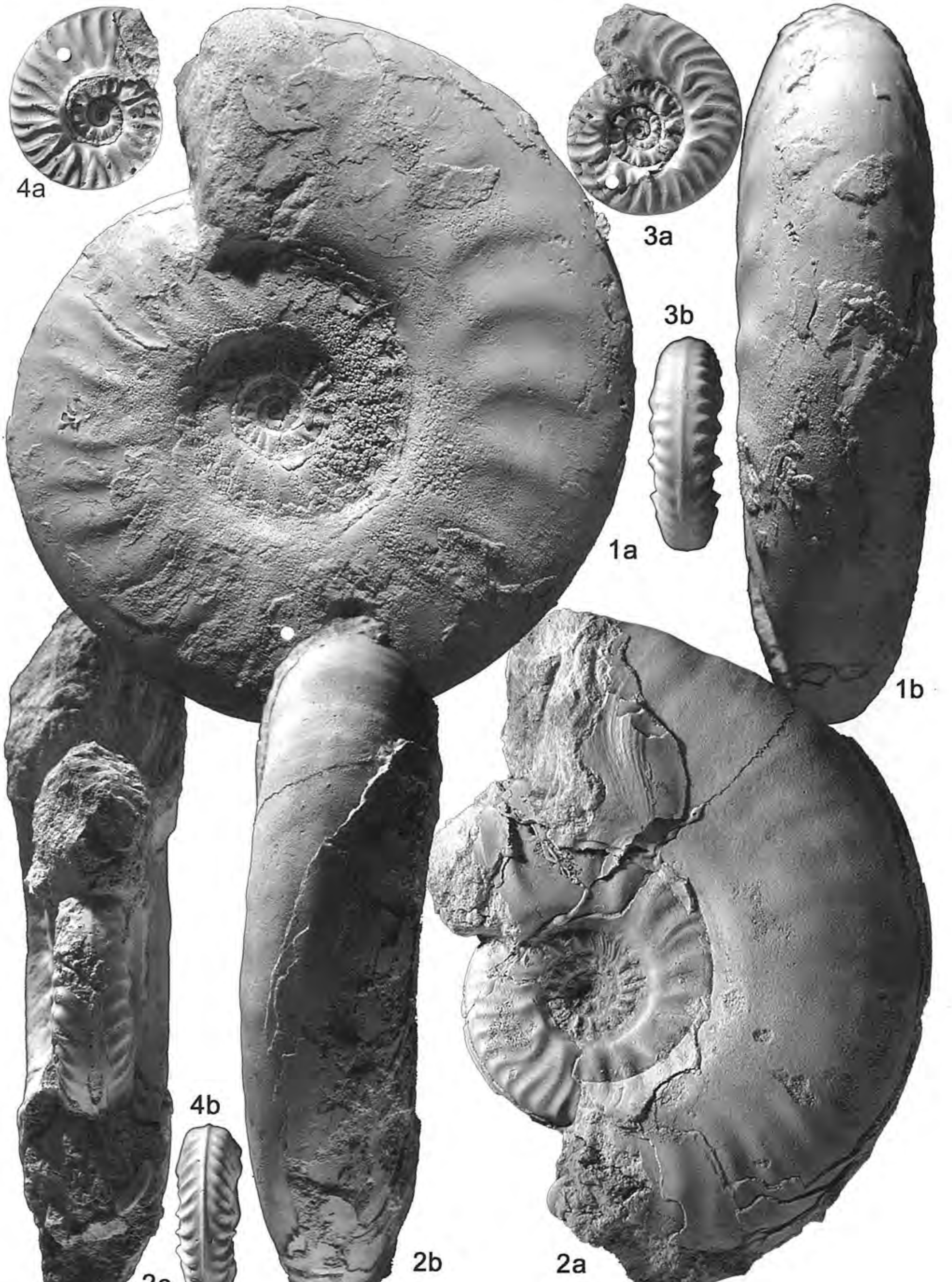

Plate 1: 1–4. Leioceras comptocostosum *biosp.nov.* **1–2:** *[M].* **1a,b:** HOLOTYPE. **2a,b:** *paratype (1).* **3–4:** *[m].* **3a,b:** ALLOTYPE, *paratype 4.* **4a,b:** *paratype 5. All specimens here and in subsequent plates from bed 2c, horizon Aa-3b; mature adults, natural size, the onset of bodychambers indicated by white spots. Collection registration-numbers are in Table 1*

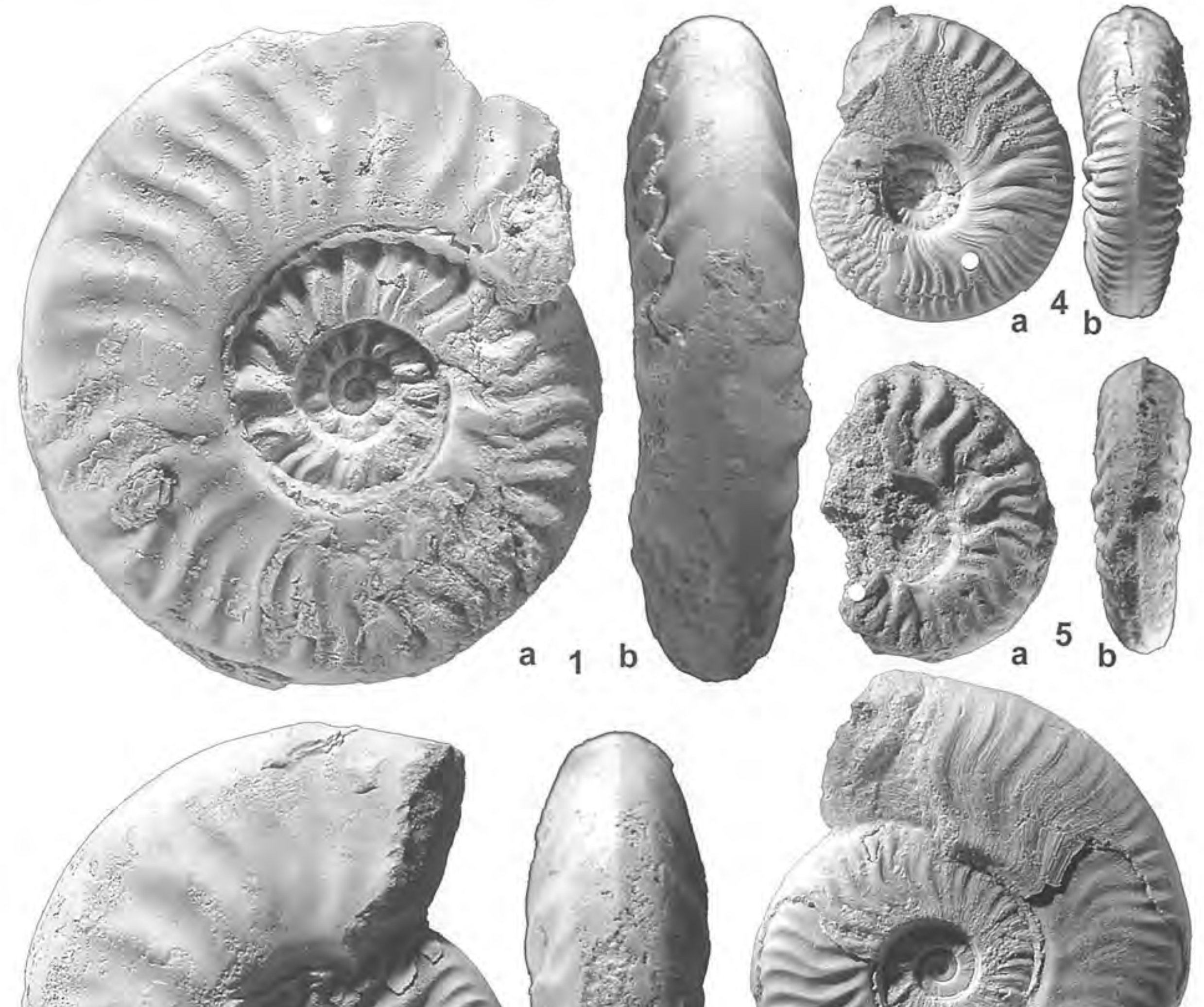

Plate 2: 1–6. Leioceras comptocostosum *biosp.nov.* **1–2:** *[M].* **1a,b:** *paratype (3);* **2a,b:** *paratype (2): both strongly and coarsely-ribbed.* **3–6:** *[m]. Particulars as in Pl.1. Existing morphospecies from other horizons whose types closely resemble the variants figured on this and subsequent plates and whose names, demoted to varietal status, could be used to refer to them, are listed in Table 1. The microconchs cover a large part of the spectrum of their variability.* **3a,b,** *var. patula ex Buckman sp., is among the largest and most evolute variants;* **4a,b,** *var. cosmia ex Buckman sp., among the most inflated and densely-ribbed forms; and* **5a,b,** *var. bullifera ex Buckman sp., among the most coarsely-ribbed*

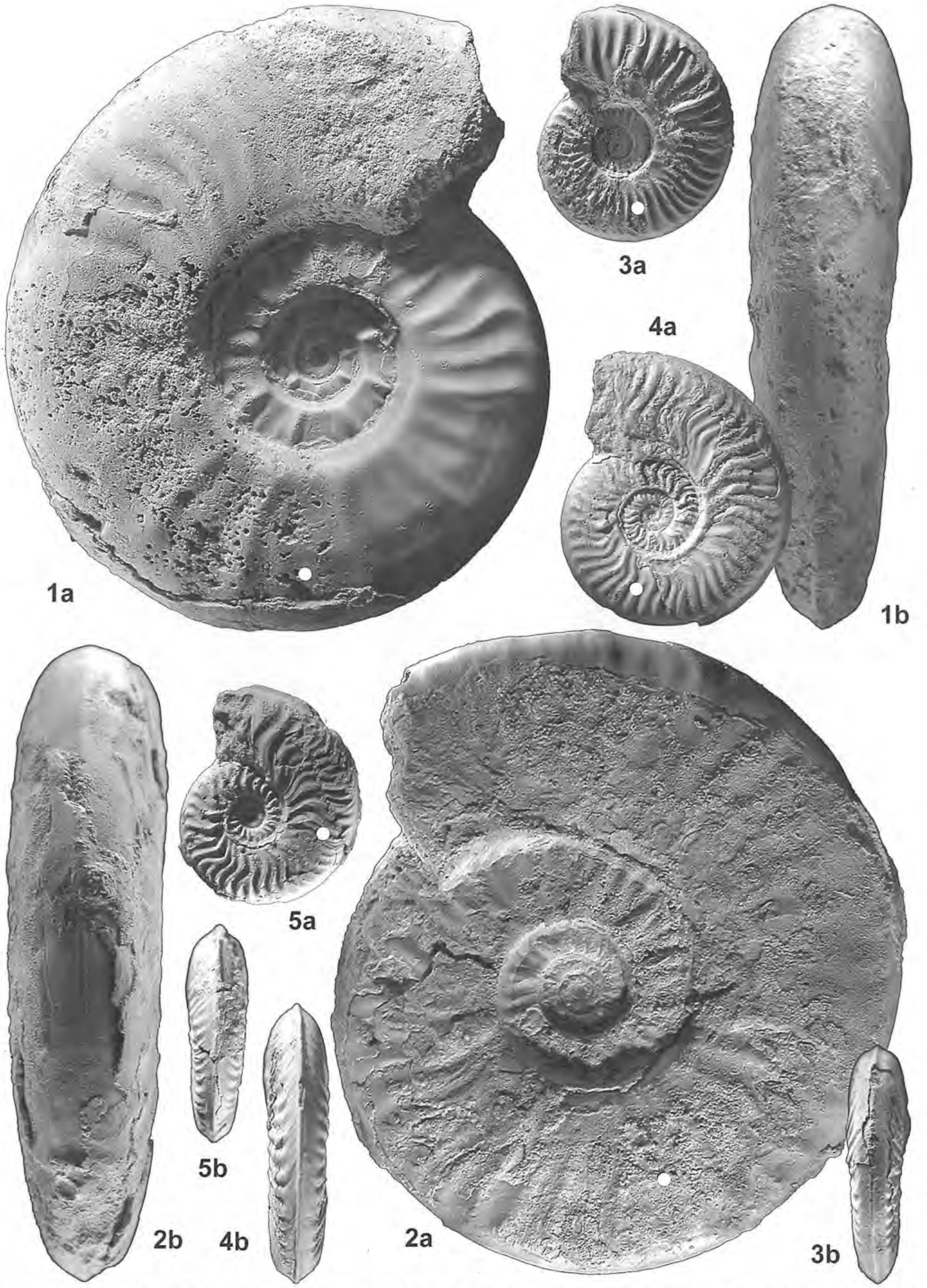

Plate 3: 1–5. Leioceras comptocostosum *biosp.nov.* **1–2:** *[M].* **1a,b:** *note the coarse, bullate primary ribbing on the inner whorls.* **2a,b:** *a large form with subdued ribbing.* **3–5:** *[m]: compressed, densely-ribbed forms*

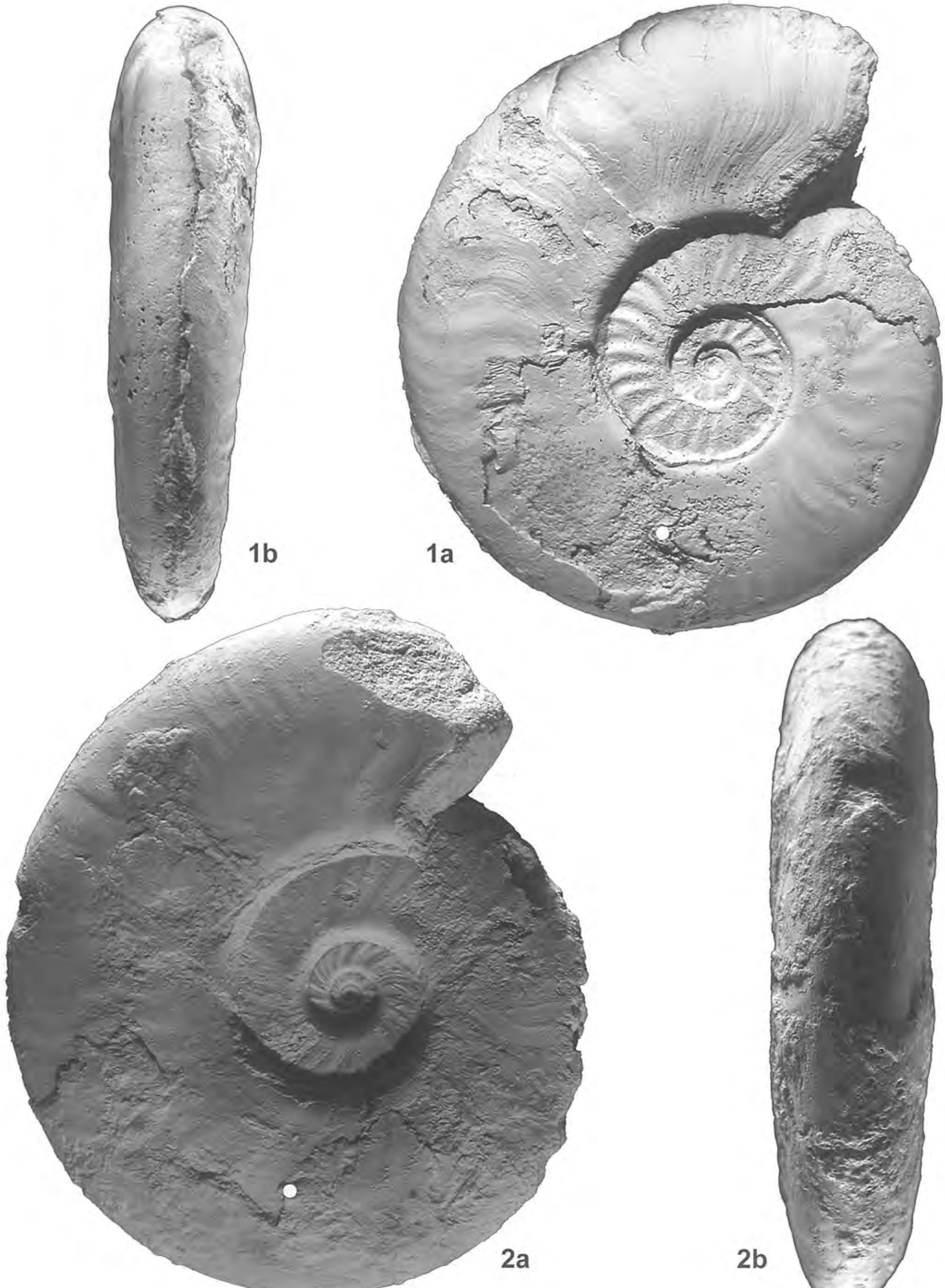

Plate 4: 1–2. Leioceras comptocostosum *biosp.nov.: [M]. Large forms becoming smooth on the bodychambers as in earlier* Leioceras, *e.g.* L. lineatum, *but more evolute*

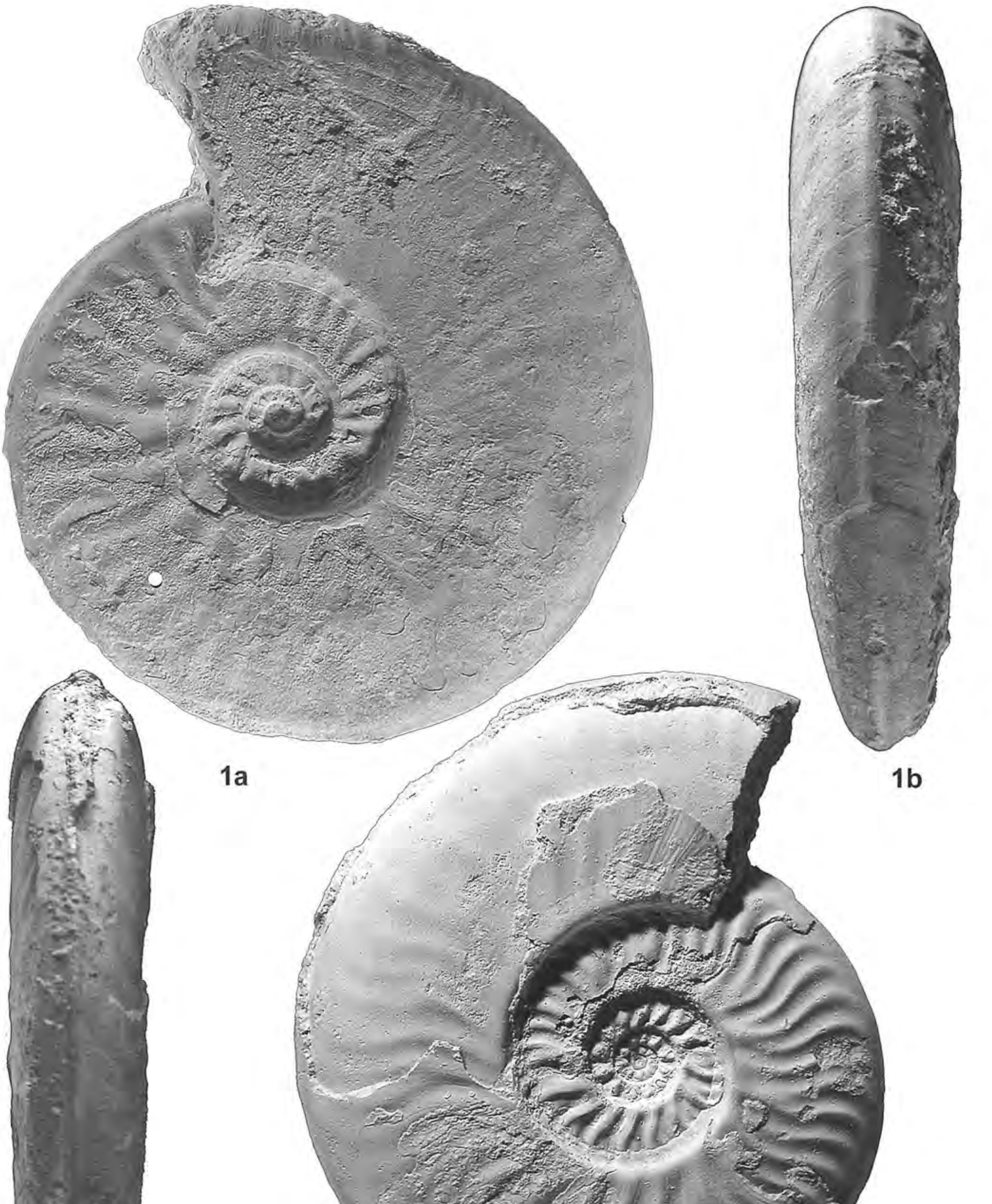

Plate 5: 1–2. Leioceras comptocostosum *biosp.nov.: [M]. Large forms with still acute ventral carinas but ribbing increasingly typical of later* Ludwigia

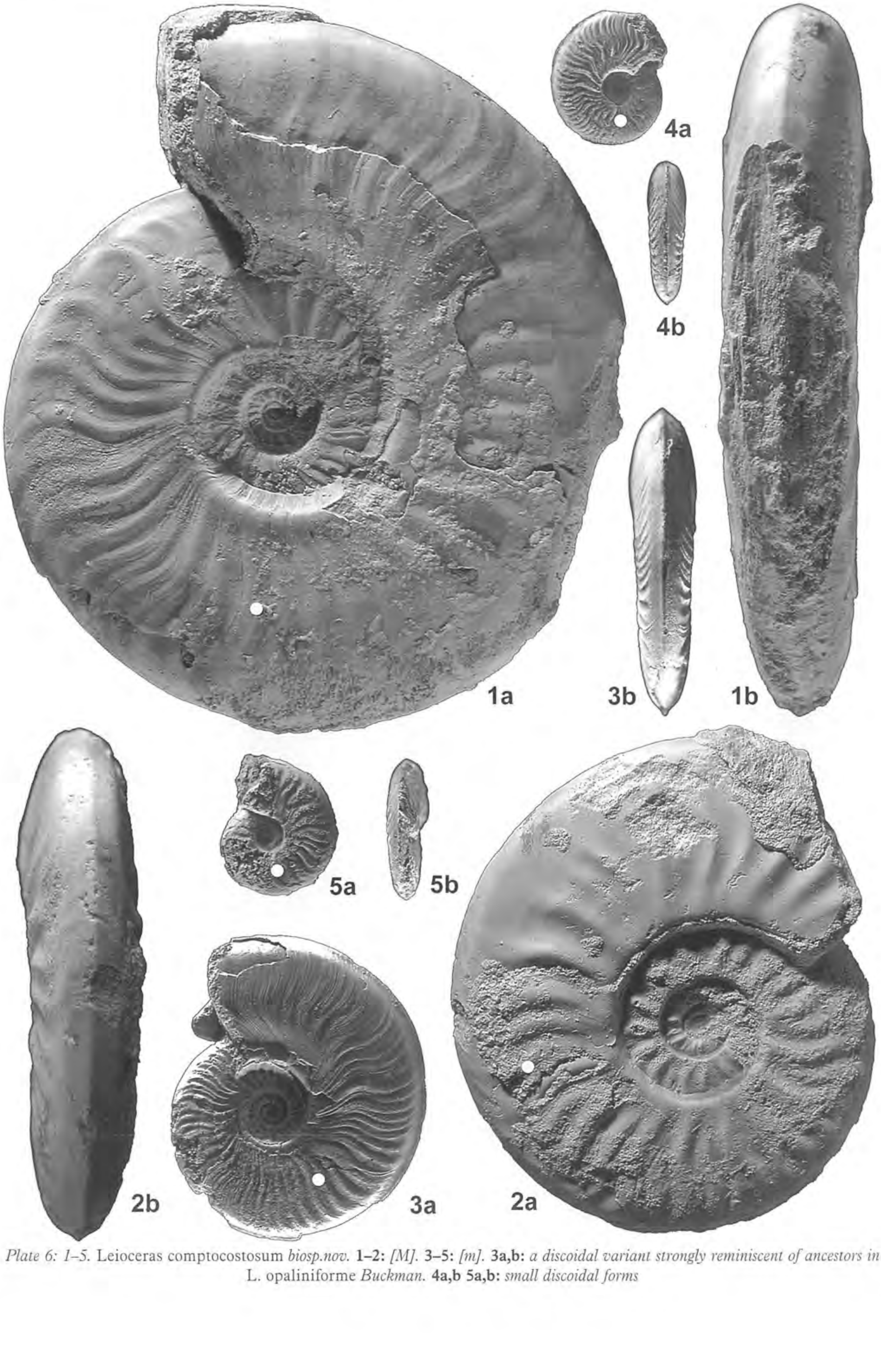

Plate 6: 1–5. Leioceras comptocostosum *biosp.nov.* **1–2:** *[M].* **3–5:** *[m].* **3a,b:** *a discoidal variant strongly reminiscent of ancestors in* L. opaliniforme *Buckman.* **4a,b 5a,b:** *small discoidal forms*

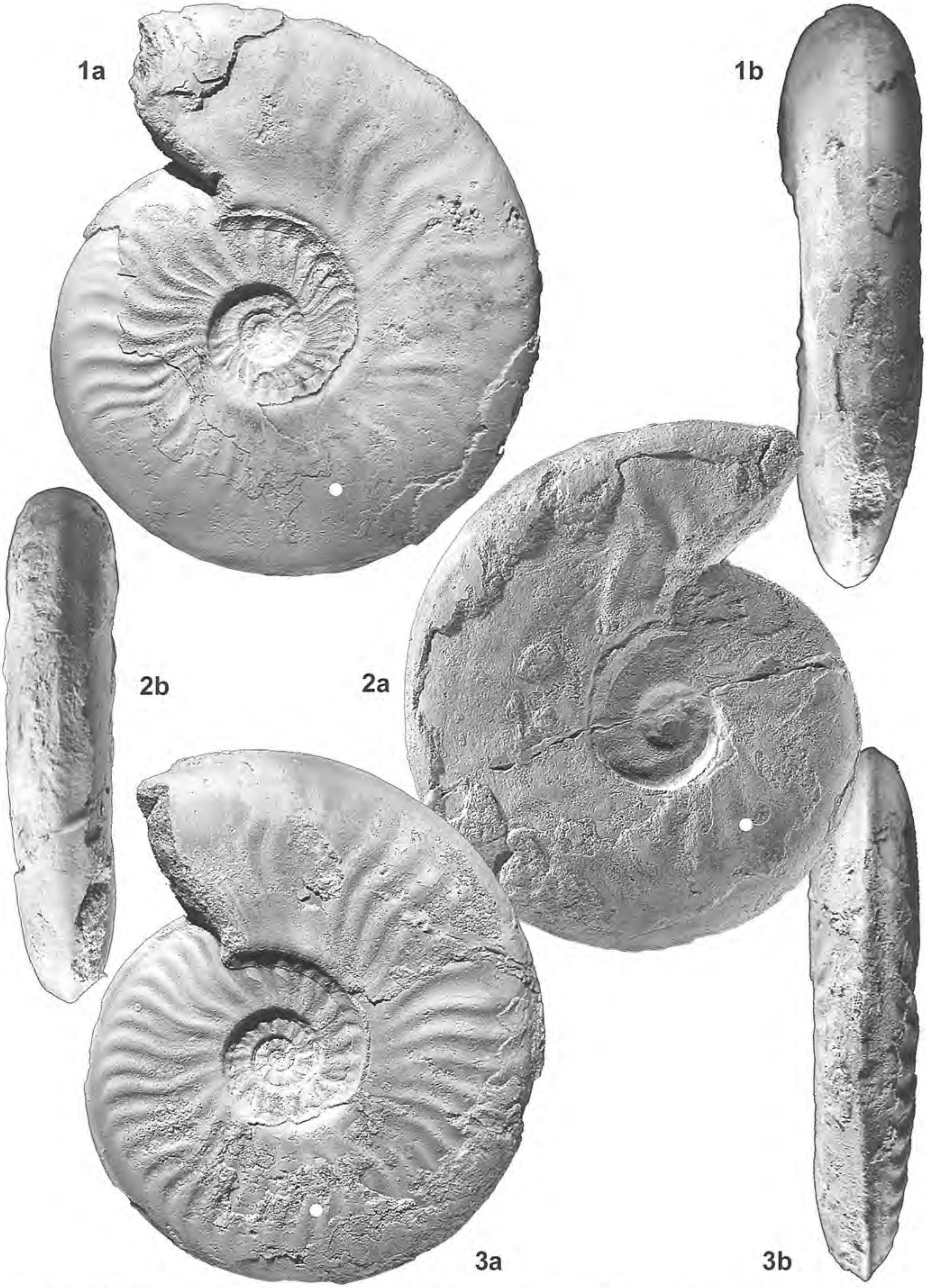

Plate 7: 1–3. Leioceras comptocostosum *biosp.nov.: [M].* **1a,b:** *a form conventionally regarded as typical of* Ancolioceras, *var. costatum ex Buckman sp.* **2a,b:** *a smooth form typical of those found in lower horizons, var. lineatum ex Buckman sp.*

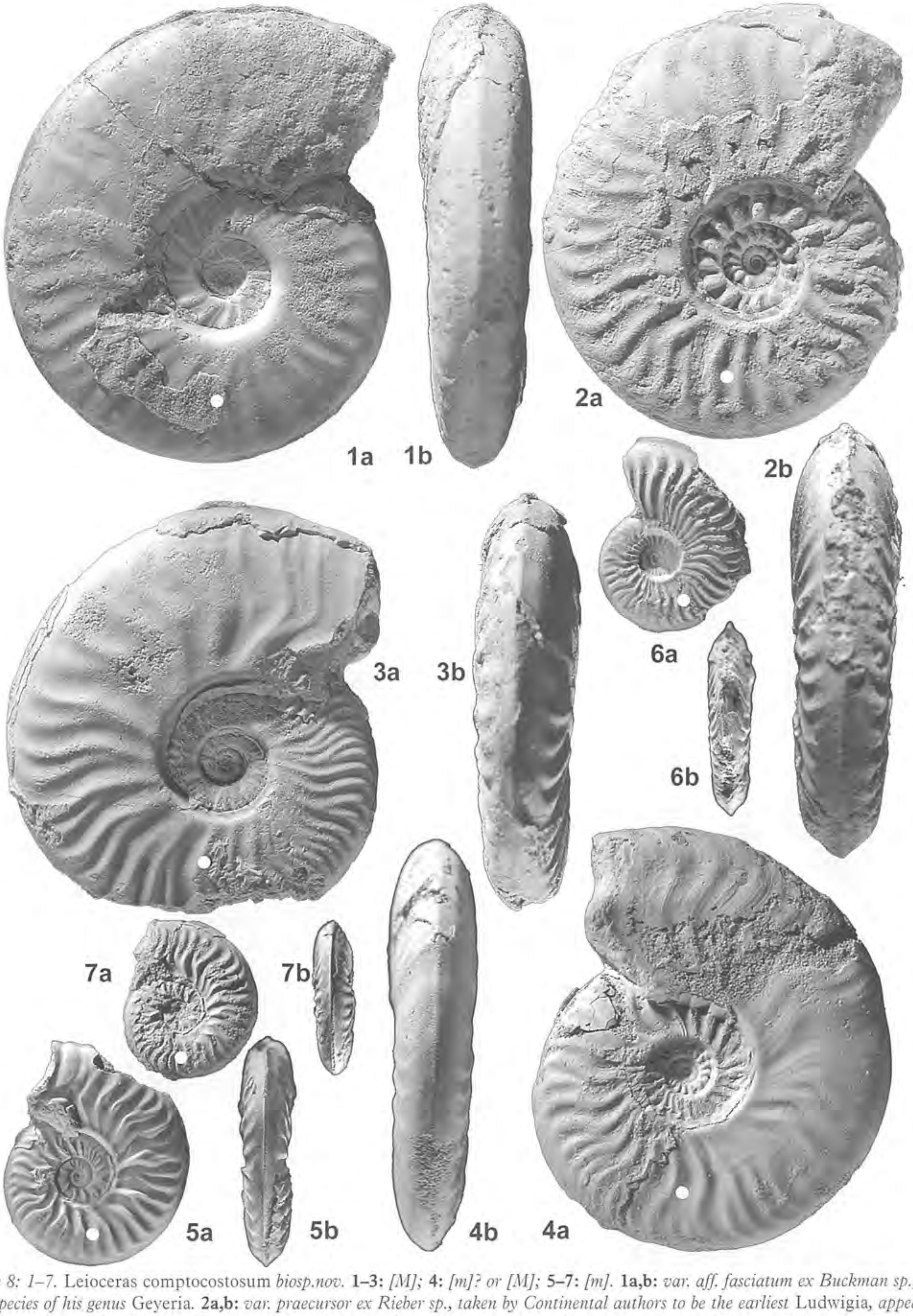

Plate 8: 1–7. Leioceras comptocostosum *biosp.nov.* **1–3:** *[M];* **4:** *[m]? or [M];* **5–7:** *[m].* **1a,b:** *var. aff. fasciatum ex Buckman sp., the type species of his genus* Geyeria. **2a,b:** *var. praecursor ex Rieber sp., taken by Continental authors to be the earliest* Ludwigia, *appearing already in pre-Murchisonae Zone beds - hence the name.* **3a,b:** *a specimen most closely resembling the holotype of* Geyeria evertens *Buckman, 1899, one of the few specimens described by him from 'Mapperton', and hence potentially a name-giving candidate with priority over the new name introduced here – a possibility however rejected (see text).* **4a,b:** *a form that on the one hand resembles the other large [m]s as seen in Pl. 2, Fig. 3, but on the other hand, the typical [M] seen here in Fig. 3.* **5a,b:** *the form most closely resembling the type of* L. costosum *(Quenstedt), reproduced in Text-fig. 4(e) (see text); note the fine lappet*

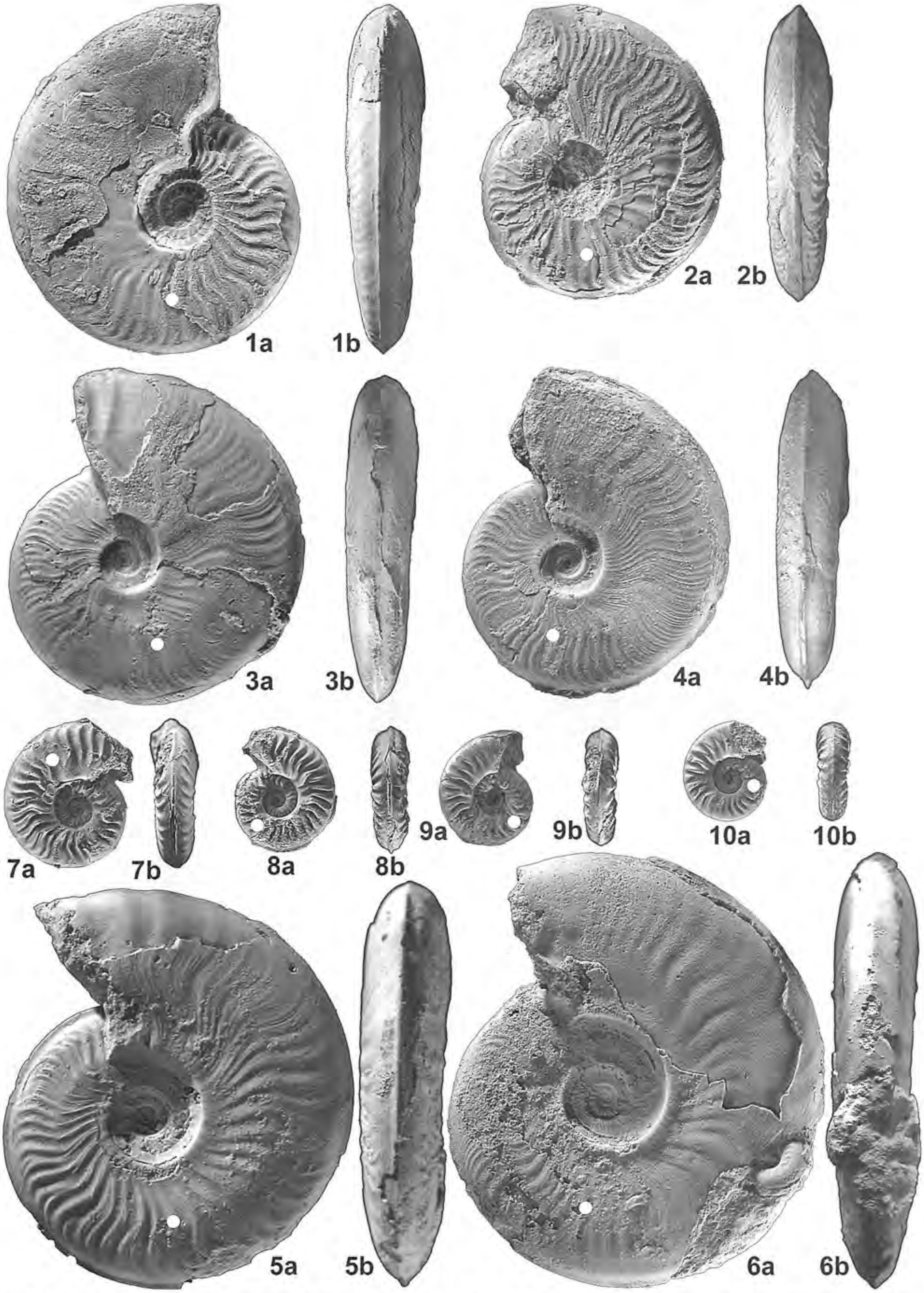

Plate 9: 1–10. Leioceras comptocostosum *biosp.nov.* **1–6:** *[M];* **7–10:** *[m]. 1–4: a range of variants of relatively small size, compressed, involute and finely ribbed.* **3a,b:** *var. opalinoides ex Mayer sp., 1864, whose type horizon lies higher and is taken to be the index of horizon Aa-4 (see Fig. 1). 5, 6: two variants of intermediate size. 7–10: a range of coarse-ribbed microconchs at the small end of the size-range*

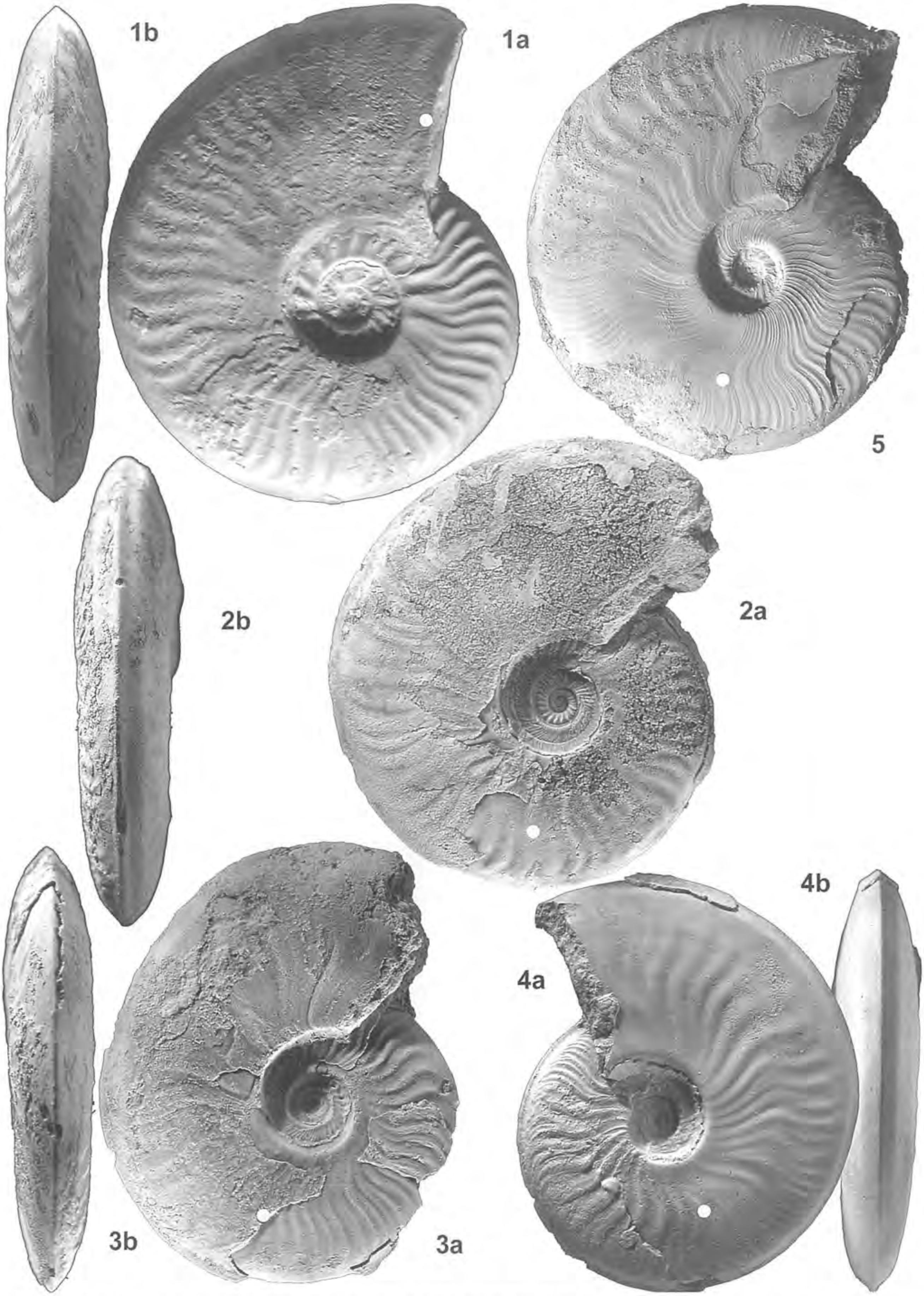

Plate 10: 1–5. Leioceras comptocostosum *biosp.nov. [M]. A range of variants of medium size, compressed, involute and carinate whorl-section conventionally assigned to* Ancolioceras

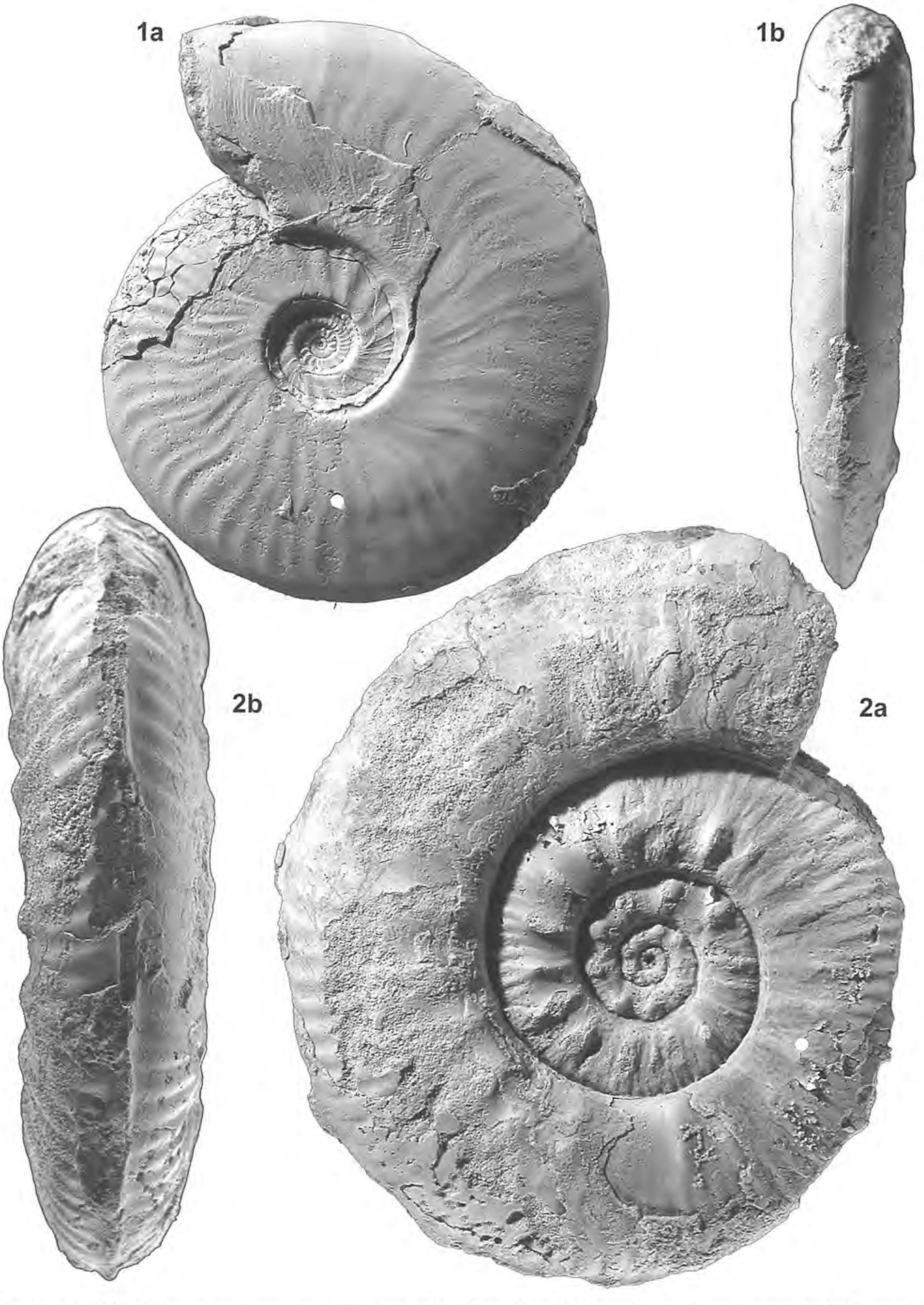

Plate 11: 1–2. **1a,b:** Leioceras comptocostosum *biosp.nov. [M]. A large, fine-ribbed* 'Ancolioceras', *var. costatum ex Buckman sp.; compare and contrast with Pl.1, fig. 2.* **2a,b:** Hammatoceras lorteti *(Dumortier) [M]. A fine example of a group of Sub-Mediterranean affinities, figured here because it is rare in Britain (see Callomon and Chandler 1994). The previous find came from horizon Aa-2 at Bridport*

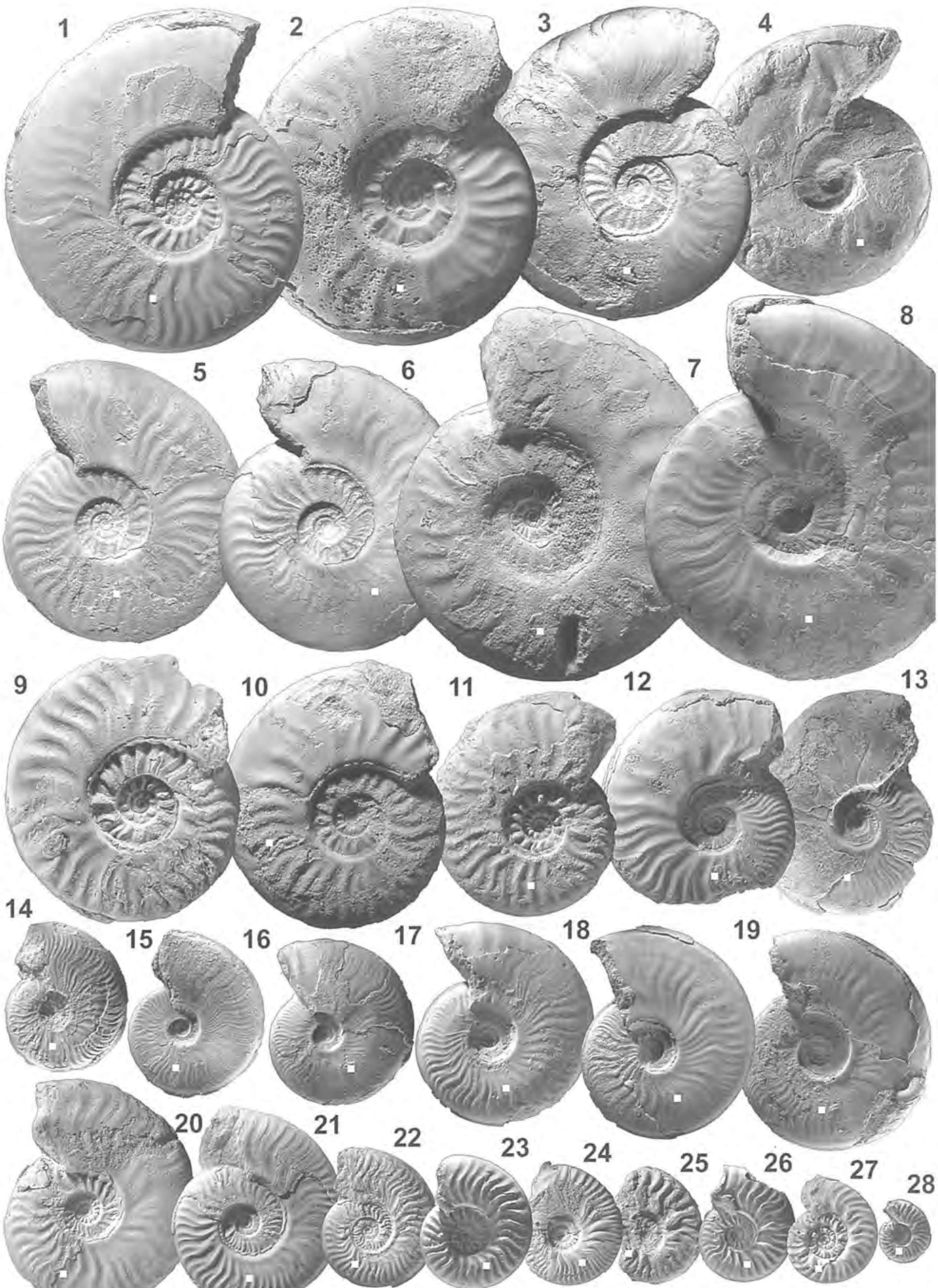

Plate 12: 1–28. Leioceras comptocostosum *biosp.nov. A selection of the specimens figured in Pls. 1–11 arranged in morphoclinal series to illustrate the ranges of intergrading variability in the principal characters of adult size, involution of umbilical coiling and coarseness of sculpture. 1–19: [M]: at one extreme (Figs. 15, 16), typical* Leioceras cf. opalinum; *at the other (Figs. 9–11), typical* Ludwigia. *20–28: [m]. All figures reduced, × 0.5*

Table 1: List of figured variants of *Leioceras comptocostosum* biosp.nov. from Mp-CQ bed 2c, biohorizon Aa-3b (col. A–C). Names of existing nominal morphospecies whose types closely resemble them but which came from other biohorizons and whose names, demoted to varietal status, could be used as labels when referring them, are given in col. D. Their type horizons, where known, are in col. H. Dimorphic status is indicated in col. E. Registration-numbers in the collections of the Sedgwick Museum, Cambridge, are in col. G. Reference to explanatory notes in col. F

A Plate	B Figure	C Fig. Pl. 12	D Name	E Dimorph	F Note	G Sedgwick number	H Type horizon
Pl. 1	1 a-b	7	*L. comptocostosum* sp. nov. HT	[M]		SM X40269	Aa-3b
	2 a-b		*L. comptocostosum* sp. nov. PT1	[M]		SM X40364	
	3 a-b	27	*L. comptocostosum* sp. nov. PT4, AT	[m]		SM X27939	
	4 a-b		*L. comptocostosum* sp. nov. PT5	[m]		SM X40367	
Pl. 2	1 a-b	9	*L. comptocostosum* sp. nov. PT3	[M]		SM X40286	
	2 a-b		*L. comptocostosum* sp. nov. PT2	[M]		SM X40285	
	3 a-b	21	*Ludwigina *patula* Buckman, 1901	[m]	[1]	SM X40370	Aa-4,5
	4 a-b	24	*Strophogyria *cosmia* Buckman, 1899	[m]	[2]	SM X27940	(Aa-3?)
	5 a-b	25	*Hyattia cf. bullifera* Buckman, 1899	[m]		SM X27982	Aa-5,6)
	6 a-b	23	*Ludwigina umbilicata* Buckman, 1899	[m]		SM X40372	Aa-4,5)
	7 a-b		*Ludwigella cf. nodata* Buckman, 1904	[m]	[3]	SM X40374	Aa-11
	8 a-b		*Ludwigella rugosa* Buckman, 1904	[m]		SM X40273	Aa-11
Pl. 3	1 a-b	2	*Leioceras crassicostatum* Rieber, 1963	[M]		SM X40287	
	2 a-b		*Ludwigia sinon* Bayle, 1878, pars	[M]	[4]	SM X40288	
	3 a-b		*Rhaeboceras tolutarium* (Dumortier)-Buckman	[m]	[5]	SM X40377	(Aa-3a?)
	4 a-b	22	*Leioceras paucicostatum* Rieber,1963	[m]	[6]	SM X27941	
	5 a-b		*Leioceras paucicostatum* Rieber, 1963	[m]		SM X27943	
Pl. 4	1 a-b	3	*Leioceras comptum evolutum* Contini, 1969	[M]	[7]	SM X40267	2.1-2.2
	2 a-b		*Lioceras lineatum* Buckman, 1899	[M]	[8]	SM X40295	Aa-2
Pl. 5	1 a-b		*Manselia subacuta* Buckman, 1899	[M]		SM X40268	(Aa-5?)
	2 a-b	1	*Lioceras uncinatum* Buckman, 1899	[M]	[8]	SM X40266	
Pl. 6	1 a-b	8	*Lioceras plectile* Buckman, 1899	[M]	[8]	SM X40298	Aa-2
	2 a-b	10	*Leioceras crassicostatum* Rieber, 1963	[M]		SM X40280	
	3 a-b		*Leioceras comptum evolutum* Contini, 1969	?[M]	[7]	SM X40371	2.1-2.2
	4 a-b		*Lioceras aff. striatum* Buckman, 1899	[m]	[8]	SM X40378	Aa-2
	5 a-b		*Canavarella cf. toma* Buckman, 1904	[m]		SM X40394	Aa-2
Pl. 7	1 a-b	6	*Lioceras costatum* Buckman, 1888	[M]	[9]	SM X40281	Aa-5
	2 a-b	4	*Lioceras lineatum* Buckman, 1899	[M]	[8]	SM X40293	Aa-2
	3 a-b	5	*Manselia subacuta* Buckman, 1899	[M]		SM X40274	(Aa-5?)
Pl. 8	1 a-b		*Geyeria aff. *fasciata* Buckman, 1899	[M]	[10]	SM X40365	Aa-2-5
	2 a-b	11	*Ludwigia praecursor* Rieber, 1963	[M]		SM X40276	
	3 a-b	12	*Geyeria evertens* Buckman, 1899	[M]	[11]	SM X28003	(Aa-2-4)
	4 a-b	20	*Canavarella ?cf. belophora* Buckman, 1904	[m]	[12]	SM X28002	(Aa-2-3?)
	5 a-b	26	*Lioceras subcostosum* Buckman, 1899	[m]	[13]	SM X40375	Aa-2
	6 a-b		*Rhaeboceras tolutarium* (Dumortier)	[m]	[5]	SM X40376	Aa-2a
	7 a-b		*Rhaeboceras cf. *tortum* Buckman, 1899	[m]	[5]	SM X40368	Aa-2-3a
Pl. 9	1 a-b		*Leioceras comptum evolutum* Contini, 1969	[M]	[7]	SM X40362	2.1-2.2
	2 a-b	14	*Lioceras cf. gracile* Buckman, 1899	[M]		SM X40359	Aa-2

A Plate	B Figure	C Fig. Pl. 12	D Name	E Dimorph	F Note	G Sedgwick number	H Type horizon
	3 a-b	16	*Leioceras opalinoides* (Mayer, 1864) auctt.	[M]	[14]	SM X40278	(Aa-4)
	4 a-b	15	*Ancolioceras *substriatum* Buckman, 1899	[M]		SM X40292	Aa-4
	5 a-b	17	*Leioceras comptum evolutum* Contini, 1969	[M]	[7]	SM X40361	2.1-2.2
	6 a-b	19	*Leioceras comptum evolutum* Contini, 1969	[M]	[7]	SM X40354	2.1-2.2
	7 a-b		*Rhaeboceras *tortum* Buckman, 1899	[m]	[5]	SM X40379	Aa-2-3a
	8 a-b	28	*Rhaeboceras *tortum* Buckman, 1899	[m]	[5]	SM X40397	Aa-2-3a
	9 a-b		*Rhaeboceras *tortum* Buckman, 1899	[m]	[5]	SM X40380	Aa-2-3a
	10 a-b		*Ludwigella cf. flexilis* Buckman, 1904	[m]		SM X40396	(Aa-11?)
Pl. 10	1 a-b		*Lioceras cf. uncum* Buckman, 1899	[M]		SM X40275	Aa-2
	2 a-b		*Leioceras crassicostatum* Rieber, 1963	[M]		SM X40405	
	3 a-b	13	*Leioceras opalinoides* (Mayer, 1864) auctt.	[M]	[14]	SM X40369	(Aa-4)
	4 a-b	18	*Manselia *subfalcata* Buckman, 1899	[M]		SM X40271	(Aa-5?)
	5		*Ancolioceras capillare* Buckman, 1928	[M]		SM X40366	(Aa-3a?)
Pl. 11	1 a-b		*Ancolioceras costatum* Buckman, 1888	[M]	[9]	SM X40400	Aa-5
	2 a-b		*Hammatoceras lorteti* Dumortier, 1874	[M]	[15]	SM X40382	

(1) *Ludwigina *patula* S.S. Buckman, 1901: LT (here designated), Buckman 1887, pl.3, Figure 3.

(2) *Strophogyria *cosmia* S.S. Buckman, 1899: LT (here designated), p.lxiii, text-Figure 20; 'Mapperton' (see text).

(3) *Ludwigella* S.S. Buckman, 1901: TSp by OD, *Amm. concavus* J. Sowerby, 1815, as stated in the *Treatise* (Arkell, 1957, p.L264, Figure 301c,d), clearly [M]; but usually interpreted in terms of the alternative type-species that Buckman tried to impose subsequently, *L. arcitenens* Buckman, *Mon.*1902, 1904, p.lxxxv, LT (here designated) Buckman 1887, pl.4, Figures 1,2, clearly [m] and almost certainly the antidimorph of *Graphoceras concavum*; Aa-13/14.

(4) *Ludwigia sinon*: type species of *Costileioceras* Maubeuge, 1950. The comparison here is with the largest of the syntypes figured by Bayle (1878, pl.83, Figure 1), whose protograph was reproduced in the *Treatise* (Figure 298.6) and a cast of which was figured by Schlegelmilch (1985, pl.10, Figure 4). But the lectotype, designated by Maubeuge, is pl.83, Figure 4, a smaller, incomplete specimen not closely matched by any of those figured here.

(5) *Rhaeboceras *tortum* Buckman, 1899 (legend to *Suppl.* pl.11, Figures 1–3, LT here designated), 1904, p.lxxii (non *Rhaeboceras* Meek 1876: no *nomen novum* appears to have been proposed, but on the basis of the LT, a suitable substitute name would be *Costiceras* Contini, 1969). *Ammonites tolutarius* Dumortier, 1874 (LT, pl.51, Figures 3, 4) was included in *Rhaeboceras* by Buckman (1904). His Dorset specimens of both species came from Aa-2 or Aa-3a, Bridport, Scissum Bed (upper part).

(6) *Leioceras paucicostatum* Rieber: type species of *Costiceras* Contini, 1969; [m] of *L. crassicostatum* Rieber. From the 'scissum-Zone' of Swabia, but precise horizon in this not certain.

(7) *Leioceras evolutum*: originally *L.* (*Cypholioceras*) *comptum evolutum* Contini, 1969, subsp. nov., described in terms of 'morphotype *subcostate, costate, striate*', meaning variants. The type specimen was var. *subcostata*. The two specimens figured here on Pl.9, Figures 1 and 5 were compared with var. *costata*. The type came from a highly fossiliferous but condensed bed at Amaurandes du Bas (Jura) that yielded material of ages ranging from Aa-2 to Aa-4. Much of it is close to Aa-3b but the precise horizon of the type is uncertain.

(8) *Lioceras* is an invalid subsequent emendation of *Leioceras* with which it should be replaced wherever it occurs.

(9) Originally *Lioceras ambiguum* var. *costatum* in text, p.29 and legend to Pl.7, Figure 7, then as *Lioceras costatum* in text, p.30; later as *Ancolioceras? costatum* (1899, Suppl. p.xlviii). Age indicated by association with a locally age-diagnostic terebratulid, *Zeilleria anglica* (Oppel) (Buckman, 1910, 63; Richardson 1919, 165).

(10) *Geyeria* (**fasciata*) Buckman, (Dec.) 1899, non Buchecker, 1880 (Lepidoptera) nec Fucini, pre-December 1899; replacement name *Geyerina* Buckman, 1913 (*Type Ammonites*, 2, p.iv).

(11) The type came from 'Mapperton', but exact locality and level are not known (see text), hence possible role as name-bearing senior synonym of *L. comptocostosum* too uncertain to be adopted here. Its range as morphospecies is from Aa-2 to at least Aa-5.

(12) The dimorphic status of this specimen is in some doubt. The traces of what appears to have been a lappet suggest a large [m] (*cf.* pl.12, Figures 20 and 21), in which case the coarse ribbing would suggest assignment to *Canavarella*, the age of whose type, *C. belophora*, is probably Aa-1b.

(13) *L. subcostosum* was based on two syntypes (see text). Buckman's larger specimen of 1899 (Suppl. pl.6, Figures 5–4) is as close a match to the LT of *Amm. costosum* Quenstedt, 1886, as could be hoped for, and thus taking this specimen from Burton Bradstock as LT of L. *subcostosum* makes this species an acceptable substitute for *L. costosum* (Quenst.), invalid because preoccupied.

(14) Mayer's species, much cited, was based on an indefinite type series. LT, des. Rieber 1963, *Amm. murchisonae acutus* Quenstedt, 1856 (non *Amm. acutus* Sowerby, 1813), refigured in Quenstedt, 1886, pl.59, Figure 5 and Schlegelmilch, 1985, pl.10, Figure 5; presumed by Rieber, 1963, to be from the beds with *Staufenia sinon* of Aalen.

(15) Hammatoceratids were spasmodic immigrants from the Submediterranean Province into Subboreal England and hence of some special interest (*cf.* Callomon and Chandler 1994). The discovery of this fine specimen from a precisely-known horizon seemed to make it worthy of illustration here.

the first, *L. comptum*, is now known to have come from much older beds. The name of the second, *L. costosum*, is invalid because preoccupied. These names and their taxa are discussed further below. However, to indicate the relationships of the Dorset species to their closely correlatable European equivalents widely known there under these names, we propose the new name *Leioceras comptocostosum* for the Dorset species: *comptus*, adorned, *costosum*, strongly ribbed.

Type series. The designation of a type series in a bio-species as morphologically variable as the present one is something of a formality, for no mere handful of type specimens can be a meaningful representation of the taxon as a whole: no one specimen is more 'typical' than another. Five type specimens are therefore designated: a macroconch holotype and five paratypes , two of them also [M], the other two microconchs, [m], one of which is designated the sexual antidimorphic allotype.

The principal characters that may be used to summarize the morphologies of the shells are (a) size: maximum adult size D_{max}, end-diameter of the adult phragmocone D_{ph}; (b) shape of conch: whorl-shape in cross-section in-plane as measured by whorl-height H and umbilical width U, inflation of whorl as measured by its whorl-width W; (c) sculpture of shell: ribbing as estimated by its strength and density (i) on the inner whorls, (ii) the middle whorls, (iii) the adult bodychamber. Not all of them are independent: H and U are clearly interdependent and constrained by D. Dimensions of the type specimens are tabulated below.

Holotype: Pl.1, Figure 1a,b [M] (SM X40269). The specimen is at the larger end of the size range at 130mm diameter, complete to within a few millimeters of the aperture. It has been chosen because it least resembles any other specimen figured in the literature and in this sense is distinct. It is a broad platycone, one side of which has the shell preserved in a rather corroded state; the other is a well-preserved internal mould. Close to the end of the phragmocone on one side there is a bivalve burrow. Coiling is evolute. The ribbing is falcoid, strong but of low relief, distant and well developed on the entire specimen. Very short primaries bifurcate close to the umbilical margin, giving rise to two or three coarse secondaries that project adorally on the venter but weaken before reaching the keel, which is rather weak and of low profile, fading completely on the body chamber. There are no tubercles. The whorl section is broad and fastigate, becoming inflated and ovoid towards the aperture. The umbilical wall is low and slightly concave on the inner whorls, with a sharply-defined edge to the flank, becoming gently rounded on the outer whorls. Septal suture-lines are well spaced and separated. They are relatively simple with well-defined lateral lobes that are not elaborately incised.

PT-1: Pl.1, Figures 2a,b [M] (SM X40364), also large, has part of the outer whorl broken away, exposing the middle whorls. These are very strongly ribbed in the style of *Ludwigia* and, found in isolation, would be unhesitatingly be assigned to this genus; but the external margin is still rather rounded, with a well off-set keel, unlike the more tabulate venter on a quadrate whorl-section found in the later forms in the Murchisonae Zone.

PT-2: Pl.2, Figures 2a,b [M] (SM X40285) is a smaller macroconch, lacking the last fraction of bodychamber. It represents the more involute but still inflated range of variability.

PT-3: Pl.2, Figures 1a,b [M] (SM X40286) is almost fully septate, so that its full size would have been close to that of the HT. The whorl section is rectangular with rather parallel flanks, in what is the most compressed among the large specimens. The ribbing is dense, persistent and very strong throughout. The point of rib bifurcation is again close to the umbilical margin. Some primary ribs on the inner whorls are swollen into sub-tubercles.

PT-4: *Allotype*: Pl.1, Figures 3a,b [m] (SM X27939). An evolute variant, around the middle of the size-range, complete adult with stumps of lappets preserved. Whorl section sub-rectangular, the whorl-height increasing slowly, giving a serpenticonic appearance to the shell. Strongly ornamented throughout by falcoid ribs that bifurcate near the internal part of the flank and sweep adorally over the venter, fading before reaching the keel, which is distinct but weakly developed; on inner whorls, the primaries can swell at the furcation-points into incipient tubercles.

PT-5: Pl.1, Figures 4a,b [m] (SM X40367), more involute than the allotype, more inflated on the inner whorls, the ribbing less flexuous.

Dimensions

Coiling

As is well-known, the coiling of the regular planispiral ammonites follows quite closely that of a Bernoulli logarithmic spiral during the isometric stages of growth, i.e. those of the phragmocone, excluding the initial stages seen in the ammonitella and the final stages in the adult bodychamber. The coordinate of growth is the spiral angle, θ, and the radius enlarges as

$$r(\theta) = r(0).\ \exp(a\theta)$$

where θ is measured from some arbitrary origin at which $r(\theta) = r(0)$ and a is a constant defining the tightness of the coiling. It is useful to change the scale of growth into units of half-whorls, n, so that $\theta = n\pi$ (radians: $\pi = 180°$). Then

$$r(n) = r(0).\ \rho_\pi^{\,n}$$

where ρ_π is the *spiral half-whorl constant*, which is the ratio of the radii half a whorl apart:

$$r(n{=}1)/r(n{=}0) = \rho_\pi$$

Table 2a: Measurements of type specimens of *Leioceras comptocostosum* sp.nov [M]

Specimen # [M]	D_{max}	D_{ph}	bch	D	h	w	u
HT (#SMX40269)	130	100	0.6	130	0.35	0.27	0.42
				110	0.36	0.28	0.36
				90	0.39	0.3	0.37
PT-1 (#SMX40364)	125	NA	0.5	125	0.32	0.26	0.32
				65	0.38	0.32	0.38
PT-2 (#SMX40285)	90	65	0.4 ∩	90	0.39	0.28	0.33
				70	0.40	0.33	0.29
				60	0.42	0.29	0.33
PT-3 (#SMX40286)	115	100	0.2 ∩	115	0.30	0.22	0.39
				80	0.35	0.26	0.38
				70	0.31	0.30	0.37

D_{max}: maximum preserved diameter, mm; D_{ph}: diameter at end of phragmocone, mm; bch: length of bodychamber preserved, as fraction of a whorl, ∩ indicating not complete. h: coefficient of whorl-height, H/D; w: of whorl breadth; u: of umbilical width, all at diameter D.

Table 2b: Measurements of types of *L. comptocostosum* sp.nov. [m]

Specimen # [m]	D_{max}	D_{ph}	bch	D	h	w	u
PT-4 (#SMX27939)	39	28	0.6	39	0.36	0.31	0.46
				30	0.33	0.30	0.43
PT-5 (#SMX40367)	35	31	0.2 ∩	35	0.37	0.31	0.40
				27	0.37	0.37	0.48

It is easy to show that this is then also the ratio of the diameters of the shell half a whorl apart:

$$D(n+1)/D(n) = \rho_\pi$$

This constant is easy to measure; yet although it is such a basic character of ammonite morphology, it has rarely been quoted. Some ideas of the range of values may be obtained from the extremes that are encountered. For instance, at its most loosely-coiled, evolute, *Stephanoceras dolichoecum* (Buckman) of the Sauzei Zone (1921, pl. 265): $\rho_\pi = 1.16$ ($100 < D < 270$mm). Perhaps the most evolute, rapidly enlarging among the regularly-coiled Jurassic ammonites is *Liparoceras bechei* (Sowerby) from the basal Middle Lias (Spath 1938, pl. 22): $\rho_\pi = 1.88$ ($D = 250$mm). In living *Nautilus*, illustrations of which in median section are widely encountered in advertisements today, typical values are 1.65; in a sectioned *Cenoceras ornatum* (Foord and Crick) from the Upper Bajocian, the value is also 1.65. (Some authors, following e.g. Raup 1967, prefer to express the rate of growth in terms of the fractional increase of diameter over a whole whorl, W:

$$W = D(n+2)/D(n) = \rho_\pi^2$$

whence, for *Nautilus*, $W = 2.72$).

We have made transverse sections of three complete adults of *L. comptocostosum* and measured the ratios of shell-diameters in the phragmocones half a whorl apart. The results are:

$\rho_\pi = 1.47 \pm 0.012$ (standard error), $20 < D < 85$mm, $N = 9$

With measurements across the three bodychambers, $105 < D < 115$mm, the value drops to 1.35.

These values underline the difference between the terms 'involute', 'convolute' and 'evolute' as usually applied to the lateral appearance of the shell, expressing in effect the relative width of the umbilicus, and their meanings as applied to the tightness of the coiling of the spiral of growth. Shells such as those shown on Pl.10 would normally be described as 'involute', yet their coiling is in fact quite evolute.

Variability. The dominant feature of the species is its wide variability. Specimens chosen to demonstrate the ranges of the leading characters are illustrated in Plates 1–11. Names of existing morphospecies they resemble are collected in Table 1. As explained above, their specific epithets demoted to varietal rank may be used to label variants of the present biospecies, e.g. *L. comptocostosum* var. *plectile* ex Buckman sp. (Pl.6, Figure 1). A selection of the specimens shown in these plates has been arranged in morphoclinal series in pl. 12, reduced × 0.5, to illustrate the intergradations in some of the characters, mainly those of size, strength and coarseness of ribbing. Some numerical parameters of the distribution-functions of the variability in larger samples

Table 3: Biometric parameters of variability of *Leioceras comptocostosum*. Variability of shell size and thickness in the reference collection: parameters of normal distribution-functions (Gaussian)

	Macroconchs [M]			Microconchs [m]		
$<D_{max}>$	103.1 (± 3.6)	$\sigma = 19.8$ (19%)	$N = 32$	49.7 (± 6.1)	$\sigma = 16.0$ (28%)	$N = 9$
$<D_{ph}>$	70.3 (± 2.1)	$\sigma = 17.9$ (26%)	$N = 72$	30.3 (± 2.1)	$\sigma = 9.4$ (32%)	$N = 23$
$<w_{ph}>$	0.23 (± 0.004)	$\sigma = 0.033$ (14%)	$N = 67$	0.28 (± 0.01)	$\sigma = 0.049$ (17%)	$N = 23$

$<D_{max}>$: mean diameter of complete adults, $<D_{ph}>$: their mean diameter at the final septum of the phragmocone, both in mm, with standard errors; $<w_{ph}>$: mean coefficient of whorl-width W as fraction of shell diameter D_{ph} at final septum, W/D_{ph}. σ: standard deviations in mm and as fractions. N: sample numbers. (Note that the metric of ontogenetic growth has been taken to be simply linear measure of the shell, whereas the proper metric for ammonites would be that of the Bernouilli or logarithmic spiral, the polar spiral angle. The difference over the short spiral angles being sampled here is not important).

of the assemblages in which they could be measured are given in Table 2. Of those describing the relative proportions of shell-shape only the relative shell-breadth w seemed worth recording, as the variabilities of interdependent whorl-heights h and umbilical widths u can be adequately assessed from the illustrations.

Macroconchs range in the sculpture of their shells from smooth, involute, discoidal oxycones (var. *substriatum* ex Buckman sp, pl. 9, Figure 4 or var. *capillare* ex Buckman sp., pl. 10, Figure 5) that would in isolation be unhesitatingly assigned to *Leioceras* s.s. around *L. opalinum* or its slightly later morphotypes commonly called *Ancolioceras* (see Table 1), to coarsely-ribbed, evolute, stout forms (var. *praecursor* ex Rieber sp., pl.8, Figure 2) typical of *Ludwigia*. Maximum adult diameters also vary widely, from around 50–150mm. The standard deviations of D_{ph}, of greater than 25% are perhaps unusually high for an ammonite biospecies, although in this respect they may not be untypical of the Graphoceratinae more generally. Values of 10–15%, where they have been measured in some other groups, seem more usual. In contrast whorl-breadths w are more closely constrained. Strongly ribbed variants tend to be large, inflated and evolute, the smoother oxycones smaller and more involute – a coupling of characters found very widely among ammonites. Adult bodychambers are typically half a whorl in length, sometimes a little longer. Their umbilical seams can markedly uncoil, the more so in the variants with subdued ribbing (var. *sinon* ex Bayle sp., pl. 3, Figure 2) or those becoming smooth (var. *lineatum* ex Buckman sp., pl. 4, Figure 2) than in the strongly-ribbed (PT-3, pl. 2, Figure 1).

Microconchs range in size from tiny, 20mm, (var. *flexile* ex Buckman sp., pl. 9, Figure 10) up to over 70mm as rare extremes (var. *patula* ex Buckman sp., pl. 2, Figure 3) with most around the middle of this range. Perhaps untypically, the size-ranges of the macro- and microconchs in this species overlap and sometimes the dimorphic assignment has to be made on subtler differences, such as the evoluteness of the coiling and the onset or otherwise of variocostation in the ribbing, the macroconchs tending to become smooth. Occasionally the assignment must remain in doubt (pl. 8, Figure 4). The shells vary from compressed, discoidal (var. *striatum* ex Buckman, sp., pl. 6, Figure 4) to stout with rectangular whorl-section (PT-5, pl. 1, Figure 4), mostly rather evolute with an only slightly uncoiling umbilical seam on the adult bodychamber. Ornamentation varies from strong ribbing with tubercles at the bifurcation of the ribs (PT-4, AT, pl. 1, Figure 3) to smooth shells decorated only by growth lines; from coarse, sparse (var. *bullifera* ex Buckman sp., pl. 2, Figure 5) to fine and dense (var. *cosmia* ex Buckman sp., pl. 2, Figure 4). A prominent medio-lateral lappet is present on intact examples (var. *subcostosum* ex Buckman sp., pl. 8, Figure 5).

Predecessors and successors: England

The biohorizons that have been recognized in this country immediately adjacent to that of *L. comptocostosum* biosp.nov. are shown in Figure 1. As has been emphasised above, the distinctions between successive biospecies lie in the morphological make-up of the variabilities of their assemblages. There is considerable overlap between these, in the form of shared morphological variants. Given samples of just one or two specimens, it may therefore not be possible to identify their biohorizons unambiguously. Some of the main differences are as follows:

Predecessors: Aa-2, *L. lineatum* and Aa-3a, *L. bifidatum*: the majority of forms lie at the smooth, compressed, involute, carinate range of variability still resembling ancestral *Leioceras*: cf. Pl.10, Figure 5 (see Table 1), Pl. 9, Figures 4, 5, 6 – the largest resembling Pl. 4, Figure 2. Coarser-ribbed variants begin to appear, cf. Pl. 7, Figure 3, but they are more involute than Pl. 5, Figure 2. They tend to retain some of the fine striate ornament of *Leioceras*, which has almost disappeared in *L. comptocostosum*. The evolute, coarse-ribbed forms already typical of *Ludwigia* seen here on Pl. 2, Figure 1 are absent, as are the large inflated forms such as Pl. 1, Figure 2. A large selection has been figured by Buckman from the Scissum Bed of Burton Bradstock, on the Dorset coast ('*Scissi* hemera').

Successors: Aa-4, *Ancolioceras opalinoides*: the fauna of this horizon is still only poorly known in England. It has however been amply documented in Germany and France: see below. The index has therefore been chosen more as an import than that of a separately characterised English assemblage. Forms close to the index-species do however occur. Compressed, carinate forms persist, usually referred to as *Ancolioceras*, such as Pl. 7, Figure 1, but *Ludwigia*-like forms are now common. For this reason the horizon has been placed already in the Murchisonae Zone.

Comparisons and correlations: continental Europe

As already mentioned, the biospecific assemblage being described here contains numerous variants that closely resemble nominal morphospecific taxa that have long been known in Germany and France. They became the basis for finer stratigraphical subdivisions, either as Subzones of standard chronostratigraphical Zones, or as short-ranging biozones within Zones analogous to our biohorizons. They were labelled with the names of selected index-species, and among these, two species in particular are important for our purposes: *Leioceras comptum* (Reinecke, 1818) and *Leioceras costosum* (Quenstedt, 1886).

Chronostratigraphy: Germany. The first in continental Europe to recognize an important formation of about the age that concerns us and to characterize it by means of its guide-fossils was Quensted (1843). He named it 'Opalinusthone' after its most characteristic species and made it the basis of his Brown Jura α in his newly introduced classification of the Jurassic of Swabia. It retains its name today as that of an important formation, 80–120m thick, that came to be widely recognized as extending from the northern Swiss Jura to northern Franconia, whence had come Reinecke's *Nautilus opalinus*. The first formally to distinguish an Opalinum Zone in anything resembling a standard chronostratigraphic unit was Brauns (1865, 89) in a review of the Jurassic of the Hils region of NW Germany. He was followed by Dumortier (1874, 4, 235), who equated the Opalinum Zone of the of the Rhone Valley with Quenstedt's Brown Jura α but, following various other authors, retained it in the Upper Lias. These interpretations were confirmed by Wright (1879, 148), now in the strict Oppelian standard chronostratigraphic sense that had become customary in British Jurassic stratigraphy.

The next step was taken by Hoffmann (1913) in a detailed description of the Opalinum Zone and its ammonites in 18m of clays at Sehnde near Hanover. He recognised that the ammonites in the upper half differed from those in the lower. Although they continued to include the smooth discoidal forms of *L. opalinum* found in the lower part, they also carried much more coarsely-ribbed forms – just as in Dorset, in the distinction between horizons Aa-1 and Aa-2–3 under discussion. He therefore subdivided the Opalinum Zone into two Subzones. But what to choose as index-species? An alternative for one of them could have been another of Reinecke's venerable species of 1818, *Amm.* [*Nautilus*] *comptus*. But the original description made the interpretation of this species so uncertain that Hoffmann simply sank the name *comptum* into synonymy with *opalinum* and that was the end of it. Instead, as index for the upper he selected one of Quenstedt's forms (1886), *Amm. opalinus costosus*, referred to as *Ludwigia costosa* (Quenstedt). The Opalinum Zone thus became divided into an upper Costosum Subzone and a lower Opalinum Subzone. Unfortunately, the name *Amm. costosus* Quenstedt, 1886 is at least twice preoccupied (see below).

The first modern revision of the ammonites of the Opalinum Zone in the type region of Reinecke's *Amm. opalinus*, in northern Franconia, was made by Dorn (1935). He indicated the ages of the ammonites only in terms of their beds in formations but resuscitated Reinecke's *Nautilus comptus* as a distinct morphospecies having age-diagnostic value. He could not see Reinecke's type material, however, for Reinecke's collection had been lost. He therefore reinterpreted *comptus* on the basis of those components of his new collections that he thought most resembled Reinecke's figure. They occurred in the upper part of the range of '*Ludwigia*' *opalina* together with *L. costosa* (Quenstedt) as minor element. His newly-interpreted *L. compta* was well illustrated and its stratigraphical level precisely identified as lying above *L. opalina*. Its status as a well-defined morphospecific taxon is therefore soundly based. The type material of Reinecke's *comptus* has however now re-emerged in Coburg and it is clear that the *Leioceras comptum* of Dorn, from the higher parts of the Opalinum Zone, and *L. comptum* (Reinecke) are quite distinct, both taxonomically and stratigraphically. The latter is a *Pleydellia* of the Upper Toarcian and is older than *L. opalinum* (see below).

The most recent revision of the relevant part of the succession in Germany was made by Rieber (1963), based on large new collections from Quenstedt's original home ground in Swabia. Specimens were again obtained from precisely known levels but tended to occur in abundance at rather narrow but well-separated, ostensibly condensed horizons of resistant, calcareous, limonite-oolitic beds in otherwise recessive formations of marls or clays 20–30m thick. His stratigraphic descriptions were therefore couched in terms of 'Bänke', or Beds, in every way analogous to our biohorizons. Of these he distinguished three (in descending order):

[III] Sehndensis-Bank: with *Staufenia sehndensis* and *Ludwigia haugi*

[II] Sinon-Bank: with *Staufenia sinon* and *Leioceras opalinoides*

[I] Comptum-Bank: with *Leioceras comptum* and *paucicostatum*, *crassicostatum* spp.nov.

Below, Opalinusthon with *Leioceras opalinum* and *L. costosum*.

Taxonomically there were two important points. Firstly, he followed Dorn in his interpretation of *L. comptum*, in which this species lies above the main occurrence of *L. opalinum*. This served to consolidate the accepted interpretation of this species. Secondly, he attempted to trace the type material of *L. costosum* (Quenstedt). It transpired that the type was lost, but insofar as the original indications could be interpreted in the light of modern stratigraphy, it must have come from lower in the Opalinusthon, precisely at what level not known. This negated the value of *L. costosum* as index of a Costosum Subzone in the upper Opalinum Zone in the sense introduced by Hoffmann in 1913. Rieber did not pursue the standard chronostratigraphical zonation of this part of the Aalenian in Swabia any further. (Neither did he acknowledge or react to the invalidity through preoccupation of the name *costosum* – see below).

Chronostratigraphy: *France*. The most thorough modern descriptions of the Aalenian and its abundant ammonites in France was published by Contini (1969, and 1970). It was based on new collections carefully made in the eastern Paris Basin, in the Jura of the Franche-Comté, which provided the biostratigraphical yard-stick for correlations further afield. The ammonite faunas were described in the form of a succession of faunal horizons explicitly referred to as such in the form with which we are familiar. This convention was now being increasingly followed in France under the guidance of Mouterde, who introduced it there in the Lias (1953, 4). He based himself at least in principle on the methods of Buckman, but in rock-terms ('epiboles') rather than time-terms ('hemerae'). Mouterde's horizons lay in the standard Zones of Oppel, which in turn were subdivisions of the standard Stages of d'Orbigny. Contini's classification has achieved a certain permanence in France, adopted in later descriptions of the Aalenian in Spain and Portugal, and continues to be the accepted standard there today (Contini *et al*. 1997). We reproduce it here in Figure 3.

The similarity with the English succession as shown in Figure 1 is striking and the details are discussed further below. We note that *L. comptum* as index of the Comptum Subzone is now firmly entrenched.

Chronostratigraphy: *England*. The classification is shown in Figure 1. It differs from that of continental Europe at zonal and subzonal levels on historical grounds. A Scissum Zone was first proposed by Neumayr (1871) for a stratigraphical interval in the Middle Jurassic of San Vigilio on Lake Garda and the Italian Apennines to the south. But the rocks and their ammonites are here firmly in the Tethyan Province, for which distinct chronozonal classifications have to be adopted in any case. The use of this Scissum Zone did therefore not catch on in northern Europe.

AALENIAN		Zone	Subzone
		Murchisonae	
3.1	*Ancolioceras opalinoides*		
2.2	*Leioceras crassicostatum*	Opalinum	Comptum
2.1	*Leioceras bifidatum*		
1.3	*Leioceras lineatum*		Opalinum
1.2	*Leioceras opaliniformis*		
1.1	*Leioceras subglabrum*		
		TOARCIAN	

Figure 3: Chronostratigraphic classification of the French Lower Aalenian. This table shows the currently standard classification of most of the Lower Aalenian adopted in France following the work of Contini (1969, 1970), with his numbering of biohorizons. Note that his succession of horizons is almost identical with that in Dorset shown in Figure1, differing slightly in choices of index-species for his horizons 1.1 and 2.2. The relation between his 2.2 and our Aa-3b is discussed in the text. The French standard zonation differs from that adopted in Britain on historical grounds that are also discussed in the text

The first use of *Tmetoceras scissum* as an index-fossil in England goes back to Buckman (1898, Table I) in the form of a '*scissi*' hemera, a temporal term for the 'moment' between the hey-days of (*Leioceras*) *opaliniforme* before and (*Ludwigia*) *murchisonae* after. There has been much debate on how far Buckman's hemeral terms should be considered as bases for later chronostratigraphical rock-units, but we adopt a simple, practical rule. When Buckman introduced his hemeral description of the biostratigraphical chronology of the Inferior Oolite in 1893, based on his personal observations, each hemera was based on the fauna of a specified bed and its correlatives in one or more clearly-described sections – precisely what today we call 'biohorizons'. The relationship between rock and time was unambiguous and could be checked in the field. It was only in his later years, when he tried to extend his hemeral classification over the British Jurassic as a whole, having to rely inevitably more on literature than on personal observation, that he coined the profusion of largely conjectural hemera which brought the whole system into disrepute. We retain therefore those of his hemerae, translated into biohorizons, that were based on unambiguous biostratigraphy. This includes the *scissum* horizon of Buckman 1898, reaffirmed in 1904 (Suppl., clxx). Its stratigraphical basis lay at Chideock (Buckman 1910, 60). The promotion to the Scissum Zone of today goes back to Arkell in his authoritative *Jurassic System in Great Britain* (1933) and defined the convention that has been followed in Britain ever since. It has not found favour in continental NW Europe because the

Tethyan *Tmetoceras* is rare there and its striking form did not influence the historical choice of index-fossils in the way it did in Dorset, where it is fairly common. The Opalinum Zone had already been imported earlier from the Continent by T. Wright (1879, 148).

Correlations with Europe. Of immediate concern is the correlation of our new horizon of *L. comptocostosum* with those of Germany and France. The correlation with Rieber's 'Comptum-Bank' of Swabia is certainly very close. Some of the 20 specimens he figures match variants of *L. comptocostosum* (see e.g., Table 1) but some do not; and conversely, some of those from Mapperton, particularly the large ones, are not described from Swabia. The best that can be said is that the Swabian and Mapperton faunas are close, within the precision of the time-interval between, say, Aa-3a and Aa-4 of Figure 1. But attempts to get closer than this would be hampered by uncertainties in the Swabian assemblages. The majority of Rieber's specimens appear to be incomplete and he gives no indications of the onset and lengths of bodychambers, if preserved. His figured selection, moreover, comes from several localities and perhaps levels. Attempts at further progress would need to concentrate on the Swabian faunas.

The comparisons with Contini's descriptions, shown in Figure 3, seem more secure. There can be little doubt that the ages of the faunas of the *comptocostosum* and *crassicostatum* horizons are very close. Again, several of the French forms are found at Mapperton (Table 1), including now some of the larger forms. But the choice of index is unfortunate. *L. crassicostatum* Rieber is a Swabian form. Its holotype is only a wholly septate nucleus of some 60mm diameter; and although the author gives the type locality and even a diagrammatic section: neither on it nor in the text does he reveal the precise level from which the specimen came. One fears it may have been loose. So the species is very much a loosely-defined morphospecies having very limited stratigraphical value. For this reason, as well as the others enumerated previously, we choose not to adopt any of the existing morphospecific names to label either the Mapperton biospecies or its biohorizon.

Leioceras comptum (Reinecke, 1818)

- *non* 1818 *Nautilus comptus* Reinecke, p. 57, pl. 1, Figures 5, 6 (protograph reproduced here in Figure 4(c))
- *non* 1935 *Ludwigia compta* (Reinecke) – Dorn, p. 66, pl. 12, Figure 3, pl. 14, Figure 3, pl. 22, Figure 5, pl. 23, Figure 3, pl. 25, Figure 4, pl. 26, Figure 4, pl. 28, Figure 2, pl. 29, Figure 2.
- cf. 1935 *Ludwigia goetzendorfensis* Dorn, p. 69, pl. 23, Figure 6, pl. 24, Figure 4, pl. 25, Figure 2, pl. 27, Figure 2.
- 1972 *Nautilus comptus* Reinecke – Zeiss, p. 32 (proposes neotype)
- cf. 1972 *Leioceras goetzendorfensis* (Dorn) – Zeiss, p. 32 (designates lectotype)

As Reinecke gave no indications of locality or stratigraphy, subsequent attempts at interpretation have had to rely entirely on his illustration (see Figure 4(c)) and brief description (Reinecke, a man of many talents, independently discovered lithography and the illustrations in his *Maris protagaei* were made by him – see Heller 1972). Dorn attempted to rejuvenate the species on the basis of a new collection of leioceratids from a locality Niedermirsberg near Ebermannstadt (*q.v.* by Google Maps). He had always been secretive about precise sources of his material and the only indications of horizon were 'upper Opalinuston' with some range, most common above the main occurrence of *L. opalinum* but still associated with it, together with *L. costosum*. He figured eight specimens of what appears to be a closely-defined morphospecies of only moderate size, around 60–70mm, and took as a leading character the fine, hair-like striate ribbing on the involute, oxycone whorl-side. To confirm and stabilise this interpretation of Reinecke's species, Zeiss propose a neotype to be Dorn's pl. 26, Figure 3. This is reproduced here in Figure 4(b). Dorn's species seems still closer to *L. opaliniforme* or *lineatum* (*sic*), Aa-1b–Aa-2, than it does to *L. bifidatum* or *comptocostosum*, and in France, Contini's horizons 1.2–1.3 (Figure 3), still in his Opalinum Subzone rather than in his Comptum Subzone.

A second species introduced by Dorn is *L. goetzendorfensis*, from the eponymous village not far to the north-west. He figured four syntypes, judging by which the differences from *L. comptum* sensu Dorn are very small. A lectotype was designated by Zeiss – Dorn, pl. 5, Figure 2 – who agreed that the differences were small. The LT is also shown here in Figure 4(a).

Since then, there have been new developments. Reinecke's type material has been rediscovered in Coburg by Dr Eckard Mönnig, who has kindly allowed us to borrow it. It appears that *Nautilus comptus* was based on a type series of (at least) four syntypes. Three of these, all finely ribbed, bear a quite close general resemblance to Reinecke's figure, within the uncertainty to be expected in such early illustrations, although there are significant differences. The fourth stands apart in being strongly and coarsely ribbed. Of the first three we have selected the one that most closely resembles Reinecke's figure and show a picture of it in Figure 4(d). It has the fine striate ornament referred to by Reinecke, consisting of sinuous, falcoid, dense ribbing arising in sheaves at the umbilical edge, the sheaves separated by shallow constrictions on the last quarter whorl. Its diameter is 25mm and it is wholly septate. The last two septa are slightly approximated and simplified, which, together with incipient uncoiling of the umbilical seam, indicates that the specimen is the complete phragmocone of an adult, therefore a microconch. Its preservation is that of an internal limonitic cast, without test, brown in colour as mentioned by Reinecke. More extensive descriptions of the whole type series will be given elsewhere but the evidence is

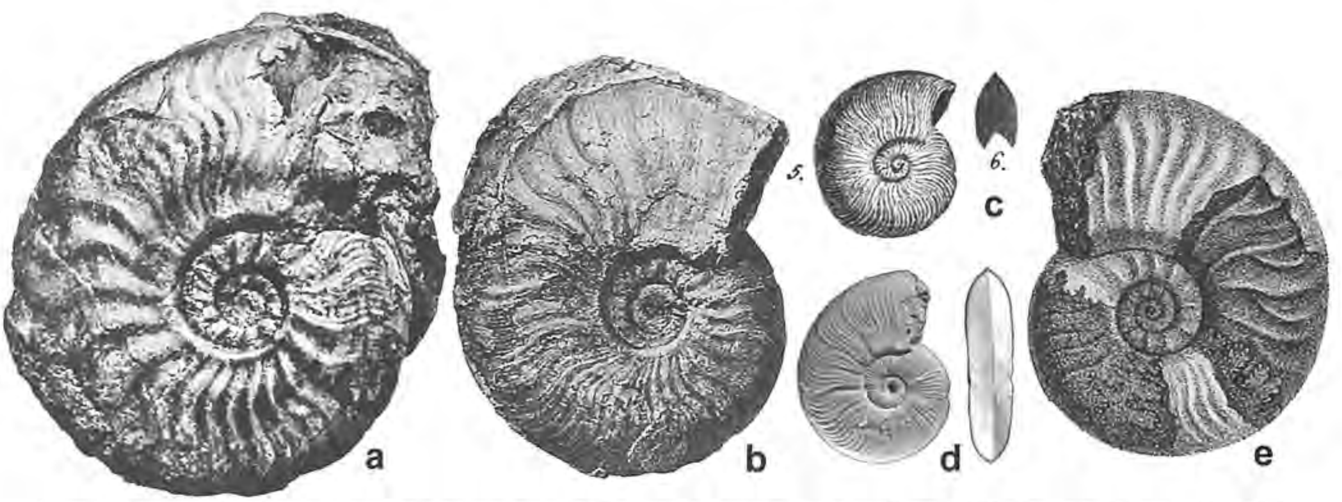

Figure 4: Protographs of some important type specimens. **a:** Leioceras goetzendorfense *(Dorn, 1935): lectotype, Dorn (1935) pl. 25, Figure 2.* **b:** Leioceras comptum *(Reinecke, 1818): neotype, Dorn (1935) pl. 26, Figure 3, proposed by Zeiss (1972).* **c:** Nautilus comptus *Reinecke 1818: syntypes, Reinecke's original figure.* **d:** Leioceras comptum *(Reinecke, 1818), proposed lectotype, Reinecke's collection, Naturkunde-Museum, Coburg, photograph of left-lateral side reversed, to match Reinecke's lithograph, which is also reversed.* **e:** Ammonites opalinus *costosus Quenstedt, 1886, lectotype, pl. 55, Figure 4. All figures natural size; fig. c courtesy of Dr Mönnig, Coburg. Figures a–d are of specimens from northern Franconia; Figure e, from southern Swabia*

clear enough for us to designate the specimen figured here to be the lectotype of *N. comptus* Reinecke. Its affinities are closest with and typical of *Pleydellia*: *cf. Pl. fluens* Buckman, 1902 (*Mon.*, pl. 31, Figure 1, inner whorls), *Pl. misera* Buckman in Ohmert 1996, p. 25, Figure 22d, *Pl. pseudoarcuata* Maubeuge 1950, p. 11, Figure 10b: all Torulosum Subzone, top Aalensis Zone, top Toarcian, below *Leioceras opalinum*, a long way below the Comptum Zone or Subzone or biohorizon of Continental authors.

This creates a problem. Under the *Code* (*ICZN* Art. 75.8), rediscovery of members of an original type series automatically sets aside a neotype, so that the post-Dorn (1935) interpretation of *L. comptum* would lapse. There are two possible solutions to the resulting problem.

Solution *A*. That the return to Reinecke's original definition be upheld and that the species be interpreted in terms of the rediscovered syntypes. The consequences would be that:

(i) A new index species would have to be chosen to label the Comptum Zone/Subzone wherever this description appears; this would have no consequences in Britain. *L. comptum* would cease to play any role in the Aalenian and become *Pleydellia compta* (Reinecke); and
(ii) Dorn's species would have to be renamed; an obvious candidate would be *L. goetzendorfense* Dorn, into which it could be merged. Alternatively, some other name could be found for it.

Solution *B*. That an application be made to the *ICZN* to waive the provisions of Art.75.8 in the interests of stability in stratigraphical nomenclature and to maintain Dorn's interpretation of *Leioceras comptum* based on its neotype as designated by Zeiss (1972) . But the benefits of this action would be questionable because the true stratigraphical position of Dorn's species is itself not in fact well-known, certainly not with the precision of the age-determination of a biohorizon: it is doubtful whether it occurs even in the Subzone in France that currently carries its name.

The final decision must await more detailed descriptions of Reinecke's types and their precise stratigraphical positions. But we unhesitatingly support Solution A.

Leioceras costosum (Quenstedt, 1886)

non 1883 *Amm. bucklandi costosus* Quenstedt, *Amm. Schwäb. Jura*, p. 70
non 1885 *Amm. jamesoni costosus* Quenstedt, *id.*, p. 254
1886 *Amm. opalinus costosus* Quenstedt, *id.*, p. 465, 467, pl. 44, Figures 5, 19, 20, 21
non 1886 *Amm. sowerbyi costosus* Quenstedt, p. 497
1889 *Ludwigia costosa* (Quenstedt) – Buckman, p. 102: lectotype designation
1899 *Leioceras costosum* (Quenstedt) – Buckman, Suppl. p.xxxvii, pl. 6, Figures 1–4
1899 *Leioceras subcostosum* Buckman, Suppl. p.xxxvii, pl. 6, Figures 5–7
1913 *Ludwigia costosa* (Quenstedt) – Hoffmann, p. 67 (index of Costosa Subzone of the Opalinum Zone)
1963 *Leioceras costosum* (Quenstedt, 1886) – Rieber, p. 31, 32
1985 *Leioceras costosum* (Benecke, 1905) – Schlegelmilch (1985), pl. 9, Figure 16 (Quenstedt' syntype, pl. 55, Figure 21, refigured)

Much erroneous taxonomy has arisen in the subsequent interpretation of this taxon through the uncertainty in the interpretation of Quenstedt's notorious third names. There were two alternatives.

(1) *Either* these third names were to be regarded as of infrasubspecific, varietal rank, which is what Quenstedt often but not consistently claimed for them and in which they would not be subject to the rules of priority. Authors could then promote them to full specific rank in some genus other than *Ammonites* without regard whether such a promotion had already been made in another case, but the authorship and date would become those of the promotion, not those of the original introduction of the name. In this case, the proper name of the taxon would have become *Ludwigia costosa* Buckman, 1889, type *Amm. opalinus costosus* Quenstedt, 1886.
(2) *Or* they should be regarded as of subspecific rank in the species-group, in which case they would be subject to the rules of priority and *Leioceras costosum* (Quenstedt, 1886) would become invalid and in need of replacement – the author and date of the *nomen novum* being also those of the reviser.

The matter was resolved Callomon *et al.* (2004; ICZN Opinion 2123, 2005): Quenstedt's trinomina are to be treated as of subspecific rank. Hence his *Amm. opalinus costosus* is preoccupied and the name *Leioceras costosum* (Quenstedt, 1886) is invalid, to be treated as if it did not exist. The taxon to which it was applied, however, continues to exist: only its nomenclature needs revision.

Type series: three syntypes (see synonymy above), one uncertain specimen (cf. *costosum*, pl. 55, Figure 19) and additional topotypes alluded in text without details. LT designated by Buckman 1889 = Quenstedt's pl. 55, figure 20, the figure reproduced here in Figure 4(e). The specimen retained nearly half a whorl of body-chamber with no signs of approximation or simplification of the final septal sutures, features otherwise common in the leioceratids. This suggests that it was a juvenile, as already surmised by Quenstedt: then a juvenile macroconch.

In an attempt to revise the taxon, Rieber (1963) failed to find the lectotype in Quenstedt's collection in Tübingen or elsewhere and had to conclude that it was lost. Attempts to trace the exact locality and horizon from which it came were also unsuccessful, for Quenstedt's indications were imprecise: shelly calcareous concretions in the upper part of the (100m thick) Opalinusthone near Boll.

Interpretation of the taxon: Yet further attempts to revive the name of a species that has no extant type, whose type locality and type horizon are essentially unknown and whose only function beyond that of a subjective morphospecies, that of index of Hoffmann's Costosum Subzone, has fallen into disuse, seems hardly worth the effort. Instead of designating a neotype, an alternative solution is to merge the taxon into another already existing one that is so similar that the differences are insignificant. In the present case such a species exists. It is:

Leioceras subcostosum Buckman, 1899 (Suppl., p. xxxvii).

It was based on two syntypes:

ST 1: *Ludwigia costosa* (Quenstedt) – Buckman 1889, pl. 20, Figures 11–12
ST 2: *Leioceras subcostosum*. Buckman 1899, Suppl., pl. 6, Figures 5–7 (LT: MCZ 107489)

Of these, the first is a small microconch, not closely determinable. The second resembles Quenstedt's (1886) lectotype very closely in all characters, of size and sculpture, and is also the nucleus of a macroconch. It is here designated lectotype. A third very similar specimen, a topotype, was also figured by Buckman in 1899 (pl. 6, Figures 1–4) and is good microconch. All three specimens came from Burton Bradstock, horizon Aa-2. The morphospecies ranges up into the new horizon Aa-3b: see the typical specimens shown here on Pl. 8, Figures 5a,b, 7a,b. The similarity of the names *costosum* and *subcostosum* should underline the close similarities of the two taxa to which they refer, although both continue to be morphospecific.

Conclusions

After 150 years of intensive study, our knowledge of the stratigraphy and ammonites of the Inferior Oolite of southern England must be among the best known and most detailed of any part of the Jurassic in Britain – perhaps of anywhere. It has set examples of method that have been and continue to be widely followed all over the world. It has been sampled in innumerable sections, its leading guide-fossils, the ammonites, described exhaustively in journals and monographs. What could possibly remain to be discovered?

It has come, therefore, as something of a surprise to see how much just one more section, properly evaluated, has contributed to our understanding to what continue to be some of the very general topics of historical geology. The first is stratigraphical: the question of the 'completeness of the geologic record'. Armed with one of the best time-recording geological clocks we have, the rapidly evolving ammonites as guide-fossils, we have discovered at Mapperton in a bed of limestone barely a foot thick a new faunal horizon, Aa-3b, hitherto not previously recognized anywhere else in Britain and questionably in continental Europe. Its rich fossil contents records the marine biota of a geological instant – a 'hemera' : an instant on a time-scale of the subdivision of the Aalenian Stage, of duration of perhaps 4Ma (GTS2004: Gradstein *et al.* 2005), into intervals between the 18 biohorizons of Figure 1 of on average 200ka. The duration of time recorded in the bed itself is almost certainly much shorter, perhaps even on a time-scale of only 1000–10,000 years. The conclusions is that even at the present level of time-resolution the record in the Inferior Oolite remains highly incomplete. In the picture of Buckman's famous simile of a net, the string remains thin but the holes are becoming smaller. There continue to be wide gaps in the geological record waiting to be filled. There is room for yet further discoveries of new biohorizons.

The second general topic is that of biologic evolution as exemplified by the ammonites. In this the new collections from Mapperton make three contributions. The most basic is the question of what is it that evolves? The fundamental unit is the species in the technical sense: the biospecies. And here the new *Leioceras comptocostosum* provides one of the clearest demonstrations yet of what a natural species – a population – looked like in terms of an assemblage of its fossils, for at the time-resolution of faunal horizons, the assemblages approximate sufficiently to a population to be treated as isochronous. The corollaries are twofold: that the morphological variability of the shells could be enormous, in ways that make their biological function in the interactions of the organisms with their environment quite mysterious; and that the assemblages of isochronous *Leioceras* as found at Mapperton are monobiospecific (albeit strongly sexually dimorphic). Next, the species *comptocostosum* constitutes a transient in the evolution of the phylogenus *Leioceras* at an interesting intermediate point at which the morphology of its variants ranges from that of its smooth, discoidal ancestors in *Leioceras opalinum* (Aa-1–2) to those of its strongly-ribbed, evolute descendents in *Ludwigia murchisonae* (Aa-5–7). And the way this transition occurs is in a gradual shift in variability of the population, not in a gradual transformation in all members of the population. Finally, *L. comptocostosum* by its example provides further strong support to the conclusion that the assemblage of forms of the whole European subfamily Graphoceratinae constitutes the successive transients of but a single monophyletic lineage ranging from the Toarcian into the Bajocian. Classification suddenly becomes simple. The former family-bush of countless morphospecies and genera dissolves into a single, tall, majestic family tree. It seems fitting that the focus of such progress should continue to lie in Dorset.

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Note added in proof:

When writing this article, we overlooked a highly significant account of another morphologically strongly variable ammonite biospecies: ceratitic *Czekanowskites rieberi* Dagys and Weitschat (1993), from the Lower Trias, top Lower Anisian, at a locality in the lower reaches of the R. Olenek in arctic Siberia. It was based on an assemblage of some 700 beautifully preserved shells crowded together in a layer 5cm thick at the centre of a single large concretion and at least most of them appeared to be complete adults of maximum sizes in the range 20–40mm. The largest degree of variability lies in the inflation of the shell, with a marked asymmetric distribution-function and strong co-variation with the openness of coiling as seen in the umbilical width. There is no evidence of bimodality in any character reflecting sexual dimorphism. More extensive biometric analysis of a selected sample of the assemblage was carried out by Checa *et al*. (1997), which showed that whereas the ontogenetic development of individual characters such as whorl-height, whorl-width and umbilical width were strongly allometric, their correlation ensured that the area of whorl cross-section, and hence probably the volume of the bodychamber, grew isometrically in the logarithmic metric of the curve of growth of the coiling.

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Dinosaurs of Dorset: Part I, the carnivorous dinosaurs (Saurischia, Theropoda)

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Summary

Theropod dinosaurs in Dorset are found in the Lower Jurassic (Blue Lias Formation), the Middle Jurassic (Inferior Oolite and Forest Marble Formations), the Late Jurassic (Kimmeridge Clay and Portland Stone) and the Lower Cretaceous (Purbeck Limestone Group and 'Wealden Beds'). They include representatives of several major theropod groups: the megalosaurids Duriavenator *and* Magnosaurus, *the sinraptorid* Metriacanthosaurus, *the basal tyrannosauroid* Stokesosaurus *and the dromaeosaurid* Nuthetes. *Theropod fossils from Dorset have been reported since 1835 and the record from the county is one of the oldest globally. It continues to yield new data on dinosaur evolution and biogeography and will contribute to our understanding and insight of theropod evolution into the foreseeable future.*

Introduction

Dorset dinosaurs

Early studies on the geology and palaeontology of Dorset played a vital role in shaping the nascent Earth sciences during the 19th century and its rocks and fossils continue to be crucial in many ongoing investigations of global significance. This has been recognised recently by the designation of the Dorset coast as the UK's only natural UNESCO World Heritage Site (Brunsden 2003). Here, we intend to highlight one specific aspect of Dorset's palaeontological heritage: its contribution to dinosaur studies. Dorset dinosaurs are known from rocks of Early Jurassic (Hettangian) to late Early Cretaceous (late Aptian) age (Weishampel *et al.* 2004a), thus spanning an interval of approximately 90 million years (Gradstein *et al.* 2004). This is an impressive record, especially given the relatively small surface area of the county (2653km^2). By comparison, the famous dinosaur-bearing deposits of the Late Jurassic Morrison Formation have an outcrop in excess of one million km^2 (Foster 2007). Although Dorset cannot compete with the Morrison Formation in terms of numbers of specimens or species, it can still lay claim to a number of firsts in the field of dinosaur palaeontology, which will be outlined below. Buckland (1835) provided the earliest report of possible Dorset dinosaurs (see below); but Richard Owen produced the first detailed accounts in a series of papers on the fossil reptiles of what are now termed the Blue Lias Formation and Purbeck Limestone Group (e.g. Owen 1854, 1861a, b, 1863). The first dinosaur trace fossils were also reported at this time (Beckles 1854). Work on Dorset dinosaurs shows no sign of abating and new species continue to be described today (Benson 2008a, b). No comprehensive review of the entire Dorset dinosaur record, which consists of both body fossils and trace fossils, has appeared since the publications of Delair (1959, 1966). We aim to update this information to account for the many new discoveries and taxonomic revisions that have taken place during the intervening period, beginning with a review of the theropod dinosaurs and placing these discoveries within broader UK-based and global frameworks. Sauropodomorph and ornithischian dinosaur discoveries will be reviewed at a later date.

Theropod dinosaurs: a brief introduction

Theropod dinosaurs first appeared in the Late Triassic period, *c.* 230 million years ago and quickly achieved a panglobal distribution (Weishampel *et al.* 2004a). Their representatives include some of the most familiar of all dinosaurs, including *Baryonyx*, *Megalosaurus*, *Tyrannosaurus* and *Velociraptor*. All theropods were bipedal animals with powerful hindlimbs and an elongate tail that counterbalanced the head and abdomen. The forelimbs were adapted for predation and the hands were ideally suited for grasping and manipulating prey items. Most theropods were carnivorous and they were the most diverse and abundant vertebrate predators in most Mesozoic ecosystems. Theropods occupy a special place in our understanding of vertebrate evolution as the group gave rise to, and includes, the birds (e.g. Padian and Chiappe 1998). All non-avian theropods became extinct at the Cretaceous-Paleogene boundary 65 million years ago. Detailed reviews of theropod classification and biology can be found in Weishampel *et al.* (2004b). Several theropod subgroups are represented in the Dorset fossil record, including members of the Dromaeosauridae, Tyrannosauroidea and various basal tetanurans (Figure 1).

In 1824, William Buckland described *Megalosaurus* from the 'Stonesfield Slates' of the Taynton Limestone Formation of Stonesfield, Oxfordshire. This was the first dinosaur to be named and was followed by numerous reports of other British theropods (Mantell 1827, 1833; Owen 1842, 1857, 1883; Huxley 1869; Phillips 1871; von Huene 1923, 1926a, b). Indeed, the British theropod record rose to prominence as the first representative and well-sampled record of this group. A substantial part of this record was recovered from Dorset. Dorset theropods are known from the Blue Lias Formation (Hettangian–early Sinemurian, Lower Jurassic: Getty 1980), the

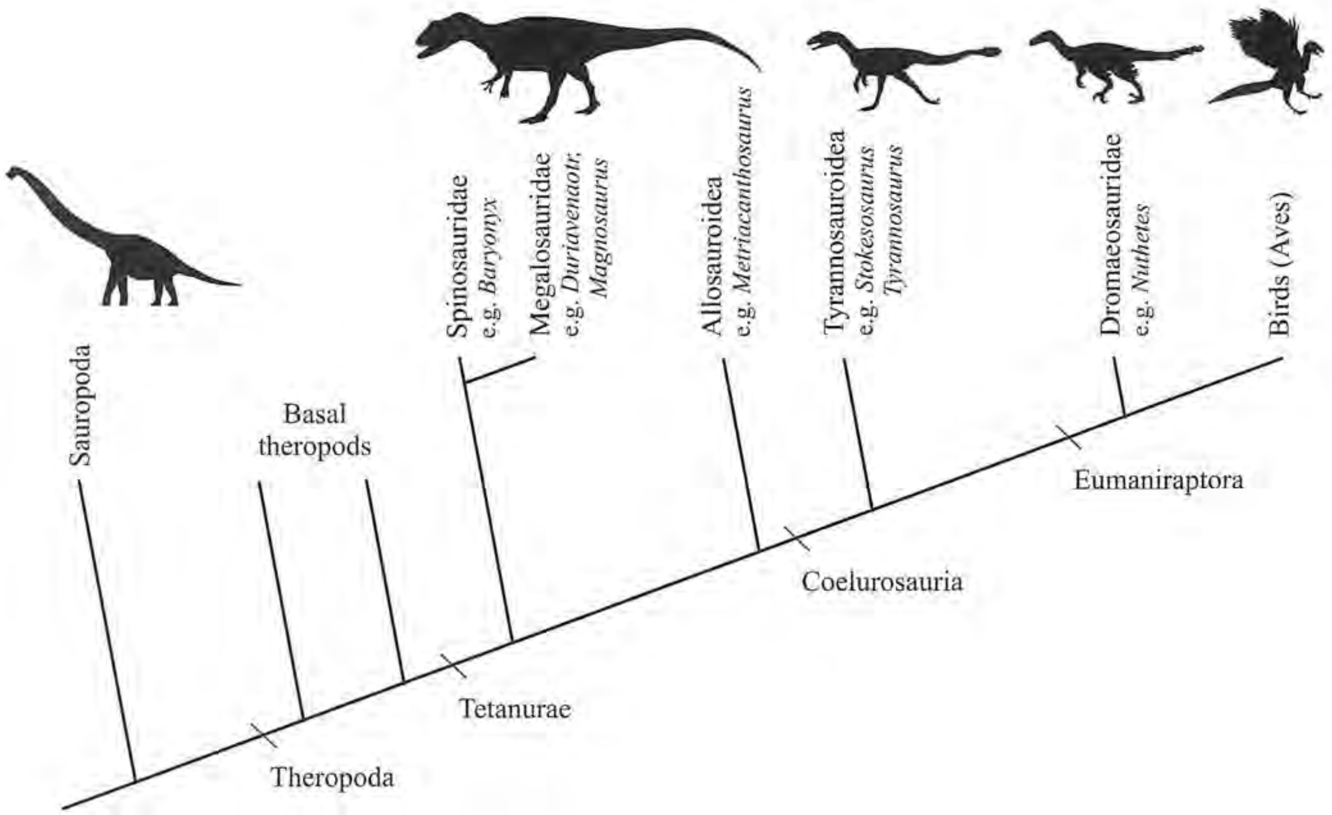

Figure 1: Scheme showing the relationships of theropod dinosaurs. Silhouettes modified from Xu et al. *(2004) and other sources*

Inferior Oolite Formation (Aalenian–Bajocian, Middle Jurassic: Parsons 1980), the Forest Marble Formation (upper Bathonian, Middle Jurassic: Torrens 1980), the Kimmeridge Clay Formation (Kimmeridgian–lower Tithonian, Upper Jurassic: Gradstein *et al.* 2004; Cope 2006), the Portland Stone Formation (Tithonian, Upper Jurassic: Wimbledon 1980), the Purbeck Limestone Group (Tithonian–Berriasian, Upper Jurassic–Lower Cretaceous: Rawson *et al.* 1978; Wimbledon 1980; Rawson 2006) and the 'Wealden Beds' (Valanginian–lower Aptian, Lower Cretaceous: Rawson *et al.* 1978; Table 1). Because dinosaurs were terrestrial animals they are generally rare fossils in these formations, most of which were deposited in marine conditions (but it should be noted that parts of the Purbeck Limestone Group and 'Wealden Beds' represent more terrestrial conditions).

A note on use of the name *Megalosaurus*

The British record of theropod dinosaurs is taxonomically entwined with the first-named dinosaur taxon, *Megalosaurus*. Early theropod workers referred numerous specimens to *Megalosaurus*, most of this material is now considered to represent theropods from different theropod genera or higher taxa, or undiagnostic theropod or archosaur remains (e.g. Buckland 1824; Mantell 1827; Owen 1842, 1857; Phillips 1871; von Huene 1923; Depéret and Savornin 1927; Welles 1954). Because of taxonomic uncertainty surrounding the genus *Megalosaurus* (Allain and Chure 2002; Day and Barrett 2004) the content of the family Megalosauridae was not understood in a formal phylogenetic context until recently (Benson 2008c, d, 2009). Historically the term 'megalosaurid' or 'megalosaur' was used with little formal justification to include taxa from a wide range of time periods and geographic areas. For example, Middle Jurassic Chinese theropods such as *Gasosaurus* (Dong and Tang 1985) and *'Szechuanosaurus' zigongensis* (Gao 1993) and the Late Cretaceous *Chilantaisaurus* (Hu 1964) were referred to Megalosauridae. However, more recently, Benson (2009, in press) resolved many of these uncertainties: current evidence demonstrates that the genus *Megalosaurus* is known only from the Great Oolite Group (Bathonian, Middle Jurassic; Torrens 1980) of Oxfordshire and Gloucestershire, and megalosaurids form a monophyletic clade of spinosauroid theropods primarily known from the Middle Jurassic of Europe and Africa (Sereno *et al.* 1994; Rauhut and López-Arbarello 2009), but also including the Late Jurassic North American and Portuguese taxon *Torvosaurus* (Galton and Jensen 1979; Mateus and Antunes 2000). Most previous reviews of British theropods, including Delair's (1959, 1966) reviews of the Mesozoic reptiles of Dorset, have referred abundant theropod remains to *Megalosaurus*. However, this is not justified and such specimens, even those from the Middle Jurassic, should no longer be uncritically referred to 'megalosaurs' or *Megalosaurus*.

Table 1: List of theropod specimens known from Dorset

Specimen	Description	Locality	Identification	Primary references
Blue Lias Formation				
NHM 39496	Left knee joint	Charmouth	Theropoda indet.	Owen 1861a; Newman 1968 plate 7, Figure 2; plate 8, Figures 1, 4–5, 8, 10, 13.
BGS 109560	Left femur	Charmouth	Theropoda indet.	Owen 1861a plate 1, Figures 1–3; Newman 1968 plate 7 Figure 3.
BGS 109561	Ungual phalanx	Charmouth	Theropoda indet.	Owen 1861
NHM 41352	Tooth	Lyme Regis	Theropoda indet. '*Megalosaurus lydekkeri*'	Lydekker 1888 Figure 28; Carrano and Sampson 2004.
Inferior Oolite Fmtn				
Unknown specimen	Unknown	Bridport	?Theropoda indet.	Phillips 1871; Delair 1959.
OXFUM J.12143	Partial skeleton	Nethercombe	*Magnosaurus nethercombensis*	Von Huene 1923, 1926a Figures 41–43, 1926b Figures 2–4; Waldman 1974 plate 44.
NHM R332	Partial skull	Sherbourne	*Duriavenator hesperis*	Owen 1883 plate 11; Waldman 1974 plates 42–43; Molnar *et al.* 1990 Figure 6.29a; Benson 2008a Figures 1–2.
Forest Marble Fmtn				
BGS 85053	Femur	Long Burton	Theropoda indet.	Benton and Spencer 1995, p.125
?University College, London	Small teeth	Watton Cliff	Coelurosauria indet.	Evans and Milner 1994, Figure 18.7C–G
Oxford Clay Fmtn				
OXFUM J.12144	Partial skeleton	Jordan's Cliff	*Metriacanthosaurus parkeri*	Von Huene 1908, 1923, 1926a Figures 47–53, 1926b Figures 5–11; Walker 1964 Figure 16e-f; Molnar 1990, Figure 14.7a-g.
Kimmeridge Clay Fmtn				
OXFUM J.331	Partial skeleton	Isle of Purbeck	*Stokesosaurus langhami*	Benson 2008b Figures 1–12.
DORCM G10603	Right maxilla (fragment)	Seabed west of Portland	Spinosauroidea indet.	Powell 1987 Figure 6.
AJBC1662	Phalanges	Weymouth	Theropoda indet.	Brokenshire and Clarke 1994 Figure 1A–C.
AJBC 3573	Ungual phalanx	Weymouth	Theropoda indet.	Brokenshire and Clarke 1994 Figure 2A–C.
Portland Stone Fmtn				
Portland Museum (specimen not located)	Metatarsals	Isle of Portland	?Theropoda indet.	Delair 1992, 1993.
Portland Museum (specimen not located)	Vertebra	Isle of Portland	?Theropoda indet.	Delair 1992, 1993.
Purbeck Limestone Grp				
CAMSM J13956	Phalanx	Durlston Bay	Theropoda indet.	Milner 2002.
NHM R6908	Metatarsal II	Isle of Purbeck	Coelurosauria indet.	Milner 2002 Figure 1H–I.
NHM 44806	Tooth	Swanage Bay	Theropoda indet.	Owen 1883; Lydekker 1888; Milner 2002.
DORCM G 913 (holotype) NHM 48207, 48208, 15870–78, CAMSM J13951	Dentaries and teeth	Isle of Purbeck	Nuthetes destructor	Owen 1854 Figures 1–4, 1861b, 1878 plate 12 Figures 8–9, 1879 plate 2 Figures 13–15; Milner 2002 Figure 1A-G, plate 1.

Institutional abbreviations: BGS, Geological Survey Collection, Keyworth; BYU, Brigham Young University Museum of Earth Sciences, Provo, Utah; CAMSM, Sedgwick Museum of Earth Sciences, Cambridge; DORCM, Dorset County Museum, Dorchester; MACN, Museo Nacional, Buenos Aires, Argentina; NHM, The Natural History Museum, London; OXFUM, Oxford University Museum of Natural History, Oxford; UC, University of Chicago, Chicago.

The Theropod Dinosaurs of Dorset

Blue Lias (Hettangian–early Sinemurian, Lower Jurassic)

The Blue Lias has yielded only fragmentary theropod specimens, all of which were collected during the 19th century. Benton and Spencer (1995) stated the reptile-bearing beds at Lyme Regis range from the *planorbis–semicostatum* ammonite Subzones of the Blue Lias (Hettangian–early Sinemurian; Page 2003). A distal femur with an articulated proximal tibia and fibula (NHM 39496; Owen 1861a, Figures 1–3; Newman 1968, pl. 7, Figure 2 and pl. 8, Figure 1, 4, 5, 8, 10, 13), a small left femur (BGS 109560; Owen 1861a, pl. 1, Figures 1–3; Newman 1968, pl. 7, Figure 3) and an ungual phalanx (BGS 109561; Owen 1861a, plate 2, Figures 4–6) from Charmouth were reported by Owen (1861a) as part of the syntype series of the ornithischian *Scelidosaurus*. Newman (1968) recognised that these specimens were in fact theropods ('megalosaurid'), not ornithischians, and both Carrano and Sampson (2004) and Naish and Martill (2007) suggested that they represented the earliest remains of tetanuran theropods. However, Benson (2009) reviewed this material and concluded that its diagnostic value was low and proposed that these specimens should be regarded as indeterminate theropods of uncertain taxonomic status.

NHM 41352, an isolated tooth from the Blue Lias of Lyme Regis (Lydekker 1888, Figure 28), was made the holotype of a new species of *Megalosaurus*, *M. lydekkeri* (von Huene 1926a). This specimen was referred to '?*Zanclodon* sp.' in Delair's (1959) review. However, isolated theropod teeth are rarely diagnostic and this specimen is of the recurved, serrated form typical for the majority of theropod taxa and lacks synapomorphies that could be used to refer it to any particular theropod group. As such it should be identified as an indeterminate theropod and '*M. lydekkeri*' should be considered a *nomen dubium* (Molnar *et al.* 1990; Carrano and Sampson 2004; Holtz *et al.* 2004).

Delair (1959) briefly mentioned an isolated vertebra from Lyme Regis (BGS 582) and suggested that it might be referable to a theropod. However, this vertebra (a cervical) does not resemble those of any theropod as the centrum lacks pneumatic foramina ('pleurocoels') and there is no evidence of the complex vertebral laminae that are usually present in the group. Most of the features present in the vertebra are similar to those in a variety of other Mesozoic reptile groups and we consider it an indeterminate reptile vertebra of unknown taxonomic affinities.

Inferior Oolite (Aalenian–Bajocian, Middle Jurassic)

Magnosaurus nethercombensis and *Duriavenator hesperis* are both known from the Inferior Oolite Formation of Dorset. Both taxa are based on partial skeletons collected in the late 19th and early 20th centuries and represent megalosaurids (*sensu stricto*) that were previously referred to *Megalosaurus* (as *M. nethercombensis* and *M. hesperis*, respectively: Waldman 1974). However, the anatomy of these taxa differs significantly from that of *Megalosaurus bucklandii* (Benson 2008c, 2009) and both can be recognised as valid separate genera on the basis of a suite of unique diagnostic features.

Magnosaurus nethercombensis (von Huene 1926b) (Figure 2)

The holotype specimen of *Magnosaurus nethercombensis*, a partial skeleton (OXFUM J.12143), was reported by von Huene (1923) as a new species of *Megalosaurus*, '*Megalosaurus*' *nethercombensis*. He subsequently published brief descriptions and figures of the specimen as *Megalosaurus* (subgen. b) *nethercombensis* (von Huene 1926a, Figure 41–43) and *Megalosaurus nethercombensis* (von Huene 1926b, Figures 2–4). As both works were published in 1926 the month of publication determines which work constitutes the original publication of the species name of *M. nethercombensis*. The volume of *Revista del Museo de la Plata* containing von Huene (1926a) does not specify the date of publication in print, whereas the volume of *Annals and Magazine of Natural History* containing von Huene (1926b) specifies May 1926 as the date of publication. Article 21.3.2 of the International Code of Zoological Nomenclature (ICZN; International Commission on Zoological Nomenclature, 1999) states that when only the year of publication of a work is specified or demonstrated then the date

*Figure 2: The right dentary of Magnosaurus (OXFUM J.12143) in medial (**a**) and lateral (**b**) views. Scale bar equals 100 mm*

of publication should be taken to be the last date of that year (i.e. 31st December 1926). Therefore, under the principle of priority, von Huene (1926b) should be regarded as the first work to make the name *M. nethercombensis* available under the ICZN. This judgement is supported by the dates of receipt of von Huene (1926a: 22nd October 1926) and von Huene (1926b: 12th May 1926) at the NHM library. von Huene (1932) later erected the new genus *Magnosaurus* for *M. nethercombensis*. The specimen consists of the dentaries, fragmentary dorsal and caudal vertebrae, the ischial peduncle of the right ilium, portions of the pubes, femora, tibiae and various unidentifiable bone fragments.

Magnosaurus nethercombensis was recovered from the *Stephanoceras humphriesianum* ammonite Zone and Subzone (lower Bajocian; Gradstein *et al.* 2004) of the Inferior Oolite. It is important to our understanding of theropod evolution as it might represent the earliest record of the major theropod group Tetanurae (Benson 2009; Weishampel *et al.* 2004a). Tetanurae is a large sub-group of theropods that encompasses most of their ecological and species diversity, including small- to large-sized carnivores (e.g. from *Microraptor* with a body length of approximately 47mm [Xu *et al.* 2000] to *Tyrannosaurus*, with a total length of 12.5m [Brochu 2002]), unusual herbivorous forms (e.g. ornithomimosaurs and therizinosauroids: Paul 1984; Kobayashi *et al.* 1999; Barrett 2005) and flying birds. Documenting the anatomy of the earliest-known tetanurans, such as *Magnosaurus* and *Duriavenator* (see below), is important in order to establish a baseline for understanding the subsequent pattern of tetanuran evolution and diversification, which culminates in the origin of numerous familiar theropod groups, including allosauroids, tyrannosauroids, ornithomimosaurs, dromaeosaurids and birds. Circumstantial evidence derived from phylogenetic analyses suggests that tetanurans may have originated as early as the Lower Jurassic: the closest relatives of tetanurans, the ceratosaurs (*sensu* Forster 1999; Rauhut 2003a; Carrano and Sampson 2008), have their earliest record in the Pliensbachian–Toarcian (Lower Jurassic) of Morocco (Allain *et al.* 2007) and as these two major groups share a common ancestor the first appearance of tetanurans should also date to this period. Therefore, tetanurans older than *Magnosaurus* are expected to be discovered in the future.

The holotype specimen of *Magnosaurus* (OXFUM J.12143) is small relative to many other basal tetanurans as the tibia is 490mm long, but the fused neurocentral sutures of the vertebrae indicate that the specimen represents an adult individual. Comparisons with more complete skeletons of similarly-sized taxa, such as *Piatnitzkysaurus*, from the Callovian (Middle Jurassic) of Argentina, suggest that *Magnosaurus* stood around 1m tall at the hips. Although some other Middle Jurassic tetanurans such as *Poekilopleuron* (from the lower Bathonian of France: Allain and Chure 2002) and *Piatnitzkysaurus* had comparable small body size, other near contemporaries, such as *Megalosaurus*, were significantly larger (tibia length = 660mm; OXFUM J.13562). Late Jurassic basal tetanurans such as *Allosaurus* (tibia length = 750; BYU 17106, but larger individuals are known) and *Torvosaurus* (tibia length = 710mm) from the Morrison Formation (Kimmeridgian–Tithonian) of North America were even larger than both *Magnosaurus* and *Megalosaurus* (Madsen 1976a; Britt 1991). *Marshosaurus*, a basal tetanuran with comparable size to *Magnosaurus*, has also been described from the Morrison Formation (Madsen 1976b) however, suggesting that relatively small basal tetanurans played a continuing role in Jurassic dinosaur ecosystems.

Duriavenator hesperis (Waldman 1974) (Figure 3)

Theropod skull material was recovered by Edward Cleminshaw from quarrymen at Greenhill. This discovery was reported in the Dorset County Chronicle (June 15th, 1882 'Report of a meeting of the Dorset Natural-History and Antiquarian Field Club': cited in Waldman 1974) and Richard Owen (1883, pl. 11) used the specimen as the basis for his skull reconstruction of *Megalosaurus bucklandii*. Waldman (1974) referred this material (NHM R332) to a new species, *Megalosaurus hesperis*, but more recent authors have questioned the generic assignment due to lack of shared features between *M. bucklandii* and *M. hesperis*: the taxon is usually referred to as *'Megalosaurus' hesperis* in the literature, reflecting this uncertainty (e.g. Paul 1988; Holtz *et al.* 2004). *'M.' hesperis* is a valid species based on the presence of two distinctive autapomorphies: a deep groove on dorsal surface of the jugal process of the maxilla containing numerous pneumatic foramina and an array of small foramina in the ventral part of the maxillary articular surface for the premaxilla (Benson 2008a). It also shows numerous anatomical differences from *Megalosaurus bucklandii*, including the presence of an enlarged, subcircular third dentary alveolus, smooth medial surfaces of the maxillary interdental plates, and an anteroposteriorly elongate maxillary anterior ramus in *'M.' hesperis*. On this basis, Benson (2008a) erected the new genus *Duriavenator* ('Dorset hunter') for the species *'M.' hesperis*.

Although the material of *Duriavenator* is limited to a single partial specimen, it does contribute to our knowledge of the dentition of some carnivorous dinosaurs. Large-bodied, carnivorous theropods are often considered to have teeth with a relatively uniform morphology along the tooth row (homodonty), although heterodonty (differences in tooth morphology along the tooth row) has been noted in some tyrannosaurids (e.g. Smith 2005). However, in most spinosauroids, the allosauroids *Acrocanthosaurus* and *Neovenator* (Brusatte *et al.* 2008) and some non-tetanuran theropods, such as *Dilophosaurus* (Welles 1984), the mesial three alveoli of the dentary are subcircular and the third is enlarged relative to the other alveoli. This contrasts with more distal alveoli and the alveoli of most other large-bodied

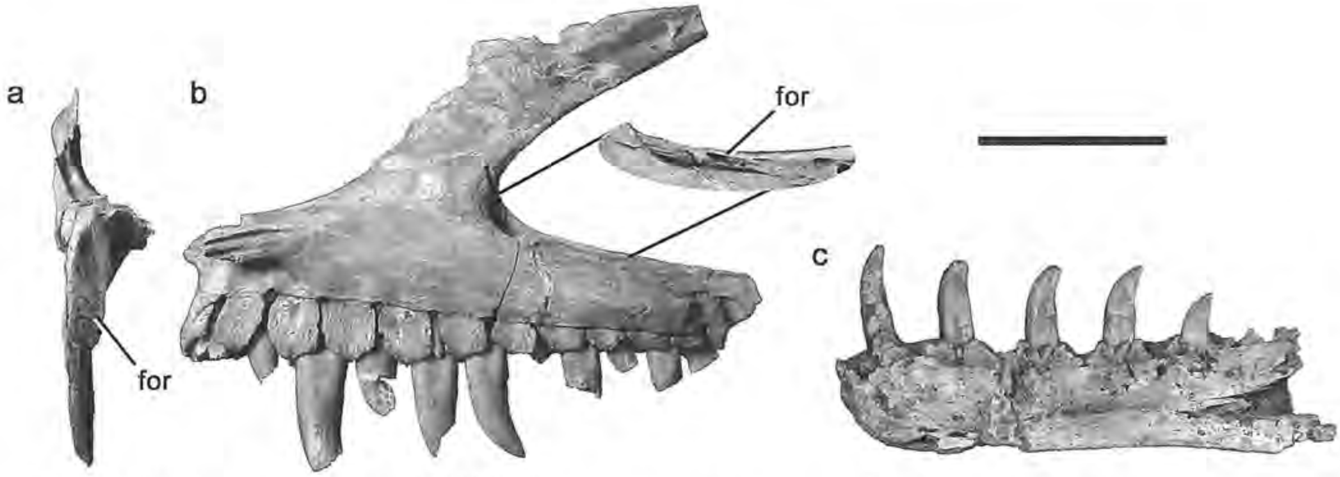

Figure 3: Skull bones of Duriavenator (NHM R332). (**a-b**), *right maxilla in anterior* (**a**) *view, showing foramina ('for') on articular surface for premaxilla and in medial view* (**b**) *with detail showing foramina on dorsal surface of jugal process;* (**c**), *right dentary in medial view. Scale bar equals 100mm. Images modified from Benson (2008a)*

carnivorous theropods, which are oval and diminish in size gradually distally. However, with the exception of *Duriavenator*, the tooth morphology associated with these alveoli is not known. *Duriavenator* shows that the mesial dentary teeth were longer than the distal teeth, had a circular cross-section and were inclined slightly anteriorly. An extreme development of this condition, in which mesial dentary teeth are strongly inclined (procumbent) is present in the small abelisauroid *Masiakasaurus* from the Maastrichtian (Late Cretaceous) of Madagascar (Carrano *et al.* 2002). Heterodonty in spinosauroids, *Acrocanthosaurus* and *Neovenator* may be associated with plucking or precise grasping during food acquisition.

Other material

Unspecified remains of *Megalosaurus* from the Inferior Oolite near Bridport were reported by Phillips (1871). Delair (1959) was unable to relocate this material, but suggested it might form part of the collection at the Oxford University Museum of Natural History. However, a search through this collection has failed to identify any theropod specimens with this provenance and this record should be regarded as doubtful until the material is re-discovered.

Forest Marble (upper Bathonian)

Benton and Spencer (1995, 125) listed unspecified remains of ?*Megalosaurus* from the ?Forest Marble of Long Burton (the Forest Marble and Cornbrash of this locality were described by Woodward 1894, 346, 438) and Weishampel *et al.* (2004a) listed unspecified remains of *Megalosaurus* sp. from the Forest Marble of Dorset. These records correspond to the same specimen, which is a small theropod femur of indeterminate affinities (BGS 85053; M.J. Benton, pers. comm. 2008).

Evans and Milner (1994, Figure 18.7C–G) figured a number of small theropod teeth that were referred to as 'dromaeosaur-like' and a 'possible troodontid' from the Forest Marble of Watton Cliff. These teeth are indeed similar to those of troodontids and dromaeosaurids in overall shape and size. Dromaeosaurs and troodontids, which are small-bodied, derived tetanurans, are generally considered to be the closest relatives of birds: consequently, documenting the timing of their earliest appearances is important in establishing the timing of bird origins. All specimens of the earliest-known bird, *Archaeopteryx*, have been collected from the Solnhofen Limestone (Kimmeridgian) of Germany (von Meyer 1861; Ostrom 1976), which was deposited more than 10 million years after the Forest Marble Formation. If the theropod teeth from Watton Cliff can be referred to dromaeosaurs and troodontids then this implies that birds must also have been present during the Middle Jurassic, but remain undiscovered. Consequently, the claims of Evans and Milner (1994) must be examined rigorously.

Other than general similarity, no specific features have been proposed in support of the dromaeosaurid or troodontid affinities of the Watton Cliff teeth. However, in some of these teeth the denticles of the mesial carina are much smaller than those of the distal carina, as is characteristic of dromaeosaurs (Rauhut and Werner 1995) and the basal tyrannosauroid *Eotyrannus* (Sweetman 2004). Middle Jurassic coelurosaurs are poorly known (Holtz *et al.* 2004) and basal coelurosaur phylogeny is in a state of flux (e.g. Rauhut 2003a; Holtz *et al.* 2004; Senter 2007; Turner *et al.* 2007). It is therefore not established whether this disparity in denticle size was present in the most recent common of *Eotyrannus*, dromaeosaurs and troodontids, or whether it evolved independently in each of these groups. As such, although dromaeosaurids and troodontids must have originated by the Kimmeridgian (based on the occurrence of *Archaeopteryx*), the teeth from Watton should be considered as referable to indeterminate coelurosaurs until further evidence comes to light. A conservative stance on the timing of dromaeosaur and troodontid origins should be adopted until more reliable indicators, such as non-dental body fossils bearing unambiguous diagnostic features, are discovered.

Upper Oxford Clay Formation (lower Oxfordian)

von Huene (1908) mentioned a partial skeleton in James Parker's Collection in Oxford, which he later referred to the new species *Megalosaurus parkeri* (von Huene 1923). When Parker died in 1912 this material was purchased for the Oxford University Museum (OXFUM J.12144) by W.E. Bolston. The specimen comprises the pelvis, partial hindlimbs, parts of the vertebral column and a metacarpal of a large-bodied theropod. The specimen was collected from Jordan Cliff (also known as Furzy Cliff; Benton and Spencer 1995), 1.5 miles north of Weymouth and is the only theropod known from the Upper Oxford Clay (Benton and Spencer 1995). Walker (1964) determined that *M. parkeri* was from the Upper Oxford Clay (lower Oxfordian; Wright 1980) based on a specimen of the bivalve *Gryphaea dilata* attached to the ilium. He also felt that the differences between *M. parkeri* and *M. bucklandii* were sufficient to justify a generic distinction and referred *M. parkeri* to the new genus *Metriacanthosaurus*.

Metriacanthosaurus was only recently included in a phylogenetic analysis (Benson 2008c, d, 2009). It was recovered as a sinraptorid allosauroid along with *Lourinhanosaurus*, a *Magnosaurus*-sized theropod from the Kimmeridgian–Tithonian of Portugal (Mateus 1998). Sinraptorids are otherwise only known from the Oxfordian (Late Jurassic) of China (Currie and Zhao 1993), at which time they are the only large-bodied theropods known from eastern Asia. They are known from several complete skeletons from Sichuan Province and Xinjiang Autonomous Region (Dong *et al.* 1978, 1983; Gao 1992). The occurrence of sinraptorids in Europe suggests that the group was geographically widespread during the Oxfordian, although their success may have been short-lived as large-bodied sinraptorids are not known after the Oxfordian.

Although they are members of a relatively derived theropod clade (Allosauroidea), sinraptorids are of particular evolutionary interest as they possess a number of apparently primitive features otherwise found in non-tetanuran theropods, including a coracoid with a weak posteroventral process, the presence of a metacarpal IV, a reduced pubic distal expansion with a ratio of pubic distal expansion length to pubic shaft length <0.3, the fibular flange extending to the proximal end of tibia, the ischial terminal processes fused in adults, and a wide distal fibula with the ratio of the anteroposterior width of the fibular distal end to its minimum midshaft width is >2.3. Although some authors have considered these, or similar characters, to reflect a primitive position within Allosauroidea (Currie and Zhao 1993; Holtz *et al.* 2004), these features are present in their derived state in other basal tetanurans. This suggests that many of the 'primitive' features of sinraptorids are acquired independent of their ancestry and actually represent derived features within Allosauroidea (Benson 2009). Reversals in character evolution resulting in the reappearance of apparently 'primitive' anatomical features are common among basal tetanurans. Different suites of 'primitive' features are seen in other groups such as the megalosaurids, the Chinese Middle Jurassic taxa *Chuandongocoelurus* and *Monolophosaurus*, and in the Argentinian Middle Jurassic taxa *Condorraptor* and *Piatnitzkysaurus* (Benson 2008c, d, 2009).

Kimmeridge Clay Formation (Kimmeridgian–lower Tithonian)

Stokesosaurus langhami (Figure 4)

Benson (2008d) described a partial skeleton comprising axial, pelvic and hindlimb material collected from the *Pectinatites pectinatus* ammonite Subzone (lower Tithonian) of the upper Kimmeridge Clay Formation, six miles west of Swanage on the Isle of Purbeck. The specimen was referred to a new species of the North American tyrannosauroid *Stokesosaurus*, as *S. langhami*, and was named in honour of the collector, Mr Peter Langham of Bridport. It is significant as it represents one of only two Jurassic tyrannosauroid taxa known from associated skeletons worldwide.

Tyrannosaurids are among the most iconic of dinosaurs. They dominated the large-bodied predator niche during the Campanian–Maastrichtian (Late Cretaceous) of North America and Asia (e.g. Osborn 1905; Lambe 1917; Maleev 1955; Holtz 2004). Taxa such as *Tyrannosaurus rex* attained colossal body masses of up to seven tonnes (Henderson 1999; Brochu 2002), ranking among the largest body sizes attained by any terrestrial predator. The remains of basal tyrannosauroids (the more primitive relatives of the later tyrannosaurids) are very poorly-represented in the fossil record prior to the Late Cretaceous. They include *Guanlong* from the Oxfordian (Late Jurassic) of China (Xu *et al.* 2006), *Dilong* from the late Barremian to early Aptian (Early Cretaceous) of China (Xu *et al.* 2004) and *Eotyrannus* from the Barremian (Early Cretaceous) of the Isle of Wight (Hutt *et al.* 2001). The rarity of these primitive taxa obscures the interrelationships and early evolution of this group (e.g. Holtz 1994; Rauhut 2003a; Turner *et al.* 2007).

Prior to the discovery of *Stokesosaurus langhami*, *Stokesosaurus* was known only from the holotype ilium and one referred ilium collected from the Morrison Formation of Utah. *Stokesosaurus* is significant due to its Late Jurassic age, which represents a very early snapshot of tyrannosauroid history. The *Stokeosaurus* remains from Dorset represent an individual with an estimated hindlimb length of around 1.6m and a body mass of 350kg (Benson 2008b). These indicate more gracile body proportions than those of more primitive tetanurans. Perhaps surprisingly, tyrannosauroids are

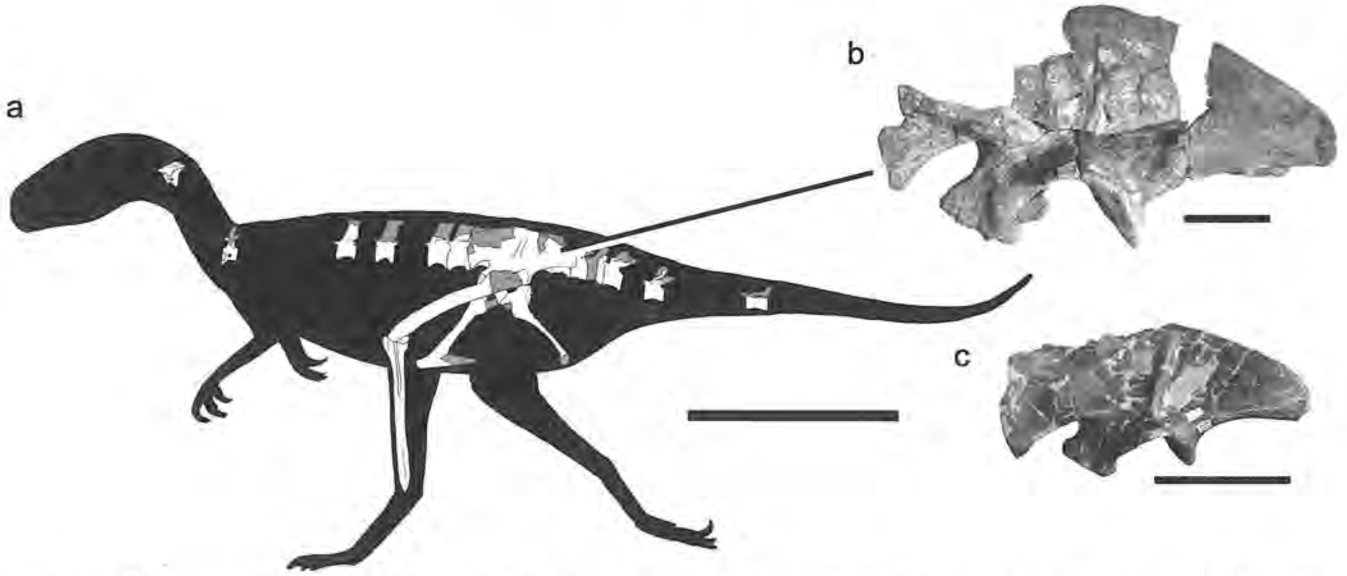

Figure 4: Stokesosaurus. *(***a***), skeletal drawing of* Stokeosaurus langhami *(OXFUM R331) (modified from Benson 2008b); (***b***), left ilium of* S. langhami *in lateral view; (***c***), holotype left ilium of* S. clevelandi *from North America in lateral view. Scale bars equal 1m (***a***) and 100mm (***b, c***)*

closely related to a number of otherwise small-bodied theropod taxa including compsognathids, troodontids and dromaeosaurids (e.g. Holtz 1994; Rauhut 2003a; Holtz *et al.* 2004). This suggests that the ancestors of tyrannosauroids should also have been small animals (Holtz 1994) and the relatively small size of *Stokesosaurus* confirms this prediction, although *S. langhami* is the largest pre- Late Cretaceous tyrannosauroid yet discovered (Benson 2008b).

Stokesosaurus also provides data on dinosaur biogeography and more specifically on the timing of the breakup of the Mesozoic supercontinent Pangaea. The shared presence of this genus in Dorset and the USA lends support to a hypothesis that posits a more recent biogeographic connection between North America and Europe than between either region and Africa during the Late Jurassic (Rauhut 2005; Benson 2008b). *Stokesosaurus* is known from the Morrison Formation (Kimmeridgian-Tithonian) of North America (Madsen 1974) and the Kimmeridge Clay Formation of the UK (Benson 2008b). A second, unnamed tyrannosauroid taxon is known from the Morrison Formation (Foster and Chure 2000), and this is closely similar to *Aviatyrannis*, from equivalent strata in Portugal (Rauhut 2003b). Tyrannosauroids are not known from the pene-contemporaneous Tendaguru Formation of Tanzania (Rauhut 2005; Benson 2008b).

Other theropod taxa, such as *Allosaurus*, *Ceratosaurus* and *Torvosaurus*, show a similar distribution and have been reported from Kimmeridgian–Tithonian deposits in Portugal (Pérez-Moreno *et al.* 1999; Mateus and Antunes 2000; Antunes and Mateus 2003; Mateus 2006; Mateus *et al.* 2006) and North America (e.g. Gilmore 1920; Galton and Jensen 1979) but have not been recorded (or only mistakenly reported on the basis of undiagnostic material) from Tanzania (Tykoski and Rowe 2004; Rauhut 2005). However, support for this biogeographical connection is less convincing if other dinosaur groups are considered (Upchurch *et al.* 2002; Mateus 2006; Foster 2007).

Other material

A fragment of large theropod right maxilla recovered by a scallop trawl and brought to the Dorset County Museum by Mr E. Taylor was reported by Powell (1987: DORCM G10603). It is likely to have come from the *Aulacostephanus autissiodorensis* ammonite Zone (Kimmeridgian) of the lower Kimmeridge Clay Formation, based on ammonites dredged from the same area (Van der Vyver 1985, 168–169). The fragment is abraded and comprises the anterior portion of the maxilla, preserving the first to fourth alveoli, each of which contains a partial crown. Replacement teeth are visible between the unfused interdental plates adjacent to the second, third and fourth alveoli. The medial surfaces of the interdental plates are marked by coarse dorsoventral striations (Powell 1987, Figure 6) as in *Megalosaurus* (OXFUM J.13506), *Piatnitzkysaurus* (MACN CH 895) and abelisaurids (Sampson *et al.* 1996). The junction between the bases of the interdental plates and the medial surface of the maxilla ventral to the anteromedial process slopes anteroventrally. The combination of this feature and unfused interdental plates is only otherwise found in megalosaurids such as *Afrovenator* (UC OBA 1), *Megalosaurus* (OXFUM J.13506), *Duriavenator* (Benson 2008a) and *Torvosaurus* (Britt 1991) among basal tetanurans. DORCM G10603 should therefore be considered as a specifically indeterminate megalosaurid and may have affinities with *Megalosaurus* based on the combined presence of striated interdental plates and anteroventrally sloping interdental plate bases, which are otherwise only found in *M. bucklandii*.

Additional theropod specimens from the *Rasenia cymodoce* Zone (Kimmeridgian) of the lower Kimmeridge Clay Formation were reported by Brokenshire and Clarke (1994). This material, collected from the shore at Wyke Regis, consists of unassociated pedal phalanges, two of which were provisionally identified as those of an ornithomimosaurid theropod. Such a discovery would be of global significance as ornithomimosaurids are otherwise known only from Cretaceous deposits (Makovicky *et al.* 2004). However, this material shares no distinctive features with ornithomimosaurs beyond their slender, gracile morphology: similar elements are known in many other theropod groups. Consequently, these elements, and a third larger ungual phalanx collected nearby from the same horizon (Brokenshire and Clarke 1994), should be regarded as indeterminate theropod material on the basis of current evidence.

Portland Stone (Tithonian)

Delair (1992, 1993) reported 'megalosaur' metatarsals from the 'Whit' bed (Portland Stone; Tithonian) of the Bath and Portland Stone Company's quarry and a partial vertebra from the same horizon in Parkfield Quarry, both on the Isle of Portland (Portland Museum, uncatalogued specimens). This report was also mentioned by Benton and Spencer (1995, 199–200). The fossil collection at Portland Museum remains uncatalogued. The specimens are no longer on display and could not be located in the collections on recent visits to the museum by RBJB or by P. Ensom (pers. comm., 2009). The record should conservatively be regarded as an indeterminate theropod, pending re-examination.

Purbeck Limestone Group (Tithonian–Berriasian)

Milner (2002) reviewed the theropod fossils of the Purbeck Limestone Group of Southern England and stated that they were the rarest terrestrial vertebrate fossils reported from the Group. Theropod body fossils are known only from the 'Middle Purbeck Beds' (although the latter straddle both Lulworth and Durlston formations, the theropod-bearing horizons all lie within the Lulworth Formation: Clements 1993), but trackways attributed to theropods have been reported from many different horizons throughout the Purbeck Limestone Group (reviewed in Ensom 1995).

Nuthetes destructor

Nuthetes is the only valid theropod genus named from the Purbeck Limestone Group. It has a chequered taxonomic history that was reviewed in detail by Milner (2002). Owen (1854) erected the genus based on a small, fragmentary left dentary (DORCM G 913) from 'Feather Quarry' on the Isle of Purbeck (exact locality unknown) that was collected by Charles Willcox. (Milner [2002, 191] stated, incorrectly, that the material was co-discovered by Willcox and W. R. Brodie). In a footnote to his description, Owen stated that the specimen was collected from the 'Chert Beds' (bed numbers J. 81–84 of Austen 1852). In modern nomenclature, these horizons correspond to beds DB97–101 (Clements 1993; P. C. Ensom, pers. comm., 2009), which lie within the Cherty Freshwater (Clements 1993) or Worbarrow Tout (Westhead and Mather 1996) Member of the Lulworth Formation (depending upon the preferred lithostratigraphical divisions adopted for the Purbeck Limestone Group). However, in a later account Owen (1861b, 31) mentioned that the holotype was recovered from 'the bed marked *k* 93 in Mr Austen's "Guide" . . .', which is also known as the 'Mammal Bed' or 'Dirt Bed' (Clements 1993): this bed is not recorded in the sequence at Feather Quarry (Austen 1852). The 'Mammal Bed' occurs lower in the Purbeck Limestone Group sequence than those beds recorded in the Feather Quarry: it is termed bed DB83 by Clements (1993) and lies within the Marly Freshwater (Clements 1993) or Worbarrow Tout (Westhead and Mather 1996) Member of the Lulworth Formation. This suggests that the original locality and stratigraphic data provided by Owen (1854) may have been incorrect, though Owen did not mention the conflict with his earlier account. Owen (1871, 1878, 1879) added further to the confusion by mentioning that the holotype and a set of referred specimens collected by Samuel H. Beckles was from the 'Feather Bed'. Although the latter horizon was recorded in the section at Feather Quarry (bed J. 74 of Austen 1852: P. C. Ensom, pers. comm., 2009), it lies at a higher stratigraphic level than any of the aforementioned horizons and is the equivalent of bed DB 108 (Clements 1993: this horizon lies within the Cherty Freshwater/Worbarrow Tout Member). Finally, Milner (2002: following Owen 1854) noted that the Feather Bed (incorrectly cited as the 'Feather Bed Marl') was the source of the holotype and stated that this was equivalent to bed DB102 of Clements (1993): however, this is incorrect as the 'Feather Bed' is actually bed DB108 (see above). Consequently, there is considerable doubt regarding the exact provenance of the specimen. However, P.C. Ensom (pers. comm., 2009) has noted that the preservation of the *Nuthetes* holotype differs substantially from that of the block containing limb bones and osteoderms figured by Owen 1854, Figure 5 from the Feather Quarry. Moreover, at least one isolated tooth of *Nuthetes* (CAMSM J13951) is known from the 'Mammal Bed' (bed DB83: Milner 2002). Consequently, it is plausible that the holotype was recovered from bed DB83 as stated by Owen (1861b: from an unknown locality – not Feather Quarry as this bed does not occur there), while additional material may have come from higher in the sequence (Owen 1879). Unfortunately, this situation is unlikely to be resolved unless further documentary evidence comes to light that provides more exact records for the provenance of items in the Charles Willcox collection. The Jurassic/Cretaceous boundary occurs in the Lulworth Formation close to the base of the

Cypris Freestones Member (Callomon and Cope 1995; Rawson 2006, 381), indicating that all of the *Nuthetes* – bearing beds are of Berriasian (Lower Cretaceous) age.

In his description of *Nuthetes*, Owen (1861b) noted strong similarities between these teeth and those of *Megalosaurus*. However, he referred *Nuthetes* to Lacertilia (i.e. a lizard) due to the absence of an alveolar wall and alveolar divisions, which led him to interpret the tooth attachment as pleurodont. Owen (1879) subsequently changed his mind and listed *Nuthetes* as a crocodilian. Other authors placed *Nuthetes* in an uncertain ordinal position (Lydekker 1888) and it was even identified as a mammal (Seeley 1893a; retracted in Seeley 1893b) and it was not formally assigned to Theropoda (as a 'megalosaurid') until much later (Swinton 1934). Romer (1956) and Steel (1970) later proposed that *Nuthetes* was a junior subjective synonym of *Megalosaurus*, leading to the novel combination *Megalosaurus destructor*, although von Huene (1956) re-identified *Nuthetes* as a lizard.

Milner (2002) re-described and re-assessed the teeth and bones referred to *Nuthetes*, including those specimens described by Owen (1878, pl. 2, Figures 13–14, pl. 12, Figures 8–9; 1879, pl. 2, Figure 15c) as well as additional material from the Purbeck Limestone Group of Buckinghamshire, Sussex and Wiltshire (Delair 1959; Benton and Spencer 1995). Other teeth referred to cf. *Nuthetes* have subsequently been reported from the equivalent of bed DB 102 at Sunnydown Farm (Ensom *et al.* 1994) and elsewhere (Milner 2002), and from other horizons at sites on the Isle of Purbeck (P. C. Ensom pers. comm., 2009). Several theropod features, such as interdental plates, were identified by Milner (2002), who suggested that *Nuthetes* was a dromaeosaurid. This conclusion was based on the difference in size between denticles of the mesial and distal tooth carinae: those of the mesial carina are much smaller than those on the distal carina. As a result, there are between 1.14–1.55 times as many denticles on the mesial carina than on the distal carina. High denticle density ratios ranging up to 1.5 are found only in dromaeosaurids (Rauhut and Werner 1995). Dromaeosaurids are closely related to birds and were widespread during the Cretaceous (Weishampel *et al.* 2004a). The group includes a number of taxa such as *Deinonychus* from the Aptian–Albian (Lower Cretaceous) of North America, *Unenlagia* from the Turonian–Coniacian (Late Cretaceous) of Argentina and *Velociraptor* from the Santonian–Maastrichtian (Late Cretaceous) of Mongolia (Norell and Makovicky 2004). The Berriasian age of *Nuthetes* makes it one of the oldest definitive dromaeosaurids from anywhere in the world: by coincidence it is also the first dromaeosaurid taxon to have been described, even though it was originally incorrectly identified as a carnivorous lizard (Owen 1854, 1861b, 1878) or a crocodilian (Owen 1879). The 'granicones', small pieces of dermal armour that were formerly referred to *Nuthetes* (Owen 1878, 1879), are now considered to pertain to a solemydid turtle (Barrett *et al.* 2002).

Other body fossils

The distal half of a right metatarsal II (NHM R6908) from an unknown Isle of Purbeck locality was reported by Milner (2002, Figure 1H–I) and identified as an indeterminate eumaniraptoran theropod (the group containing birds, dromaeosaurids and troodontids). This referral was based on the slender proportions of the element and the absence of any proximal narrowing that might indicate the possession of what is known as the arctometatarsalian condition, as occurs in some other theropod groups (e.g. ornithomimosaurs and tyrannosauroids: Holtz 1994). Non-avian eumaniraptoran remains other than *Nuthetes* are rare in the UK, known otherwise only from the Isle of Wight where isolated velociraptorine dromaeosaurid teeth were discovered (Sweetman 2004). NHM R6908 could belong to a large individual of *Nuthetes* but it is unlikely that *Nuthetes* attained large body sizes as all currently known remains are small. It is therefore likely that it indicates the presence of an additional, larger-bodied, eumaniraptoran. Milner (2002) also reported an unidentified theropod phalanx (CAMSM J13956) from the 'Mammal Bed' at Durlston Bay (bed DB83, Cherty Freshwater Member, Lulworth Formation). This was identified as a pedal phalanx (from digit III, phalanx 1) and is similar to that of *Allosaurus*, but cannot be identified beyond the level of indeterminate theropod (Milner 2002).

Mantell (1827, 1833) mentioned teeth of *M. bucklandii* from the Purbeck Limestone Group of Swanage, but did not provide any precise locality data. This is probably the same record as that mentioned by Owen (1842, 1857) as *Megalosaurus* from the Purbeck Limestone of Swanage Bay. The current whereabouts of this material is unknown.

Lydekker (1888) listed a tooth (NHM 44806) as *Megalosaurus dunkeri* from the Purbeck Beds of an unknown locality. The tooth was also mentioned by Delair (1959), who stated that records at the Natural History Museum gave a locality of 'Dorset' for NHM 44806 and that if this were correct then the specimen may correspond to at least one of the aforementioned records from Swanage Bay. Molnar (1990) and Milner (2002) both regarded NHM 44806 as an indeterminate theropod tooth, although Milner noted a denticle size difference index of 1.0, indicating that the denticles on the mesial and distal carinae were of similar size and distribution to each other, as also occurs in some other large theropods such as *Allosaurus* (Milner 2002). This supports the presence of a second, larger theropod taxon in the Purbeck assemblage. It is possible that this large-bodied theropod taxon was responsible for the tracks mentioned below. However, other large theropods may also have been present as several are known from most well-sampled dinosaur faunas. For instance, *Allosaurus*, *Ceratosaurus* and *Torvosaurus* are known from the North American Upper Jurassic Morrison Formation (Foster 2007).

Trace fossils

Numerous dinosaur tracks and trackways have been identified in the Purbeck Limestone Group (see reviews in Ensom 1995, 2002a). The majority of these tracks were made by three-toed (tridactyl) bipeds and they are frequently attributed to '*Iguanodon*-like' or '*Megalosaurus*-like' trackmakers. However, variations in preservation and sedimentary dynamics can make identification of trackmakers difficult (e.g. Gatesy *et al.* 1999; Ensom 2002a; Manning 2004) and in many cases it may not be possible to distinguish ornithopod and theropod tracks unless preservation allows the recognition of taxon-specific features (e.g. the characteristic handprints of iguanodontian ornithopods [Wright 1999] or the narrow claw marks expected in a theropod [e.g. Day *et al.* 2004]). Only a small number of the bipedal trackways from the Purbeck Limestone Group have been documented in detail (e.g. Wright 1999; Ensom and Delair 2007). In other cases, many of the taxonomic conclusions based upon isolated tracks and trackways should be considered tentative until more information is available.

'*Megalosaurus*-like' tracks and trackways have been reported from many horizons within the Purbeck Limestone Group (Ensom 1995; Wright *et al.* 1998), spanning the 'Middle Purbeck Beds' and 'Upper Purbeck Beds' (corresponding to the upper part of the Lulworth Formation and the Durlston Formation). They are particularly well-known from the Intermarine Member of the Durlston Formation (Clements 1993: Stair Hole Member of Westhead and Mather 1996) and the Cherty Freshwater Member of the Lulworth Formation (Clements 1993: Worbarrow Tout Member, of Westhead and Mather 1996). Only one potential theropod trackway has been reported from the 'Lower Purbeck Beds' (Ensom and Delair 2007), from the Isle of Portland, and pertains to the Hard Cockle Member (Clements 1993: Worbarrow Tout Member, of Westhead and Mather 1996) of the Lulworth Formation. The ichnotaxon *Taupezia landeri* was established for a small tridactyl footprint from the 'Roach Bed' (bed DB 125 of the Intermarine Member/Stair Hole Member of the Durlston Formation: Clements 1993; Westhead and Mather 1996) of Worth Matravers (Delair 1963) and it was suggested that it represent a small theropod trackmaker.

Some multilayered eggshell fragments with an ornithoid basic type structure (see Mikhailov 1997) have been recovered from the Cherty Freshwater Member (Clements 1993: Worbarrow Tout Member, of Westhead and Mather 1996) at Sunnydown Farm (Ensom 2002b) and may be referable to either a non-avian theropod or avian egg-layer. A number of small bones bearing scratches and pits interpreted as theropod bite marks have also been recovered from the same locality and horizon (Ensom 2002a).

'Wealden Beds' (Valanginian–lower Aptian)

The 'Wealden Beds' exposed in Swanage Bay comprise a thick sequence (>600m) consisting of the upper 'Wealden Shales' (lower Aptian) and lower 'Variegated Marls and Sandstones' (Valanginian–Barremian: Rawson *et al.* 1978). Dinosaur specimens from these horizons are usually found as beach-rolled bones that have eroded out from the cliffs and exposures below sea-level (e.g. Delair 1959): for this reason the exact stratigraphical provenance of each find is usually unknown. Buckland (1835) was the first to report '*Megalosaurus*-like' dinosaur bones from this unit, which were collected by the Rev. F.O. Bartlett. Sadly, Buckland provided few details and the current location of these specimens is unknown. Unspecified '*Megalosaurus*' remains were noted *in situ* from the near the base of the Wealden Beds at Ridgeway (Damon 1860), but the whereabouts of this material is currently unknown (Delair 1959). Delair (1966) suggested that a number of vertebrae and limb elements in the privately-held Newman Collection were referable to '*Megalosaurus*': other 'Wealden Beds' specimens are held in the Dorset County Museum (P.C. Ensom, pers.comm., 2008) and amongst these, theropods may be represented. We have not yet had the opportunity to examine this material in person. Finally, tracks and trackways have also been reported from the 'Wealden Beds' some of which authors have attributed to '*Megalosaurus*-like' trackmakers (Ensom 1995): however, none of these occurrences have been described in detail.

Discussion

Dorset has yielded the remains of five valid theropod taxa: the first of these (*Nuthetes*) was named in 1861 (Owen 1861b) and the most recent, *Duriavenator*, was recognised in 2008 (Benson 2008a). The theropod record of Dorset includes a number of global firsts: *Nuthetes* represents the first dromaeosaurid to be described scientifically (the next dromaeosaurid to be named was *Dromaeosaurus* in 1922, six decades later: Matthew and Brown 1922) and is currently one of the earliest-known taxonomically valid members of this group; and the lowest Bajocian (lower Middle Jurassic) age of *Magnosaurus* makes it a contender for the earliest known tetanuran theropod. Other noteworthy occurrences include *Stokesosaurus langhami*, which offers a rare and valuable insight into the early evolution of tyrannosaurids and also suggests possible palaeobiogeographical links between North America and Europe during the Late Jurassic. *Metriacanthosaurus* was the first sinraptorid allosauroid to be discovered and, along with *Lourinhanosaurus* from Portugal is one of only two known from outside of China, extending our knowledge of the distribution of this clade. Moreover, some Dorset theropods rank among the earliest dinosaurs ever discovered (Buckland 1835). In general, they have had a strong impact on the early development of dinosaur studies and continue to exert an important influence today.

Future discoveries, and the relocation of historical specimens that are currently lost, will be of paramount importance in advancing our knowledge of the Dorset theropod assemblage. More complete material is needed to fully realise the potential of these animals in determining the evolutionary relationships of theropods to each other and the geographical relationships of Dorset dinosaurs with those from elsewhere in the world. Dorset clearly has the potential to yield this material and many surprises may await us: for example, it would be fascinating to recover material of early birds, or definitive material of other theropod groups (ceratosaurs, troodontids, ornithomimosaurians and spinosaurids, for example) that are currently unknown from the county, but which have been found in equivalent strata elsewhere in the UK or in other parts of the world.

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Inferior Oolite (Middle Jurassic) hardgrounds and the associated faunas at Coombe Quarry, Mapperton, near Beaminster, Dorset

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Summary

Coombe Quarry near Beaminster exposes an example of the incomplete succession of Inferior Oolite rocks that typifies South Dorset. There are two large non-sequences within the succession, one in the Lower and one in the Middle Inferior Oolite, that are marked by distinct hardgrounds. These show different features that can be related to their contrasting mode of formation. The first occurrence of Gastrochaenolites lapidicus *within the Inferior Oolite of Dorset is recorded.*

During the Middle Jurassic the area of South Dorset around Beaminster was near the centre of what has become known as 'the Dorset Swell' (Penn 1982; adapted in Callomon and Cope 1995). This part of the seafloor was elevated relative to adjacent areas due to tectonic activity at that time. Its topography, together with syn-sedimentary faulting and differential pene-contemporaneous erosion on a very localized scale, has given rise to thin beds separated by hardgrounds and non-sequences of variable duration and hence large-scale variations in the preserved thicknesses of Aalenian and Bajocian strata over very small distances. Here the term 'hardground' is used to define sedimentary discontinuities at which the substrate became lithified, with evidence of borings or encrustations indicating that the surface lay exposed on the seafloor for a variable length of time prior to further sedimentation. In some cases lithification was followed by physical or chemical erosion resulting in fossils being planed off at the surface; in others unlithified sediment was burrowed and subsequently cemented. In all cases the hardground surface has been preserved by sediment cover.

The stratigraphical succession and palaeontology of Coombe Quarry (Mp-CQ) are discussed in detail in the preceding paper from which the bed numbers and lithostratigraphic names are derived (Chandler and Callomon 2009). The purpose of this communication is to describe two very different discontinuity-surfaces and some of the faunas associated with them.

Lithology and fauna

The Comptocostosum Bed (Bed 2): Lower Aalenian, Scissum Zone, upper part

The top part of the Comptocostosum Bed (bed 2 of Chandler and Callomon 2009) was examined in detail using sawn sections of samples from the centre of the quarry. The bed can be separated into two courses, a lower (bed 2c) and an upper (bed 2d). Bed 2a and bed 2b were not relevant to this investigation.

Bed 2c is a fine-grained, well-cemented, intensely and coarsely burrowed, dark grey ironshot oosparite, with lenses of poorly sorted small to medium-sized ooliths. It is a highly fossiliferous bed containing many horizontally aligned ammonites particularly near the top of the bed as well as large bivalves and gastropods and much shell debris.

Bed 2d is a conglomerate of pebbles, limonite crusts and limonitic pockets in a matrix of densely ironshot, highly ferruginous limestone. It is capped by a flat but somewhat pitted surface covered with stromatolitic crusts, oncolites and masses of serpulids and occasional planed off ammonites and nautiloids. Cavities extend down from the hardground surface for varying depths of about 0.07m which is generally where the separation from Bed 2c occurs. The cavities have narrow openings of from 0.01–0.06m in cross section and open out to as much as 0.10m as they extend downwards. The upper part of many cavities is filled with laminated limonitic layers similar in appearance to sections through a 'snuff box' (Figures 1a and 1b). These upper parts of the cavities may contain masses of serpulids often following the limonitic layers. The deeper portions of the cavities are filled with oomicrite, or in some cases with very fine-grained purplish deposits of uncertain affinity.

A diverse fauna of gastropods and bivalves and ammonites occurs in beds 2c and 2d, the gastropods being particularly concentrated at the base of the cavities where they often lie in pockets of fine-grained purplish matrix. Gastropod specimens are commonly slightly eroded or damaged prior to fossilisation but in many cases fine sculptural detail is well preserved. The bivalves and ammonites in the cavities are usually less than 0.06m in diameter. The following species of gastropods have been identified on the basis of the descriptions by the original authors and the revisions provided by Fischer and Weber (1997).

Ataphrus laevigatus (J. Sowerby)
Cirrus leachi J. Sowerby
Delphinula alta-acanthica Huddleston
Discohelix dundriensis (Tawney)
Discohelix pulchior (Hudleston)
Natica dundriensis Tawney
Perotrochus allionta (d'Orbigny)
Pleurotomaria (Talantodiscus) baugieri d'Orbigny

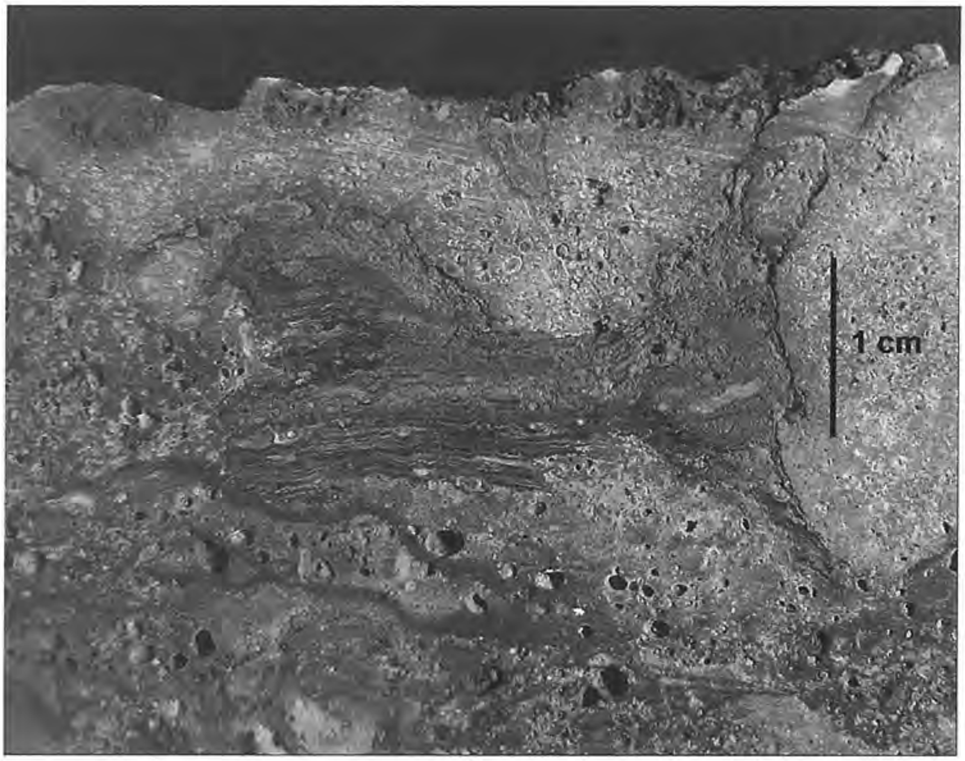

Figure 1a: Sawn section of the hardground at the top of the Comptocostosum *Bed (Bed 2) showing a cavity filled with limonitic algal layers containing serpulids. In some cases the laminae pass around the undersides of the serpulid tubes*

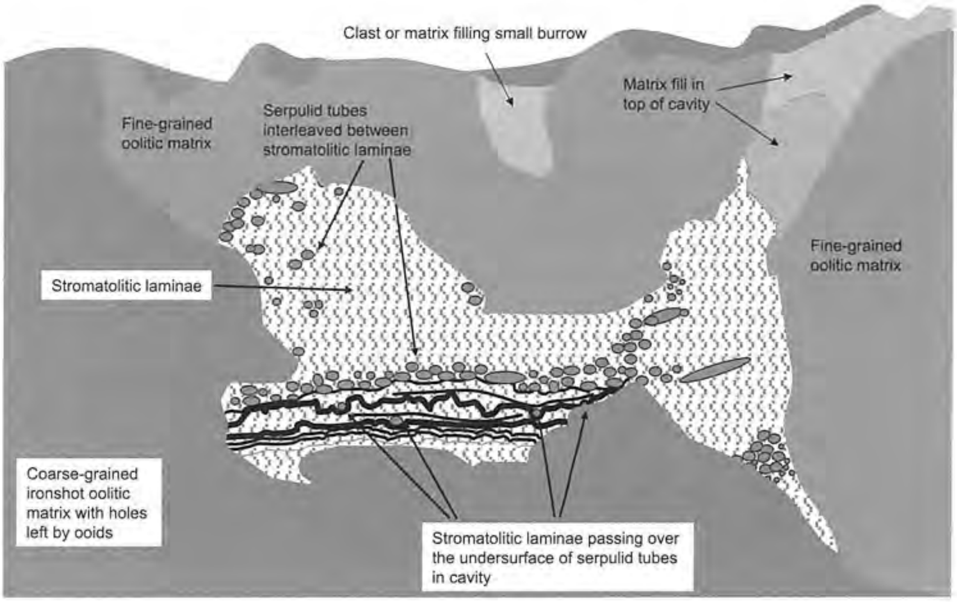

Figure 1b: Schematic drawing of the key features seen in Figure 1a

Pleurotomaria (Talantodiscus) mirabilis J.A. Eudes-Deslongchamps
Pleurotomaria actinomphala J.A. Eudes-Deslongchamps
Pleurotomaria fasciata J. Sowerby
Pyrgotrochus bicingulata (Hudleston)
Pyrgotrochus elongatus (J. Sowerby)
Pyrgotrochus punctata (J. Sowerby)
Pseudomelania lineata (J. Sowerby)
Pseudomelania procera (J.A. Eudes-Deslongchamps)

Disarticulated valves of the bivalve *Cucullea oblonga* J. Sowerby are particularly common both within and outside the cavities. Other bivalves, predominantly occurring in bed 2c are:

Ceratomya bajociana (d'Orbigny)
Ctenostreon pectiniformis (Schlotheim)
Entolium corneolum (Young and Bird)
Gresslya abducta (Phillips)
Gervillella intermedia (Whidborne)
Inoperna plicatus (J. Sowerby)
Pholadomya fidicula J. Sowerby
Pleuromya uniformis (J. Sowerby)
Pseudisocardia cordata (J. Buckman)
Trigonia costata Parkinson

Solitary corals of the genus *Chomatoseris* are frequent. The ammonites are discussed by Chandler and Callomon (2009).

The Horn Park Ironshot (Bed 3): Lower Bajocian, Discites and ?Ovale Zones

This thin bed represents all that is preserved of the Middle Inferior Oolite at this location. The bed has a wedge-shaped development across the quarry, thickening from a barely divisible 0.10m at the western end (containing ammonites indicating Bj-2) to 0.30–0.35m at the eastern end (containing, at the top, ammonites indicating Bj-3–4?), where it is divisible into three courses. The top of the bed is diachronous as where it is thicker it contains ammonites typical of higher biozones. The body of the rock is a medium- to coarse-grained densely ironshot limestone, locally biosparitic, ferruginous, marly to argillaceous, with pockets of very coarse-grained, light brown ooliths in grey matrix; strongly burrowed, with occasional oncolites ('snuff-boxes'). The ammonites are listed by Chandler and Callomon (2009). The commonest bivalves are:

Trigonia costata Parkinson
Plagiostoma richardsoni (Cox)
Isognomon ['*Gervillia*'] *bathonicus* (Morris and Lycett)

The bed was examined in detail using sawn sections from samples collected near the centre of the quarry, where it was about 0.10m thick and easily separated as a single layer from the underlying Comptocostosum Bed (Bed 2 of Chandler and Callomon 2009).

The contact between the Comptocostosum Bed and the overlying Horn Park Ironshot is sharp and flat with the heavily burrowed, encrusted, lithified surface of the Comptocostosum Bed directly overlain by a 0.01–0.02m thick concentration of shell fragments and belemnites generally lying flat and accompanied by iron-staining in a matrix of poorly sorted biomicrite with oolitic lenses. None of the body-fossils appear to be attached to the contact between the beds. The full thickness of the bed contains well preserved macrofossils, the shells of some of the molluscs preserved as recrystallized calcite (Figure 2). Large ammonites are aligned horizontally, though fragments may lie at all angles up to vertical, occupying the upper 0.07–0.08m of the bed. These fragments are sometimes cut across by the sharp and planar erosion surface at the top of the bed. Specimens of *Sonninia (Euhoploceras)* spp. frequently have damaged body chambers, their fragments lying partly attached or close by. Ammonites are encrusted by serpulids primarily on their under surfaces. Bivalves are usually disarticulated and frequently broken. Large ferruginous oncoliths are occasionally present in the lower 0.05m of the bed. Most of the thick shells and the belemnites are perforated by borings ranging from 0.5–2mm in diameter.

The upper surface of the Horn Park Ironshot has a very thin, patchy calcareous limonitic encrustation and is penetrated by infrequent flask-shaped (clavate) borings (Figure 2). The borings have a thin calcareous lining and may be readily recovered intact from the matrix. The necks of the flasks open to the erosion surface and are lined by calcareous laminae. In large ammonites cut across by the erosion surface, a boring may in some cases enter the bodychamber, as seen in the example of a *Sonninia (Euhoploceras)* sp. shown in Figure 3.

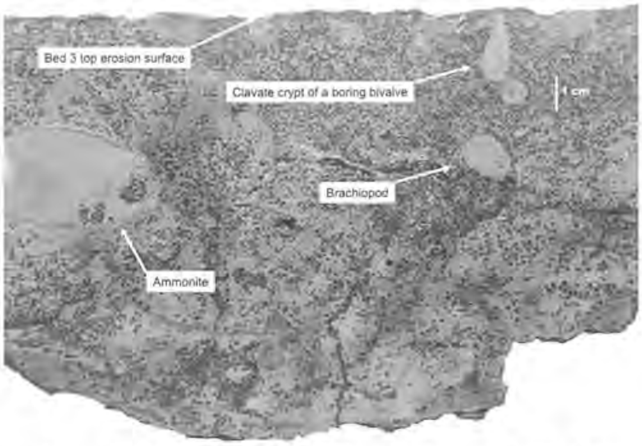

Figure 2: Sawn section of the Horn Park Ironshot (Bed 3) showing a clavate crypt of Gastrochaenolites lapidicus *penetrating down from the top erosion surface*

Figure 3: Sample of Horn Park Ironshot (Bed 3) showing part of a truncated ammonite Sonninia (Euhoploceras) sp. *with a clavate crypt of* Gastrochaenolites lapidicus *which has been partially developed from the matrix. The boring penetrates obliquely downwards into the phragmacone from the top erosion surface of Bed 3*

Discussion

The Comptocostosum Bed (Bed 2)

The hardground at the top of the Comptocostosum Bed contains evidence of a complex series of events resulting from excavation by burrowing organisms and subsequent lithification. The general appearance is very similar to that described for the Bajocian of Calvados (Fürisch 1971) and the proposed processes of its formation are similar. We suggest the following sequence of events: *Thalassinoides*, the feeding traces attributed to semivagile and vagile deposit-feeding decapod crustaceans (Neto de Carvalho *et al.* 2007) were made in firm sediment. The upper surface of this sediment was then lithified to form a hardground while the lower part remained soft. Surface erosion occurred and the *Thalassinoides* were enlarged, perhaps by chemical dissolution, bio-erosion, current action and collapse, to form pockets of varying size which became partially filled with sediment and then colonised by layers of serpulids and stromatolites. Finally shallow marine oncolites and stromatolites were deposited on the hardground surface.

In the case of the Comptocostosum Bed at Mapperton, the tops of many burrow cavities are filled with limonitic laminae. The laminae are interleaved with layers of serpulids and serpulid tubes occur as masses sometimes on the under surfaces of the putative cavity roofs. The laminae underneath the tubes sometimes pass around them as though they were deposited after the tubes grew as seen in Figure 1a and 1b. This arrangement of the serpulid tubes between the limonitic laminations strongly suggests that the serpulids grew on the base of the laminae and thus that the entire laminated structure of successive layers of laminae and serpulids grew downwards from the top of the cavity into the space below. Difficult as this is to imagine it accords with the view put forward by Palmer and Wilson (1990) that the accreting side of 'snuff boxes' was downward facing. The preference of serpulids to grow in cavities and on under surfaces is also seen in the Horn Park Ironshot (see below). The characteristic corrugated structure of the laminates typifies them as laminae formed by stromatolites (Radley 1986). By analogy with modern stromatolites they are thought to have been formed by carbonate sediment trapped by mats of blue-green algae and bacteria. Although they typically occur today in shallow water facies they are not dependant on photosynthesis and may grow at depths of 1,000m or more.

The occurrence of gastropods, together with small disarticulated bivalves and ammonites, in pockets of the fine-grained purplish matrix at the bottom of apparent burrows, suggests that they may have been washed into them by current action. However we cannot exclude the possibility that the purplish matrix was laid down before the burrowing and formation of the hardground and was moved into the cavities by bioturbation. There is no evidence to suggest that this is a dwarf or juvenile fauna inhabiting the burrows.

The Horn Park Ironshot (Bed 3)

The 'tumbled' orientation of quite large ammonites and the presence of shell fragments and ammonites spanning almost the full thickness of the Horn Park Ironshot indicates very active bioturbation by large burrowers. Much of the shell damage can probably be attributed to this. This suggests that the sediment was unconsolidated for the duration of its deposition, an interpretation furthered by the common occurrence of the infaunal bivalve *Trigonia costata*.

Sedimentation of the Horn Park Ironshot at Mapperton was probably slow as indicated by the presence of oncolites ('snuff boxes') (Gatrall *et al.* 1972). These curious structures are at present believed to have originated when fragments of shell or other debris were coated by mucilaginous bacteria active at depths in and beyond the photic zone. These coatings in turn trapped and were covered by successive concentric crusts of sediment rich in ferric iron. The evidence suggests that they accumulated as concretions lying free on a sea bottom where there was current winnowing (Palmer and Wilson 1990). This may also explain the concentration of shells and fragments at the base of the bed and the presence, on the underside of ammonites, of serpulids that typically grew on the roofs of cavities beneath shells where sediment has been washed away (Palmer and Fürsich 1974; Hallam 1975, 66; Palmer and Wilson 1990). However the regime must have been one of relatively low energy as most of the fossils are well preserved, lacking mechanical abrasion and curved shells lie both concave and convex side uppermost suggesting little current sorting (Hallam 1963). The damage that has occurred is probably the result of bioturbation and predation rather than current action as fragments of ammonites often abut the specimens from which they are derived. On the larger scale, the Lower and Middle Inferior Oolite of Dorset as a whole is remarkable for the absence of any signs of higher-energy water movements, such as cross-bedding, suggesting an enduring position below storm-wave base.

The small irregular borings which are very common in shell fragments and belemnites are typical of the ichnogenus *Entobia* and may possibly be attributed to the activity of the sponge '*Cliona*' sp. (Palmer and Fursich 1974).

The occasional flask-shaped clavate crypts at the top of the Horn Park Ironshot exhibit a thin calcareous lining with concentric laminae around the neck and, based on their shape, can be assigned to the ichnospecies *Gastrochaenolites lapidicus* Kelly and Bromley 1984. The supposed inhabitants of the borings were bivalves of the genera *Lithophaga* and *Gastrochaena* (Kelly and Bromley 1984). These shells bore into the substrate when young and grow in the crypt by enlarging it. The narrow siphonal tube is an adaptation to escape predation by surface dwelling organisms (Carter and Stanley 2004). Lithophagid and gastrochaenid species appeared in the late Triassic and have been described from the European Middle and Upper Jurassic (Fürsich *et al.* 1994), though, as far as we are aware, this is the first record from the Inferior Oolite of Dorset. Their presence, together with the planed off macrofossils, unequivocally indicate that this hardground was cemented before being eroded. The very flat smooth surface at the top of the Horn Park Ironshot suggests that the abrasive action of a temporary mobile sediment cover was probably the dominant erosive agent, though bioerosion may also have made a contribution (Goldring and Kazmierczak 1974).

The bed commences with ammonite biohorizon Bj-2 extending up to Bj-3–4? in some places at the eastern end of the quarry (Callomon and Chandler 1990). However where it is only 0.10m thick in the centre of the quarry this residual part of the bed may represent a shorter time frame, possibly only Bj-2 or even a small part thereof. The presence of fossils spanning the full thickness of the bed where it is at its thinnest suggests that it remained unconsolidated for the duration of its deposition. Above the erosion surface at the top of the Horn Park Ironshot there is a non-sequence spanning the Ovale to Garantiana zones, faunal horizons Bj-5–Bj-23. This massive gap of five ammonite zones above the erosion-plane probably represents a duration of some 4 million years (Callomon 1995) and the variation in thickness of the Horn Park Ironshot around the quarry suggests that sediment may have been repeatedly deposited and removed during this time. The infrequency of borings suggests that the hardground was only exposed for a small part of this time or suffered significant late erosion.

The two hardgrounds that we have described show very different features. The surface of the Comptocostosum Bed is a hardground at the top of a highly condensed succession that has been burrowed in a semi-consolidated state, lithified and undergone surface colonisation followed by a long period of non-deposition, with oncolite growth. In contrast the top of the Horn Park Ironshot is a hardground in sediments that were lithified and then planed off by erosion as indicated by the sections of ammonites and other fossils and the planar nature of the surface. This surface has then been bored by bivalves to produce clavate crypts, described here for the first time from the Inferior Oolite of Dorset. There is no evidence to indicate to what extent the non-sequence above the bed, or the diachronous nature of its upper surface, represents the removal of material or non-deposition.

Acknowledgements

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The sources and distribution of Roman Purbeck Limestone roofing slabs

JOHN PALMER

Summary

Data from the writer's inventory of Roman Purbeck stone are used to show the geographical distribution of Purbeck Limestone roofing slabs. An attempt is made to identify the routes of distribution from quarries to building sites. It is concluded that while south Dorset was self-sufficient in this material, most of the Purbeck Limestone roofing found in south Wiltshire, north-east Dorset, and even west and north Hampshire, was obtained from south Wiltshire quarries. There is a lack of evidence for shipment of this material from south Dorset to Hampshire via Southampton Water.

Introduction

Since 1996 the author has been collecting data on the occurrence of Purbeck Limestone (PL) artefacts on Romano-British sites, and organising them in a database, which is open to public inspection on the World Wide Web (Palmer 2002, 2005).

PL studies have often concentrated on the so-called 'Purbeck Marble', a fossiliferous limestone filled with small snail-shells which give an attractive appearance when polished. The importance of this stone for decorative and architectural purposes, both in Roman and in medieval times (Beavis 1971; Leach 1978), has tended to distract attention from the rougher and less distinctive sorts of PL, which are also of archaeological importance. Recently Professor Fulford and his colleagues have done much to call attention to the complex and interrelated stone industries of the Purbeck area in the Roman period (Allen and Fulford 2004; Allen *et al.* 2007). The present paper will describe a rather different industry, which was based on PL, but was not solely or even primarily dependent on quarries in the Isle of Purbeck.

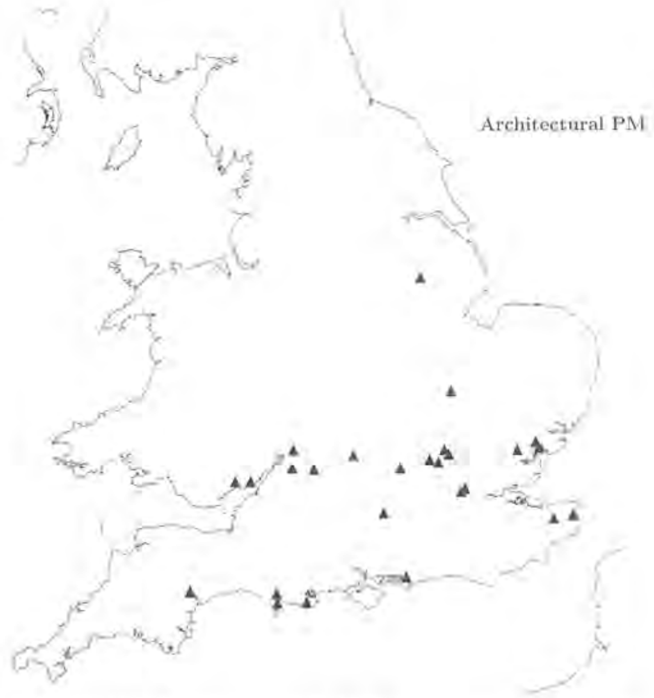

Figure 1: Distribution of Purbeck Marble (PM) architectural items

Purbeck Limestone roofing material

Roman buildings of stone or brick were commonly roofed with either clay tiles or with natural stone slabs ('slates'), or a combination of the two. Mixed stone and ceramic roofing was found, for instance, at Colliton Park (Drew and Collingwood Selby 1938) and Dewlish (Putnam 1972). Stone slabs might be used wherever a source of suitably thin-bedded and splittable stone was available. Their typical shape and manner of use is described in Palmer (2002).

It is, of course, a truism that objects made from scarce material are often carried far from their place of origin, while those of commoner stuff remain close to their source, particularly if they are heavy or bulky. Purbeck Marble was a high-value material in Roman Britain, and architectural ornamentation of Purbeck Marble is distributed very widely in Britain (Figure 1). Small portable artefacts may also become widely distributed; for instance Purbeck Limestone mortars, whether made of Purbeck Marble or of the less prestigious kinds of PL such as Burr, are also widely scattered across Britain (Figure 2). On the other hand, the distribution of PL roofing material is much more localised (Figure 3).

Figure 2: Distribution of Purbeck Limestone (PL) mortars

Figure 3: Distribution of Purbeck Limestone stone roofing material

The distribution of PL roofing is remarkable because most of the finds, apart from the expected concentration in the Isle of Purbeck itself, lie in a band of country that extends for some 100km west to east, but hardly exceeds 20km in breadth. This band is geologically Chalk country. The paradox of PL roofing is that it was employed in an area that corresponds remarkably well to the outcrop, not of PL, but of the Chalk; to the south-east it verges into the Tertiary gravels. This band or area includes much of central and north-east Dorset, south Wiltshire, and west and north Hampshire. Williams (1971), in his review of Roman building materials in south-west England, says 'A distribution that does not go north of Wilts or east of Hants is supported for Purbeck roofing material'. In the present writer's database there are many other sites with PL roofing besides those listed by Williams, but even so, none have been found that contradict Williams' statement.

The main objective of this paper is to try to explain this curious geographical distribution of PL roofing in Roman Britain. To begin this task, it is necessary first to consider the places where PL roofing material could be won from the ground. Here it will be useful to use a map on a larger scale (Figure 4).

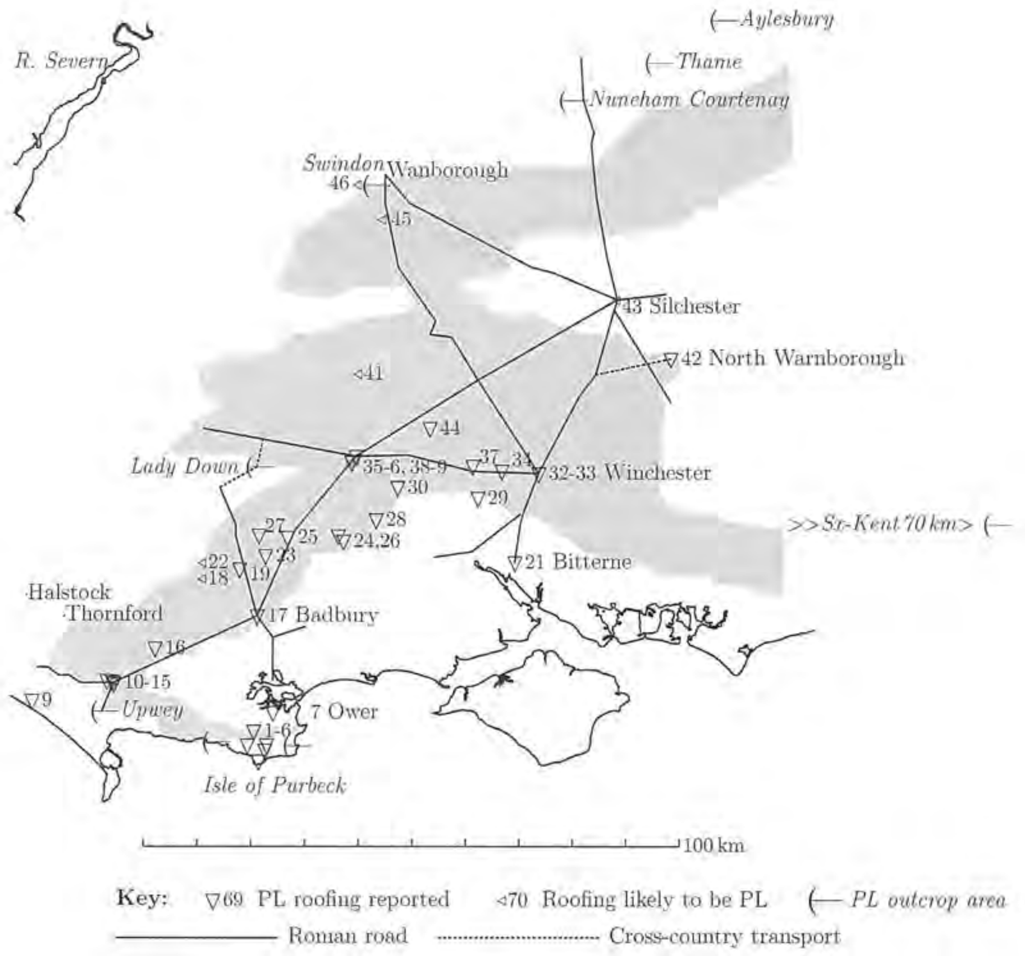

Figure 4: Purbeck stone roofing material, larger scale. Large triangles, sites with reported PL roofing; smaller triangles, sites with stone roofing judged likely to be PL because of the proximity of PL quarries or of other sites with PL. The shading shows the approximate extent of Chalk country in the mainland

Purbeck Limestone sources in Britain

The strata of the Purbeck Limestone Group crop out in five distinct parts of Britain (Arkell 1933). In Figure 4, these areas are marked with pick-axe symbols.

South-east Dorset

This area includes not only the linear outcrop in the Isle of Purbeck, from Swanage in the east to Worbarrow Tout in the west, but also many other patches further westwards, as far as Portesham. In the Isle of Purbeck the outcrop is an east-west band, terminated by the sea at Swanage in the east and Worbarrow Tout in the west. Between those points there is a wide choice of places where it would be practicable to extract roofing stone. In modern times the so-called Downs Vein, also called Upper Building Stones or Intermarine Member (Clements 1993), is particularly noted for producing good slabby roofing stone.

Westward of Worbarrow the outcrop runs out to sea, and appears in the cliffs from Mupe Bay to Durdle Door, but access is difficult and the strata greatly reduced in thickness. However, further west the strata recover in thickness, and there are various sites that have been quarried in modern and no doubt in ancient times. Particularly important is the site of the great quarry at Upwey on the Ridgeway. This was intensively worked in the 19th century but, since it lies right beside the Roman road from Dorchester to a port on the Wey (Farrar 1952, p. 94–99), it has long been identified as the likely source of the PL in Roman Dorchester, which includes several finds of roofing material. At Upwey the Purbeck beds have almost the same thickness that they have in the Isle of Purbeck itself, and include most of the same strata, including those most prized for roofing purposes. The pick-axe symbols on the map are placed approximately at Swanage, Worbarrow Tout and Upwey.

South Wiltshire

The Vale of Wardour and the Nadder valley, around Tisbury. Several quarries in this area are reputed to have been used in Roman times, as mentioned by Andrews (1884) and Stallybrass (1906, p. 421–2). Many of them are in the Portland beds rather than the Purbeck, but all the PL quarries lie within about 5km of each other. Among them, the most likely source for PL roof slabs in the Roman period is on Lady Down, around National Grid ST 959 308. This is recognised as a quarry site on the map of Roman Britain (Ordnance Survey 1991). The geology here is Middle Purbeck (British Geological Survey 1976), a term which includes the Downs Vein of the Isle of Purbeck. The evidence for Roman use is circumstantial and indirect, as is not uncommon with ancient quarries. The National Monuments Record (NMR) at Swindon has aerial photographs from 1946 and 1952 showing small quarry pits over some 11 hectares which were also faintly observable on the ground. Close by is (to quote the local website: *www.naddervalley.co.uk/28.html* (last accessed on April 21, 2009)) 'Pits Wood, or Pugpits as it used to be called, . . . on the north slope of the hill between Chilmark and Tisbury, next to the road. . . . It is ancient woodland of oak, ash and thorn. The Romans dug small opencast quarries there to get stone for their buildings. These deep pits are now overgrown.' The NMR says it contains approximately 12.5 hectares of pits. Just south-east is the 19th century Lady Down quarry, of which Stallybrass (1906, p. 421–2) says 'on Lady Down till recently stone tiles were quarried equal to any in hardness, evenness and readiness of bed'.

Swindon

A very small area of PL in north Wiltshire. The principal quarry site for PL in modern times was the Town Quarry (Sylvester-Bradley 1940). Nearby, archaeological excavations (Thamesdown Archaeological Unit 1986) have revealed Romano-British quarry workings in the PL strata. Swindon also has an outcrop of Portland stone, and 'Swindon stone' (whether Purbeck or Portland is unclear) was used in the Roman town at Wanborough (Passmore 1914, 1922, 1937, 1948). Roman stone roofing (not clearly specified as PL) has been recorded close by at Okus, Swindon (Passmore 1899) and Draycot Foliat (Burnham *et al.* 1997).

Oxfordshire and Buckinghamshire

Here PL outcrops in small areas from Nuneham Courtenay (near Oxford) through Thame to Aylesbury. In these areas there appears to be no evidence of Roman quarrying, or of local use of the stone in the Roman period; it will be necessary however to consider these outcrops as possible sources for PL roofing finds in north Hampshire.

East Sussex and West Kent

Around Battle, Heathfield and Mountfield (Lake *et al.* 1987). These authors describe modern quarrying by 'bell-pits', but there is no evidence of Roman quarrying; the remarks on bell-pitting in Dunning (1949) should not be taken as referring to anything but modern working. In any case, this area lies far from any find of Roman PL roofing (in fact off the map in Figure 4), and need not be discussed further in this paper.

Quarry sources and routes of supply

About forty sites with Roman PL roofing material are recorded in the writer's database. These sites are identified by numbers in Figure 4, and a list of them, with a fuller description of each, is given at the end of this article. The problem is to try to identify from what sources the roofing stone was obtained, and by what route it was brought to the building sites.

For this purpose lithological evidence, comparing the stone in the roofing slabs to stone in the quarries, is not very helpful. The Purbeck Limestone includes rocks of many visibly different kinds, but there are few recognisable types or *facies* of PL that are distinctive of a particular source. Purbeck Marble is an exception, for it is found only in the Isle of Purbeck (Beavis 1971), but it was hardly ever used for roofing; the writer knows of just one instance, no. 2 in the list. All geological reports on PL roofing slabs are non-committal about where the material was quarried; see, for instance, numbers 27 and 28.

In the absence of lithological guidance one must go on the common-sense assumption that Roman builders would normally get their materials from the nearest available source; not necessarily the nearest in a direct line, but that which involves the least cost or greatest convenience. The area in which Roman PL roofing was employed is remarkable for its network of Roman roads, which includes some of the principal trunk routes of Roman Britain (Ordnance Survey 1991). These roads are marked by solid lines in Figure 4. We can assume that these roads were available for civilian transport purposes during the time that most of the buildings were being erected.

Not all the building sites, and few of the quarries, are close to one of these roads, but we may suppose that the carriers, whether using wagons or pack-animals, would follow the road as far as possible and take the shortest cross-country route where needed. Some of the assumed cross-country routes are marked with closely-spaced dots in Figure 4.

It is particularly easy to calculate distances along Roman roads from National Grid coordinates. Each straight segment of road is the hypotenuse of a right-angled triangle; the other two sides can be measured respectively as the difference of the eastings of the two end-points, and the difference of the northings of the same points. Summing the lengths of the segments gives the total distance travelled. For simplicity, distances along cross-country routes have been computed by the same method; of course this tends to underestimate cross-country distances, but so long as these form a small proportion of the total journey, this kind of error will not invalidate the conclusions that follow.

The discussion will be complicated by considerations of sea transport as an alternative to overland. One may assume that, as in other historical periods, sea was much cheaper, mile for mile, than road. But *how* much cheaper is less clear, and one also has to consider the different risks involved, and the costs of transhipment when a bulky load has to be moved from ship to wagon or muleback, or vice-versa.

To avoid repetition, the sites will be taken in geographical groups, chosen so that the transport considerations are similar for all the sites in each group. The road-numbering of Margary (1955) is used, but Margary's numbers are not shown on the map to save confusion with the site-numbers; it should be plain from the text which roads are meant.

Geographical groups of sites

The Isle of Purbeck

The Isle of Purbeck itself, mainly south of the Chalk ridge. includes the sites numbered 1–7. The obvious source of roofing stone for these sites is the limestone ridge in Purbeck itself.

Around Dorchester

Not only in Dorchester itself (numbers 10–15), but also westward to Puncknowle (9), and eastward to Dewlish (16). This group of sites would be most conveniently supplied from the various outcrops of PL that lie west of Purbeck, especially those on the Ridgeway near Upwey. The Roman road from Dorchester to the presumed port at Radipole crosses the Ridgeway right next to the great Upwey quarry which was worked in the 19th century. It seems very likely that this was also the site of Roman quarrying, and was the source of the PL found in Roman Dorchester. The finds at Puncknowle to the west, and Dewlish to the east, are also naturally within range of the Ridgeway quarries.

The Tarrant Hinton group

This group of sites (numbers 18, 19, 22, 23, 25, 27) is nearer to the Wiltshire quarries than to any source in Dorset. Taking Lady Down as representative of this group of quarries, the distance by road to any of these sites from Lady Down is less than that from Upwey or any other PL exposure on the Ridgeway, and *a fortiori* less than from any in the Isle of Purbeck. Stone could have been brought to this area by the Roman road that extends northwards from Badbury (Margary 46), which runs close to the Tarrant Hinton site.

Some writers have clearly recognised that the source of stone for these sites is likely to have been in Wiltshire. Hutchins (1863, p. 547) describes the roofing at Gussage St Andrew (23) as 'Tisbury stone', and about Woodcuts (27), Pitt-Rivers (1887) writes 'The nearest stone of this kind is between Wardour and Tisbury, 6 miles north.' Pitt-Rivers was probably thinking of the Wockley quarry (ST 955 287), which lies 10.6km from Woodcuts in a straight line; Lady Down is only 2km further. The actual haulage distances would, of course, have been greater than this.

Badbury Rings

This site (number 17) is almost equidistant, by road, between the Ridgeway quarries and the Wiltshire ones. It is 35km from Upwey, via Dorchester, and 33km from Lady Down, assuming that stone was transported from the quarries to the nearest point on Margary 46, and thence down that road to Badbury. In this calculation the cross-country section, from Lady Down itself to the road, has been treated as a straight line, which of course it was not, so the two alternative journeys may have been more nearly equal than the calculation suggests. On grounds of distance, then, the find of Purbeck

Limestone roofing material made at Badbury (Papworth 1997, 2001) seems equally likely to have been obtained from either source.

The Downton and Rockbourne group

These sites are numbered 24, 26 and 28. These also would be supplied most conveniently from the Wiltshire quarries; the distance is *c*. 25km as the crow flies. There is no obvious direct route by Roman roads, but all other possible quarry areas are clearly further away.

The Salisbury-Winchester group

This large group may conveniently be taken together because they lie around the west-east, Sarum-Winchester Roman road (Margary 45a). For this group, the question arises whether they were supplied with stone from the Wiltshire quarries to the west, or by the sea route from south Dorset through a port on Southampton Water, probably at Bitterne, Southampton (21).

There is a notable group of finds in the area of Roman Salisbury itself (numbers 35, 36, 38 and 39). The East Grimstead find (30) is very close and may be considered at the same time. All these sites are close to the Wiltshire quarries. The distance to Old Sarum from Lady Down is about 23km, crossing by the most direct route from the quarry to the Roman road (Margary 45b), and then following it to Sarum. For these sites, supply by the sea route seems unlikely, as Sarum lies some 52km from Bitterne (using the obvious road via Winchester, Margary 42b and then 45).

Sites in the same group but further east than this include Kings Somborne (37), Sparsholt (34), Winchester itself (32, 33), and also some sites listed by Scott (1988) for which the writer has been unable to obtain further documentation: Wallop (44) and Braishfield (29). For these, supply of stone could perhaps have been by sea from Purbeck to Bitterne, from which the stone would be carried by road the 20km, or so, to Winchester. The economic choice between this source and the Wiltshire one depends on the relative costs of road and sea transport.

The fact that PL roofing has been found at Bitterne itself (Williams (1971, p. 178), and Andrew Russel, pers. comm.), suggests that Winchester could have been supplied by sea through Bitterne, and the other places from Winchester; but the distance to Lady Down is 57km, just over three times that to Bitterne which is 17km. Bitterne however is not the ultimate source; a considerable sea voyage must be added. It appears that for supplying Purbeck roofing stone to Winchester, the advantage only lies with the sea route if the cost of getting stone from the quarry in Purbeck to Bitterne by water is less than that of carrying it some 40km (57 minus 17km) by road.

If Bitterne were supplied from Purbeck there must have been an exporting port, which would probably be on the south shore of Poole Harbour, considering that it was from this area that Purbeck stone was shipped in medieval times (Legg 1989, p. 17). The site at Ower (7) is the obvious candidate for the Romano-British port. PL roof slabs were found there, but not yet pierced for nails, so not used for roofing a building on that site, as reported by Sunter and Woodward (1987, p. 105) and Cox and Hearne (1991, p. 175). Woodward thought it unlikely that they were being manufactured at Ower, but they still might have been shaped elsewhere and brought to Ower for loading into a coastal craft; instead of all of them being shipped out, some might have been diverted to post-packing and cist construction as Woodward suggests. Against this idea, it is worth noting that no Roman PL roofing seems to have been recorded from the Isle of Wight, though from Ower it is a shorter voyage to the Island than to Bitterne. In short, though there is little evidence for shipping stone through Ower, if any stone was sent from Purbeck by sea, Ower to Bitterne still seems the most likely route. The distance by sea is around 70km, but the main cost of moving stone by this route would be in getting it to Ower from the quarries and transhipping it at the two ports. Unfortunately we lack the data that would enable us to compare this cost with that of carrying the stone any specified distance overland. In the end the most that can be said is that Hampshire building sites *might* have been supplied by sea, but that it would also have been practicable to supply those same sites from Wiltshire by road.

For many places west of Winchester, the land route from the Wiltshire quarries has a clear advantage over the sea route. For Sparsholt (34), 50km from Lady Down and 24km from Bitterne (via Winchester, which seems the likely road taken) the sea route is economically preferable only if the cost of shipping from Purbeck to Bitterne is less than that of 26km of road transport. For Kings Somborne (37), 45km from Lady Down and 30km from Bitterne, the sea route pays off only if the cost of shipping from Purbeck to Bitterne is less than that of 15km by road.

For places still further west, including Wallop (44), Netheravon (41) and East Grimstead (30), the land route is definitely advantageous, even if we suppose the cost of the transit from Purbeck to Bitterne by sea, including transhipment, to be *nothing*. But since it was clearly far from zero, the real break-point, east of which the Wiltshire source was uneconomic, must lie to the east and south of here.

It appears therefore that, on balance of probabilities, sites in the gap between Salisbury and Winchester were supplied down the Salisbury road from Wiltshire quarries. It is a small step from that to suggest that the same was true for Winchester itself (32, 33). For Winchester, the advantage lies with the sea route only if the cost of getting stone from the quarry in Purbeck to Bitterne by water is less than that of carrying it some 40km by road.

Places further north-east of Winchester

For these sites, the case is similar to that of Winchester itself. For instance, North Warnborough (42): from Lady Down, this is 93km via Winchester and about 98km via Silchester, but 53km from Bitterne, so the sea route would pay if it were cheaper than 40–45km of road transport. This result is the same as for Winchester, which is not surprising as the supply route to North Warnborough must pass either through or quite close to Winchester, whether the stone be brought from Wiltshire, or from Purbeck via Bitterne.

On the other hand it should be noted that North Warnborough is only about 73km from Swindon or 60km from Nuneham Courtenay (via Silchester in each case), so it is possible that the North Warnborough PL came neither from south Wiltshire nor from south Dorset. On the other hand, PL roofing was in use at Winchester in large quantities, and it would not be surprising if a portion of that material were surplus the needs of Winchester builders, but found a buyer further to the east.

The Swindon area

These sites (numbers 44 and 45) used local roofing stone, as noted by the excavators, who regarded this as so commonplace that they did not describe it by any more precise geological term. But it is highly probable that it was Purbeck stone. Swindon has both Portland and Purbeck stone, but Portland stone is less likely as roofing material, since it tends to be massive rather than thin-bedded.

Discussion

Several authors, writing about Roman sites in the area where Wiltshire, Dorset and Hampshire meet, have stated their belief that the PL found on those sites was probably quarried in the Wardour Vale area, for instance Pitt-Rivers (1887), Rahtz (1963, p. 326), Moore as reported by Beavis (1971), Hutchins (1863, p. 547) taken with Green (1991). Other authors, though, have not been prevented from assuming that PL found in Wiltshire must have come from the Isle of Purbeck itself; Williams (1971) makes this assumption for East Grimstead, and so does Cunliffe in the Victoria History (Crittall 1973, p. 450), though the analysis here should make clear that this is unlikely.

The data presented here suggest that, in the Roman period, quarries in the South Wiltshire PL outcrop area supplied roofing material to a wide area including south-east Wiltshire, north-east Dorset, and much of Hampshire, including Winchester and maybe as far away as Silchester. The PL outcrop in Wiltshire has thin-bedded limestones that lend themselves well to being split into roofing slabs. The 'customer' area of this industry is geologically Chalk, which provides excellent foundations, plentiful water-supplies, and adequate building materials, but neither fissile stone for roof slabs nor clay for making tiles; so it is not unnatural that Romano-British builders in this area should import natural stone roofing.

Williams (1971), while recording that Roman PL roofing is not found north of Wiltshre or east of Hampshire, says nothing about the westward limits of PL roofing but, from the present data, one can go some way towards answering the question that he leaves open. As we have seen, it is common in south-east Dorset, but absent from the west of Dorset though frequent in the north-eastern corner of that county. In Wiltshire it is confined to the south, apart from the neighbourhood of Swindon, and in Hampshire apparently to the west and north. The lack of distribution northwards and westwards from Dorset and South Wiltshire may perhaps be explained by the fact that the country to the north and west has its own sources of slabby stone for roofing. For instance, at Halstock (Lucas 1993, p. 109, 111) and at Thornford (Buckman 1877) the local Lias was used. The Old Red Sandstone of the Mendips was also used at Halstock. Apparently it was also used on one building in Salisbury (Algar 2002, p. 23), even though this must have been significantly more expensive than PL from South Wiltshire.

Winchester is close enough to tidewater at Bitterne for it to be very natural to assume that the PL roofing found there was brought in by sea. The present analysis shows, however, that sites in and around Winchester can also be seen as an eastward extension of the area supplied from South Wiltshire, as the supposed economic advantage of obtaining supplies by sea is far from clear-cut. If this is true of the Winchester area, the same applies to sites to the north and east as far as North Warnborough, Hants, since the supply route to them inevitably passes close to Winchester, whether the ultimate source is in south Wiltshire or in south Dorset. These sites might however have been supplied from nearer sources at Swindon or even near Oxford.

On the other hand, Romano-British PL roofing in *south* Dorset must undoubtedly be of South Dorset origin. The find of PL roofing at Badbury Rings, of late Roman date (Papworth 1997, 2001) is close to the natural economic break-point between a southern area which used Dorset PL, and an northern one that used the south Wiltshire quarries, and the roofing found here is equally likely to have come from either source.

Conclusion

This analysis shines a small light into a small corner of a distant period. In spite of the massive and lasting evidence of Roman roads, we still know little enough about the nature of the traffic on them, and freight transport in particular. Here, though, in southern Britain, we can see how good roads aided the builders of the time and the traders who supplied their needs. Here hauliers did not share the troubles of the northern merchant who wrote 'I would have fetched those hides from Catterick except I didn't care to hurt the animals while the roads are bad' (Bowman and Thomas 1994, tablet 343). Good communications opened up possibilities, and allowed more freedom of choice to builders and their clients. Without good roads we would have been unlikely to see Mendip stone used at Salisbury (site no. 35) when Wiltshire stone was also available from a nearer source, and without them the use of Purbeck stone would hardly have spread so far into the Chalk country. Roofing slabs were a conveniently divisible load and, no doubt, went by wagon when possible, but could be distributed across the packs of many mules if it were necessary to transport them for a distance off-road.

Acknowledgements

The author thanks the Editor for discussions that led to the choice of the word 'slabs' rather than 'slates' or 'tiles', since 'slate' tends nowadays to suggest the Welsh product, and 'tiles' are normally ceramic.

List of Roman sites with definite or likely Purbeck Limestone roofing material

Sites are identified by the same numbers as in Figure 4.

1. St Aldhelm's Head, probably at SY 9633 7597; Royal Commission on Historic Monuments (1970, 474). On display at the Square and Compass public house, Worth Matravers (Mr C. Newman). 6 roofing slabs of shelly limestone, displayed as on a roof. Mr Newman identifies them as Downs Vein, except for one that has bivalve fossils.

2. Compact Farm, Worth Matravers, SY 975 780; Hinton (2002, p. 42). Three pieces of Purbeck Marble slabs which is unusual for roofing, but is locally available.

3. Compact Farm, Worth Matravers, SY 975 780; Hinton (2002, 42). Pieces of Purbeck Limestone slabs, other than Purbeck Marble, some with peg-holes but none complete.

4. Encombe, SY 9427 7898; Farrar (1955, 80), Farrar (1967, 120). Romano-British building and shale armlet manufacturing site near the Obelisk, Encombe. The 1955 report describes a rectangular pit lined on three sides with reused hexagonal roofing slabs of PL.

5. Gallows Gore, Lander's Quarry, SY 9782 7901; Calkin and Piggott (1939), Calkin (1948, 1949, 1953), Royal Commission on Historic Monuments (RCHM; 1970). Occupation continuous from late Iron Age to late Roman (RCHM). Calkin (1948) records a rectangular chamber about 4ft 6in by 3ft of Purbeck flagstones set on edge, which appeared to be reused roof tiles, and two similar chambers in the vicinity.

6. Bucknowle villa, SY 9545 8154; object on display (2008) in Langton Matravers (Coach House) Museum. A roof slab, 49 × 29.5 × 1.5cm, hexagonal, with the left side leaning in somewhat towards the top; one nail hole, slightly to one side of the centre of gravity. The donors had worked on the excavation of the Bucknowle villa (Reg Saville, pers. comm.). The museum label says the stone is probably from the Downs Vein, and gives the date as 1st century, but the site was occupied from 5th century BC to 4th AD. Final excavation report in preparation; meanwhile see Farrar (1976), Keen (1977, 1978, 1979, 1980), Collins and Field (1981), Field (1982), Collins *et al.* (1983, 1984, 1985, 1986, 1987, 1988, 1989).

7. Ower, south shore of Poole Harbour, SY 99 85; Keen (1979, 112–3), Sunter and Woodward (1987, 100, 105), Cox and Hearne (1991, 77, 175). Woodward *in* Sunter and Woodward (1987, 100) gives 17 complete limestone roofing tiles, 15 of which were in 3rd–4th cent. occupation and structures, 2 in post-Roman agricultural disturbance; (p. 105) paucity of material, lack of fixing holes and inconsistency in size indicate that none had actually been used for roofing; some used for post-packing and cist construction. Not likely to have been manufactured here for export because the site is far from the source of raw material. J.M. Mills *in* Cox and Hearne p. 175, gives 5 Purbeck limestone roof tile fragments, from 1st to 4th century contexts; like those recorded by Woodward, without nail holes, and may not have been used as roofing material; possibly in course of manufacture.

8. Not used.

9. Puncknowle, SY 5399 8730; Bailey (1986). The writer notes that there is at least one large Purbeck Limestone rooftile from this site in the Dorset County Museum reserve collection (DORCM 1988.13.3), which is not mentioned in the cited excavation report.

10. Charles St, Dorchester, 1989–1990, SY 6935 9045; Adam (1991), Davies and Farwell (1990). Seven roof tiles of Roman pattern. Not individually described in the publications cited, but identified by Kathryn Knowles (pers. comm.) as Purbeck Lower Building Stones, i.e. Cherty Freshwater Member (Clements 1993). Dorset County Museum reserve collection (DORCM 1996.31).

11. Greyhound Yard, Dorchester, 1981–1984, SY 693 906; Woodward *et al.* (1993). Stone roof tiles, mostly very fragmentary, only 10 complete enough to describe. Identified by Paul Ensom as Middle Purbeck limestone, except for one which may be lower Lias.

12. Colliton Park, Dorchester, 1937, SY 690 909; Drew and Collingwood Selby (1938). The building (now exhibited as 'The Roman Town-House') was roofed with stone slabs, except for the two stoke-holes which seem to have been covered with ceramic tiles.

13. Dorchester Prison, 1858, SY 693 909; Oliver (undated), Bingham (1859). Bingham quotes J.V. Lawrance, prison governor. A set of these roofing slabs is exhibited in the main hall of the Museum. Their appearance is consistent with their being PL. Dorset County Museum reserve collection (bay 158 shelf B) includes 1 'portion of the roofing of a Roman house exhumed in the grounds of Dorchester castle, August 1858'. The Castle is the site of the Prison.

14. Not used.

15. Poundbury, Dorchester, 1966–1980, SY 68 91; Farwell and Mollison (1993). Limestone roofing slabs re-used as stone linings and cists in 3rd–4th century Roman cemetery. Some of these slabs, in Dorset County Museum reserve collection, appear to the writer to be probably Purbeck Limestone.

16. Dewlish villa, *c.* 1969–1984, SY 77 97; Putnam (1970, 1971, 1972), Putnam and Rainey (1973), Putnam (1974), Putnam and Rainey (1975), Putnam (1976), Keen (1977, 1978, 1979). The main roof of the villa was of 'Purbeck or Portland' stone tiles, with dressed Ham stone blocks at the ridge (Putnam 1972). To the writer the stone appears to be Purbeck rather than Portland.

17. Badbury temple, 1995, ST 96 03; Papworth (1997, 2001). Fragments of PL probably once used as roofing tiles (1997); also a single posthole filled with fragments of PL roof slabs (2001). Building may have been roofed with clay tiles in the early Roman period but with PL later (2001, 29).

18. Hod Hill, 1860, ST 86 10; Oliver (undated), Hutchins (1861, 309). On north (Hutchins), or south-east (Oliver, more likely to be correct) side of the camp, in a field called Great Bones, large quantities of stone roofing tiles, many with large flat-headed iron nails still in the holes, with coins of Constantinian period. Not specified as PL, but likely to be so because of proximity to site 19, below.

19. Tarrant Hinton, ST 927 118; Tanner (1974), Graham (2006). Purbeck stone rooftiles over a work-shop/store, possibly used for lead working. Graham (58) also records a path paved with broken roof tiles both of diamond type (i.e. stone) and of earthen-ware. Others found in the filling of a well (Graham, 149, caption to plate 27); details of finds in Graham, 149–151.

20. Not used.

21. Bitterne, Southampton, (*Clausentum*), SU 44 13. Williams (1971, 178) writes 'Purbeck limestone [roofing] may have been used at Clausentum'. Andrew Russel, Southampton Archaeological Unit, in a pers. comm. of 2001 stated 'I can confirm that we do have them from Site SOU 857 on the Bitterne peninsula'.

22. Iwerne, 1897–1900, ST 86 13; Hawkes (1948). Part of a limestone roof tile with iron nail, in Salisbury and South Wilts museum, Pitt-Rivers collection, Iwerne display. Appeared to the writer to be PL; not specifically mentioned by Hawkes.

23. Gussage St Andrew, Minchington, ST 975 143; Ashford (*c.* 1998), Hutchins (1863, 547), Green (1991). Hutchins mentions tiles of 'Tisbury stone'; Green, Purbeck limestone and clay rooftiles. Date, from pot-tery, 3rd–4th century.

24. Rockbourne villa, SU 120 170; Williams (1971, app. IIa), Scott (1988, HA79), H.C. Bowen *in* Rivet (1969, 47), Beavis (1971, 185), Morley-Hewitt (1965). Morley-Hewitt: Room XXII, a peristyle or corridor with a sloping roof around a courtyard, had 'an almost complete collapsed roof of Purbeck tiles, enabling one to measure and compare tilers' practices of the Roman period and that (*sic*) of today.' Several such slabs on display on site; one at Salisbury museum. 3rd–4th cen-tury. Also found on this site was a milestone of Purbeck Limestone, naming Tetricus the younger, reused as lintel to a stokehole: Wilson and Wright (1962, 195), Morley-Hewitt (1965).

25. Oakley Down, Wimborne St Giles, (nearer to Sixpenny Handley), SU 016 177; Brown *et al.* (1996). One PL rooftile with a pierced fixing hole. Probably 3rd–4th century.

26. Rockbourne Down corn-driers, SU 11 18; Sumner (1914, 42), H.C. Bowen in Rivet (1969, 47). Sumner describes Roman roofing tile slabs of Purbeck stone; 10 larger (15–18 by 12 in.) and 4 smaller (12 by 8 in.), mostly used to bridge flues in hypocaust. Bowen says: 'one and a half miles to the north [of the Rockbourne villa] is the carefully built enclosure . . . with 3 T-shaped corn-drying ovens called hypocausts by the excavator. . . . the flues . . . included . . . Purbeck stone roofing slabs'.

27. Woodcuts, ST 963 181; Pitt-Rivers (1887, 135, 137, Figure 13, Plate XLVII no. 47). 'Roofing tile of Purbeck shale, highly fossiliferous. These tiles vary from 0.4–1.1 in. [thickness] and are perforated by a round hole from 0.22–0.6 in. diameter, in one of which an iron nail was found fixed by corrosion. 648 fragments were found in all. 86 had holes or portions of holes. . . . The nearest stone of this kind is between Wardour and Tisbury, 6 miles north.' By 'shale' Pitt-Rivers clearly means thin-bedded limestone. Some of these tiles may be seen in the Salisbury and South Wiltshire Museum.

28. Downton villa, 1954, SU 18 21; Anon. (1954), Taylor and Wright (1956, 142–3), Rahtz (1963, 305), Williams (1971, app. IIa). Anon. 1954 says: Excavation directed by Morley-Hewitt of Fordingbridge. Roof of Purbeck tiles, some still retained nails. Taylor and Wright: House of late 3rd to early 4th century, roof of Purbeck slabs. Rahtz 305: 'A few heavy nails were all the evidence to represent the roof timbers, on which were nailed hexagonal slates of Purbeck stone . . . capped by a ridge coping of oolite'. Helen Macdonald of the Geological Survey in Rahtz 326: 'Roof slates: sandy shelly limestone, similar to specimens of Purbeck age from Swanage', adding that the oolite ridge coping is possibly from the *Portland* beds of Tisbury; Williams repeats this. C.N. Moore, reported by Beavis (1971, 185), suggested that the tiles, and similar ones at another villa south of Salisbury (probably no. 30, East Grimstead), might be of Wardour Vale origin.

29. Braishfield villa, SU 37 25; Scott (1988, HA18) claims this site had Purbeck stone roofing; Percival and Piggott (1934, 247) mentions this site without discussing roofing material.

30. East Grimstead, Wiltshire, SU 22 27; Sumner (1924, 19, 30, 37), Williams (1971, app. IIa). Sumner says: finds in Salisbury museum. 19: Bath-house I, bridging of hypocaust flue made of 3 layers of slab-stone roofing tiles. 30: Bath-house II with tiled roof, each tile 14 lb weight. 37: 'Slab-stone roofing tiles from Purbeck'. Williams states 3rd–4th century date. 'From Purbeck' suggests that Sumner assumed Isle of Purbeck origin, but this is probably one of the finds that C.N. Moore suggested might be PL of Wiltshire origin (Beavis 1971, 185); cf. Downton villa, no. 28.

31. Not used.

32. Winchester, The Brooks, SU 484 296; Frere *et al.* (1989, 318), Zant (1993, 107). Frere *et al.*: building of late 3rd century date with 4th century modifications; roof of Purbeck limestone tiles. Zant: 'most of the building debris associated with XXIII.3 was removed by machine, fragments of stone roofing slates were seen to be present . . . though none of this material was recovered'. Date *c.* 400 AD.

33. Winchester, St George St, 1953, SU 484 296; Bennett-Clark (1954, 320), Taylor and Wright (1954, 101), Williams (1971, app. II, 178). Excavation in advance of widening St George Street. Bennett-Clark: 'Plaster and roofing slabs [of PL] lying on the floors to a depth of 20 in'. Taylor and Wright: 'a substantial building with a roof of Purbeck slabs'. 3rd or early 4th century.

34. Sparsholt villa, SU 415 301; Williams (1971, app. II and 178), see also (though no mention of Purbeck stone) Wilson and Wright (1966, 214), Johnston (1968). Pers. comm. Johnston to Williams: 'the body of the house was roofed with Purbeck slates apart from one room at either end'. 3rd–4th century.

35. Salisbury, Stratford-sub-Castle, Post Office Corner–Castle Keep development, 1965–6, SU 1350 3170–1345 3180; James (2002, 5 (no. 33), 8), see also Stratton (1965, 138), Stratton (1966, 106), Algar (1970, 208), Algar (2002, 19), Moore (1966, 1967). James: Purbeck Stone roofing tiles, 1st–4th century; Algar 2002: Purbeck stone and ceramic roofing tiles. Algar also notes a small slab of polished Purbeck marble from this site, a total of 5 fragments of limestone 'possibly ?Chilmark or Purbeck' found in a gas main trench cut 1969 in Stratford-sub-Castle, and (23, note 4) a personal communication from John Stratton that a building next to the Roman road in Stratford-sub-Castle, excavated 1977, had a roof of nailed *Mendip* stone slabs. Mendip stone would have been brought to Salisbury by the same road (Margary 45b) as Wiltshire Purbeck, but the distance would have been about three times as far.

36. Salisbury, Stratford-sub-Castle, west side of Stratford Road, 1965, SU 1340 3175; James (2002, 5 (no. 32), 8), see also Stratton (1966, 106). James: Stone roofing tile, lithology not mentioned, likely to be PL because of similar nearby sites. 1st–4th century.

37. Kings Somborne villa, SU 36 31; Scott (1988, 139), who refers to Geographic J., 1923, 342 (map). Purbeck stone roof tiles.

38. Salisbury, Bishopdown, 14–22 Juniper Drive, 1953–55, SU 1435 3225; Stone and Algar (1956), Williams (1971, app. IIa), James (2002, 5 (no. 25), 7). Fragments of perforated roofing tiles of shelly limestone, one ovate specimen complete. Shelly limestone is likely to be PL because of similar nearby sites. 3rd–4th century.

39. Old Sarum, NE sector, 1957, SU 143 328; James (2002, 3, 5 (no. 26)); see also Rahtz and Musty (1960). (Grid easting corrected; James gives 193.) Pieces of Purbeck or Chilmark roofing tiles, with part of a block of dressed Chilmark stone; mentioned in James but not by Rahtz and Musty. The writer takes the phrase 'Purbeck or Chilmark' to mean that the slabs are from the Purbeck Limestone Group and most probably from the Chilmark area (close to Lady Down) rather than from Purbeck itself. Date 1st–3rd century.

40. Not used.

41. Netheravon villa, on Air Force site, 1996, SU 148 482; Rawlings (2001, 151). Nearly 150 kg of stone roof tiles of 3 main stone types: cream/white shelly limestone (not identified by the excavator as Purbeck, but might be so), greenish-grey sandstone, red micaceous (Pennant) sandstone. Date 3rd–4th century, with some activity in 1st–2nd.

42. North Warnborough, Lodge Farm, 1929–30, SU 73 51; Liddell (1931, 226), Williams (1971, app. IIa). Liddell says 'The Baths . . . The roof was chiefly of red, flat, flanged tiles, the joins of the flanges being covered with . . . *imbrices*, and partly of small slates of Purbeck stone.' 4th century date, from coins. Williams' account might be taken to mean that Chilworth Ring, the other site covered in Liddell's paper, also had Purbeck slabs, but this is not so (pers. comm. Andrew Russel, Southampton Archaeological Unit).

43. Silchester, 1895, SU 63 62; Hope and Fox (1896, 218). 'The one house that stood within Insula XIII . . .

from the broken pieces . . . evident that it was roofed with the usual thin hexagonal stone slabs or slates'. Not specified as Purbeck, but this is not improbable given the proximity of no. 42.

44. Over Wallop villa, SU 28 38; Scott (1988, HA71). A Purbeck stone roofing slab. The writer has not found the original publication; the nearest approach is Piggott (1952) which describes Roman graves at *Middle* Wallop and does not mention Purbeck Limestone.

45. Draycot Foliat, SU 191 770; Burnham *et al.* (1997, 445). Roman building with fallen roof slabs, which may well be Purbeck as found so close to the Swindon outcrop.

46. Okus, SU 145 835; Passmore (1899). Roman building, with stone roofing tiles; material of these not stated, but likely to be Purbeck as near the Swindon outcrop.

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The Dorchester Debating Society and the Hardy Players

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The Dorchester Debating Society and the Hardy Players

On the 9th of October 1896 the Dorset County Chronicle reported 'There is a proposal to bring about the revival of the Dorchester Debating Society, which existed about twelve years ago . . .'. The Chronicle went on to say 'The value of such a Society in a town like Dorchester cannot be over-estimated and the inhabitants will do well in according to it the support it deserves.' A meeting for the 'resuscitation' of the Society was called for the 19th of November in the Council Chamber and ladies were 'cordially invited to attend.'

The following year, on 7th October, 1897, giving notice of the first Annual General Meeting of the Society, the Chronicle – which had reported nothing of the Society's activities during the previous year – nevertheless wrote 'We sincerely hope the success of the first session will continue in the second.' At the AGM it was reported that the meeting was presided over by the minister of the Congregational Church, the Rev. J. McClune Uffen.[1]

The involvement of McClune Uffen in the revived Society provides a link with its earlier manifestations. Uffen had become minister of the Congregational Church in 1891. His predecessor, William Gooby, had come to the church in 1887, and had instituted the Congregational Improvement Society at the church in December that same year. Present at that first meeting were several people who were later to be involved in the Hardy plays; in particular there were Walter Reginald Bawler and William Watkins. The programme of the Society consisted of lectures And debates as well as readings and recitations from well-known works. In a speech in January, 1889, Gooby was proud to state that 'he was more pleased than he could express that the Society of which he could claim to be the parent had flourished even far beyond expectations.'[2]

This was not the only such society in the town; there was also the YMCA Mutual Improvement Society and a Dorchester Lecture Society, which began in 1878, and earlier still, the Working Men's Institute was bringing well-known personalities such as George Grossmith into the town to lecture on Dickens and to act each of his characters. 'Mr Brandram the eminent Shakespearian Reciter' appeared regularly at the invitation of the Lecture Society.[3] In 1882 The Dorchester Amateur Dramatic Club was formed and presented 'Bombusters Furioso' and 'To Paris and Back for £5' in aid of the Dorchester Cricket Club. This was so successful that it was decided to 'perpetuate the Dramatic Club. In the orchestra for this performance were W.R. Bawler and William Watkins.[4]

In January 1890, a local schoolmaster, Thomas Middleton Dron, gave a lecture to the Congregational Improvement Society on 'The Wit and Wisdom of the Dorset Novelist.' When he read the report of the lecture in the Chronicle Hardy Immediately wrote an appreciative letter to Dron, saying that his performance was 'unique for this county.'[5] Although public readings and lectures on his novels had been given in other parts of the country and in America, this was the very first such recognition of Hardy in his own county and his own home town.

Those who became the Hardy Players were already displaying their talents. The Chronicle (24 October 1885) reported on an evening of entertainment held in the Congregational Church (now the Dorchester United Church in South Street). This included a song by Walter Bawler, two recitations by Willfred Fare, a duet from Miss Bawler and Mrs Fare, a piano duet by Mrs Fare and Miss Webber, and a solo by Mrs Fare. The Fares had come to Dorchester in 1894 from Bath. In January that year, before moving to Dorchester, Willfred Fare had organised and presented a programme of recitations and recitals in Bath in which he gave two recitations himself. In April 1897 a concert was given in the Town Hall in aid of choir funds of All Saints in which A.H. Evans played violin solos accompanied by his wife on the piano.[6]

In 1901 the local Catholic priest, Dr O'Loughlin, became president of the Debating Society. His interests and were in literature and his particular talent was elocution. Through his influence the Debating Society widened its activities adding 'Literary' to its designation, and began to include readings and recitations for which it awarded prizes. (Willfred Fare was presented with a copy of Jane Austen's Sense and Sensibility as a prize for reading in 1907.) When the Society held its end-of-season soiree in April 1902, the entertainment was arranged by the then Secretary, A.H. Evans, and T.H. Tilley. They presented songs and sketches performed by Evans and his wife and a farce, 'My Lord in Livery' the cast of which included Evans, Tilley, H.O. Lock and Reg. Barrow.[7]

The Society began to give dramatic readings of plays by Shakespeare, Sheridan, Goldsmith and others to which the public were invited. They continued to perform these even after they begun the Hardy plays; a 'Dramatic Reading' of Sheridan's School for Scandal was given in the Town Hall in April 1911. A public reading of Twelfth Night was given in December 1905, and then, in March 1906, Evans produced a series of Shakespeare tableau at the 'annual tea and soiree' at the Congregational church. The following month, what was still 'The Dorchester Debating Society' gave an acting performance of The Taming of the Shrew in the Corn Exchange in aid of the Dorset County Hospital. The play was directed by the Rev. Kenworthy Browne and the Stage Manager was T.H. Tilley, who played Grumio and also designed and painted most of the scenery. Petruchio was played by A.H. Evans and Katherina the Shrew was played by his wife. Again in the cast were H.A. Martin, H.O. Lock, E.J. Stevens and W.J. Fare. The following year, in February 1907, they put on two performances of Twelfth Night directed by Evans. The first night of which was attended by Hardy. Later, in November the same year, they gave two performances of Much Ado About Nothing directed by the Rev. M.C. Dasent, who was a Cambridge graduate and the curate-in-charge at Tolpuddle.

Hardy's interest in these activities was aroused by another member of the Society, Harry Pouncy. In February 1906 Pouncy gave a lecture to the Society on the Dialect poetry of William Barnes, assisted by Walter Bawler and Edwin Stevens.

Then in October that year he staged an entertainment in the Town Hall which he Called 'A Dorset Day.' This included songs and scenes in dialect and a presentation 'A Few Crusted Characters' with scenery by Tilley. William Watkins, the Secretary of the Society of Dorset Men in London, invited them to London and they performed for that Society there in 1906 and again in 1907. Hardy wrote to Pouncy offering advice on old Dorset songs and giving him permission to use one of his poems. With this encouragement, in October 1907, Pouncy put on 'Hours in Hardyland' which was attended by Hardy and his wife. This presentation included a lantern slide lecture by Pouncy on 'A Jaunt From Casterbridge to Kingsbere and Back' and scenes from Far From the Madding Crowd.

In February 1908, the writer, A.M. Broadley, was invited to give a lecture on 'Napoleon's threatened Invasion of England.' A.H. Evans (according to his daughter, but Keith Wilson thinks it was probably Harry Pouncy)[8] had the idea of illustrating the lecture with a scene from The Trumpet Major, which showed the way ordinary people at the time feared Napoleon as a dreadful ogre, who was reputed to eat babies alive. Hardy readily gave his approval and help with this and attended the lecture and the performance, which was directed by Evans with Tilley as the stage manager. The success of this occasion prompted Evans to further approach Hardy for permission to write and produce a fuller stage version of the novel. Following several consultation visits by Evans to Max Gate The Trumpet Major was presented in the Corn Exchange on 18th November, 1908.

In a letter to The Times correspondent, Harold Child, Hardy gave his own explanation of how the performance came about. 'The thing began by the manager – an enterprising burgher – asking me if he might do the scene of the Miller's party to help a miscellaneous entertainment he had got up.' (This was a 'Merrie Mae Fayre' at Holy Trinity Church in May 1908). Hardy went on 'To my surprise the scene – detached as it was – was received with the wildest enthusiasm. This suggested making a complete play of it.'[9]

Most of the leading players in this performance had earlier been seen in the Shakespeare plays, and they formed the core of the future productions of the Hardy Players. They were: H.O. Lock, H.A. Martin, W.R. Bawler, E.J. Stevens, R.C. Barrow, T.H. Tilley, T. Pouncy and W.J. Fare. In particular, Martin, Bawler, Stevens and Pouncy appeared in nearly every subsequent play. Evans and his wife Both acted in this and in the next production, which was Far From the Madding Crowd.

Hardy did not have great expectations of the production. He wrote to his publisher, 'The only permission I have given in relation to the story is one to the Dorchester Debating and Dramatic Society (a body of amateurs in the town) to make a play, or scenes, or what they choose ... to act for their own personal amusement and that of the inhabitants of the town here. I assented merely to oblige them and it would not do ... to let anybody print as by authority what no doubt will be a hash of the story, as none of the young men have any skill in dramatizing that I know of.'[10]

Hardy's fame and connections, as well as considerable interest in seeing a dramatised version of Hardy's novel, brought famous personalities and the top London critics hot foot to Dorchester to see the performances, which – considering that this was a company of local amateurs – was taken surprisingly seriously and remarkably well received. The Chronicle (28 November 1908) reported: 'Never before, not even in the days, nearly a century ago, when Edmund Keane wore the buskin in Dorchester, has a Dorchester play-house attracted to itself so much notice from London ... on Wednesday night ... there were to be observed in the front seats a posse of leading dramatic critics who had come down direct from London for the occasion, and the telegraph messenger stood at the front exit ready to dart off to the Telegraph Office with the critiques, to be wired to Town piping hot from their busily-plying pencils. Seldom in a provincial town, and certainly never before in Dorchester, has such attention been given by the London Daily and weekly papers to an amateur local production.'

Hardy promoted the play himself by inviting the drama critic of The Times, Harold Child, to stay with him for the occasion at Max Gate. The Times subsequently gave almost a whole column to its review and two days later even devoted a leading article to the Players. In his review Child wrote, 'The acting ... was not that of the professional, but those characters especially who were not afraid of the local accent and colour, like the miller of Mr Bawler, the Crippleshaw of

Mr Tilley, the Corporal Tullidge of Mr T. Pouncy, were delightful, and the whole evening was much enjoyed by a large audience.'[11] Hardy himself wrote to congratulate Bawler on his performance which he said 'in the opinion of good judges was very real and lifelike: also very amusing.'[12]

In a letter to Child Hardy suggested that 'the special attributes of the production . . . (were) that that the great grandparents of the actors (many of them) were the real actors in the scenes depicted – they all know the events traditionally – and of course, are themselves the continuators of the dialect, humours etc. of the personages.' Hardy was romanticising a little (no doubt in his effort to persuade the critic that this was an occasion not to be missed). He does however go on to note that among the cast were the Mayor of Dorchester (T.H. Tilley) the Mayor's sister, and a former Mayor's son, (H.O. Lock) and his sister Evelyne.[13]

The Index to Terry Hearing's book of the Dorset Quarter Sessions, 1625–1638[14] Gives an interesting list of those who appeared before the court in that part of the seventeenth century. It shows that there were several families who could trace their ancestry back for generations before the Napoleonic period. The familiar names of many of those who appear in the casts of the Hardy plays are there. Along with the Hardys themselves, the list includes: Bawler, Bugler, Dawes, Fussell, Lock, Major, Martin, Pouncy, Stevens, Tilley (and also Woodhall).

But the leading players in 1908 were the solid citizens of the town. They were Business, trade and professional people, pillars of the local churches and of the Civic and social life of the community. Henry Osmond Lock, the son of a former Mayor, was a partner in the firm of Locke, Read and Locke, Hardy's own solicitors. E.J. Stevens was clerk to the Commissioner of taxes, and H.A. Martin an auctioneer. Mrs Ethel Major, who took part in ten of the plays, including Tess, who was the daughter of a gentlemen's outfitter, and after her husband died ran a tea shop. Willfred Fare was a grocer and provisions merchant, who had started his own business in High West Street in 1894, and was, among other things, a founder member and later president of the Dorchester Chamber of Commerce and also of the Rotary Club, and Sunday school Superintendent at the Congregational church, where W.R. Bawler was the church secretary and a choir member. Bawler, who was one of the most regular and popular of the players, was a solicitor's clerk and Deputy Registrar. His father was the Deputy Governor of the prison. Reg Barrow, who appeared in nearly every production except The Return of the Native, was an auctioneer's clerk with Henry Duke and son. Tom Pouncy was a local builder.

The most important of the original players were A.H. Evans and T.H. Tilley. Evans, whose father had also been a well-known Dorchester chemist, lived In Icen Way and ran a prosperous chemist's shop in High East Street. He became a member of the Borough Council in 1899. In spite of having been fined five shillings for selling strychnine without properly recording its sales, he went on to serve on the magistrate's bench.

Evans produced, scripted and directed The Trumpet Major, Far From The Madding Crowd, The Mellstock Choir, The Distracted Preacher and The Woodlanders. He also directed The Three Wayfarers which had been adapted by Hardy himself. Evans and his wife also appeared in the first two plays. Although Evans and his family left Dorchester to live in London in 1910 he continued to return to Dorchester until 1913 to produce the plays.

The Tilley family were particularly well-known locally. Beginning with bicycle Shops they went on to establish garages in Weymouth as well as Dorchester.

Tilley's father was a monumental mason and had been Mayor of Dorchester. Harry Tilley carried on his father's business and became Mayor himself in 1908. (There had been some suggestion at the time that the first of the Hardy plays should have been The Mayor of Casterbridge which would then have been performed with a real live Mayor of Casterbridge in the cast.) Harry Tilley also went on to become a magistrate and served for very many years as the churchwarden at Holy Trinity.

Tilley had a remarkably lively and energetic personality, as well as possessing considerable practical and professional, as well as acting skills. He was a born comedian, and there is a wonderful doleful picture of him as Sir Andrew Aguecheek in the Debating Society's production of Twelfth Night.

From the start, as well as acting in the plays he was also the stage manager and he designed and built the scenery, which meant tat he was fully occupied backstage. The Chronicle's report of The Trumpet Major said that 'Mr Harry Tilley, besides his considerable labour in looking to properties and in the superintendence of the scene shifting, acted the part of Crippleshaw with a mellow wit, often amounting to unction, which was quite delightful.'[15] After Evans left Dorchester Tilley went on to adapt and direct The Return of The Native in 1920, and A Desperate Remedy in 1922 as well as the Mummer's Play, The Play of St. George in 1923.

Following the success of The Trumpet Major, Hardy consented to Evans' request to adapt Far From the Madding Crowd. Harry Tilley had built a model theatre to help him design the sets. He worked closely with Hardy on the scenery, who was evidently pleased with the results. In April 1909, Hardy had been in correspondence with a well-known architect, Morley Horder, who had been engaged to landscape the gardens and work on the interior of Waterston Manor, the setting for Bathsheba's house in the novel. Tilley's scenery must have been a remarkably accurate depiction of the house, because, with what reads like some enthusiasm, Hardy wrote to Horder again in November recommending that he and the owner of the manor should go to see the play. In Hardy's words, 'the drama of Far "From the Madding Crowd" which is being played in Dorchester just now has, as the scene of its action, the exterior and the interior of that house as it existed about 70 or 80 years ago.' Hardy not only tells Horder when and where the play is to be performed but also that tickets '(if any are left)' could be obtained from Mr W. Watkins, the Secretary of the Society of Dorset Men in London.[16]

William Watkins, a solicitor's clerk, had moved from Dorchester to London, where, with Sir Frederick Treves as the first President, he re-founded the Society of Dorset Men in London in 1904. In Dorchester he had attended the Congregational Church and had played the cello in concerts there, and so was already well- acquainted with the leading members of the Hardy Players. It was at his invitation that the plays were taken to London and performed there to his Society.

Far From the Madding Crowd repeated the success of The Trumpet Major. Evans contributed more to the audience's enjoyment of the play than he had anticipated. Hardy had written very precise details about how the sheep-shearing should be carried out in the very important sheep-shearing scene. Evans engaged a professional, together with some sheep, to make sure it was done properly. The man complained of thirst, and to help him overcome his stage nerves he was supplied with unlimited quantities of free beer. Happy in his work, the man proceeded to clip the sheep, singing to them as he did so, drowning out the words of the actors on stage and getting drunker and drunker as the scene proceeded.[17]

The distinguished classical actor, Maurice Evans, who was the producer's son, then eight years old, made his first stage appearance in this play as Teddy Coggan, an urchin like 'Just William'. The part of Bathsheba was played by Mrs Evans who was personally congratulated by Hardy for her performance.

The Hardy plays were now becoming an annual event, although the Dorchester Debating Society did not become the Hardy Players but continued with its other activities. Nor were they restricting their dramatic presentations wholly to Hardy. In March 1910, they gave a public reading of As You Like It in the Town Hall. The cast of this included H.O. Lock, H.A. Martin, A.H. Evans, E.J. Stevens and W.J. Fare. But, no doubt because they had become nationally celebrated, they were now taking their performances seriously. To read the part of Rosalind they obtained the professional services of Miss Ella Tarrant, who was a member of Frank Benson's famous Shakespearean Company, and she also coached the rest of the cast in their parts.

Later that same year the players presented The Mellstock Choir, which Evans adapted from Under the Greenwood Tree. Hardy became more fully involved in this production, supplying the music for the carols sung in the play, attending three rehearsals and even seizing Mrs Emma Tilley, Harry's wife, as his partner to demonstrate a country dance which he remembered from his youth. It became the established pattern that the preliminary readings of each new play would take place at Hardy's invitation at Max Gate, often in the presence of his distinguished guests such as James Barrie and Lawrence of Arabia. Hardy and his wife usually attended the dress rehearsals in the Town Hall.

On the evening of 16th November 1910, in the Corn Exchange just before the first performance, Hardy was presented with the freedom of Dorchester. Hardy had again invited distinguished guests to be with him to see the play, and among them this time was the poet, Sir Henry Newbolt.

The next presentation, on November 1911, put together two short plays to make up one performance. The first, The Three Wayfarers, was an adaptation by Hardy himself from his short story, The Three Strangers which had earlier been performed by the Stage Society in 1903. For the Dorchester performance an old-time fiddler in his seventies called Harry Bailey was engaged to play for the christening party scene. He had been used to playing in fairs and festivals in local villages and got so carried away on the stage that he resisted all attempts to get him to stop playing when the scene came to an end.

The other play was The Distracted Preacher, adapted from another short story about smuggling by A.H. Evans. The following year brought a revival of The Trumpet Major, and then, in 1913 Evans adapted and produced The Woodlanders, in which a newcomer, sixteen-year-old Gertrude Bugler, made her first appearance as Marty South. Harry Tilley, who was producing the play, had recognised her her exceptional talent when he had seen her acting as an old servant in a school concert which had included a scene from As You Like It. 'Tilley immediately decided that she would be ideal for Marty South.' Her special qualities were also recognised by Hardy, who 'declared her to be "just the girl" he was thinking of when he created Marty.'[18]

The Woodlanders was the first of the Hardy plays to have a sad rather than a happy ending, but this revealed Gertrude's exceptional talent for expressing emotional distress. The Daily News (20 November 1913) reported 'the performance will probably be remembered by most people as a setting for the debut of Miss Gertrude Bugler.' And went on to suggest that if the Dorchester players 'should ... ever attempt the grand tragedy of Tess' then 'Gertrude Bugler might ... achieve the greatest dramatic triumph the Corn Exchange here has known.'

The outbreak of the First World War brought an end to the Hardy plays as an annual event. But it was Hardy himself, in 1916, who brought the players together again for a new performance. By then the War had been going on for two years and the climate of the time was one of national danger, patriotism and pride. In The Dynasts Hardy had described an historic setting for these same emotions in events that had taken place one hundred years before, but which were resonating powerfully once more in the fresh emergency. Responding to the current situation, Hardy proposed that some Wessex Scenes From the Dynasts should be performed in order to raise money for the British and Russian Red Cross.[19]

For the play, which was presented first in Weymouth and then in Dorchester, Hardy put together five scenes which presented the rural Wessex response to the threat of invasion by Napoleon, leading up to Nelson's victory at Trafalgar and the Battle of Waterloo. Hardy described events which he said, took place 'in spots that are not more than a mile from where the performance itself goes on.'[20]

He also developed a love interest between a waiting maid and a young soldier which provided a special role for Gertrude Bugler who was now becoming a star performer. Unfortunately, all the suitable young men had gone off to war, so the part of Gertrude's lover was taken instead by a Miss N. Jones from Wales which rather spoilt the romance. James Barrie attended the opening night in Dorchester and went backstage at the end to congratulate the cast. It was in the programme for this production – which was the first that Hardy had fully identified himself with – that the performers were first referred to as the Hardy Players.

A revised production of The Mellstock Choir with a number of cast changes was put on at the beginning of 1918 with Gertrude Bugler taking over the part of Fancy Day. The success of this revival prompted the Chronicle to suggest that the players might produce a dramatic version of The Return of the Native.[21] This became the next production, and Harry Tilley's adaptation was presented in Dorchester in November 1920 and at the Guildhall School of Music in London in January 1921. Gertrude Bugler was given the part of the heroine, Eustacia Vye. Although the novelty of the Hardy plays had now worn off with the London press who had become much harder to please, the hailed Gertrude as a bright new star. The Daily Mirror even compared her with Ellen Terry and Sarah Bernhardt.[22] Not all the critics were so impressed, and there was a particularly and damaging review from Newman Flower, who was the Editor of the Dorset Men in London Year Book.

Gertrude Bugler married a cousin in September 1921, but it was still anticipated that she would be available to act in the next play. This turned out to be an adaptation by Tilley of Desperate Remedies, with Gertrude expected to play Cytherea Graye. However, she became pregnant and had to withdraw from the production. After the performance, Hardy's wife, Florence, who had been something of a sponsor of Gertrude, wrote a disparaging account of the play to Sydney Cockerell. In this she said that 'Poor Gertrude Bugler seems to have suffered agonies at being cut out by a rival leading lady, Ethel Fare, and the tragic climax is that she had a still-born baby son on the day of the performance.'[23]

Florence Hardy's phrase 'cut out by a rival actress' misrepresents the situation. Ethel Fare did not 'cut out' Gertrude. She was given the part because Gertrude was unavailable. They were never 'rivals' and they did not compete with each other for for parts. Ethel was a few months older than Gertrude and they had known each other from their schooldays. Ethel recognised and admired Gertrude's talent, and knew that no one else could possibly play Tess. Many years later, just after Gertrude had died, Ethel replied to a letter from her sister-in-law, (my wife's mother) in which this question was raised. Ethel wrote 'It is kind of you to think of me in connection with Gertrude Bugler – but I can honestly say I have never been jealous of her. I could see for myself – that for Mr Hardy – she WAS Tess – and I agree with him.'[24]

Gertrude's unavailability for A Desperate Remedy meant that another actress needed to be cast, and Ethel was chosen, and, in spite of the criticisms of the play and the production (which suggest it was the least successful of all the Hardy plays) she herself was a considerable success. One national newspaper declared that 'there is a brilliant newcomer in the person of Miss Ethel Fare.'[25] Her brother Rex played the part of her lover, Edward Springrove. The report went on to say that 'The best part of the play is the rustic element, the cider making and the belfry scenes bringing out the real genius of the Hardy Players.' When the Players went to London to perform the play in the King's Hall, Covent Garden, they again received a great deal of pre-publicity, with pictures of them in The Times and Evening News arriving at Paddington Station, and the play itself was given long – if not always favourable – reviews.

The next production attracted even more attention, since this was not an adaptation of a well-known novel but an original play written by Hardy himself. Hardy presented the Players 'For the first performance on any stage' with a script in verse which he called The Famous Tragedy of the Queen of Cornwall. Keith Wilson rightly says that this attests on Hardy's part 'to a marked degree of faith in their abilities.'[26] It was also a considerable test of them. The length of the play was just over an hour, so that the action took place in 'real' time. Two short plays, O Jan, O Jan, O Jan! and the Mummers' Play of St. George were included to make up the programme.

Hardy had it in mind for Gertrude Bugler to play the part of the Queen, but she was pregnant again and once more unable to perform, so the part was played instead by the wife of a serving army officer, Mrs Katherine Hirst, in her only performance with Players. Ethel Fare played Iseult the Whitehanded, with another occasional player, a local doctor, E.W. Smerdon, in the part of Sir Tristram. Ethel was given special coaching in her part by a very famous actress of the time, Dame May Whitty, (best remembered now for being the lady who vanishes in Alfred Hitchcock's film). A meeting of the Dramatic Sub-committee agreed that Mrs Major, who had a small part in the chorus, Should be allowed to sell chocolates at the performances.

Such was the interest in the play that the first performance from the Corn Exchange was broadcast by the BBC which had then been in existence for less than a year. The photographs of the play show the large microphone suspended over the performers. This was a huge novelty at the time, and since the broadcast was to be 'radiated from the Bournemouth station only' the press notice of the event declared 'Bournemouth may justly claim some measure of notice as the town from which the great drama will be radiated to the largest audience which has ever listened to a Hardy play.'[27]

Although the play itself had a mixed critical reception, its leading actors received considerable praise. Mrs Hirst received a complimentary letter from Hardy himself. The Morning Post reported that 'The play was extremely well put on, and very well acted', praising especially Dr Smerdon saying 'Whether a physician can or cannot live or die in Dorchester, this one can act and sing . . . Miss Fare is a most attractive Iseult . . . a perfect representation of clinging, distraught and none too trustworthy womanhood.'[28] She was further hailed by a well-known writer, H.W. Massingham, as 'near an actress of genius as one can look for in a company of zealous amateurs.'[29] The Telegraph however was not impressed, feeling that Hardy's play was too difficult for amateurs, saying of the leads 'All three in fact did creditable amateur work, and it was hardly their fault that in this case creditable amateur work sufficed only to scratch the surface of the play.'[30] Most of the critics failed to appreciate that Hardy had imposed his own strict ideas on how the play should be performed, so that the players were being criticised for actually doing what Hardy had told them to do.

In February 1924 the play was put on in London and again received a great deal of attention. The Morning Post said that 'the four principals were very good indeed.'[31] One journalist, who was disappointed with the performance but loved the verse and impressed with Ethel Fare, wrote 'My sympathies were for the first time in my life, entirely with Iseult of the White Hand, who was the only member of the cast to show any real emotion Or ability. I went round afterwards to see her and found a young fair-haired girl who told me she had only acted once since leaving school.'[32]

In August 1924 the Dramatic Sub-committee of the Debating Society met in Mrs Major's restaurant to plan the programme for 1924 and 1925. Harry Tilley reported that Mr Hardy had 'intimated his willingness to allow the Society to produce the play written by him some thirty years ago, Tess of the D'Urbevilles,[sic] but which had never been acted.' 'Certain conditions as to this upon which Mr Hardy insisted were read by Mr Tilley. (It was) 'Resolved unanimously: That the production of the Play be undertaken and a vote of thanks be accorded to Mr Hardy.'[33]

At the AGM in September Tilley was made an honorary member of the Society in place of Sir Frederick Treves, who had just died. Tilley reported that 'it was proposed to produce Tess.' The meeting responded by unanimously deciding 'that the grateful thanks of the Society be conveyed to Mr Hardy for his interest in the Society and for the great favour accorded the Society in entrusting to them the production of the Dramatic version of Tess.'[34]

Tilley had already approached Gertrude Bugler and told her that unless she played Tess Hardy would not allow the play to be performed. Hardy also insisted on his right to veto other casting decisions he did not like. This was wise. Some of the original actors who had earlier played romantic leads were now getting too old to be credible, although they were still eager to perform.

The Times critic, Harold Child, asked Hardy if he attend address rehearsal. In his reply, Hardy wrote, 'of course, at these rehearsals, as you know, though the players will be in costume, they will not be made up in face and head, and a slightly bald Angel Clare will perhaps damage your estimate of him.'[35]

The play was performed in Dorchester in November with Dr Smerdon as Angel Clare, and a young newcomer, Norman Atkins, (who had appeared in The Queen Of Cornwall) as Alec d'Urberville. Ethel Fare and her brother Rex were in the cast as Izz and Felix Clare. Gertrude's sister, Augusta, was also making her second appearance in a Hardy play.

The national interest in the play was even greater than ever. According to the Daily Express, applications for tickets had 'poured in from the furthest north of Scotland, from Ireland, from remote corners of Wales, and from every part of England.'[36] Among those who came to see the play were T.E. Lawrence, Siegfried Sassoon, E.M. Forster, Augustus John and Lewis Casson.

The press coverage was considerable, and Gertrude Bugler attracted most attention. Harold Child in The Times declared that 'Miss Gertrude Bugler . . . was born to act the part of Tess . . . she is so like the Tess of the book in appearance . . . that . . . she might have sat for the portrait of this imaginary girl before she was born.'[37] Hardy was so delighted with her that he gave her a signed copy of the book, writing in it, 'To the Impersonator of Tess.'

Although Child saw this as 'the outstanding performance' there were others he said, had 'considerable merit'. Among these were Dr Smerdon as Angel Clare, Tom Pouncy, ('an old favourite with this audience' as Tess's father) and especially Mrs Major as Tess's mother, who, he said, 'gave a rich and racy performance.' He ended his report by saying 'No account of this notable piece of dramatic history should close before tribute has been paid to the Honorary Stage Manager, Coach and Producer, Mr T.H. Tilley.' Child was particularly impressed with Tilley's scenery for the dairy scene and 'the tremendous simplicity of Stonehenge . . . the whole staging of the play gave proof of his skill and devotion.'[38] At the end of the final performance the President of the Debating Society presented Gertrude with a bouquet and a card 'To Tess, from The Hardy Players.'[39]

All the Hardy Players then came together for an informal party and reunion in The Council Chamber. Both Hardy and his wife were there, and Mr and Mrs William Watkins from the Society of Dorset Men. Albert Cox, who had appeared in each performance from the Dynasts in 1916, and played Jonathan Kail in Tess, wrote a poem, 'To Our Tess' which was recited by Ethel Fare: 'Accept dear Tess, in this your crowning test, The heartfelt praise of those who love you best . . .'[40]

One of those who saw the play was Frederick Harrison, the manager of the Haymarket theatre, who asked Gertrude if she would like to play Tess in London. Hardy, (who never seems to have praised the company as a whole, usually referring to them rather disparagingly as 'our local amateurs') did single out individuals and praise them for their performances. He wrote to Harrison, praising Gertrude, and also recommending both Tom Pouncy and Mrs Major, who had played Tess's parents, saying that 'if you should have any difficulty in getting a good Sir John . . . the one we had here – Mr T. Pouncy – can hardly be bettered . . . Joan, Tess's mother, was also very good.'[41]

On this occasion, Hardy's wife, Florence, persuaded Gertrude not to go to London, but in 1929, the year after Hardy died, she encouraged Gertrude to play Tess in a professional production at the Duke of York's Theatre which ran for sixty performances. The theatre critic McQueen Pope described her performance then as 'a triumph.'

In 1926, eight of the Hardy Players gave a live broadcast from Bournemouth which included excerpts from The Mellstock Choir and The Three Wayfarers as well as Dorset Songs and Readings from William Barnes. They also performed 'The March Song of the Loyal Volunteers of Burton Bradstock, Dorset, during the Great Terror, 1796–1805'. Ethel Fare, who took part, received some very complimentary fan-mail from those who were moved by her beautiful speaking voice.

Tess was the last of the Hardy plays, although the Debating Society continued for a few more years. In July 1924, A.H. Evans wrote to Hardy from London asking permission for the Hornsey Players to put on a Hardy play, saying 'They are more able to give a due rendering of subtle acting than my dear friends the old Hardy Players could ever do.'[42] Hardy refused his consent, replying that the original agreement was only for Dorset players to act in Dorset and only for the Society of Dorset Men in London, adding 'The Dialect would be a great difficulty except for Wessex players and a drawback to a London performance.' He suggested that Instead they should put on a 'less local play by some London writer.'[43]

William Watkins died in 1925 and H.A. Martin was elected an honorary member of the Society in his place. In January 1926, the Drama Sub-committee decided not to produce a play but to arrange a dramatic reading in March. The Society decided to join the Drama League. At the AGM in October 1927 Harry Tilley declined to be re-appointed as Stage Manager and turned to his other interests of architecture and bird watching. E.J. Stevens and Willfred Fare followed one another as Presidents, Dr Smerdon was elected but declined, and H.A. Martin was elected instead. Ethel Fare was appointed Honorary Secretary, but then in 1930 she married a baker, became Mrs Lloyd and moved away from Dorchester.

The Debating Society continued until 1939. Willfred Fare and Florence Hardy were made magistrates together on the same day in 1924, and Willfred became Mayor of Dorchester, serving for two consecutive terms in 1931 and 1932. When Hardy's statue was unveiled at the Top O' Town in 1931, he received in on behalf of the town from Sir James Barrie, and also organised the ceremony for the unveiling of the American monument by Hardy's cottage in Bockhampton. In June 1940, the Hardy Players marked the centenary of Hardy's birth by laying a wreath on the statue at the Top O' Town. When Harry Tilley died in 1944 Willfred Fare was appointed an Alderman in his place. Gertrude Bugler died in 1992 and there were long obituaries to her in all the national papers. Ethel Fare died in 1998, aged 102.

For over two decades in the first half of the last century, the Hardy Players were the most famous amateur dramatic company in Britain. They attracted to Dorchester many of the most eminent people in the country, and were the pride of Dorchester, along with Hardy himself. They deserve to be well remembered in their home town.

Acknowledgements

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Abbreviations

DCC, Dorset County Chronicle; CL, The Collected Letters of Thomas Hardy; KW, Keith Wilson; and DCM, Dorset County Museum.

NOTES

1 DCC, 14 October 1897.

2 *Ibid.* 10 January 1889.

3 *Ibid.* 7 December 1882.

4 *Ibid.* 8 November 1883.

5 CL, Vol 7, p. 112. 24 January 1890.

6 DCC, 29 April 1897.

7 *Ibid.* 17 April 1902.

8 KW, p. 57.

9 CL, Vol 3, p. 332. 12 September 1908 (But according to KW p. 59. the performance – which Hardy attended – was of three scenes from The Dynasts).

10 CL, Vol 3, p. 299. 27 February 1908.

11 The Times, 19 November 1908.

12 CL, Vol 3, p. 148. 2 November 1908.

13 CL, Vol 3, p. 356. 16 November 1908.

14 Terry Hearing and Sarah Bridges: The Dorset Quarter Sessions 1625–1638 (The Dorset Record Office 2006).

15 DCC, 28 November 1908.

16 CL, Vol 4, p. 17. 21 April 1909.

17 Evelyn Evans Monograph My Father Produced Hardy's Plays (Toucan Press 1964).

18 KW, p. 99.

19 CL, Vol 4, p. 149. To Edmund Gosse 15 March 1916 and to Sir Arthur-Quiller Couch 19 March 1916.

20 KW, p. 99.

21 DCC, 7 February 1918.

22 Daily Mirror, 19 November 1920.

23 The Letters of Emma and Florence Hardy (ed. Millgate 1996) p. 193. 26 November 1922.

24 Letter, 19 August 1992 in the Fare family collection.

25 Daily News, 16 November 1922.

26 KW, p. 121.

27 Unidentified press cutting in Ethel Fare's press cuttings scrapbook in the Fare collection.

28 Morning Post, 29 November 1923.

29 Unidentified cutting in the Fare collection.

30 Daily Telegraph, 29 November 1923.

31 Morning Post, 22 February 1924.

32 Unidentified cutting in the Fare collection.

33 Dorchester Debating and Dramatic Society Minute Book (Dorset History Centre D349/1), 25 August 1924.

34 *Ibid.* 30 September 1924.

35 CL, Vol 6, p. 285. 13 November 1924.

36 Daily Express, 27 November 1924.

37 The Times, 27 November 1924.

38 *Ibid.*

39 DCC, 4 December 1924.

40 *Ibid.*

41 CL, Vol 6, p. 295. 13 December 1924.

42 CL, Vol 6, p. 265. 14 July 1924.

43 *Ibid.* July 1924.

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Numbers of Mute Swans on the Fleet lagoon, Dorset, UK, AD 1808–2008, and their likely effects on nutrient loadings

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In an earlier paper (Weber *et al.* 2006), nutrient (nitrogen and phosphorus) loadings upon The Fleet Lagoon, Dorset from its catchment (Figure 1), were 'hindcast' for the period AD 1866–2004, using modelling of historical land use changes, livestock numbers, marine inputs and human and wildfowl populations. Loadings were defined in terms of critical limits (Vollenweider 1975): (a) 'permissible' – unlikely to force oligotrophic bodies to change from their present state; and (b) 'dangerous' – likely to continue to force eutrophic bodies to change (O'Sullivan 1995).

Agriculture was found to be the main long-term nutrient source, with human and marine inputs, and wildfowl, representing minor contributions. By 1866, the Fleet was already grossly overloaded with total nitrogen, remaining so throughout the period examined, and reaching a maximum during the 1980s. Total phosphorus inputs lay below 'permissible' limits until that time, but exceeded them during the 1940s in the inner, less tidal part of the lagoon (the West Fleet). Phosphorus loadings on Abbotsbury Bay (the least tidal part of the Fleet) had already exceeded 'permissible' limits by the 1860s, becoming 'dangerous' during the mid-20th century.

However, owing to the limited nature of the data then available, it was not possible to calculate nutrient loadings to the Fleet from waterfowl for each year of the study. Instead, data on recent numbers (1996–2000), kindly supplied by Mr D. Wheeler, Swanherd of Abbotsbury Swannery, were used in order to derive a 'flat rate' contribution from that source, which was then employed as a maximum likely input for recent decades. It was believed that waterfowl numbers were likely to have been lower during earlier decades, owing to the absence of modern wildlife conservation measures. Nitrogen inputs were calculated to be unimportant, but

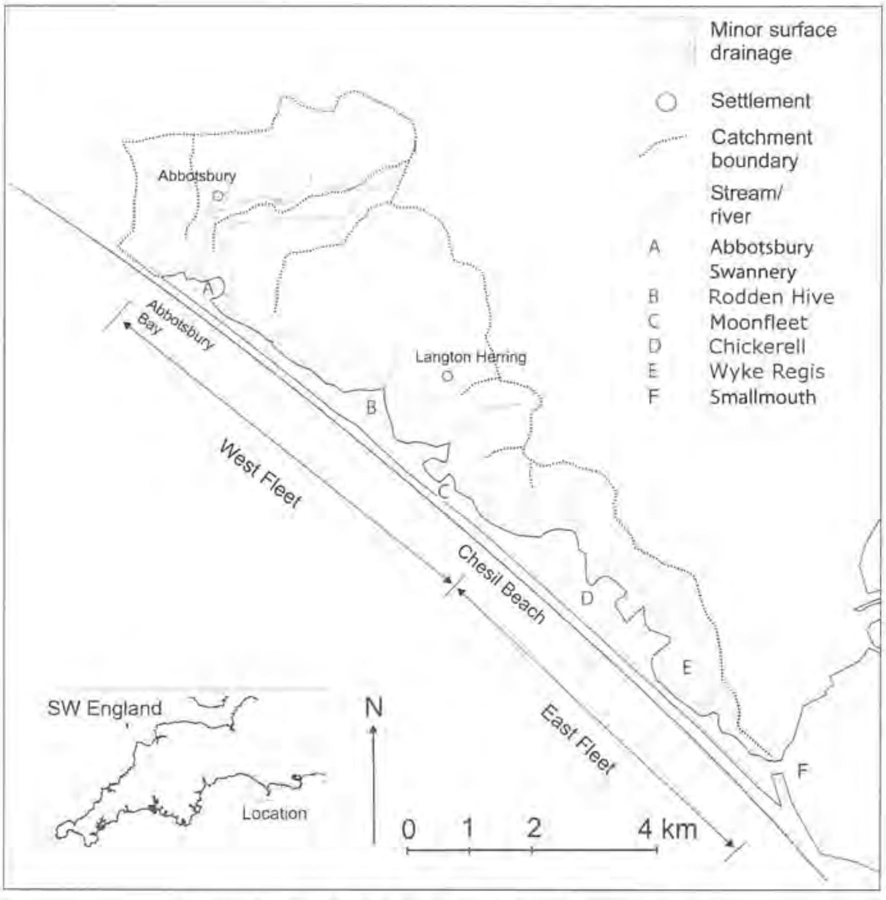

Figure 1: The Fleet Lagoon, Dorset, and surroundings

it was found that waterfowl probably do contribute a significant proportion of the current total phosphorus budget of the lagoon (*c.* 35%, or *c.* 7× that from sewage effluent). Of this, Abbotsbury Swannery (see below) was thought to produce *c.* 4.5% of the total phosphorus budget; broadly equivalent to the present human input.

Current nutrient concentrations in the Fleet are highest in Abbotsbury Bay and the West Fleet, declining towards the lagoon entrance. The Bay receives by far the greatest annual areal loadings of any part of the Fleet, augmented by effluent from Abbotsbury sewage treatment works, particularly phosphorus. Here, macro- and microalgal blooms, the greatest oxygen deficits and concentrations of chlorophyll *a*, and the highest ratios of nitrogen to phosphorus are observed (Johnston and Gilliland 2000; Langstone *et al.* 2003), and various species of eel-grass native to the lagoon (*Zostera* spp., *Ruppia* spp.; Holmes 2000) have been partly replaced by filamentous green algae.

The impact of catchment nutrient loadings is therefore greatest in the innermost parts of the Fleet, where reduced tidal flushing, high temperatures and high pH produce extreme conditions. Abbotsbury Swannery, located in the same part of the lagoon, is one of the largest UK colonies of Mute Swans (*Cygnus olor* L.), and has existed for at least seven hundred years (Morris 2002). Since 1970, maximum numbers in the colony have risen from *c.* 50 to *c.* 400 adult birds (McCleery *et al.* 2002). Because the impact of increased nutrient loadings is greatest at that end of the lagoon, concerns have sometimes been expressed that the Swannery constitutes a significant nutrient source.

Since our earlier paper, more extensive data on numbers of Mute Swans on the lagoon for the period before 1996 have become available. As the question of the effects of such populations upon total nutrient loadings has sometimes been considered controversial, this article will review these data, and suggest what the effects of swans on such loadings over the period examined may have been. It should be stressed that the data reviewed here refer: (a) not to waterfowl as a whole (except for the last decade), but mainly to Mute Swans; and (b) to numbers of swans on the lagoon as a whole, and not just those in Abbotsbury Swannery, which are the subject of a separate long-term and much more systematic investigation (Birkhead and Perrins 1986; McCleery *et al.* 2002; Perrins and Ogilvie 1981).

Methods

Data sources and interpretation

Numbers of swans on the Fleet for the period AD 1808–2008 were reconstructed using data from:

1. For the early 19th century (1808–1844): Estate records (Box 151A, County Record Office, Dorchester; Morris, 2002, p. 146), and (for 1844) 'Cockburn's opinion' (Box 333, County Record Office, Dorchester), which reiterates an earlier opinion, of 1830 (also in Box 333), by Phillip Williams, also of Lincoln's Inn. In both documents, numbers of swans are given in terms of 'upwards of', suggesting that they are *minimum* estimates.
2. For the second half of the 19th, and the early 20th century (1848–1939): Various volumes of the Post Office Directory of Dorset (Kelly and Co. London, after 1880, Kelly's Directory), along with isolated values from Hunt's (E. Hunt and Co. 1851) and Harrod's Directory (J.G. Harrod and Co. London, 1865). Data were obtained for 3–4 year intervals between 1848 and 1939. Here, swan numbers are usually given as 'as many as', which suggests that these are *maximum* estimates. For one year (1895), the value (1057) recorded is so precise as to imply greater accuracy, but generally numbers appear to be cited to the nearest 100 swans.

   Such directories were compiled for general sale by commercial publishers, and published every five years or so. Larger publishers (including Kelly), who employed full-time local agents, produced the most accurate data (Shaw 1982). Information was collected from paying contributors by local letter carriers, who circulated forms during their postal rounds, and delivered the finished directory on commission. Whilst they clearly do not give precise figures, directories therefore probably do represent fairly accurate records of local conditions. It is fortunate that in this case, estate records from the 1920s and 1930s may be used to test for validity (see below).
3. For the middle part of the 20th century (1928–1972), a notebook entitled 'The Swannery, Abbotsbury. Summary of Countings, commencing 22nd May 1928' held in the offices of Ilchester Estates, Melbury Sampford, Dorset, which states that the summary is of 'swans counted on the Fleet' (i.e. not just the Swannery). Numbers are given both for early summer (May or June, although once April [1944], and occasionally July), and for autumn (mostly October/November, although initially also September, and once [1940], December). Values for the early part of the year represent the permanent, breeding population of the lagoon, whilst those for the latter half include swans visiting for the annual moult (D. Wheeler, pers. comm.). Autumn values also mostly contain numbers of cygnets, listed separately from adult swans until 1944, but within the total from 1946. Also recorded are numbers of: (a) skins sent to London; (b) swans which died but whose skins were of no use; (c) those taken by foxes; (d) those which were sold, given away, taken to Melbury Sampford for the table, or, occasionally, shot; and (e) high swan mortality (1963–1964). Estate records for the early 19th century (see above),

which also list numbers of cygnets, may therefore also refer to the second half of the year.

As indicated, these data may be used to validate values for the 19th and earlier 20th century abstracted from Kelly's Directory, and so test them for accuracy. So also may a letter from the Earl of Ilchester to *The Times* (London) of 6 July 1935, which states that, during the 1880s, numbers 'rose to over 1500', but that they 'are now again well below 800' (Morris 2002). For 1875 and 1880, there is reasonable agreement between Kelly's Directory (1200–1500) and the Earl, but during the later 1880s, Directory values fall to 700, which would seem, from the letter, to be an underestimate. In contrast, for the 1930s, numbers in Kelly's Directory (cited throughout as 1000) would seem to be overestimates, both from the Earl's letter, and from the Summary of Countings, which indicates that for most of that decade, values lay below 500.

However, for the period 1928–1932, the Summary of Countings also gives figures in excess of 1000, so that values printed in Kelly's Directory may be accurate for the early 1930s, but, for the latter part of the decade, somewhat out-of-date. Thus it would appear that the data from 'Kelly's' are reasonably accurate for the later 19th, early 20th, but that this accuracy is lost during the second half of the 1930s. Fortunately, this is an interval for which primary data are available.

4. Recent data (1984–2008) also collected by Abbotsbury Swannery, recording total numbers of Mute Swans and other waterfowl on the Fleet as a whole, kindly provided by Mr D. Wheeler, Swanherd: For the interval 1984–1996, data were collected for autumn (Sept, Oct, Nov) and winter (Dec, Jan, Feb) only, but from 1996 onwards, on a monthly basis for the whole year. Until 1996, only swans, geese and ducks were counted but, from January 1997, other species were added, including waders, gulls and terns. Therefore, data series appear in Figure 2 (overleaf) as Summer and Autumn for the period 1928–1972, Autumn and Winter for 1984–1996, and all four seasons from 1997 to the present. Winter counts include not only swans present for the moult (see above), but also winter visitors sheltering from conditions elsewhere, who leave the lagoon before the breeding season (D. Wheeler, pers. comm.).

For 1984–1996, enumeration points used were Abbotsbury, Langton (Herring), Chickerell and Wyke (Figure 1). Since 1997, data from the Fleet have been fed into the British Trust for Ornithology's Wetland Bird Survey (Webs; http://www.bto.org/survey/webs/). These are collected in four sections of the Fleet: (a) Swannery to Rodden; (b) Rodden to Moonfleet, (c) Moonfleet to Chickerell; and (d) Chickerell to Ferrybridge (Smallmouth) at the ouflow from the lagoon (Figure 1). Sections (a) and (b) correspond broadly to the inner, less tidal West Fleet, and (c) and (d) the more tidal East Fleet (see Weber *et al.* 2006). Counting methods employed by individuals may differ, but singles and 'tens' of birds are counted mainly individually, whereas 100's and 1000's may be estimated in groups of ten or 100, or so, by working out the area occupied by ten or 100 birds, and then multiplying this value throughout the observed flock, adjusting the area by the density of birds (email from Steve Groves, Deputy Swanherd of Abbotsbury Swannery, 16th February 2009).

Data manipulation

Nutrient loadings to the Fleet were calculated using a model originally developed by Jørgensen (1980), as adapted by various authors listed in Weber *et al.* (2006). External nutrient loads upon a waterbody are 'predicted' by summing outputs from all potential diffuse and point sources of nitrogen and phosphorus within and over the catchment and the body itself, as in:

Natural (i.e. diffuse/non-point) losses:

$$LP = \sum_{i=1}^{n} . A \times EP \text{ (where } EP = Ep_f + Ep_{ag} + EP_u$$

where LP = loss of phosphorus (kg ha^{-1} yr^{-1})
A = area of watershed (ha)
EP = export coefficient for phosphorus, where:
$_f$ = forest, $_{ag}$ = agricultural land, $_u$ = urban areas

Direct input from precipitation:
$IP = CP \times A_0$
where IP = input of phosphorus
CP = P concentration in precipitation (mg l^{-1})
A_0 = area of water body (ha)

Load from sewage treatment:
$LP = (D_{ca}P \times H \times 365 \times M \times B \times R_s)/10^6$
where LP = phosphorus loss (t a^{-1})
D_{ca} = phosphorus discharge $person^{-1}$ (g day^{-1})
H = sewered human population
M = loss during mechanical treatment (10–15%)
B = removal during biological treatment (10–15%)
C = removal during chemical treatment (80–90%)
R_s = retention coefficient of filter bed (1–88%)

Coefficients for wildfowl contributions were derived from data given by Manny *et al.* (1994) and Marion *et al.* (1994), but no values for Mute Swans could be found. Coefficients were therefore based on those cited by Mitchell and Wass (1995) for Black Swans (*Cygnus atratus* Latham; 1.2g N and 0.23g P day^{-1}), but multiplied by two, in order to account for the greater body weight of Mute Swans. For the most recent data, numbers of swans were multiplied by numbers of bird residence days (BRDs), based on modern bird census data, in order to account for seasonal shifts in populations. Residence was assumed to imply 100% delivery of faecal material to the lagoon, and none to the adjacent land; a 'worst case scenario' also adopted by other modellers of the Fleet (e.g. Mainstone and Parr 1999).

Results

Changes in numbers of Mute Swans on the Fleet

These are now discussed in terms of the same four time intervals listed above. Values are then used to calculate loadings to the lagoon from swans, and comparisons with other nutrient sources made. No systematic attempt is made to account for long term variations in swan numbers, either in terms of local or national economic factors, or environmental changes, which are beyond the scope of this article. As stated above, the swans of Abbotsbury Swannery itself are the subject of a separate, more systematic long-term investigation.

The early 19th century (1808–1844; Table 1)

Values for 1808–9 are low compared with those in the rest of the data (both for this and for subsequent periods, see below), with only 167–170 adults, and 27–40 cygnets present. However, the fact that numbers are low, and that cygnets are also mentioned, may indicate that these values refer only to the Swannery, and not to the Fleet as a whole. Against this argument is another passage in Cockburn's opinion, which states that

> 'In the 32nd (year of) Eliz:(abeth) (i.e. AD 1589–1590) it was found that from the village of Abbotsbury to the sea ... is an estuary Meer or Fleet ... and in it are 500 swans; 400 white and 90 signets ... *the greater part whereof* ... were the possession of Joan, late wife of Sir John Young Knight, which lady was a Strangways.' Hilary Term, 34th Elizabeth. Case of Swan's (sic) and Mr Cockburn's opinion thereon. Lincoln's Inn, London, July 10th, 1844, italics added (Box 333, Ilchester Estate Records, County Record Office, Dorchester).

Table 1: Numbers of Mute Swans on the Fleet lagoon, 1808–1844

Year	Swans	Cygnets	Source
1808	167	27	Estate Records
1809	170	16	Estate Records
1830	400		Cockburn's Opinion
1844	500		Williams's Opinion

Therefore it is possible that Estate Records for the early 19th century do indeed record a real minimum in the Swan population of the Fleet. Values for the fourth and fifth decades (1830, 1844) are higher (4–500), and more typical of the rest of the century (see Table 2).

The later 19th, early 20th century (1848–1939; Table 2)

For the mid-19th century, numbers remain between 500–700, but from 1875–80, a sharp rise to 1200–1500 is recorded, to values broadly confirmed by the Earl's letter of 1935. Numbers then fall to 700 for the later 1880s, but rise again to 1000–1200 for the period 1895–1915, only to decline again for the 1920s to 800. They then rise again during the 1930s, but, as stated, these values do not tally precisely with those given by the Earl, or by the Summary of Countings (see below). They may be correct for the early part of the decade, but not for later years.

The mid-20th century (1928–1972; Figure 2)

Numbers are high for the first part of the 1930s (see above), but fall sharply during the second part of the decade, remaining low, and declining until the early 1950s. Values for spring decline from *c.* 400 during the mid-1930s, to just over 250 by the late 1940s. Corresponding changes for autumn are less marked,

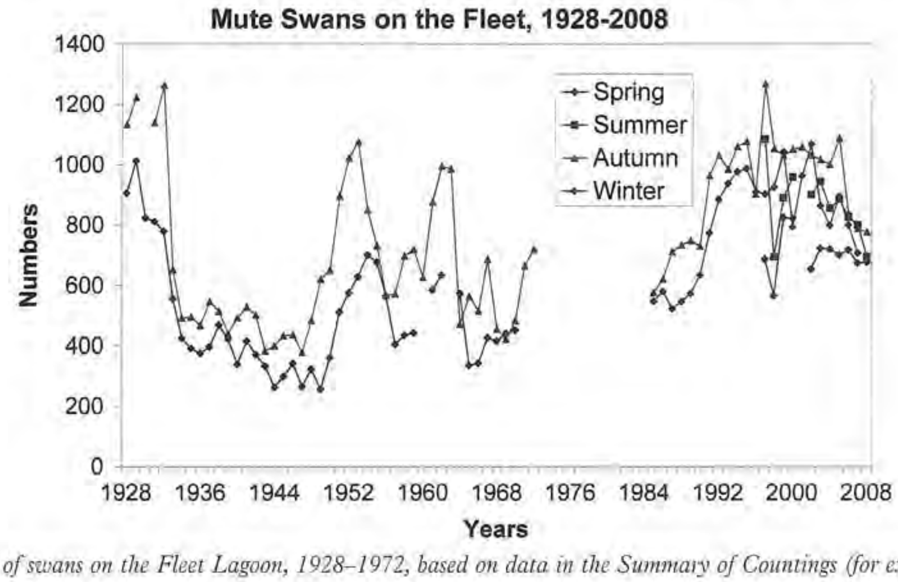

Figure 2: Numbers of swans on the Fleet Lagoon, 1928–1972, based on data in the Summary of Countings (for explanation, see text)

Table 2: Numbers of Mute Swans on the Fleet lagoon, 1848–1939

Year	Swans	Source (Directory)	Year	Swans	Source (Directory)
1848	500	Post Office	1903	1200	Kelly's
1851	700	Hunt's	1907	1200	Kelly's
1855	500	Post Office	1911	1200	Kelly's
1859	500	Post Office	1915	1000	Kelly's
1865	800	Harrod's	1920	800	Kelly's
1867	600	Post Office	1923	800	Kelly's
1875	1200	Post Office	1927	800	Kelly's
1880	1500	Kelly's	1931	1000	Kelly's
1885	700	Kelly's	1935	1000	Kelly's
1889	700	Kelly's	1939	1000	Kelly's
1895	1057	Kelly's			

from *c.* 500–600 to *c.* 400–450. Numbers then rise sharply during the late-1940s, early 1950s, to an autumn peak of *c.* 1000 birds during 1952–3, and again in 1962–3. Spring values are slightly lagged for the earlier decade, and peak once only, in 1954–5, at *c.* 670–700. After the mid 1950s, values fluctuate, but with an overall downward trend to *c.* 400–450 birds in both parts of the year (although autumn values for 1971–2 recover to *c.* 670–720). Unfortunately, there is no spring count following the severe winter of 1962–3, although '4 feet' (*c.* 1.2m) of ice is recorded. A total of 452 swans died of a virus during the autumn (190) and spring (262) of 1963–4.

Recent data (1985–1996, 1997–2008; Figure 2)

Autumn numbers for the mid-1980s (575–700) are similar to those of the 1960s. No spring data were recorded until 1997. Values then increase consistently throughout the 1990s. Winter counts rise sharply from the low of the mid-1980s to values between 750–900 by 1994, autumn figures mainly to *c.* 950–1000. The highest value recorded is 1245 swans (Autumn 1993). Spring values for the period 1997–2005 are somewhat higher than those of the 1960s.

As pointed out by Fair (2000), numbers of swans on the Fleet have increased during recent decades, although from Figure 2, it would seem that they are now declining once more. Fair (*ibid.*) offered no explanation beyond the effects of the mild winters of the 1990s, but another possibility is that the recent rise in Swan numbers on the Fleet is associated with the general increase in Mute Swan populations in Britain which has followed the banning of the use of lead shot for weights in angling (Kirby *et al.* 1994; D. Wheeler, pers. comm.). However, it is also possible that the increase seen in Figure 2 is not real, in that the maximum recorded number of swans for the period 1974–1981 (where there is, unfortunately, a gap in the data available) is 1238 (Ladle 1981; appendix 1, p.1). Whether this value refers to spring or autumn is not indicated, but, from other data discussed here, the latter seems more likely.

Table 3: Export coefficients for the main types of wildfowl present on the Fleet Lagoon (from Weber *et al.* 2006)

	Nutrient loadings (g ca^{-1} day^{-1})	
	Nitrogen	Phosphorus
Swans	2.4	0.46
Geese	1.57	0.49
Gulls	0.44	0.24
Other wild fowl and waders	0.72	0.22

Effects of swans and other waterfowl on nutrient loadings

The effects of swans and other wildfowl on nutrient loadings to the Fleet can now be calculated using the same export coefficients as employed by Weber *et al.* (2006; Table 3). For ease of discussion, these results will be evaluated using the most recent data first.

Loadings from all waterfowl, 1997–2005 (Table 4)

Species are listed only in those categories employed in nutrient loading calculations. Values are given as 'means' for the period 1997–2008, except that 2001 was not included in the calculations, as counts for that year are incomplete. In order to account for seasonal patterns in migration, etc. species numbers are given in terms of bird residence days (BRDs), calculated from monthly counts.

Waterfowl currently contribute 2.040t nitrogen and 0.575t phosphorus to the Fleet lagoon. These values are very close indeed to those given in our earlier paper (2t nitrogen, *c.* 0.5t phosphorus; Weber *et al.* 2006), calculated using a shorter base period (1996–2000). Of the new figure, Mute Swans produce *c.* 37% of the nitrogen loading from waterfowl (*c.* 0.75 t), and *c.* 24%

Table 4: Mean annual loadings from waterfowl to the Fleet lagoon, 1997–2005. (BRDs = 'bird residence days'; for explanation, see text)

Species Category	BRDs	Load nitrogen (t)	Load phosphorus (t)	% Total waterfowl load N	P	% Total load N	P
Mute Swans	311157	0.747	0.141	36.6	24.5	0.97	9.4
Geese	173452	0.272	0.085	13.3	14.8	0.35	5.7
Gulls etc	357090	0.157	0.086	7.7	15.0	0.20	5.7
Other waterfowl and waders	1199584	0.864	0.264	42.3	45.9	1.12	17.6
Total	1761292	2.040	0.575			2.65	38.30

Table 5: Nutrient loadings to the Fleet lagoon from Mute Swans, 1830–2008

Interval	Mean number of Mute Swans (a^{-1})	BRDS per time interval	Mean nutrient load from Mute Swans (t a^{-1}) N	P	% Total nutrient loading N	P
1830–1869	360	5217067	0.31	0.06	0.75	7.79
1870–1879	800	2934600	0.70	0.13	1.64	18.00
1880–1889	650	2363983	0.57	0.11	1.32	15.00
1890–1919	760	5533677	0.66	0.13	1.55	16.97
1920–1929	920	2245947	0.54	0.10	1.16	11.8
1930–1932	950	693500	0.83	0.16	1.80	20.99
1933–1939	500	1828650	0.63	0.12	1.36	17.42
1940–1949	390	1430618	0.34	0.07	0.75	7.15
1950–1959	645	2389108	0.57	0.11	1.1	8.90
1960–1972	575	2722273	0.50	0.10	0.88	6.78
1985–1996	565	2480960	0.50	0.10	0.53	4.69
1997–2008	840	3683648	0.74	0.14	0.91	8.90

of phosphorus (*c.* 0.14 t). Of this, and assuming a current population of *c.* 400 adults (McCleery *et al.* 2002), *c.* 0.35t nitrogen (*c.* 17%) and *c.* 0.07t phosphorus (*c.* 12%), are supplied by Abbotsbury Swannery.

A further *c.* 0.27t nitrogen (*c.* 13%) and 0.085t phosphorus (*c.* 15%) are contributed by geese, mostly Canada Geese (*Branta canadensis* L.) and Dark-bellied Brent Geese (*B. bernicla bernicla* L.), and *c.* 0.16t nitrogen (*c.* 8%), and *c.* 0.09t phosphorus (15%) by gulls and terns. An additional 0.86t nitrogen (42%), and 0.26t phosphorus (46%) are produced by waders and other waterfowl, of which 0.079t nitrogen (3.8%) and 0.024t phosphorus (*c.* 4%) are supplied by the former, and *c.* 0.78t nitrogen (*c.* 38%), *c.* 0.28t phosphorus (*c.* 42%) by ducks and other similar species.

Current total nutrient loadings on the lagoon are *c.* 77t nitrogen, and *c.* 1.5t phosphorus (Weber *et al.*, 2006). Of these, waterfowl produce in total 2.04t nitrogen (2.66%), and 0.575t phosphorus (*c.* 38%). Mute Swans therefore supply *c.* 1% of nitrogen loading, but *c.* 10% of phosphorus inputs, and ducks and waders together respectively *c.* 1% and *c.* 18%. The main waterfowl contributors to nutrient loadings on the Fleet are therefore Mute Swans, and ducks of various kinds.

Loadings from Mute Swans, 1830–2008 (Table 5)

Nutrient loadings to the Fleet from Mute Swans alone, for the period 1830–2008, are shown in Table 5. Loadings were calculated for unequal intervals, according availability of data, and for mean annual swan numbers (predicted BRDs) based either on: (1) single annual figures (1830–1928); or (2) means of spring and autumn counts (1928–1970, 1997–2008). No data are available for the period 1973–1985, and for 1971–2, and 1985–1996, no spring counts. Therefore, for this interval, autumn counts only were employed. (NB: winter numbers are also recorded for 1985–1996, but these were not used in the calculations, on grounds of lack of comparability with earlier data).

It was also found that the ratio between spring and autumn counts, for the three decades preceding the 1980s for which data are available, is *c.* 0.67. Autumn values for the interval 1985–1996 were therefore multiplied by thus number, in order to calculate likely average annual numbers of swans. Similarly, values from

Kelly's and other directories, which are given in these sources as 'as many as', are also considered likely to be maximum values for the years, and were therefore also multiplied by 0.67 for the purposes of calculations. 'Number of Mute Swans (a-1)' as listed in Table 5 therefore consist of a mixture of 'most likely' calculated values (1830–1930) and actual recorded numbers (1930 onwards). Several compromises both with the amount, and the nature of the data, and with the number of results reproduced here, have therefore been found necessary. Nonetheless, it is considered that the loadings discussed here are valid, given the above limitations.

Values for nitrogen loadings indicate that Mute Swans have never contributed more than 1.8% of the total loading of this element on the lagoon. Inputs vary between *c.* 0.3 and *c.* 0.8t a^{-1}, with the greatest amounts supplied during the late 19th, early twentieth century, when swan numbers appear to have been relatively high, and last decade (1997–2008), when they have mostly risen again. The proportion of nitrogen emanating from Mute Swans was also greatest during the interval 1870–1939, but fell as contributions from other sources rose with the introduction of modern agricultural methods. A slight rise in this percentage is seen for the last decade, owing to a decline of nitrogen inputs from agricultural sources produced by implementation of various agri-environment schemes in the catchment of the lagoon, particularly around Abbotsbury.

In contrast, phosphorus loadings from Mute Swans to the Fleet do seem to have been significant during the late 19th, early 20th century, reaching 15–18% of the total inputs during the period 1870–1919. Loadings of the element from agriculture were relatively small at this time, and there were no direct inputs of effluent into tributaries of the lagoon (Weber *et al.* 2006). Contributions during the 1920s and 1930s vary between *c.* 11 and 17.5%, with a peak value of *c.* 21% for the early 1930s. However, this particular result is based on data abstracted mainly from Kelly's Directory, and so should perhaps be viewed with some caution (see above). With the introduction of more intensive, modern agriculture, percentage contribution then falls sharply after 1940, to values between *c.* 5–9%, but rises again, to almost 9%, for the last decade (1997–2008), owing to the recent decrease in phosphorus loadings on the lagoon from agricultural sources (Weber *et al.* 2006).

Conclusions

Numbers of Mute Swans on the Fleet lagoon have varied considerably over the past two centuries, being greatest during the late 19th, early 20th centuries, the early 1930s, and the 1950s and early 1960s. Populations were smallest during the later 1930s and the 1940s, and also possibly the later 1960s, and have only recently recovered to values typical of the earlier decades of the 20th century, although they may now be falling again. Swans appear to have been more abundant during times when human impact, especially that of agriculture, was considerably less than that of today, but have also clearly benefited from modern conservation measures.

Waterfowl currently contribute *c.* 2.6% of the total nitrogen budget of the lagoon, but *c.* 38% of the total phosphorus budget. Of these, the main sources are Mute Swans (1% of nitrogen, 9.4% of phosphorus), and ducks and other similar species (*c.* 1.1% of nitrogen, 18% of phosphorus). Historically, Mute Swans have contributed between approximately 0.3 and 0.8t nitrogen, and 0.06 and 0.16t phosphorus annually to the lagoon; between 0.5 and 1.8% of its annual nitrogen budget, and 4.7 and 18% of its annual phosphorus loading. Absolute loadings of both elements have increased during recent decades (since *c.* 1960), but this change only represents a recovery to values characteristic of the late 19th, early 20th century, after the low numbers of the middle 20th century. Percentage contributions to the total budget of both elements fell during the second half of the 20th century, as inputs from more intensive agriculture rose, but have recovered over the last 10–15 years, owing to implementation of agri-enviroment schemes in the catchment of the lagoon.

Mute Swans have probably therefore never been major sources of nitrogen loadings to the Fleet, but have probably contributed significant amounts of phosphorus. Abbotsbury Swannery, which currently contributes *c.* 0.35t nitrogen, and 0.07t phosphorus annually (equivalent to *c.* 17% of the nitrogen, and *c.* 16% of phosphorus supplied by waterfowl), is therefore not, *by itself*, a significant source of either element. One *caveat*, however, is that introduction of increased phosphorus inputs over the past three decades (both from agriculture, Abbotsbury sewage treatment works and the recently increased numbers of swans in the Swannery; McCleery *et al.* 2002) into the relatively confined waters of Abbotsbury Bay, may be responsible for some of the ecological changes recently observed there (e.g. decline of eelgrass; Holmes 2000). The very short water residence time of the Bay (*c.* 12.5 days), however, helps to counteract such effects (Weber *et al.* 2006), as does the recent introduction of agri-environment schemes.

Waterfowl populations of the Fleet *as a whole*, are clearly an important source of phosphorus to the lagoon (*c.* 38 % of total annual input, broadly equivalent to twice the contribution from sewage treatment works; Weber *et al.* 2006), which for a site of such great nature conservation value, is not particularly surprising. Unlike sewage effluent, however, waterfowl, especially the Abbotsbury swans, are also part of the inherent value of the Fleet (O'Sullivan 2005), and hence its attraction to human visitors.

Acknowledgements

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A fossil tree trunk in the Intermarine Member, Durlston Formation, Purbeck Limestone Group of Dorset, southern England

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A new and unusual pipe-like feature, that we interpret as a partially exposed fossil tree trunk, has been exposed in the cliffs of Durlston Bay, Swanage. To the best of our knowledge, fossil trees have not yet been recorded from the Durlston Formation of the Purbeck Limestone Group of Dorset.

Introduction

The late Jurassic and early Cretaceous Purbeck Limestone Group of Dorset consists of a series of limestones, sometimes sandy, with clays, shales and marls. Minor evaporites, calcitised evaporites, and palaeosols also occur, especially towards the base of the succession (West 1975). These *c.* 145–140 Ma sediments were deposited in environments ranging from supra-tidal coastal flat, to lagoon and freshwater lake, sometimes with exposed surfaces which dried out leaving desiccation cracks. The sediments yield a rich fossil flora including a variety of algae, ferns, cycadophytes, and conifers (Batten 2002; Francis 1983). Invertebrates include gastropods and bivalves (Arkell 1941; Clements 1973, 1993; Radley 2002), ostracods (Clements 1993; Horne 2002), other crustaceans including conchostracans, decapods and isopods (Ross and Vannier 2002), insects (Coram and Jarzembowski 2002), and echinoids. Vertebrates include fish (Underwood and Rees 2002; Woodward 1916–19), amphibians (Evans and McGowan 2002), reptiles (Evans and Searle 2002; Howse and Milner 1995; Milner 2002, 2004; Norman and Barrett 2002; Salisbury 2002) and mammals (Sigogneau-Russell and Kielan-Jaworowska 2002), but not yet birds. The eggshell of reptiles (Ensom 2002a) and possibly avians (Benson and Barrett 2009) has been found at several horizons, and there is a rich trace fossil fauna in which dinosaur tracks are especially abundant (Ensom 1995a,b; 2002b, Ensom and Delair 2007).

A visit to Durlston Bay by one of us (R.E.), in the Spring of 2008, to the section which had yielded the discoidal plants and crocodile skull recorded in last year's Geology Report (Edmonds 2008), revealed the carbonaceous outline of a pipe-like feature, interpreted as an inclined trunk or stem of a more substantial plant (Figures 1–2). This note is intended to provide a record of this discovery, one which may, in time, warrant a fuller description.

Repository acronym for specimens collected is DORCM (Dorset County Museum, Dorchester, Dorset).

Location, stratigraphy and palaeoenvironment

The tree trunk is, at present, exposed in an eroding cliff above normal high tide level in Durlston Bay, Swanage (NGR SZ 03798 78470), adjacent to the fallen blocks which yielded a crocodile skull and distinctive discoidal plant fossils reported by Edmonds (2008) examples of which have been accessioned DORCM G 11,802.

The trunk is located within Bed DB 129b (beds prefixed DB are those of Clements 1993 and are used

Figure 1: The inclined trunk seen in the cliff at Durlston Bay, nr Swanage, viewed from the north. Arrows point to upper and lower exposed ends of trunk. Scale bar 10cm

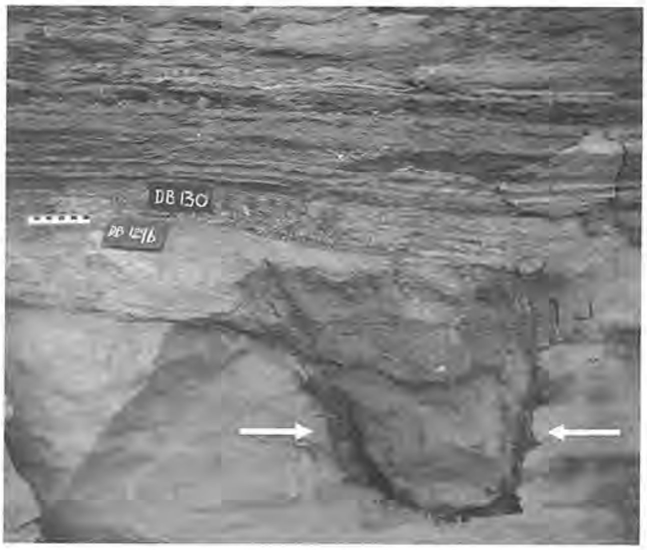

Figure 2: The crushed trunk inclined in DB 129b, truncated at the boundary with DB 130. Arrows indicate left and right vertical flanges. Scale bar 10cm

throughout this note) with its exposed upper part truncated by Bed DB 130. Clements 1993 described bed DB129b as a sandy calcareous mudstone unit; the bed appears to be poorly lithified, yet remains intractable. While the bedding appears to be generally horizontal, within part of the bed, there is evidence of small scale cross-bedding and channelling, and possible dinoturbation. The overlying bed (DB 130) comprises clays with layers of poorly preserved bivalve shells which form unlithified or poorly lithified shell beds, especially in the lowest 0.1–0.15m. Both beds lie within the Intermarine Member, between the lower strata collectively known as the 'Freestone Beds' and the overlying 'Rags'.

As the name suggests, the Intermarine Member is sandwiched between strata which contain faunas of a more 'marine' nature, though whether they genuinely represent normal marine conditions, or are the result of climatic and geomorphological controls is a matter of debate. Within DB 129b, Clements (1993) recorded fresh-brackish water elements such as the remains of the calcareous alga *Chara*, and the gastropod *Viviparus* which is generally regarded as freshwater. *Neomiodon*, a bivalve tolerant of low salinity, brackish water conditions (oligohaline to mesohaline), was observed in the sediment surrounding the trunk. The presence of these fossils is consistent with a fresh or brackish water depositional setting for the trunk itself.

Description

The feature that we are interpreting as a tree trunk is a pipe-like structure that emerges from the cliff to expose an outer mostly convex surface that is bounded by a distinctive thick carbonaceous layer (Figures 2–3). The base of the trunk is at present invisible, and the toughness of the sediment thwarted our attempts to expose the lower end. The top of the trunk is apparently truncated by the base of bed DB 130. The total exposed length is 0.53m. The exposed circumference at the top measures 0.55m, which represents approximately half the estimated true circumference, and the diameter is estimated at approximately 0.43m. Further excavation and removal of sediment overlying the trunk (bed DB 130) revealed that it is not full round and that the carbonaceous layer is present only on the exposed convex surface. In other words, the pipe-like structure appears to have collapsed in upon itself. The general convex shape of the trunk is most pronounced

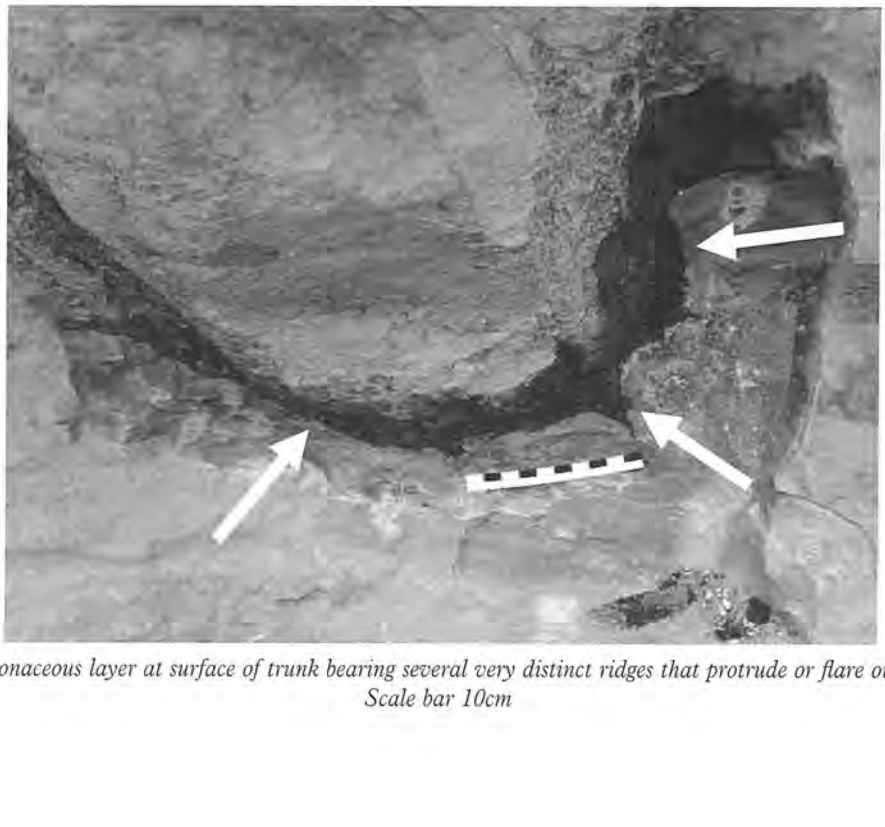

Figure 3: Thick carbonaceous layer at surface of trunk bearing several very distinct ridges that protrude or flare out into the sediment. Scale bar 10cm

towards the middle of the long axis, tailing off towards each vertical edge, giving the appearance of two vertical flanges. There is no evidence of any branching. The carbonaceous layer on the exposed surface of the trunk is of variable thickness (<1cm to >3cm thick in places) and it has a glassy fractured appearance. No cell structure is apparent. The outer and inner surfaces of the carbonaceous layer that define two aspects of the trunk's surface are not quite the same shape. The outer surface exhibits several very distinct ridges that protrude or flare out into the sediment (Figure 3). The inner surface also appears to be ridged or folded, but not to the same extent and not in the same places. The specimen's long axis, on the basis of what is currently exposed, appears to be aligned N030°E, which when the dip of the strata is taken into account, dips at 57° in a north-north-easterly direction.

The base of bed DB 130, which overlies and apparently truncates the tree trunk, is a variably lithified shell-rich marl containing fragments of oyster, bone fragments and fish teeth, 0.045–0.05m thick. This bed appears to sag smoothly over the surface of the trunk (Figure 1), giving the impression that there has been a degree of differential compaction across this feature. Similarly, a horizon within DB 129b cuts across the feature and also shows evidence of this differential compaction; within the trunk it is 0.175m below DB 130, and to the sides of the trunk is 0.125m (south-west) and 0.14–0.15m (north-east) below DB 130. This horizon has yielded the small discoidal plant fossils (Edmonds 2008, Figure 3). Samples from the trunk and associated rocks are accessioned DORCM G 12,081.

Interpretation

We interpret this pipe-like structure as a partly exposed and truncated fossil tree trunk that has collapsed under compression during diagenesis. The visible pipe-like feature is therefore a sedimentary fill of the collapsed trunk. This interpretation is consistent with the general size and shape of the specimen and with the presence, position, and structure of the coalified layer. Under compression, the cylindrical stems or trunks of plants can take on a variety of shapes. Key factors that affect shape include, the degree to which the stem is mineralised (petrified), the amount and internal distribution of sediment infilling, the nature of the encasing sediment, the orientation within the sediment, the proximity to other structures (e.g., other fossils, rocks), and the degree of compaction during diagenesis (Rex and Chaloner 1983). It is not uncommon for one surface of a stem to collapse into the opposite surface to produce an apparently single convex surface with associated coaly layer. For this to occur, there must be no early diagenetic mineralization and no infilling of any tissue system within the stem by sediment. Under our interpretation, collapse and compression of the trunk has been very severe. All that remains is a coalified layer of variable thickness that represents the entire crushed remains. Even though collapse of this nature severely alters the shape of a trunk in cross section, it is unlikely to distort the diameter significantly.

Rygel *et al.* (2004) drew attention to the hitherto unrecognised importance of both hydrodynamics and decay in vegetation-induced sedimentary structures (VISS) within clastic depositional sequences. The slight sagging of the upper surface of DB 129b above the trunk, and of the thin argillaceous band as it crosses the trunk towards the top, may be a response to tissue decay. An apparent slight down-turning of the edges of the strata immediately surrounding the trunk is another characteristic of decay related VISS.

On the basis that this interpretation is correct, a number of questions arise:

Firstly, was this an in situ plant or a drifted root bowl with attached trunk?

In the basal Purbeck Limestone Group, silicified in situ and fallen trees are associated with dirt beds (Francis 1983; West 1975). There is no evidence or record of a palaesol in this part of the succession, neither are there any previous records of larger rooted plants in this bed, nor in the Intermarine Member in general. We consider that an *in situ* interpretation is therefore most unlikely.

Excluding the Purbeck fossil forest horizons, fragmentary silicified and carbonaceous remains, sometimes of large size, but invariably parallel to the bedding planes (personal observation by PE) are not uncommon in other beds throughout the Purbeck Limestone Group of Dorset. A tool-mark (Ensom 1994) in the form of a substantial groove on the top of a cross bedded shell biosparrudite in the overlying Rags (DB 133) does show that larger objects, possibly plants, were floating or drifting in water in the Intermarine Member environment. The presence of a more or less complete root structure on the trunk together with adhering soil debris could have provided a temporary anchor, with any associated bottom-weight helping tilt the attached plant into a semi-vertical position. Although plausible, there is no direct evidence of roots on the short length of visible trunk.

Secondly, when did truncation occur in relation to the collapse of the stem?

We accept that all that remains could be all that was deposited and that no truncation occurred. However, we note the change in sediment type immediately above the truncated trunk, and conclude that this is not a coincidence. The gentle sagging of these sediments noted in the description above, suggests that they had been deposited over the decayed and collapsed trunk before final compaction took place. Truncation and collapse are likely to have been more or less synchronous and pre-date the deposition of DB 130.

Thirdly, do the discoidal plant fossils found within DB 129b have any connection with the trunk?

The discoidal plant fossils found close to the trunk and documented by Edmonds (2008) are most probably parts of flower-like cones of the family Williamsoniaceae (Bennettitales/Cycadeoidales). It is tempting to suggest a connection, but given the environmental context, the nature of our taphonomic interpretation, and the structure of the trunk, this seems unlikely. First, there is no certain taxonomic link between tree trunk and these associated plant fossils. The affinity of the trunk is ambiguous, but it is unlikely to be bennettitalean, because the surface does not exhibit any clear evidence of the robust petiole bases that are characteristic of the trunks of this group. Second, the two sets of plants are not in organic connection, and there is no anatomical evidence of affinity (e.g., distinctive cuticles on both), meaning that there is insufficient evidence to link the two. These two sets of remains appear to be an allochthonous assemblage. Close physical proximity within bed DB 129b cannot therefore be regarded as evidence favouring a connection between tree trunk and the associated flower-like cones.

Fourthly, do the above answers tell us anything about the rate and *nature of sedimentation at this time?*

The deposition of bed DB 129b it is unlikely to have been continuous; evidence for this comes from the more weathered surface of the cliff adjacent to the trunk. Here much of the bed is predominantly horizontally bedded, visible as alternations of poorly and marginally better lithified sediment. In addition there is the pronounced cross cutting horizon of more argillaceous sediment 0.15m below bed DB 130 (Figure 2), the horizon at which the discoidal plant remains were observed.

Despite this, we consider the deposition of bed DB 129b to have been relatively rapid, an interpretation which is consistent with the preservation and orientation of the tree trunk documented here. Rapid sediment deposition has been noted in other arenaceous facies of equivalent age in Sussex (Dr Ian West, pers. comm. to R.E., 24.04.2008), strata which Howitt (1964) equated with the Intermarine Beds [Member] of Dorset. Allen (1998) proposed climatic amelioration to a wetter regime with less seasonality for the Durlston Formation, and Schnyder *et al.* (2009) placed the boundary of their transitional (semi-arid to semi-humid) stage to their third, semi-humid, stage at the boundary of DB 130/131. They identified increasing freshwater and sediment input during their transitional and third stages. Between 0.37m and 0.62m above the base of DB 129b, 0.14m below the exposed base of the trunk, the sediment exhibits small-scale cross-bedding and minor channelling. The sediments are, at times, disturbed but whether this is due to rapid deposition and related dewatering or dinoturbation, or perhaps a combination, is unclear. Rygel *et al.* (2004) describe sedimentary structures created in hydrodynamic environments created by plant remains. The possibility that the lowest and unseen portion of the trunk is responsible for some or all of these sedimentary structures cannot be ruled out.

By the time that the deposition of DB 130 was initiated, there is further evidence that shallow water or perhaps emergent conditions prevailed. Approximately 8m south-west of the tree trunk, horizontal bedding within the top few centimetres of DB 129b shows conspicuous distortion. These features could be interpreted as non-biologic load casts, but one of us (P.E.) believes there is a high probability that they represent dinosaur tracks made at the start of the deposition of DB 130. The disruption of the shelly sediment with passive fill of the depressions immediately above, and the distortion in the bedding below, are compatible with one or more dinosaurs walking across this unconsolidated shelly sediment. Dinosaur tracks are consistent with shallow water or emergent conditions. Desiccation cracks have not been noted at this level, but their absence may be related to sediment type. We conclude that the sediments of bed DB 129b may therefore represent a period of rapid but non-uniform deposition followed by shallow water or emergent conditions and a sedimentary hiatus at the start of the deposition of DB 130.

Conclusions

An arenaceous component in the Purbeck strata is relatively uncommon, except in the Intermarine Member, and overlying Scallop and basal Corbula members, where sandy beds are, by comparison, frequent (Clements 1993). The sandy calcareous mudstones of DB 129b may represent the basinal signature of a period of higher rainfall over the surrounding landmass, with increased run-off transporting a higher proportion of land derived sediment than usual towards the Portland-Wight Basin's depositional centre, which lies between the Isle of Purbeck and the Isle of Wight. The fossil tree trunk and discoidal plant fossils may have all been washed into the Purbeck Basin during a flood event, where these remains, with very different sizes and masses, found a final resting place in close proximity to each other on the western fringes of the basin.

The discoveries of fossil plants in Durlston Bay reported here and by Edmonds (2008) support the desirability of active monitoring of DB 129b, as there is clearly potential for further discoveries to be made. Specifically, if a root structure is attached to what we believe to have been a drifted plant, there is a chance that clasts from the original location may still be adhering and could be present in these sediments towards the base of bed DB 129b. If so, they might provide an insight into the strata exposed on land surrounding the basin margins at this time. These fossils, and the interpretation of the sediments associated with them, add further colour to our attempts to reconstruct Purbeck environments.

Acknowledgements

We thank both Natural England and Swanage Town Council for their permission to carry out the small scale excavations required to investigate the tree trunk reported in this note. We also thank Margaret Collinson, Jane Francis, Howard Falcon Lang and Bob Spicer for their views, variously on the origins of the discoidal plants and the trunk, and Ian West for discussion. We are especially grateful to Jason Hilton for reviewing this contribution and his constructive comments.

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'Wild Downs and Hills'[1] – The Historic Landscape Character of the Cranborne Chase and West Wiltshire Downs Area of Outstanding Natural Beauty

EMMA ROUSE

This short paper introduces a new project, which has been studying the Historic Landscape of the Cranborne Chase and West Wiltshire Downs Area of Outstanding Natural Beauty (AONB) and introduces the relevance of the project to enhancing understanding of the nature of the historic aspects of the landscapes of north-east Dorset.

The Cranborne Chase and West Wiltshire Downs AONB – a 'naturally beautiful' landscape

An AONB is an area of land which has been nationally protected in law due to the outstanding and precious quality of its constituent landscapes. Since the inception of the concept of AONBs in 1949, as part as the 'National Parks and Access to the Countryside Act' (which is, incidentally, celebrating its 60th anniversary in 2009), the concept of Natural Beauty has changed to the extent that the term 'Natural Beauty' is now taken to mean more than just flora, fauna, the geological and the physiographical aspects but also to include cultural heritage. This has been mirrored by developments around the concept of 'landscape'. These changes are encapsulated by the European Landscape Convention, which came into force in the UK in March 2007, and defines landscape as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors' (Council of Europe 2000). The primary purpose of the AONB as an organisation is to conserve and enhance the Natural Beauty of the landscape. Taking on board the matured understanding of what comprises both 'natural beauty' and 'landscape'; it becomes evident that for any AONB to undertake its primary purpose it must have a detailed understanding and appreciation of all the aspects, which comprise 'landscape' and this includes how the archaeological and historical aspects of the landscape contribute to the area's 'natural beauty'. It was this need in mind (i.e. to gain an enhanced understanding), that the Cranborne Chase and West Wiltshire Downs AONB first decided to take a fresh look at the historical character of the area within its borders.

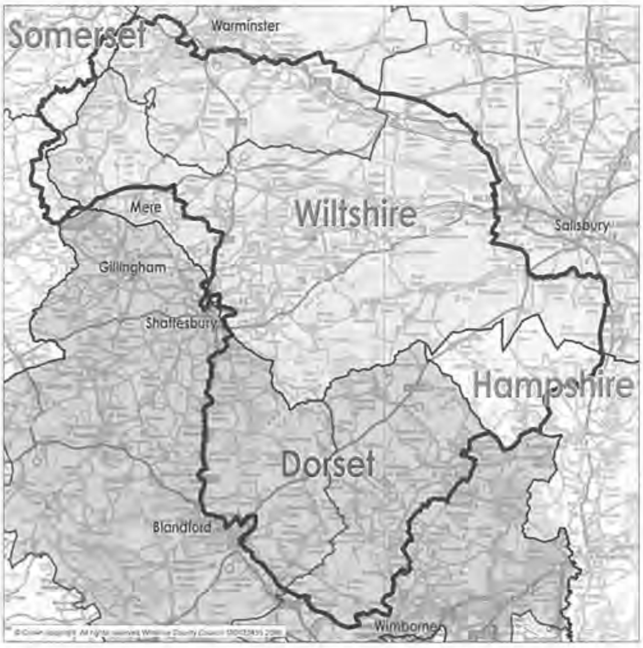

Figure 1: The location and border of the Cranborne Chase and West Wiltshire Downs Area of Outstanding Natural Beauty with its distinctive 'Africa' outline

Figure 2: The outstanding landscape of the AONB has a wealth areas with distinctive character including; (A) Downland (at Swallowcliffe); (B) Veteran Woodland Site (at Great Ridge Wood); (C) Chalk river valleys (Wylye Valley); and (D) Rolling Clay Vales (at Meadow Fen, Teffont Evias). © CCWWD AONB

The AONB in question, one of 37 such areas in England, covers an area of 981 square kilometres of rural south-west England. It has a roughly 'Africa' shaped boundary (Figure 1). The boundary of the AONB makes a circuit between the deeply rural area of land between Warminster to the north, bends out to the west near Frome and Mere, and passes the eastern side of Shaftesbury and Gillingham before passing Wimborne to the south and then returning northwards to the western side of Salisbury. The AONB encompasses four counties. A major constituent part is Dorset which comprises 30% of the AONB (the other counties being Hampshire, Somerset and Wiltshire). The AONB also encompasses within its borders a variety of landscape types and areas (see Figure 2) such as chalk escarpments including the stretch between Melbury and Blandford, open chalk downland, chalk river valleys including the Wylye and the Tarrant, greensand terrace and hills, the rolling clay vales of the Wardour Vale and the wooded chalk downland of the core of the Cranborne Chase (Land Use Consultants 2003).

Historic Landscape Characterisation: A new way of perceiving the present day landscape

In wishing to enhance its understanding of the historic character of these landscapes, the AONB became aware of a new tool which was being developed and championed by English Heritage called Historic Landscape Characterisation (HLC). HLC looks and studies landscape in a slightly new way. It is less concerned with the more traditional angle of seeking to reconstruct, understand and study the landscape of the past, and focuses instead on the historic aspects of the present day landscape. For an organisation such as an AONB, which is concerned both with the active management of today's landscape and with the creation of the best possible quality future landscapes, it presents a particularly useable and applicable tool.[2] HLC forms part of a national programme of study instigated by English Heritage in the early 1990s but which has gathered momentum in recent years. It is a continually evolving method but which has at its heart a series of core principles or concepts, which are aligned with the European Landscape Conventions definition of landscape. The most important of which are (after Clark *et al.* 2004):

- **Present not past**: it is the present-day landscape that is the main object of study;
- **Landscape as history not geography**: the most important characteristic of landscape is its time-depth; change and earlier landscapes exist in the present day landscape;
- **Landscape not sites**: HLC-based research and understanding are concerned with area not point data;
- **All aspects of the landscape**, no matter how modern, are treated as part of landscape character, not just 'special' areas; and
- Semi-natural and living features (woodland, land cover, hedges etc.) are as much a part of landscape character as archaeological features; **human landscape – bio-diversity is a cultural phenomenon.**

The main product of the project is the creation of a multilayered map, created in a computer Geographical Information System (GIS), which identifies and maps parcels of land in the present day AONB which have both shared land use history and shared morphology (shared morphology in the case of fields, for example, would include factors such as the shape and size of the fields, whether the boundaries are straight or curving, or whether the boundaries are hedge or fenced). The shared land use history is determined by a careful process of historical map regression, to identify the time period in which a change in land use occurred. These parcels of land, with shared characteristics, are allocated a generic Historic Landscape Type e.g. water meadows, parliamentary enclosure, veteran woodland. The Historic Landscape Types provide the basic units through which the history of the landscape of the AONB is characterised. Information is also recorded on a range of topics relating to the historic character of the land parcel in question including previous land use history; sources used, and associated place name evidence. The map based dataset is supported by a series of generic descriptions of each Historic Landscape Type.

In the case of the AONB the completed Historic Landscape Characterisation dataset consisted of 4337 mapped parcels. Each of these parcels had an entry in an associated data table which contained over 30 different columns into which information could be entered. The dataset therefore contained over 10,000 separate pieces of information (Rouse 2008). The flexibility of the GIS system means that it is possible to analyse and map any aspect of the data. As an example, analysis could include the following:

- Maps showing which parcels of land have been assigned a particular Historic Landscape Type;
- Numerical calculations indicating what percentage of fields have a certain morphology; and
- Maps showing which woodlands are associated with a particular place name AND are associated with a particular Previous Historic Landscape Type e.g. common land.

This flexibility and power is limited of course by the time constraints of the project, therefore only particular aspects of the data recorded in the project have so far been explored in detail. It is also important to emphasize that HLC represents a relatively generalised characterisation of the landscape. It is not intended to be a freestanding or a replacement for other more established datasets, such as Historic Environment Records, but instead to be used alongside them.

Historic Landscape Characterisation and the County of Dorset

The particular relevance of the AONB Historic Landscape Characterisation to the county of Dorset is threefold. Firstly, it allows a landscape scale overview of the contribution of the historic aspects of landscape to local character and distinctiveness. Secondly it provides an opportunity to have a fresh look at the relationship between past and present land use across the whole timescale of human intervention in the landscape or, put more plainly, to look at how the daily activities of those who once or still live and work in the area contribute to the character of the landscape. Thirdly, it can begin to place the history of land use in the Dorset area in the context of a wider cross county pattern of human activity. The interest in boundaries and borderlands is an area which in particular is beginning to receive much more attention rather than the traditional

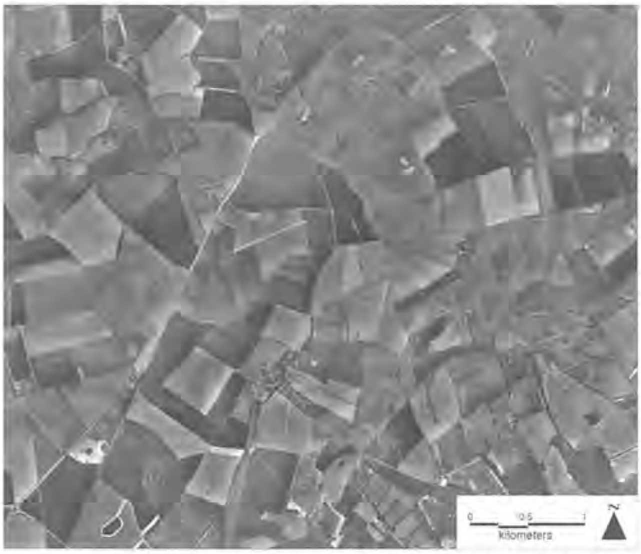

Figure 3: Aerial view of north-east Dorset and Wiltshire, the line of the Ackling Dyke can be clearly seen running from North to South to the left of the photograph leaving the area of Martin Down and entering a patchwork of fields. The Bronze Age round barrow cemetery can be seen in the lower left and corner. (North is at the top.) © and database right Landmark Information Group Licence No. 000394 and TP0024

perspective of viewing the history of a landscape from one side of a border.

There is not time within this short introduction to the project to outline the entire longue durée of human activity or the range of land uses present in this area of Dorset which has inscribed itself on the landscape of today. I will instead outline a brief example of the way in which the HLC can be used, to gain an understanding of how the historic character of fields contributes to the modern day landscape. It must be remembered that the project has looked at a range of other broad landscape types including open land, woodland, settlement and industry. Further discussions of the historic landscapes of the AONB can be found in a new edited volume which explores recent work on the archaeology, history and natural history of the area (Barker 2009)[3].

The evidence that the HLC has gathered regarding the relationship between local distinctiveness and character and historic landscape character in Dorset can be effectively demonstrated by following the course of the Ackling Dyke Roman Road as it marches its straight course across north east Dorset towards Badbury Rings, see Figure 3. Following its course effectively cuts a useful transect through the landscape. As the Ackling Dyke enters the County of Dorset it leaves behind a large swathe of open chalk downland at Martin Down. It is immediately surrounded by a mosaic of medium to large sized fields, with irregular outer boundaries and straighter internal boundaries which are intermittently hedged. These are interspersed with smaller scale regular fields created through Parliamentary Enclosure Acts in the 19th century (Figure 5). The creation of Parliamentary Enclosure broadly in the period between

Figure 4: The open downland at Martin Down, a view that once would have been much more ubiquitous across large swathes of this area of Dorset and Wiltshire © CCWWD AONB

AD1750 and AD1850 is a process which has received much attention and is broadly defined as the process 'by which land that has formerly been owned and exploited collectively is divided into separate parcels, each owner exchanging rights in parts of it' (Sandell 1971, 1).

These fields have been created through the subdivision of once open downland which in the 18th century supported vast flocks of sheep, marvelled at by Daniel Defoe in his travels as 'a sight truly worth observation' (Furbank et al. 2006, 91). The contribution of the once open downland in this area to today's landscape character, receives less attention, but it remains in the size of the 'prairie' scale fields which have subsequently been created maintaining wide open vistas and sense of space redolent of the grass downland in remnant place names and in the survival of a large number of prehistoric and later earthworks, including the Ackling Dyke. Many of these are now under plough but several fortunately remain 'set-a-side' such as the Round Barrow cemetery to the east of the Sixpenny Handley roundabout on the A30.

An interesting reflection about the area of Martin Down (Figure 4) is that the protection and continuing survival of this area is due to its use as a military area in the early 20th century and latterly to its status as a National Nature Reserve, which is based on the quality of its grassland habitat and the wide range of downland flowers, insects and birds it supports. In the context of historic landscape character, however, it also represents an often unappreciated historical survival, of land use and grazing regimes, which was once more ubiquitous and widespread and in this sense is as nationally important as the Scheduled Ancient Monuments which are found scattered across it.

Travelling 2km south from where the Ackling Dyke crosses the B3081, the Dyke was used as the north-western edge of the great wooded 'Brownian' ride of the historic park of Wimborne St Giles. The interior of this

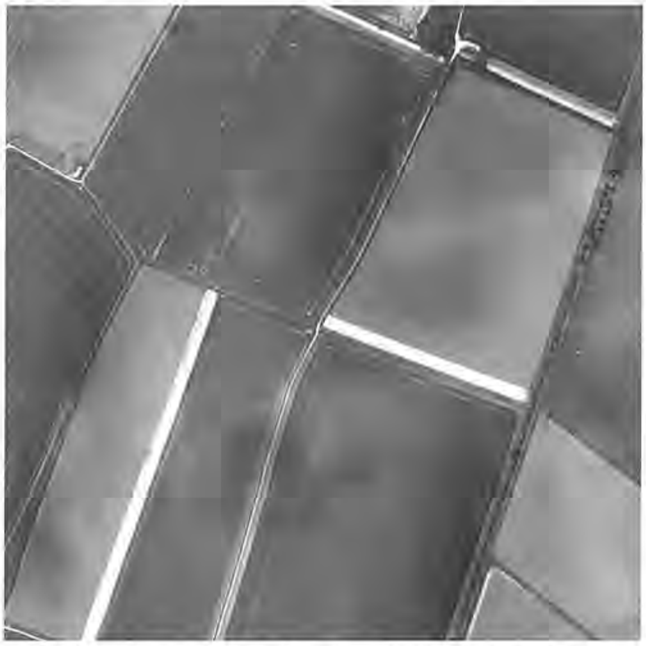

Figure 5: Aerial view of regular grid-like Parliamentary Enclosure in the parish of Gussage All Saints. The Ackling Dyke is running from North to South along the right hand side of the photograph (North is at the top.) © and database right Landmark Information Group Licence No. 000394 and TP0024

park represents a much altered and modified landscape from the 17th century onwards. It is also interesting to note that much of the later land use tends to respect and bound the much earlier Roman road even after it was replaced as a routeway by the modern road to the east.

In the area to the south of the ride historic landscape character changes again, with the presence of a set of prominent ruler straight parliamentary fields in Gussage All Saints parish. These are much smaller and grid-like than those to the north (Figure 5) suggesting a much tighter and centralised control during their creation. The process of undertaking the mapping during this project and the comparison undertaken between enclosure maps, late 19th century Ordnance Survey maps and modern maps have shown very clearly that the depiction of parliamentary enclosure and the reality of their creation on the ground vary considerably between parishes. In some the depicted enclosures themselves were never actually created, whilst in others the fields depicted on the maps can be traced exactly on the ground today. Straying briefly beyond the borders of Dorset, in the area of the West Wiltshire Downs, notably to the south of Sutton Veny in the Wylye Valley, Parliamentary Acts resulted in the enclosure of large strips of land stretching several kilometres regardless of topography that were not subdivided into manageable fields until the 20th century. This overall pattern is further complicated by the lack of enclosure awards, per se, in many of the areas of the Cranborne Chase, and the presence instead, in parishes such as Ashmore, of maps relating to the private Disenfranchisement Act

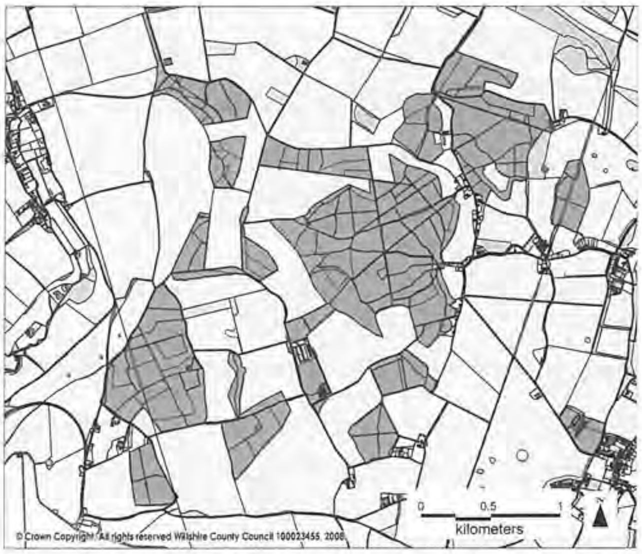

Figure 6: The fractured pattern of veteran woodland forming the core of the Medieval Chetterwood

of the Cranborne Chase (formally enrolled in 1831). These maps relate to the extinguishing of the rights of Lord Rivers to roam deer across the chase and payments made in recognition of this Act (Chapman and Seeliger 1997), and so relate to a different historical process. In some instances these maps appear to be representing fields which already existed and in some instances new enclosures.

This form of historical map regression obviously can easily identify the impact of large scale planned changes, such as the well studied Enclosure Acts, and the less studied, more adhoc, but large-scale enclosure which occurred in the 20th Century, notably after the Second World War. However, it also highlights the dramatic cumulative effect that small scale creeping intervention and short term patterns of land use can have also. Briefly leaving Dorset again, historic estate maps of the parish of Tisbury in south Wiltshire demonstrate how the small scale irregular fields with mature hedgerows that exist today were created through a process of unplanned adhoc enclosure in the centuries leading up to 1900 but yet were still within the overall control of the Arundells and the Wardour Estate who owned the land. We now return to Dorset, and an area of land to the west of the Ackling Dyke in the vicinity of Witchampton. The overall character of the veteran woods and copses of the medieval Chetterwood, also demonstrates how adhoc clearance and nibbling away at the woodland has had a similarly dramatic impact on the character of the landscape in this area, albeit one which probably occurred over a much longer time frame, (Figure 6).

Conclusion

It is hoped that this short introduction to Historic Landscape Characterisation study of the Cranborne Chase and West Wiltshire Downs AONB has whetted the appetite for the range of insights it can provide. In particular, on the contribution that past human activity has made to the character of the present day's landscapes of both north-east Dorset and further afield. In many instances the historical processes with which the study deals, such as parliamentary enclosure, are fairly well understood. In other cases, with more modern land uses, such as the impact of changes to farming regimes after the Second World War, these are only just started being looked at as processes which warrant historical and archaeological enquiry. Historic Landscape Characterisation offers a chance to look more closely at the spatial and temporal effect of all of these processes at a truly landscape scale which bridges traditional divisions of study, be it parish, county or even region. As with any study that looks at an area of landscape in a new way it raises many new issues and it is hoped that descriptions of other areas within the AONB boundary will be looked at and compared in future articles.

NOTES

1 Daniel Defoe described the land to the west of Salisbury in the 1720s as 'the wild downs and hills' in one of his descriptive letters of a journey taken through southern England. In this passage he particularly remarks upon the skilful husbandry that is allowing the grass downland to be transformed into fertile arable land (Furbank *et al.* 2006, 91)

2 The full report of the Cranborne Chase and West Wiltshire Downs AONB Historic Landscape Characterisation and more details of the project are available at the project website at http:www.historicland scape.org.uk

3 Copies of this new publication entitled 'The Chase, The Park and the Hart' are available from the Cranborne Chase and West Wiltshire Downs, AONB Office, and contain contributions by Katherine Barker, Gordon Le Pard, Caroline Cheeseman, Martin Green, John Gale and Dorothy Ireland.

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Re-investigations of Lower Palaeolithic Archaeology and Deposits at Corfe Mullen

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Introduction

The deposits of the Solent River and the Stour exposed in gravel pits at Corfe Mullen, and the recovered Palaeolithic artefacts, have been the focus of previous research, most notably by Calkin and Green (1949), Green (1947) and Bury (1923, 1933). The majority of the artefacts from the Corfe area were recovered from the Ballast Pit (at least 180) and Cogdean Pit (over 80), with smaller numbers (about a dozen) recovered from the Sleight Pit (Calkin and Green 1949, 23–28; and Figure 1). Examination of Ordnance Survey (OS Explorer 1:25,000, Sheet 118; OS County Series 1:2500, Dorset Sheet, 1st Edition and 1st, 2nd and 3rd Revisions) and British Geological Survey mapping (BGS 1:50,000, Solid and Drift, Sheet 329) indicates that all three pits were cut into terrace 12 deposits (referred to by Calkin and Green as the Sleight Terrace), with the Ballast Hole pit also exploiting bluff deposits between terrace 12 and terrace 9 (Calkin and Green's Iver Terrace).

Roe (2001, 49) noted that the handaxes from Corfe Mullen were distinguished by the presence of two types: 'flat, refined, rather square-ended ovates' and 'crudely made, thick, point or pear-shaped handaxes'. These types show similarities with handaxe patterning in other key areas, principally Highlands Farm Pit in the Thames Valley and Warren Hill in Suffolk (Wymer 1968, 191–197; 1985, 90; 1999, 139–140). Both of these sites are Anglian or pre-Anglian in age, and this is the suggested age of terrace 12 at Corfe (Wymer 1999, 106, 110; Westaway *et al.* 2006, Figure 6). This patterning is of particular interest in light of recent and current discussions regarding handaxe variability and its potential explanations (see Ashton and White 2003 for an excellent summary). Unfortunately the apparent association of the Ballast Hole artefacts with slope (bluff) deposits (Calkin and Green 1949, 21–22), a view replicated by both Roe (1981, 190) and Wymer (1999, 106), has limited past interpretations of the material as artefacts in a bluff can be potentially younger in age than the terrace itself (as anything on a slope's inherently unstable surface becomes incorporated within the deposit): thus this assemblage has been perceived as possibly mixed.

However new analysis of the historic mapping of the Corfe Mullen area has indicated discrepancies with the locations of the Corfe pits as represented

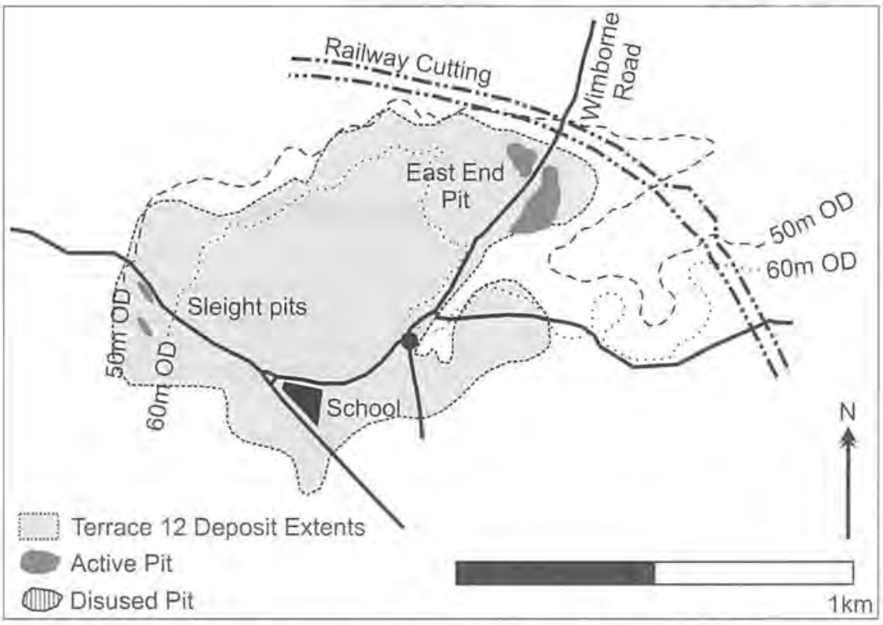

Figure 1: Corfe Mullen gravel pit locations and status prior to 1888. Data based upon OS County Series 1:2500 (Dorset Sheet, 1st ed.), © Crown Copyright and Landmark Information Group Limited (2007). All rights reserved (1888); OS Explorer 1:25,000 (Sheet 118), Reproduced from Ordnance Survey Map Data by Permission of Ordnance Survey, © Crown Copyright; and BGS Solid and Drift Geology 1:50,000 (Sheet 329, 1991), with the permission of the British Geological Survey

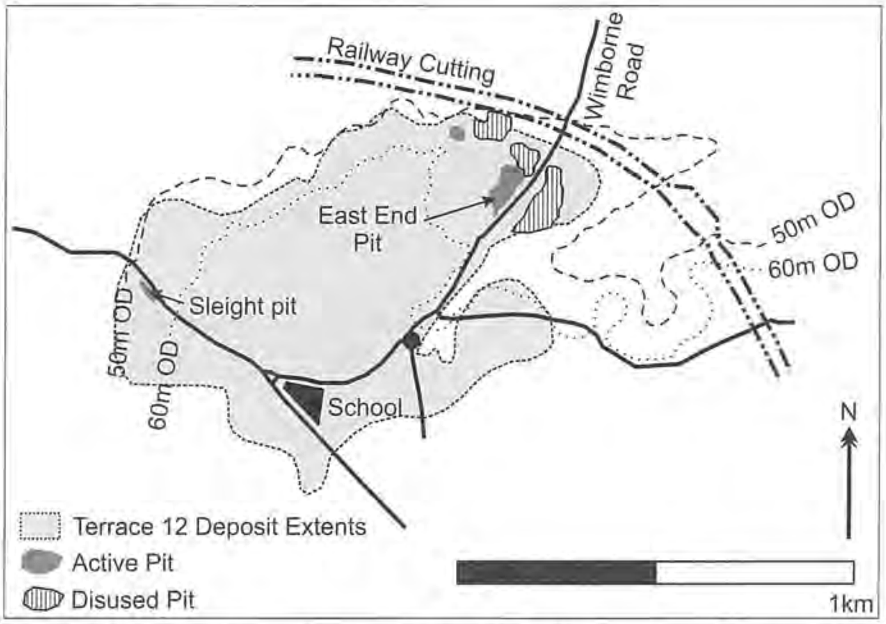

Figure 2: Corfe Mullen gravel pit locations and status between 1888 and 1901. Data based upon OS County Series 1:2500 (Dorset Sheet, 1st ed. and 1st rev.), © Crown Copyright and Landmark Information Group Limited (2007). All rights reserved (1888 and 1901); OS Explorer 1:25,000 (Sheet 118), Reproduced from Ordnance Survey Map Data by Permission of Ordnance Survey, © Crown Copyright; and BGS Solid and Drift Geology 1:50,000 (Sheet 329, 1991), with the permission of the British Geological Survey

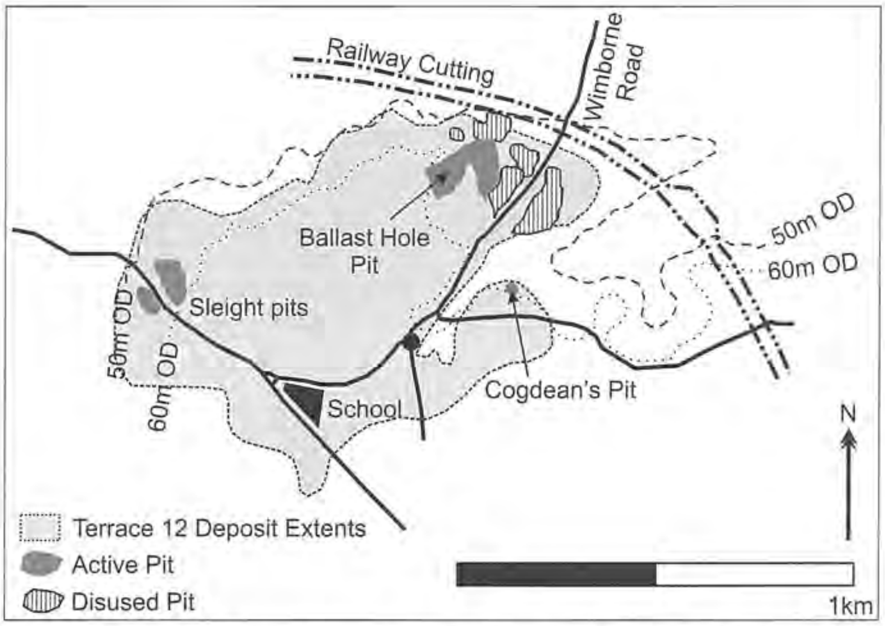

Figure 3: Corfe Mullen gravel pit locations and status between 1901 and 1928. Data based upon OS County Series 1:2500 (Dorset Sheet, 1st ed. and 1st and 2nd rev.), © Crown Copyright and Landmark Information Group Limited (2007). All rights reserved (1888, 1901 and 1928); OS Explorer 1:25,000 (Sheet 118), Reproduced from Ordnance Survey Map Data by Permission of Ordnance Survey, © Crown Copyright; and BGS Solid and Drift Geology 1:50,000 (Sheet 329, 1991), with the permission of the British Geological Survey

by the Southern Rivers Palaeolithic Project (Wessex Archaeology 1993). The key observations of our recent analysis are:

1. Prior to 1888 the main pit in Corfe Mullen was the East End Pit, exploiting the terrace 12 gravels, and lying either side of the Wimborne Road (Figure 1). There were also two small pits in the vicinity of Sleight, also exploiting terrace 12 gravels;
2. The first revision of the 1:2500 mapping in 1901 indicates a southerly extension of the East End Pit (to the west of the Wimborne Road), and the probable excavation of further spreads of the terrace 12 gravels immediately to the south of the railway cutting (Figure 2);
3. The second revision of the 1:2500 mapping in 1928 indicates the excavation of terrace 12 gravels (the Ballast Hole Pit) to the west of the East End Pit,

the first exposure of terrace 12 gravels on the site of Cogdean's Pit, and the construction of a tramway in the overgrown base of the earlier pit to the south of the railway cutting (Figure 3). At Sleight there had been an expansion of the northerly of the two earlier pits, and a new larger pit had been opened to the north-east; and
4. The third revision of the 1:2500 mapping in 1934 reveals a southerly extension of the Ballast Hole Pit, with an additional small section probably worked out between the second and third revisions, and an expansion of Cogdean's Pit (Figure 4). The largest of the Sleight pits had also been expanded in a north-easterly direction.

The significance of this re-analysis of the historic mapping with regards to the locations and histories of gravel working at Corfe Mullen and Sleight are:

1. By *c.* 1930 the majority of the Ballast Hole pit had been dug out, with the majority of the active working focused away from the terrace edge (i.e. the bluff);
2. Green's (1947) mapping of the Railway Ballast Pit therefore referred to an open area, the south-western portion of which was being worked in the inter-war years (Figures 3 and 4). This area was located away from the bluff and so artefacts collected during the inter-war years were recovered from securely stratified terrace gravel deposits away from the edge of the terrace and its bluff; and
3. The location of the Sleight Pit as mapped in 1928 and 1934 is to the west of the pit that the Southern Rivers Palaeolithic Project (Wessex Archaeology 1993, 125–126) believed to be the Sleight Pit (Kettle's Pit, which was noted as being opposite the school). It is also notable that a Kettle Pit described as opposite the school would itself be to the west of the location of Kettle's Pit as documented in the Southern Rivers Palaeolithic Project mapping (Wessex Archaeology 1993; Wymer 1999, Map 23).

When combined with the key accounts of earlier collecting activities (Bury 1923, 1933; Green 1947; Calkin and Green 1949), these observations suggest the following re-interpretations of the provenance and integrity of the artefact assemblages:

1. "The other pit, known locally as the "Ballast Hole", but marked on the 6-in Ordnance Map (Dorset Sheet XXXIV., SE) as "East End Gravel Pit" is half a mile to the north-east of Sleight, close to the railway; and here implements were fairly common a few years ago, though they have been scarce of late . . . it is practically certain that all the specimens in the Dorset County Museum (Marsden collection) labelled Corfe Mullen are from this pit; . . . The men are positive that most of them came from the base of the gravel at a point where it was 20-ft deep . . ." (Bury 1923, 25). These artefacts therefore form a clearly provenanced collection, for which we can assume a pre–1923 acquisition in light of the Bury reference, attributable to a single pit in terrace 12 (the East End Pit), away from the terrace bluff, and probably from a single horizon near the base;

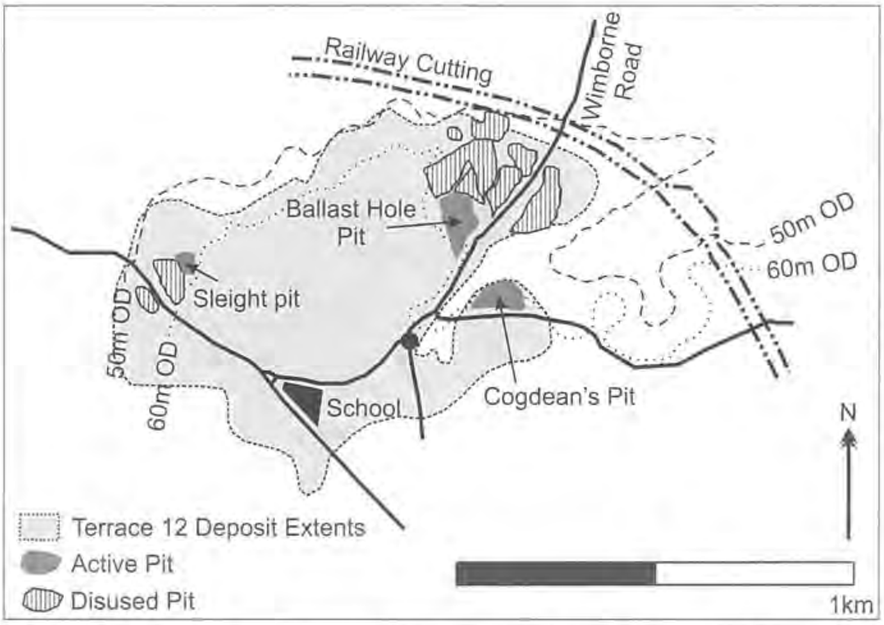

Figure 4: Corfe Mullen gravel pit locations and status between 1928 and 1934. Data based upon OS County Series 1:2500 (Dorset Sheet, 1st ed. and 1st, 2nd and 3rd rev.), © Crown Copyright and Landmark Information Group Limited (2007). All rights reserved (1888, 1901, 1928 and 1934); OS Explorer 1:25,000 (Sheet 118), Reproduced from Ordnance Survey Map Data by Permission of Ordnance Survey, © Crown Copyright; and BGS Solid and Drift Geology 1:50,000 (Sheet 329, 1991), with the permission of the British Geological Survey

2. "In the "Ballast Hole" ... the gravel is usually homogenous throughout its thickness (14–16ft.), with the upper half rather more loamy, but without contortion" (Bury 1933, 318). This is almost certainly referring to the same pit as the East End Gravel Pit in point 1 above. We suspect that the name "Ballast Hole" was transferred around to whatever pit was active in the area of the old pit, either side of the Wimborne road. For the inter-war years this was the area indicated as active in Figure 4). This was also the period (1927–1938) of 'frequent' visits by Calkin or Green, most probably Green (Calkin and Green 1949);
3. Bury (1933, 321) implies palaeoliths found in "recent years" in the "Ballast Hole" and Cogdean Pit. These pits appear to be active at the same time (Figures 3 and 4), with major digging appearing to begin at Cogdean's Pit between the second and third revisions of the 1:2500 mapping;
4. "In Cogdean pit, however, rather further east, the stratified gravel is only about six feet thick, and over it lies three to six feet of loamy gravel, usually much contorted; this is probably a kind of hill-wash rather than a river deposit." (Bury 1933, 318). These observations clearly indicate that the base of these gravels was not disturbed; and
5. "... near Corfe Mullen, there are two large pits, one at Sleight itself, where the summit of the gravel runs up to 210–215 ft OD ... It is here that the sarsens and large flints already mentioned are common, but the workmen say that only one palaeolith has ever been found there ..." (Bury 1923, 25). "In the Corfe Hills there is a clear division into two layers in the Sleight pit, the upper part containing lenticles of sand, which are usually horizontal; but in a part of the pit recently excavated they are so strongly contorted as to suggest ice action; whether this layer all through the pit is a hill wash formed under glacial conditions, the author cannot decide." (Bury 1933, 318). "In the Corfe Hills many implements have been found in the last few years on the Sleight terrace, a few at the Sleight pit (or Kettle's Pit) ..." (Bury 1933, 321). Following the mapping in Figures 3 and 4 this indicates that all of those artefacts recovered from the Sleight pits were found during the inter-war years and are therefore associated with undisturbed terrace 12 deposits.

With regard to our previous fieldwork (part-funded through the Prehistoric Society's Bob Smith Award), this re-mapping analysis indicates that two of our test pits (3 and 4, which exposed *in situ* fluvial gravels) were located at the southern limits of what was the Ballast Hole between approximately the end of World War One and the start of World War Two. More importantly, our analysis has highlighted that the terrace 12 Lower Palaeolithic artefacts at Corfe Mullen from *both* Cogdean's Pit and the Ballast Hole are securely provenanced (i.e. the Ballast Hole was primarily dug into undisturbed terrace deposits rather than the bluff (slope) of terrace 12). Combined with precise provenance information on the artefacts collected prior to World War Two which has been identified by JM, it is now possible to link individual artefacts, their depth within the terrace gravels, and the year of discovery, to the sections of the gravel pits being dug at the relevant time. These data will therefore support new assessments of key Acheulean research questions, principally whether one or two handaxe assemblages (of distinct types) are present in the Ballast Hole and how these compare to the contemporary terrace 12 artefacts from Cogdean's Pit.

With regards to our ongoing research goals we would ask any museum curators with knowledge of Lower Palaeolithic materials from Corfe Mullen to consider contacting either of the authors (McNabb: J.McNabb@soton.ac.uk; Hosfield: r.hosfield@rdg.ac.uk).

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A Geophysical examination of Round Barrow cemeteries on the South Dorset Ridgeway (Stage 1 – Bronkham Hill)

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Introduction

In 2008 Bournemouth University, in association with the Dorset AONB (as part of the South Dorset Ridgeway project), began a series on non-intrusive investigations of targeted sites within the large collective of Round Barrow cemeteries located in and around the South Dorset Ridgeway. This work has been undertaken as the first serious attempt to evaluate the archaeological potential of what is arguably the densest concentration of Bronze Age funerary monuments in southern England, by geophysical means, and builds upon the valuable work undertaken by a succession of archaeologists in the last half century and beyond (Grinsell 1955, 1981; Woodward 1991).

During the years 2008–2010 it is intended to investigate at least 3 sites/areas to examine and identify activity that may be identified through geophysical techniques that subsequently may shed further light on the origins, articulation, state of preservation and development of the cemeteries as well as potentially identifying activity that may pre- or post-date them. Recent work undertaken by the author has demonstrated the efficacy of applying such techniques to associated sites in the east of the county, which has successfully identified the presence of archaeological features that had not been previously recorded (Gale *et al.* 2004). The first site chosen for investigation lies to the south west of the village of Martinstown (Winterbourne St Martin) and covers part of Ridgeway Barrow Group R6 (RCHME 1964), which is located on Bronkham Hill centred on NGR 362441:087308. The collection of barrows at Bronkham are perhaps best known for their articulation with Dolines (variously known colloquially as Sink Holes, Shake Holes and Swallow Holes), a geological phenomena which at this site are still being formed and create an unusual landscape of humps and hollows that are spectacular to even the untutored eye (Figure 3). Whilst the barrow group on the Ridgeway at this point stretches between Smitten Corner (361650: 087700) to Corton Down (363500: 086600) only the central portion was available for investigation either due to adverse topographical problems or more usually the impenetrable ground cover of gorse which afflicts the south east of the Ridgeway in this area.

The following report is based upon a combination of two episodes of survey undertaken by students from Bournemouth University in February and March of 2008 and volunteers in April and May of the same year.

The surveys

The application of magnetic surveys to detect a variety of below ground archaeological features is well attested in the archaeological record and has in recent years been dominated by the application of the fluxgate gradiometer (Gaffney and Gater 2003, 40). With regard to the investigation of prehistoric barrow cemeteries the fluxgate gradiometer can be particularly effective in the detection of the silted up ditches of levelled barrows (the ubiquitous 'ring-ditch' often identified in aerial photography) and other negative or cut features that are likely to be near surface deposits. With this in mind a large portion of the barrow cemetery located on Bronkham Hill was chosen as the first site for investigation (Figure 1). The particular area chosen has the benefit of being largely confined to sheep farming and thus being accessible at most times of the year. The ridge at this point is also largely free from gorse and other hindrances to survey and, of course, has a significant number of well defined round barrows and a variety of pits and scoops that seem to collectively constitute an active Doline field. Although the surrounding geology is dominated by chalk, the hill itself is capped by plateau gravels and sands that result in nutrient poor soils, which have subsequently restricted the growing of crops on this part of the ridge. The poor quality of the land has, no doubt, restricted agricultural activity on the ridge and limited its productivity to animal husbandry over the centuries. The by-product of the gravels and sands overlying the chalk is also the reason for the presence of Dolines, whereby the chalk underneath has been eroded away by the solution action of the overlying gravels over extended periods of time (House 1991, 149–55).

Methodology

A grid based upon 10m × 10m units was chosen to facilitate the surveying of grids on the north-eastern flank of the ridge which had an adverse slope that would make laying out of the grids problematical with larger grid sizes. The grid was aligned broadly with the axis of the ridge and adjacent to the dry-stone wall which runs alongside the south western edge of the field. A total of 15,900 sq metres was surveyed (1.59 ha or 3.93 acres). Reading resolution was set at 1m × 0.5m at a level of 1nT. Two Geoscan FM36 fluxgate gradiometers were used in the survey. The grid was later geo-referenced with the aid of a Leica 500 Global positioning system. Both gradiometers were operated by manual trigger

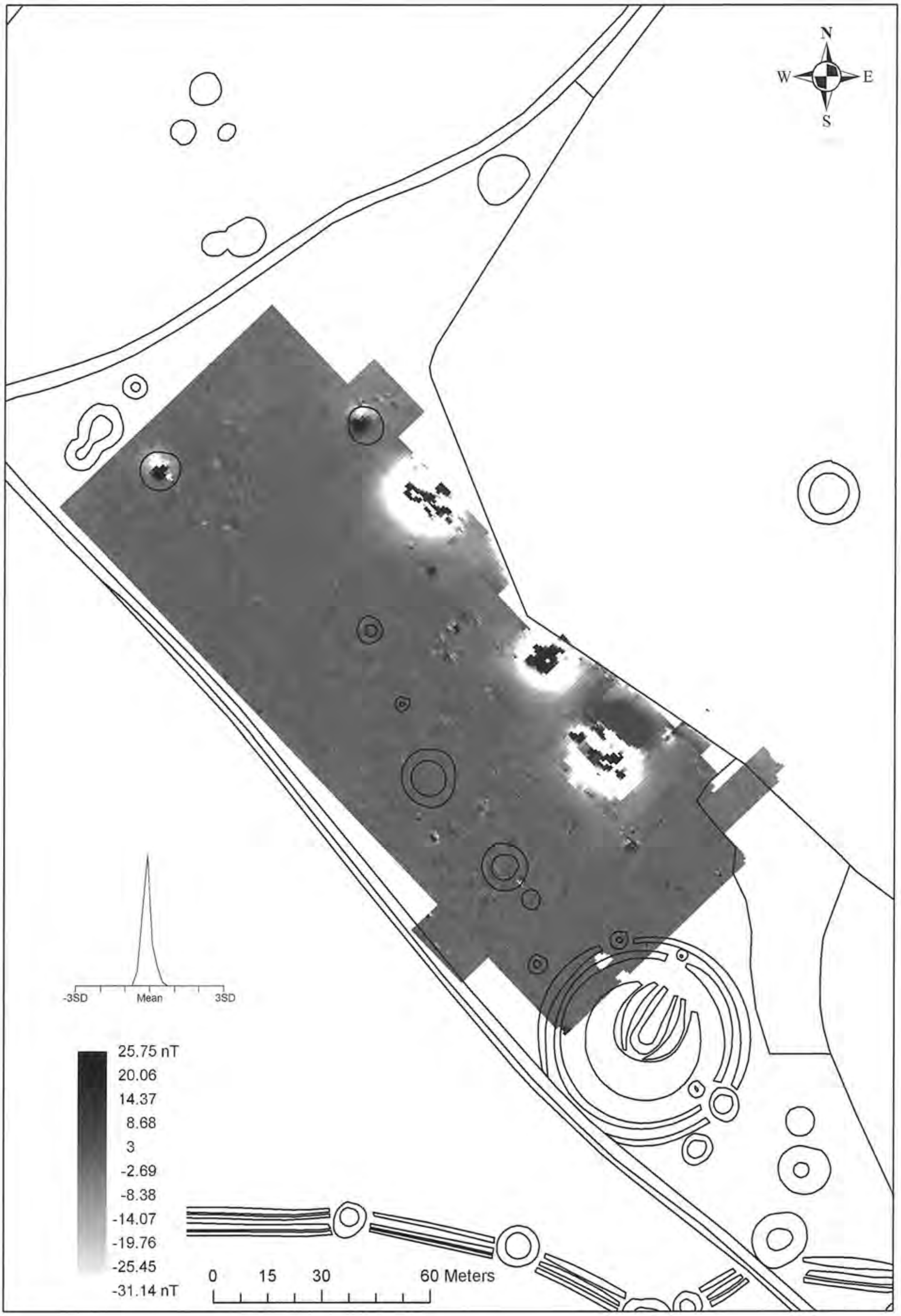

Figure 1: A geo-referenced gradiometer plot superimposed on a plan of the site. The coincidence of Dolines with magnetic anomalies can be clearly seen, the remaining circles in the surveyed area are predominantly barrows that do not register as anomalies. © Crown Copyright/ database 2008. An Ordnance Survey/(Datacentre) supplied service, with amendments

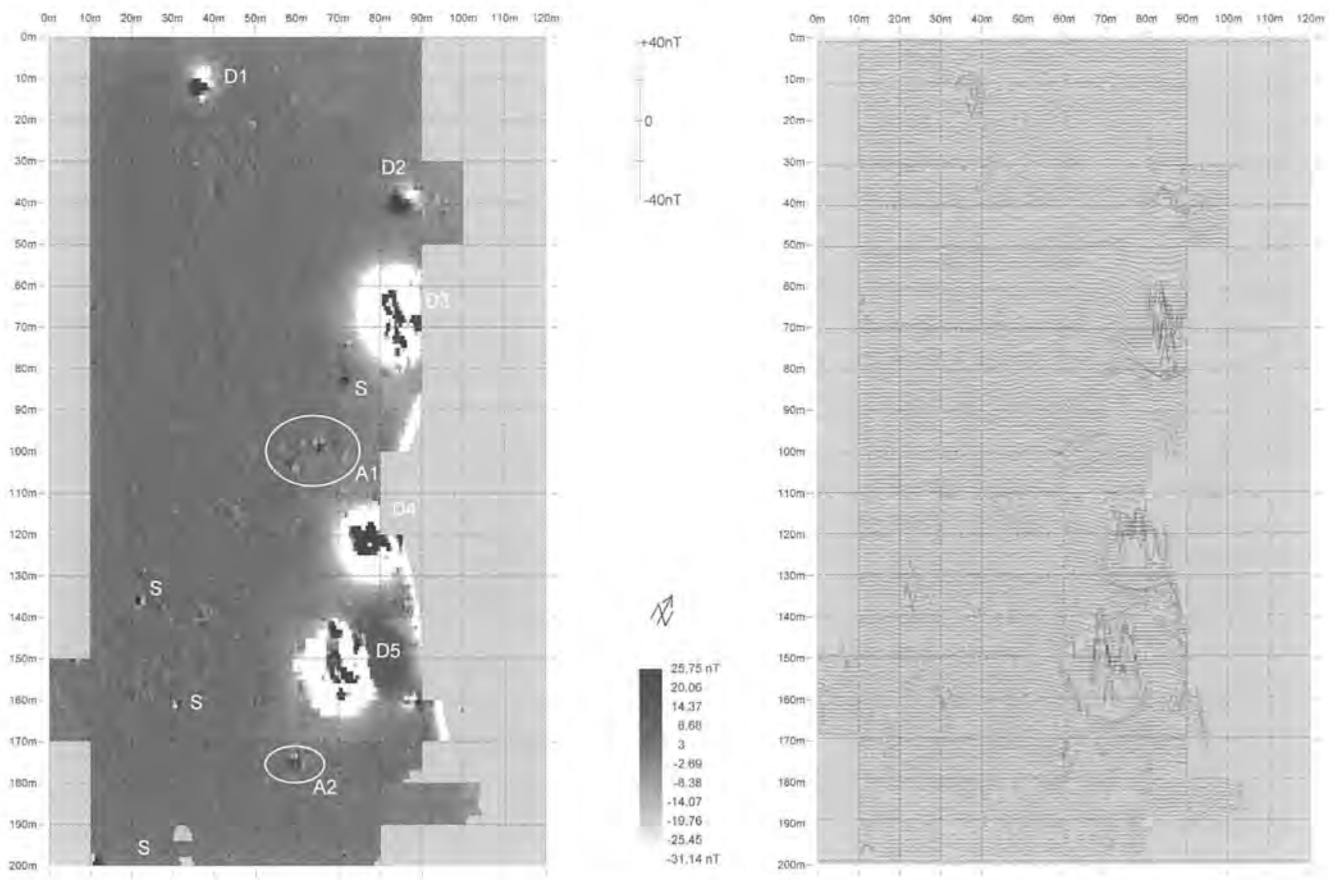

Figure 2: Interpretive plot (annotated features are discussed in the text) and a comparative trace plot of the same survey

partially due to the relative inexperience of the operators and also in part due to the occasional difficulty of the terrain.

Data was downloaded and processed in Archaeosurveyor v2 and is presented as graphic images in this report (Figures 1 and 2). The shade plots represented in Figures 1 and 2 have both been clipped, de-spiked, edge-matched and de-striped to remove non archaeological surveying artefacts and improve the visual presentation. The trace plot has merely been clipped at +/– 40nT to show the raw data. The shade plot in Figure 1 has been geo-referenced and plotted into GIS software to assist in the interpretation process showing associations of anomalies with the recorded features (both barrows and Dolines).

Results and interpretation

The most dominant anomalies discovered during the survey are the features (marked D1–5 on Figure 2). The huge responses recorded at D3–5 are all attributable to very large and still visible Dolines that have evidence for the waste dumping of large quantities of concrete, bricks and metalwork within them. All of the Dolines are now grassed over but traces of the filling materials can still be seen at or just below the surface and must represent successive attempt to backfill the holes where they would otherwise be a danger to livestock. The lesser anomalies recorded at D1 and D2 are also similarly visible but appear on the ground to be smaller and possible older with a smoother topographic profile. The magnetic response is appreciably smaller and therefore presumably represents similar features with less waste in them possibly overlain by a greater deposit of turf/soil overburden.

A number of significant spikes have survived the despiking process (S on Figure 2) most of which are probably ferric in origin and almost certainly very near to the surface. Two anomalies annotated on Figure 2 as A1 and A2 are worth of closer examination. A1 is an area of disturbance which correlates with a small mound and quarry that would appear to be not associated with the cemetery and is likely to be modern (although this is speculative). A2 would appear likely to be a pit possibly containing ferric material which may or may not be associated with the barrow cemetery.

Probably the most interesting result of the survey concerns the complete lack of evidence for the characteristic ring-ditch on the site. Not only were the presence of previously unrecorded ring ditches not recorded but also where the magnetometers were run over known ditches of barrows a similar negative result was obtained.

Magnetic susceptibility of negative features on site

It was thought likely that such a nil response for in-filled ditches must be due to fills of the ditches having a net balance of magnetic susceptibility equal to the surrounding soils that have not been subsequently enhanced by activity on the site during the gradual erosion of the site. To test the validity of this theory soil samples were taken of the A and B horizon soils from the overlying sand and gravels that overlie the entire site. The A horizon soils lie currently at a depth of no more than 10cm below the modern turf line and would form part of likely infill of any negative features. The B horizon soil forms the mass of the sub soil matrix below A which would form the main strata that the negative features would have cut through when the archaeological features were created. To determine if the soils are susceptible to magnetic enhancement soils from the A and B horizon were submitted for mass specific magnetic susceptibility tests at Bournemouth University.

The samples of soil were dried and subsequently analysed to determine mass specific magnetic susceptibility values for both untreated and treated samples (treated samples were fired red for 3 minutes) and matched to a control sample.

Table 1: Comparison of 'A' and 'B' horizon soils when treated and untreated

'A' Horizon soil		**'B' Horizon soil**	
Untreated sample =	3.72	Untreated sample =	0.79
Treated sample =	32.27	Treated sample =	94.17

N.B. Values are expressed as SI ×10[–8]/Kg

Both samples produced a high level of magnetic enhancement when heated (Table 1). This would suggest that the soils that have in-filled the ditches have the potential for enhancement through a range of human activity, but that this does not appear to have taken place after the cemeteries construction and subsequent abandonment. The resulting centuries of land use following the cemetery indicate there is little likelihood of significant human activity having taken place.

Conclusion

The application of geophysical techniques (fluxgate gradiometry) at Bronkham Hill has indicated that the tell-tale identification of negative or cut features, commonly observed in a variety of pedological conditions

Figure 3: Aerial view of part of the cemetery on Bronkham Hill, clearly showing both barrows and Dolines (the surveyed area is out of shot – to the top left of the image). © Francesca Radcliffe

on similar type sites, has not been identified in this instance, even though the presence of such cut features is known and can be identified. The soil infill of such features would appear to have the potential for magnetic enhancement but that no such enhancement has taken place is probably the lack of *de facto* development of the site which, of course, is partially confirmed by the sites overall state of preservation.

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Dorset Archaeology in 2008

ARCHAEOLOGICAL ASSESSMENTS

DRUITT GARDENS: DESK-BASED ASSESSMENT (NGR 415710 92715)

Prior to the regeneration of Druitt Gardens, Christchurch as an outside community space containing a new Community Building by a partnership of Christchurch Borough Council and the Christchurch Community Partnership, a desk-based Assessment was undertaken. This assessment brought together evidence for the Saxon Burh and a later medieval ditch within the study area. The earthworks visible in the gardens are probably the remains of 19th century boundaries or landscape gardening.

Bronwen Russell and Harry Manley

WATCHING BRIEFS

BERE REGIS: CABLE TRENCH AT WOODBURY HILL (NGR 385665 094765)

Observation of two phases of ground works revealed the possible remains of ramparts associated with the hill-fort. A large piece of dressed limestone was discovered during the watching brief, which may have come from a medieval chapel located within the hillfort. A possible post-medieval token and a Roman coin were also recovered.

Harry Manley

HORTON: HORTON AND CHALBURY VILLAGE HALL (NGR 403220 107510)

Following earlier survey and evaluation a watching brief was undertaken during the groundworks for the new village hall. No direct evidence of the Verwood Pottery industries was found at the site, although the remains of the pond may relate to clay extraction for the manufacturing of Verwood-type wares. A quantity of medieval pottery of *c.* thirteenth-century date, was recovered.

Harry Manley

GUSSAGE ST MICHAEL: BROOKSIDE HORSE MÉNAGE (NGR 397835 113005)

Observations during the excavation of foundations for a horse ménage were undertaken. However, due to the shallow nature of the foundations, no evidence of the Dorset Cursus was noted.

Harry Manley

DORCHESTER, 30 TRINITY STREET, SY 69152 90555, PERIOD: ROMAN

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief during the groundworks on a new rear extension to the La Gondola Restaurant at 30 Trinity Street, Dorchester. Monitoring of the foundation trenches revealed a substantial Romano-British demolition deposit relating to the destruction of a building from this period. The deposit incorporated clay roof tile fragments, pottery dating from the 1st to the 4th centuries AD, wall plaster fragments, many with red paint still evident, a coin of Tetricus I (AD 270–273) and a grooved bone handle of a knife. The pottery evidence would suggest a 4th century date for the final demolition of the building and this fits well with the general decline of Durnovaria that occurred towards the end of the Roman administration.

The most significant find was part of a tessellated pavement and mosaic. The mosaic is a Geometrico type with outer borders forming both a guilloche pattern and wave-crest design. Only a small portion of the central roundel was evident and the motif could not be identified as this lay outside the foundation trenches. Based on structural evidence from other sites in close proximity, the floor probably furnished a room of a well appointed town house that fronted onto the western side of a street beneath the present restaurant. However, by comparison with contemporary examples from the region, this mosaic is considered to be of mediocre quality and probably dates to the late 3rd century. The floor is also not unique in Dorchester and represents the 66th of its type at the time of discovery.

Fay Robinson and Richard McConnell

YETMINSTER, SEWER REPLACEMENT, ST 59724 11006 TO ST 59223 11299 VIA ST 59217 11144, PERIOD: MULTI-PERIOD

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief during groundworks for a sewer replacement at Yetminster, due to the route of the pipeline crossing close to the northern edge of possible medieval burgage plots. Monitoring of development excavations revealed one archaeological feature comprising a possible post-medieval/modern collapsed field drain located in the compound area at Folly Farm. An area of presumed medieval ridge and furrow orientated north-east to south-west was observed as a slight earthwork towards the centre of the scheme. A small assemblage of 18 artefacts was recovered from the residual topsoil/ploughsoil of the easement. This consisted of two ?prehistoric struck flints and 16 pottery sherds spanning the medieval, post-medieval and modern periods.

Fay Robinson and Richard McConnell

27 EAST STREET, BRIDPORT, DORSET, ST 46722 92960, PERIOD: MULTI-PERIOD

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief during development groundworks for the construction of two new dwellings at 27 East Street, Bridport, situated within the historic core of New Town. Observations revealed seven archaeological features and a small assemblage of artefacts that reflect a typical pattern of domestic refuse disposal. The majority of features relate to post-medieval and modern phases of occupation activity although the Site itself is likely to have originated as one of the shops, cellars, solars and halls that were known to have existed along East Street from the late 14th century.

Behind the present 18th/19th century building, and at a depth of *c.* 2m below modern ground level, a large post-medieval pit was exposed that contained abundant animal bone, post-medieval pottery sherds and a wooden plank that may have been part of a boat rudder. A ?post-medieval stone-lined well over 8m deep was also found. The remains of two east-west orientated walls belonging to the 18th/19th century buildings that existed just prior to development works were recorded beneath modern demolition and make-up layers. Two undated ditches were also found, one of unknown orientation near the western boundary of the Site, and the other on the eastern side near Globe Lane. The latter was extremely shallow and appears to have served as a foundation trench for another of the 18th/19th century walls that was demolished prior to the present re-development.

Fay Robinson and Richard McConnell

HARPER HOUSE, HOUND STREET, SHERBORNE, ST 63960 16660, PERIOD: UNKNOWN

Context One Archaeological Services Ltd carried out an Archaeological Field Evaluation on land to the rear of Harper House, Hound Street, Sherborne. At the base of the soil horizons in trench 3, the possible remains of an east-west aligned wall footing were encountered, which was cut by a probable post-hole of unknown date. Excavation of trench 4 in the proposed new play area revealed evidence of a formalised path that can be seen on the 1887 map. Deliberately laid hamstone fragments were observed along the southern and eastern trench edges, and probably represent the southern border of the north-east to south-west orientated path and its north-west to south-east return. The path overlay buried garden soils, probably imported for the purpose of levelling and landscaping the garden area, which in turn covered residual gravel deposits. The gravel deposits probably represent a dump of path material rather than evidence of an earlier footway. An east to west aligned path was observed at the southern end of trench 5. Due to a lack of any cartographic or artefactual evidence, the path cannot be further characterised or dated.

Fay Robinson and Richard McConnell

WALLED GARDEN AT UPTON HOUSE COUNTRY PARK, UPTON, POOLE, SY 99275 92825, PERIOD: MODERN

Context One Archaeological Services Ltd undertook an Archaeological Field Evaluation within the Walled Garden at Upton House Country Park, Poole. A prior geophysical survey carried out by COAS earlier in 2006, combining both resistivity and magnetometer surveys had identified a series of 19th and 20th century formal garden features associated with the Walled Garden. This evaluation, involving the excavation of six trenches, was carried out to investigate further, and to confirm the results of the initial survey. Overlying the natural yellow sand was an earlier (pre–19th century) post-medieval ploughsoil horizon, which did not yield any artefacts. However, it was stratigraphically earlier than, and clearly pre-dated the 19th–20th century Walled Garden. The formal garden features consisted of gravel and clinker pathways, a soak-away, a drainage gully, and two planting beds.

Fay Robinson and Richard McConnell

FORTY FOOT WAY, BRIDPORT, SY 46221 90507, PERIOD: N/A

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief during the construction of a new underground tank and layby at Forty Foot Way, Bridport. A substantial north-east to south-west aligned linear feature, interpreted as a possible (palaeo)channel, was observed across the south-east corner of the tank pit. No artefacts were recovered.

Fay Robinson and Richard McConnell

GORCOMBE FARM, THORNICOMBE, ST 87098 00649, PERIOD: N/A

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief during the reinstatement of a redundant sludge storage lagoon at Gorcombe Farm, Thornicombe. The lagoon comprised an earthwork enclosure, the northern side of which rested against a section of the Combs ditch Scheduled Ancient Monument (SAM) (Dorset M764). Monitoring was carried out to oversee the filling of the lagoon with soil from the enclosure banks and to ensure that the SAM was not damaged through remedial works.

Fay Robinson and Richard McConnell

HOLWORTH BOOSTER TO HOLWORTH TANK, SY 76560 84000, PERIOD: N/A

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief along a *c.* 70m length of a water main replacement scheme from Holworth Booster to Holworth Tank. Despite the proximity of a prehistoric bowl barrow (part of SAM no. 278) immediately to the west of the pipeline route, with further significant prehistoric and medieval archaeological events in the general vicinity, monitoring of development excavations revealed no visible archaeological features/deposits and no finds were recovered. However, this should be balanced against the nature of the pipeline scheme which had a limited ground impact.

Fay Robinson and Richard McConnell

FORMER GASWORKS SITE, NORTH STREET, WAREHAM, SY 92225 87823, PERIOD: N/A

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief at the Former Gasworks site, North Street, Wareham, Dorset. No visible archaeological features/deposits were revealed and no artefacts were found during deep excavation operations. As anticipated, the ground consisted of modern overburden, and was heavily disturbed and contaminated to the full depth of the excavations.

Fay Robinson and Richard McConnell

LOUDS MILL ALLOTMENTS, ST GEORGE'S STREET, DORCHESTER, DORSET, SY 70482 90376, PERIOD: MODERN

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief at Louds Mill Allotments, St George's Street, Dorchester. Development excavations revealed no significant deposits or features.

Fay Robinson and Richard McConnell

VESPASIAN HOUSE, BRIDPORT ROAD, DORCHESTER, DORSET, SY 68710 90648, PERIOD: N/A

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief during the groundworks for a new replacement water pipe at Vespasian House, Bridport Road, Dorchester. No visible archaeological remains and/or deposits were revealed during the pipe trench operations.

Fay Robinson and Richard McConnell

ST NICHOLAS CHURCH, CHILD OKEFORD, ST 83500 12700, PERIOD: MULTI-PERIOD

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief during groundworks for a soakaway and drainage pipe at St Nicholas Church, Child Okeford. No archaeological remains/deposits pre-dating post-medieval and modern mixed soil deposits were discovered at the Site. One residual sherd of medieval pottery was recovered during development groundworks.

Fay Robinson and Richard McConnell

STURMINSTER NEWTON CASTLE, STURMINSTER NEWTON, ST 78419 13488, PERIOD: N/A

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief during groundworks for the repair to a section of water pipeline at Scheduled Monument D0129 – Sturminster Newton Castle, Sturminster Newton. No archaeological remains/deposits or artefacts were observed during the course of the Watching Brief.

Fay Robinson and Richard McConnell

EVALUATIONS

POOLE: GREEN ISLAND (NGR 400950 086695)

An initial evaluation (two test pits) was carried out on the platform upon which stands a twentieth-century bungalow. Isolated shale finds are in accord with previous evidence for shale working in this area (Wilkes, *pers comm*). Work is in progress.

Harry Manley

DORCHESTER, CHARLES STREET CAR PARK, DORCHESTER, SY 6935 9050

An archaeological evaluation was undertaken in February and March 2007 at Charles Street Car Park, Dorchester. Three trenches were excavated in the north-western part of the development area. Trenches identified well-preserved Roman features including pits and ditches, a collapsed wall, a metalled surface and levelling and/or consolidation layers. These were all sealed by 'dark earth' and/or cultivation deposits at least 0.7m thick. Artefactual evidence dating to the Romano-British and later periods was recovered from these layers.

The evaluation has shown that Roman archaeological features are likely to survive in the part of the site examined at a depth of between 1.23m and 1.69m below the existing ground surface. The evaluation has also shown that archaeological deposits survive within the area of deep disturbance detected by the Ground Penetrating Radar Survey and that post-medieval robbing and/or disturbance of the archaeological deposits has occurred.

Tim Havard
Cotswold Archaeology

WEYMOUTH, LAND AT 12 PUTTON LANE, CHICKERELL, SY 6500 8029

An archaeological evaluation was undertaken by Cotswold Archaeology in September 2007 at 12 Putton Lane Chickerell, Weymouth. Four trenches were excavated within the proposed development area. No archaeological deposits or features were revealed during the course of this evaluation.

Stuart Joyce
Cotswold Archaeology

DORCHESTER, LAND TO THE REAR OF THE OLD FIRE STATION, TRINITY STREET, SY 6914 9041, PERIOD: MULTI-PERIOD

Context One Archaeological Services Ltd (COAS) carried out an Archaeological Field Evaluation on land to the rear of the Old Fire Station, Trinity Street, Dorchester. The work established the presence of at least 1.6m and possibly up to 2.25m of late post-medieval/modern deposits over the Site that was thought to protect underlying medieval and Roman layers. Indeed, auguring in two test pits established the presence of rubble layers at an average depth of 2.20m below ground level, potentially representing deposits of medieval/Roman date. The depth of 'overburden', which is considerably greater than at other sites in the area, may reflect the location of the Site in a hollow that has subsequently been in-filled. It is therefore possible that any deeply buried archaeological deposits will be relatively well preserved. Alternatively, the deep overburden may reflect previous disturbance of the Site and subsequent backfilling.

Cheryl Allum and Richard McConnell

FORSTON WTW, CHARMINSTER, DORSET, NGR SY 66690 94947, PERIOD: ROMAN, LATE IRON AGE

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief at Forston WTW, Charminster, during groundworks for a new contact tank. This was preceded by the observation of five small geotechnical pits on the site of the proposed tank. The Watching Brief recovered evidence for settlement or other activity broadly dating to the Roman period, possibly associated with a Romano-British villa located 60m to the north of the centre of the Site. Although the precise nature of the archaeological features could not be ascertained, the recovery of ceramic building material and limestone roof tile supports this hypothesis. The finds assemblage also indicated activity from the late Iron Age, which accords with the evidence from the earlier villa excavations. All of the excavated features were buried beneath a significant depth of subsoil that had accumulated along the lower slopes and bottom of the river valley, probably as a result of intense medieval farming and settlement in the valley.

Cheryl Allum and Richard McConnell

AFFPUDDLE, DORSET, NGR SY 80006 94417 TO ST 80737 93882, PERIOD: POST-MEDIEVAL

Context One Archaeological Services Ltd carried out an Archaeological Watching Brief during groundworks for a proposed rising main at Affpuddle. The Watching Brief recorded just one archaeological feature – a ditch to the north-west of an adjacent area of concentrated earthworks forming redundant post-medieval water meadows. The ditch was identical in shape to the water meadow features, suggesting that it belonged to the same system albeit part of a wider network of channels. A fragment of post-medieval/modern roof tile recovered from the ditch fits well with the suspected chronology of the meadows. Topsoil finds consisted of worked flint, possibly dating from the Palaeolithic through to the early Bronze Age. Although residual, these finds may have derived from an area of prehistoric occupation, in particular from the vicinity of Scheduled Monument 29054 and tumuli situated on the higher ground to the north of the Site.

Cheryl Allum and Richard McConnell

SHERBORNE SCHOOL FOR BOYS, SHERBORNE, DORSET, NGR ST 63735 16541, PERIOD: MEDIEVAL

Context One Archaeological Services Ltd carried out an archaeological field evaluation at the site of the proposed New Music Room, Sherborne School for Boys, Sherborne. The archaeological work recovered evidence for a medieval ditch, four further ditches tentatively dated to the medieval period or earlier, and a buried ploughsoil. The tiny assemblage of artefacts recovered from the ditches indicates that they were peripheral to the Saxon or medieval settlement, probably representing field boundaries. These features may have been associated with monastic agricultural activity as the desk-based research placed the Site within the outer precinct of the medieval monastery, an area typically used for agricultural or industrial purposes. The desk-based assessment also anticipated an impact from post-medieval 'landscape gardening' with the Site forming part of a garden from at least 1733, however buried garden soils were the only recorded remnant of this activity. Several modern land drains were also observed crossing the Site.

Cheryl Allum and Richard McConnell

QUEEN ELIZABETH'S SCHOOL, WIMBORNE MINSTER, DORSET, NGR ST 99856 00686, PERIOD: N/A

Context One Archaeological Services Ltd carried out an archaeological Watching Brief at Queen Elizabeth's School, Wimborne Minster, during re-development for various sports pitches. No archaeological remains/deposits were observed and no archaeological finds were recovered during the course of the Watching Brief. However, the Site was found to have undergone considerable levelling during construction of the school which may have truncated, obscured or destroyed any existing archaeological remains.

Cheryl Allum and Richard McConnell

EXCAVATIONS

EVALUATION EXCAVATION WITHIN HIGH WOOD, KINGSTON LACY ESTATE, PAMPHILL: (ST969 032) INTERIM REPORT

Introduction

High Wood lies east of Badbury Rings near the centre and highest point of the Kingston Estate Estate. The wood consists of areas of coppice and also mature timber trees (mainly oak and beech). This is an ancient woodland and at its heart, on the upper east slope of High Wood Hill (ST 970 030), stands a block of knarled and twisted pollarded oaks at least 300 years old.

The first named record of High Wood dates to 1564 (PRO DL44/103) when it was part of a group of copses surveyed for Queen Elizabeth within her duchy of Lancaster.

> 'Itm thei sayethe that the name of one of the copses ys commonlye called hywoode copes [and] conteynythe by estymacon xxvi acres the wch copes ys yet well'.

It lay near the centre of Badbury deer park and warren, part of the manor of Kingston Lacy (Papworth 1998, 45–62). It is likely that High Wood was tree covered in the medieval period as there are various references in the medieval accounts of underwood and timber being brought from Badbury Warren to mend the manorial buildings. For example in the reeve's account for 1422–1423:

> 'And John Walwayn and John Brownyng felling 50 small oaks in Badbury for making studs for the said chamber 14d. And Thomas Russell and John Legg carrying 70 oaks from Badbury as far as the manor in total 6s 8d' (DHC D/BKL CG3/15)

The wood is separated from the Iron Age hillfort of Badbury Rings by a saddle of land. Therefore, when viewed from a distance, Badbury and High Wood are a double hill with Badbury's summit lying 500m west of the crown of High Wood. The Roman surveyors chose to use the dip of ground between them as a survey marker. Their road from Poole Harbour turns and divides at this point.

The prominent hillfort earthworks of Badbury have long been valued as an important archaeological site but High Wood's archaeology has remained obscure because its tree cover has hidden its topographic significance. The trees themselves and the earthworks they shroud demonstrate a landscape stratigraphy that is intriguing. The ancient pollarded oaks and a low earthwork bank that surrounds them overlie a series of deep hollows interpreted as gravel and sand pits. These, in turn, cut into an enclosure.

Earthworks were first noted in High Wood during the National Trust archaeological survey of the Kingston Lacy Estate (Papworth 1988, 142). An earthwork survey was subsequently carried out by RCHME (Corney and Riley 1992, 70) and this revealed a sub-rectangular enclosure defined by a ditch measuring 3–4m wide and up to 0.8m deep with an external bank 3m wide and up to 0.3m high. The old sand and gravel pits have damaged the centre, east and north sides of the enclosure but it is estimated that it originally enclosed 0.5 hectare and measured 110m north-west to south-east and 100m north-east to south-west.

Mark Corney categorised this site as a Tombstone or 'D'-shaped enclosure of later Iron Age or early Romano-British date (Corney and Riley, 71) similar to those listed by Collin Bowen (1990, 91) on Cranborne Chase. However, the position of the ditch inside the bank and the occasional finds of worked flint amongst the leaf litter across the site suggested an earlier date (Richards 1992, 71). The earthwork may have been a possible henge-like structure dating to the Neolithic period and as such it would represent the earliest earthwork known within the Badbury environs.

A small excavation across the bank and ditch was carried out in May 2008 to recover dating evidence that would improve interpretation and lead to enhanced conservation management of the site.

Excavation

It was hoped that a single trench would recover dating material from the bank and ditch of the enclosure and also from one of the quarry pits. Therefore an area of undergrowth ash and sycamore saplings was cleared at ST 96915 03070 over a portion of the enclosure bank and internal ditch where a quarry pit cut the ditch.

The trench had to be positioned to avoid mature trees, old stumps and coppice stools. It was excavated on the south side of the enclosure and was aligned north north east to south south west measuring 15m long and 1.2m wide. It crossed the bank and ditch at a right-angle to create a clear section through the stratigraphy.

The geology of the High Wood and Badbury hill tops consists of Bracklesham beds overlying the chalk exposed in the arable fields surrounding the hill. The soils in the High Wood trench were acidic, consisting of compacted yellow-orange sands mixed with gravel and lenses of clay. No bone or other organic material apart from charcoal survived. The value of pollen preserved in the acid soil is affected by the established tree cover as root disturbance mixes deposits preventing the extraction of reliable environmental evidence (Chisham 2005).

Burnt and worked flint was recovered while removing the leave litter (1) and rooty topsoil (2) across the length of the trench. Below this, the sandy soil was exposed but leaching of the soil made it difficult to differentiate layers and the trench was excavated in 30mm spits with every fragment of pottery and piece of worked flint levelled and plotted onto a series of plans of the trench. Layer (3) was allocated to the area of the quarry at the north end of the trench, layer (4) at the position of the enclosure ditch, layer (5) over the bank and (6) on the exterior south side of the enclosure.

Excavation of (3) recovered flint that appears to be of Bronze Age or earlier date but below this in layer (12) was found a piece of black burnished pottery. Further south, in the ditch area, mixed with flint flakes, cores and burnt flint and Heathstone were found other fragments of Romano-British pottery in (4) and (9). From (14) below (9) and 400mm below the ground surface, a large fragment of a black-burnished flanged bowl typical of the 3rd–4th century was recovered (Woodward *et al.* 1993, 276 Figure 151 no. 362). At this stage in the post-excavation analysis all the pottery from the ditch and quarry area appears to be Romano-British or Iron Age in date although one sherd from (4) may be medieval.

The layers within the bank of the enclosure dip towards the south. To the north they outcrop at the ditch edge as though the layers had been cut by the ditch rather than being deposited as a heap of soil derived from the ditch. It is possible that the quarry had removed the ditch here as there was no differentiation visible between the cuts of these features but the shape of the bank appeared to be intact when compared with the unquarried part of the enclosure as it continues towards the north west.

The bank was made up of smaller fragments of burnt ironstone and pottery in comparison to material found in the ditch/quarry to the north and outside the bank on its south side. This would be expected as material would be broken as it was dug and redeposited. There was much prehistoric flint but mixed with this were fragments of later Iron Age to early Romano-British pottery. A clear deposit of material within the bank was (16) a grey-ochre sandy clay containing charcoal and burnt heathstone. This overlay a bright orange to ochre compacted sand (27) which was interpreted as the bottom deposit of the bank.

Layer (27) overlay (20) on the north side of the bank and (10) on the exterior south side. (20) had been cut by the ditch/quarry [29] and was a compacted deposit of a light grey to ochre sand filling the voids between Heathstone lumps up to 150mm^3 and lumps and flakes of flint apparently forming a hardstanding surface. Layer (10) was similar and it is thought that they formed part of the same layer underlying the enclosure bank although there was insufficient time to link the two deposits in the excavation trench to prove this. (10) was 50–100mm and (20) 160mm thick.

Layer (10) overlay (25), a bright orange to yellow sandy clay with occasional pebbles average size 30–50mm^3. This layer was partly excavated and proved to contain large fragments of Iron Age pottery (Figure 1) mixed with numerous charcoal lumps and flecks. A similar layer of pottery and charcoal was not found below (20) to the south. A preliminary date for the pottery is later Middle Iron Age.

The excavation did not reach the bottom of the archaeological layers within the trench, certainly not in the area below and exterior to the bank. The ditch/quarry [29] was excavated to a depth of 0.8m below the surface and the lowest excavated layer (28) was a bright orange stiff sandy clay that contained no artefacts and this may have been undisturbed geology although layer (19) above was similar and contained a small fragment of Romano-British pottery.

Conclusion

This is an interim impression of the site before specialist analysis of the pottery and stone artefacts and therefore any conclusions will need to be revised. However, Mark Corney's interpretation of the enclosure as being of Late Iron Age/early Romano-British date has been supported by the results of this small excavation. Identifying the separate deposits to date the enclosure ditch in relation to quarry stratigraphy was not possible during the excavation but it is clear from the earthwork survey (Corney and Riley 1992) that the quarries are later and cut the line of the ditch and bank.

At this stage of the finds analysis it seems that all the latest material recovered from the site was found in the filling of the ditch/quarry [29]. This was predominantly and perhaps exclusively Romano-British and indicates that the quarries date to this period. The well-preserved section of the Dorchester Roman road on the west side of Badbury is capped with pebbles similar to those found in the geological deposits within Badbury Rings and High Wood and therefore road construction may have been one of the uses for material from the High Wood pits.

We could now view the Badbury/High Wood hills as twin peaks each occupied by a significant Late Iron Age site. Perhaps the interior ditch of the High Wood enclosure was dug to keep in something valuable but whether this

Figure 1: Iron Age pottery from (25) below the bank of the enclosure

Figure 2: View of the ditch and bank of the enclosure looking north-east

was something spiritual or temporal is unclear. I would like to imagine it as a corral, a secure place for livestock, perhaps horses. However, it was constructed on land that had been occupied earlier in the Iron Age and from the flint evidence people had been living on High Wood hill long before that (Papworth 2008, 304, 310–2, 332–3).

Acknowledgements

Many thanks to Chris Green, Fay Pendall, Dave Stewart, Meg Sims, Christine Beer, Jackie Buxton, James Grasby and Nicky Ravenhill for helping to dig the trench amongst the trees despite the cloud of insects. Particular thanks to Nancy Grace the site supervisor and organiser of the trench-side 50th birthday party.

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Martin Papworth
The National Trust

FOOTBALL FIELD, WORTH MATRAVERS – EXCAVATIONS 2006–8

Between 1990 and 1993, Southampton University undertook an investigation in this field, known then as Quarry Field, Compact Farm. Field walking and excavations revealed remains of a settlement site dating from at least the early Iron Age, to a field-barn or granary with a grain-drier, probably occupied during the fourth-century AD (Hinton 2002). Subsequently, two further archaeological evaluations were carried out in the field, each as part of one of two planning applications (Oakley 2003); Wessex Archaeology 2003). No developments took place. A new landowner later identified a area in the field, now known as Football Field, which contained a back-filled, disused quarry and which appeared to be otherwise archaeologically sterile. Worth Community Property Trust decided to apply for planning permission to build five affordable houses on this site, for occupation by local people.

Late in 2006, East Dorset Antiquarian Society was requested by the Worth Community Property Trust to carry out an archaeological evaluation on the site. Initially, a magnetometer survey was carried out, covering the area containing the proposed footprints, outside the vicinity of the disused quarry. The survey plot showed a possible anomaly, in which an arc of a putative circular feature lay under a corner of the proposed footprint of a house. In November 2006, a single trench was opened by hand, transecting the possible feature, under the house footprint. Taking into account the general lack of apparent archaeology shown in the magnetometer survey, and the absence of evidence in the trench of archaeological structure, it was concluded that no significant archaeological remains within this area would be impacted by the proposed development (East Dorset Antiquarian Society 2007).

In 2007, East Dorset Antiquarian Society were requested by the landowner to establish the extent of unrecorded archaeology outside the boundary of the proposed development site and, specifically, within the gardens of two of the proposed houses. The investigation began with a magnetometer survey of much of the remainder of the field. Study of the survey plot indicated a range of anomalies, suggesting the presence of archaeological features. Five 10m by 2m trenches across the field were machine-stripped to investigate anomalies and two 3m by 2m trenches were hand-stripped in the garden areas. All trenches were subsequently excavated by hand. Three of the larger revealed pit features of varying dimensions, a fourth transected parallel linear features, which are thought to be natural. The fifth larger trench appeared to be archaeologically-sterile. The two smaller trenches contained no archaeological features. One of these yielded some pre-historic artefacts, thought to have been re-deposited, the other had none.

The most significant of the larger trenches, Trench 3, was located nearest to the Southampton excavation of the Roman field barn. Some Romano-British artefacts were found close to the surface, beneath the plough soil. Also found, partly within this trench, was a vertical, cylindrical feature which had a flat, horizontal natural limestone base. This feature, which was lined with limestone masonry, contained large amounts of Iron Age pottery, animal bones and worked shale. It is believed to have been initially a storage pit, subsequently re-used for rubbish disposal (Figure 1). A flagstone approach, from the north west of the pit to its edge can be seen.

In an enlargement of this trench, a fully-extended, supine human inhumation was found 3m from the storage pit. The remains were oriented approximately north/south and had been severely damaged by plough action. The grave was loosely defined by an arrangement of limestones, but no grave goods were found. The remains were conserved *in situ*.

In 2008, East Dorset Antiquarian Society returned to the site to establish the relationship, if any, between the previous year's discoveries and the archaeology nearby,

Figure 1: Storage pit, showing limestone masonry, base and vertical lining

Figure 2: Pit feature, similar in construction to that shown in Figure 1

recorded by Southampton University. A rectangular area of about 200 square metres, incorporating part of Trench 3, was machine-stripped and subsequently extended manually to clarify some of the archaeology revealed.

The stripped area suggested complex archaeology beneath, due mainly to a dense scatter of limestone across most of it. The area was cleaned back with hand tools, at least three times. Several pit features were excavated. Two of these were similar in size, morphology and construction to that excavated last year (shown in Figure 1) and contained artifacts which were similar in variety and age. Both appeared to be multi-phased. In particular, one of these (shown in Figure 2) seemed to have had two different diameters, each with a different upper surface. All pit features yielded a range of artifacts, including Iron Age pottery, worked shale, worked flint, animal bones and, rarely, ferrous objects. Two probable pit features were left intact and unexcavated for archaeologists of the future.

Other features investigated include a complex area of stratified occupation layers, within what appeared initially

Figure 3: Inhumation with north/south orientation

to be part of a roundhouse (the remainder being under a baulk and towards the area excavated by Southampton University). A shallow structure resembling a shallow horizontal flue, pointing towards the putative roundhouse, was uncovered. It was not completely excavated. A cluster of arranged sling-shot was found near several post-holes.

Evidence was uncovered of probable stone structures, lying in a wide band between the pit feature excavated in 2007 (Figure 1) and the field-barn to the west. High status Roman or Romano-British artefacts were found in this vicinity. A inhumation was found about 5m north of that found last year. The skeleton was flexed, complete, articulated, oriented approximately north-south and lying on its left side (Figure 3). No grave was found, but the skull was resting on a small horizontal piece of limestone, possibly a pillow. Small sherds of pottery were found next to the skull and the remnants of a pig 'joint' were located in the crook of the legs. The remains were conserved *in situ*.

Conclusion

The general research objectives of establishing the extent of archaeological settlement in Football Field (in 2007) and the clarification (in 2008) of the relationship (if any) between the investigations in 2007 and the archaeology recorded by Southampton University have largely been met, and will be clarified by post-excavation studies and specialist reporting. There is clearly an archaeological relationship between discoveries in 2007 and the results of further investigations in 2008. From these, datable and other material recovered or exposed, hopefully, will enable detailed interpretations to be made. Furthermore, a general conclusion may be drawn that the complex archaeology, found by Southampton University, indicating multiple Iron Age and Romano-British settlements, appears to continue to the east of the original site. At present, the extent of settlement may be safely extrapolated.

Discussions between the landowner and East Dorset Antiquarian Society have resulted in a decision that the latter should not continue the excavation of this site, at least for the time being, for two main reasons. Firstly, the complexity of the archaeology revealed in 2008 indicates that any further investigations would require a large amount of effort and time, and also specific experience, much of which would not be available to a volunteer group. Secondly, extending the scope of the excavation might result in damaging archaeology not presently under threat, without any guarantee of increasing knowledge of the remains. East Dorset Antiquarian Society would like to thank Bob Kenyon and Bridget Downton for permission to investigate this site and for their continued support and assistance.

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P.J.H. Roberts
East Dorset Antiquarian Society

Bournemouth University fieldwork 2007–2008

Research Projects

EAST HOLME

The *c.* 1988 geophysical survey of the East Holme Roman coin hoard site at East Holme (Steve Thompson) is no longer available in accessible form. Consequently, a new survey was carried out during 2007–8 and this has allowed for some provisional reinterpretation of the site. This first phase of the new investigation will be followed by an appraisal of the context of other Roman coins and pottery within the grounds of Holme Priory.

Iain Hewitt

WAREHAM ST MARTIN: EAST HOLTON (NGR 396200 091300)

The programme of field survey and excavation at East Holton is now complete and a report is in preparation.

Iain Hewitt and Bronwen Russell

EAST STOKE (NGR 3867701 086752)

Funding Stream: East Stoke Parish Council/Purbeck District Council/Heritage Lottery Fund).

Scheduled Monument Consent was obtained for work within the churchyard of St Mary's Old Church. This involved correcting the alignment of a number of grave stones. Once in the perpendicular, each stone was scanned in order to produce a record of shape, decoration and inscription. The surviving mass dial was recorded by the same process.

A geophysical survey of a conjectural area of settlement to the south of the churchyard remains to be completed. A report on the historical context of St Mary's Old Church will be ready in 2009.

Iain Hewitt, Bronwen Russell, Kate Welham and Harry Manley

ARCHAEOLOGICAL ARCHIVE IN STORE AT BOURNEMOUTH UNIVERSITY

The University and its predecessors have been involved in fieldwork and excavation in the County of Dorset since the late 1960s. Since that time, a substantial material archive has been amassed and this is supported by associated documentation. The process of initial appraisal began at the beginning of July 2008 and it is anticipated that this will be complete by the end of the month. To date, it has become apparent that some of the archive belong with collections held elsewhere. Integration and selective publication will follow.

Iain Hewitt

AN ANGLO-SAXON FELON AT MAIDEN CASTLE?

Lorna Gardiner

Skeleton Q1 was discovered as an isolated burial at the east end of the bank barrow on Maiden Castle during the excavations of the 1930s and labelled by Wheeler (1943) as Neolithic. A later re-evaluation by Brothwell (1971, 30) included a radiocarbon test that gave a date of AD635, early seventh-century. Here it is proposed that developments on the Q1 skeleton seen on display at the Dorset County Museum, can now be classed as an Anglo-Saxon 'deviant' execution victim, showing evidence of deadly injuries to both the skull and lower body (see Figure 1). Deviant burials can be hard to identify, many that can now be classed as such were previously tagged 'heathen' by 19th century antiquarians, of which the excavation records now have been lost.

Deviance brings to mind modern connotations of trouble and terrible behaviour, but, in archaeological terms, it describes abnormal or remarkable deposits that show unusual mortuary practices. These can be human remains that have had an ideologically prominent death (Meyer-Orlac 2007) or a body 'forcibly killed in a formalised manner' (Reynolds 1999a, 88). The remains of Q1 were described by Wheeler having been 'hacked with considerable force with a sharp instrument' (Wheeler 1943, 240), supposedly flint. Due to the muddle of bones as found *in situ*, he suggests the male skeleton as being a victim of cannibalism, but Brothwell was quick to point out that such trauma is likely to have been caused by a metal weapon 'relatively flat and extremely sharp' (Brothwell 1971, 236), and dismissed Wheeler's claims through lack of substantiation. Further analysis uncovered that 'there was probably intentional hacking at the body with a sharp weapon in order to remove the lower arms, the thighs, and the lower legs' (Brothwell 1971, 237), and trauma to the skull 'could have not been inflicted without the individual lying with

Letter	Area with inflicted injuries on skull
A	left temporal
B	left parietal
C	right asterion
D	Endocrania (not illustrated)
E	external occipital protuberance
F	foramen magnum
G	mastoid process
H	right ramus

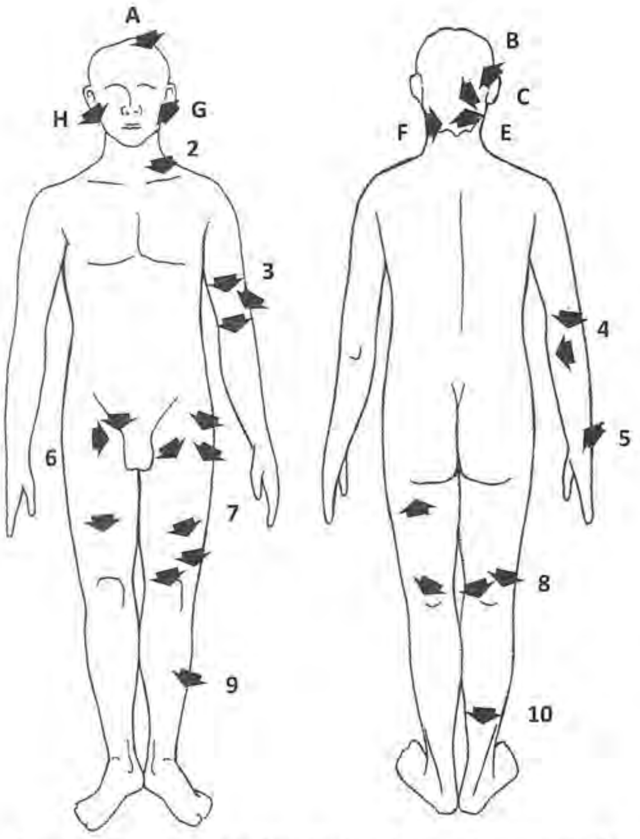

Figure 1: Illustration of where the Q1 skeleton shows cut marks on the body (diagram after Brothwell 1971) and associated tabulated key

Number	Area with inflicted post-cranial injuries
2	Left clavical
3	Left humerus
4	Right humerus
5	Right ulna
6	Right ilium
7	Left femur
8	Right femur
9	Right tibia
10	Left fibula

the back of the head placed upwards' (Brothwell 1971, 236) with a sword 'driven into the face and finishing its impact in the base of the occipital' (Brothwell 1971, 236). Although Brothwell is unsure of how to interpret such severe and complex injuries, the evidence points to a possible failed 'quartering' and a botched decapitation. Skeleton Q1 is unusual, as only a few solitary Anglo-Saxon execution burials have been discovered, but those that do exist are of a similar date, such as the beheaded man at Stonehenge (see Pitts *et al.* 2002). It seems that multiple interments or cemeteries uncovered in other counties with deviant burials, mostly date to the Late Anglo-Saxon (Buckberry and Hadley 2007; Haymen and Reynolds 2005). A study by Williams found that Wessex had the highest rate of single interments in association with monument reuse, and the lowest between deposits of 2–10 persons (1997, 19).

Skeletal analysis is not the only way to determine executed persons. Academics working on these non-compliant interments have different outlooks in validating their characteristics. Work by Reynolds uses historical sources such as the law codes and charters to prove that 87% of sites are associated with prehistoric or Anglo Saxon monuments (1999b, 108), and it was first realised by Grinsell (1991), that there is a correlation between placements of sites and hundred boundaries . This seems to be associated with the Christian conversion period (around AD 600) which created liminal boundaries for the socially rejected. As Reynolds argues, 'the choice of the hundred boundaries as a fitting repository for executed offenders probably reflects the desire to banish social outcasts to the geographical limits of local territories' (1999b, 109).

Sarah Semple takes on a more conjectural approach in discussing the ideology of the burying community and why they had preferred zones in which to deposit their criminal dead. She believes that in the early centuries, barrows were places of intense fear and mystery to the locals. Through sources of Anglo-Saxon verse she tells of dragons, spirits and other tormentors that supposedly lay within (Semple 1998); this folklore often explains why barrows have names such as Woden's Barrow or Goblin Hill (Semple 1998, 112).

It is hard to classify Q1 as a 'judicial' execution victim, as judicial would imply the presence of fully structured and implemented law in Dorset around AD 635, as it is understood that Ine (AD 688–726) was one of the first known rulers in the area to establish such codes and formal punishment, over 50 years later than the deposit in question. Q1 could be proof of an earlier form of capital punishment dealt out by local communities who were dealing with offenders in a way they deemed suitable and in accordance with contempory beliefs. Such extreme mutilation was unnecessary if the perpetrators just wanted to kill. Could the extrapolation of Q1's limbs be to keep the 'sinner' in the grave, and stop him from disturbing those who put him there (Meany and Hawke 1970, 31)? Does the disfiguring of the face beyond recognition again represent fear of that person? This would explain why the body reflects a collection of multiple injuries instead of one organized method. The placement of the body is also definitely important to note. Maiden Castle is the largest hill fort in Europe, and is surrounded by other prehistoric features. Does the size of his imprisonment inside the hill-fort coincide with the weight of his crime and the torment he should suffer? Does the location upon the hundred boundaries of Culliford Tree and St George represent the riddance and exile of an unwanted outcast?

Further investigations may eventually solve these questions, but it seems that Dorset has received a lack of interest and research into these execution burials, with most authors preferring to investigate the 'wealthier' earlier Anglo-Saxon occupied counties of Wiltshire, Hampshire and Kent. My research has highlighted many other potential deviant sites in this county (Gardiner (in prep.)) and suggests that not only should a review of post-Roman Maiden Castle should be undertaken, and also one on those sites that have been overlooked. There is a need here for a corpus Dorset charters to be compiled, place names collaborated, and the evidence raised here to be realised and applied in order to ever fully understand whether Dorset is only really liable to the odd grisly execution, or whether there are many other felons under our feet.

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INTERIM REPORT ON INVESTIGATION OF AN IRON AGE SETTLEMENT NEAR STOURPAINE, DORSET

Dave Stewart

During the winter 2007/8 the geophysical study of the Iron Age hillfort at Hod Hill (Stewart 2008) was extended by a magnetometry survey of adjoining land belonging to the Hanford Estate. The survey area comprised three fields, totalling some 50 hectares.

The original intention was to prove observations by Crawford (Crawford and Keiller 1928, 36) of habitation traces outside the northern rampart of the hillfort, to verify the course of the Roman road from Lazerton Farm to the Ashfield Gate suggested by Field (1992, 57) and to locate the remains of a Roman villa shown on the First Edition OS map. All these features proved elusive. No habitation was evident to the north and magnetometry failed to find conclusive traces of the road or villa.

However the survey did reveal many features, principal among which were unexpected traces of intensive habitation covering some six hectares in the field known as 'Big Ground'. This lies on the southern slopes of Hod Hill, bounded by the River Iwerne to the south and the Stourpaine/Hod bridleway to the east.

With the kind permission of the landowner, the exploratory excavations detailed in this report were completed in Big Ground between 15th July and 24th September 2008. Post-excavation work is ongoing, hence the views in this report may be expanded or amended in due course.

Objectives

To verify magnetometry results that purport to show 'celtic' habitation patterns and to obtain dating evidence for human activity in the field known as 'Big Ground'.

Approach

Small trenches were cut across strong anomalies in three areas of apparent activity, and two further trenches across long linear features (Figure 1). Standard trenches were 1m wide but extensions were reduced to 0.5m to minimise damage to the standing crop of maize. Maize plants were lifted and conserved with root-ball and the remaining topsoil removed by fork and spade. Other contexts were excavated by trowel, no sieving was undertaken.

Results

Trench 1

A 5m trench across the western side of a possible rectilinear feature revealed a ditch 1.2m deep with a 0.2m step on the western side. The base of the ditch may have been cut by a stakehole, but this is uncertain as it contained no artefacts and the fill resembled the natural surface of crumbly chalk. Two more possible stakeholes occur outside the ditch, one of which contained a sherd of black-burnished pottery. A horizontal line of thin limestone

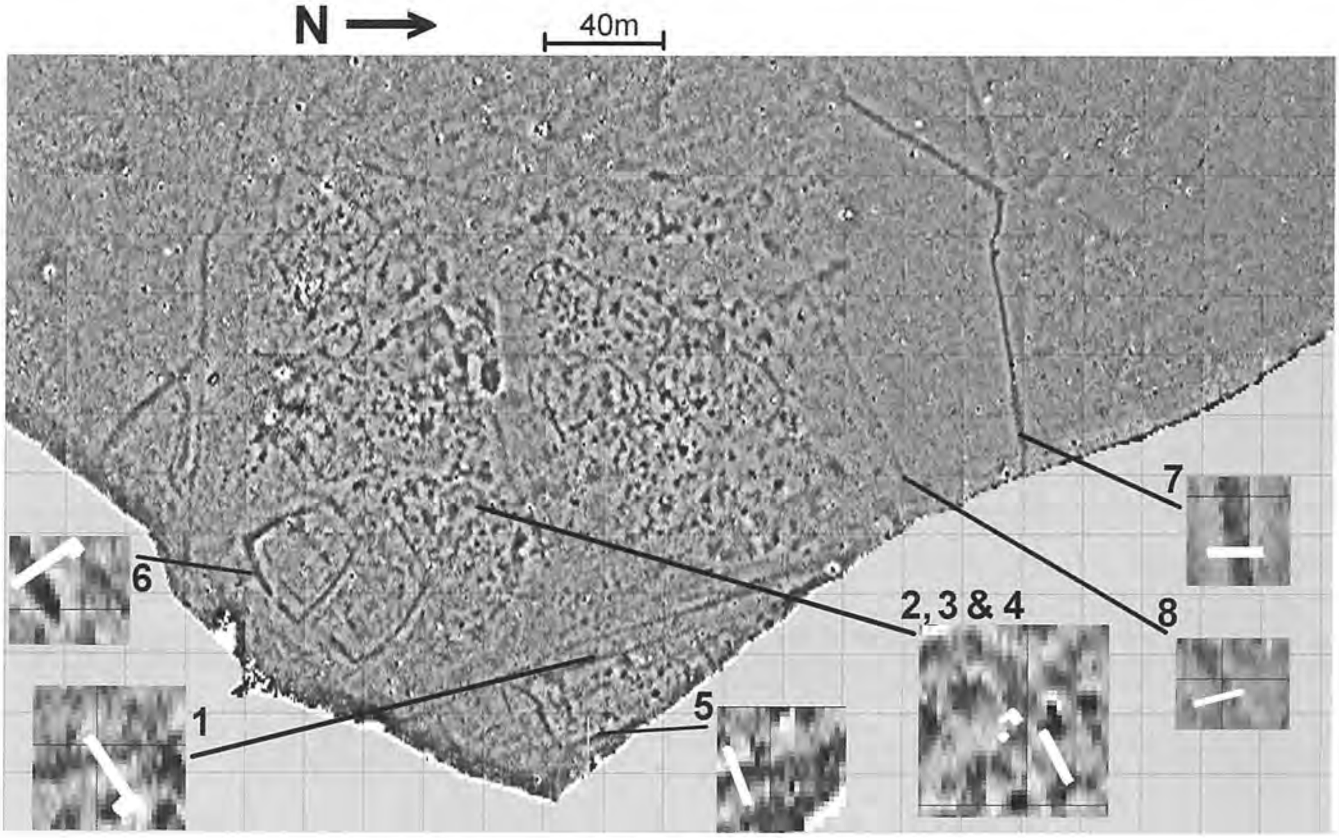

Figure 1: Magnetometry plot of settlement, showing position of trenches

pieces edged the western lip of the trench. Limestone is not natural to the site. Below the stones, a collection of soft porous pottery and bone was concentrated on the western side of the ditch. The shape and separation of finds suggest that the ditch may have supported a palisade or fence.

The trench was extended 5m eastward to locate a possible pit/hearth anomaly: the intervening area revealed only occasional animal intrusion. The anomaly proved to be a pit 2m in diameter and the trench was widened along a 1.5m section to allow excavation of a quadrant. The pit was 1.5m deep with sloping sides. The fill consisted of loamy clay and contained pottery, bone, charcoal flecks and a considerable quantity of chalk daub. The daub showed the imprint of wattle woven from sticks 1.5–2cm thick. At the base of the pit more pottery, burnt clay and the articulated foreleg of a horse had been sealed beneath a thin layer of chalk.

Trench 2

The first of three trenches in the southern cluster of anomalies, a 7m trench was dug to investigate a possible ditch and a pit or hearth lying outside it. The 'ditch' feature proved to be two separate pits cut by a short shallow ditch. One pit and the ditch showed evidence of burning and may have been contemporary. Pottery and worked flint, including a flint scraper (Figure 2), suggest that the features may be Bronze Age.

The anomaly at the NE end of the trench was a pit of the 'beehive' type, believed to be used for storing grain. The 1m wide opening belled out to 2m for most of its depth.

Figure 2: Flint scraper

Large quantities of pottery, cow bones and clay daub were recovered from the top half of the pit. Two longbones and an articulated section of spine were lying parallel to each

Figure 3: Base of beehive pit (shovel is 1.4m long)

other on a layer of chalk at a depth of 1.5m from the surface. Below the chalk the finds were fewer and comprised random potsherds and burnt clay. At 2.3m deep the base of the pit (Figure 3) is below the limit for safe working, hence it was sampled rather than fully excavated.

Much of the pottery from the pit looks like black ware from Poole Harbour and carries a lattice pattern suggesting a late Iron Age date. The daub is soft and may be sun-dried rather than burnt; the few wattle marks are >1cm wide, so this may relate to the clay cap of a pit rather than a house structure. Arthritic joints on some of the cattle bone would be typical of draught animals.

Trench 3

A 1.5m square test-pit revealed a spread of flint nodules lying on a surface of consolidated clay and chalk crumbs and covered with black soil. Pot sherds in this layer included fragments of Samian ware. Extending the trench showed the flint spread to be approximately a metre wide. This is interpreted as foundations of a Roman structure and has been left *in situ* to be further investigated using resistivity or ground-penetrating radar, since magnetometry is not good for detecting walls.

Excavation beside the flints showed the consolidated surface to contain pot, bone and burnt flint. It lies over an infilled ditch 1.6m deep and approximately 2m wide. A black charcoal-rich layer with some cattle bones covered the base of the ditch, while a darker lens to the western side might indicate recutting. This lens contained two fragments of juvenile human skull and random potsherds indicating it to be a secondary deposit. A single piece of Roman tile in the baulk below the flints shows that there had been an earlier building phase but Paul Cheetham (pers conv.) points out that the isolated nature of this find means that the earlier building is probably not in the immediate vicinity.

Trench 4

Another 1.5m test-pit revealed a ditch 1.1m deep containing pot, bone and burnt clay daub. The lower level contained a large quantity of soft, porous pottery similar to that in Trench 1.

Trench 5

A 5m trench sectioned the eastern ditch of the possible rectilinear feature. The 3m wide ditch slopes steeply on the western side to a flattish bottom 1.66m deep and some 50cm wide. After a steep step 20cm high, the eastern side then rises again at a shallow angle.

An upper layer of loamy clay with some flint gravel contained several cattle bones and a few worked flints. It overlaid a compact layer of clay with chalk crumbs that covered the eastern slope and a similar layer forming a lens to the west. At the base a dark humic layer also contained cattle bone. The scarcity of pottery among the finds suggests that this feature is more distant from habitation. The ploughsoil contained some ironworking slag but none was recovered within the feature.

No stakeholes were observed in the fill or base of the ditch, however the presence of larger flints towards the centre may relate to packing stones rather than simple gravity, hence a fence or palisade cannot be discounted. The western rim of the ditch is bordered by a 40–50cm band of large flint nodules. This is in a similar position to the limestone pieces in Trench 1 but much more substantial and could be the base of a wall or light structure. An iron object, found on the base of the eastern slope, could be a terret ring. It is badly corroded and has been sent for x-ray examination.

Trench 6

At the lower end of the field, a 5m trench across the southeast side of a lozenge-shaped feature found a ditch

Figure 4: 'Fibula'

3m wide and 1.7m at its deepest point. Its sides sloped at roughly 45 degrees with a U-shape dip at the base. A band of large flint nodules were probably packing for a palisade rather than gradual tumble. The lower levels of fill contained predominantly cattle bone with some large pieces of coarse pottery. The upper layers were very flinty with a variety of bone and pottery including a substantial number of sherds from a finer black vessel with an upstanding rim attributable to the late Iron Age. A bronze brooch or '*fibula*' (Figure 4) was also found in the upper layer. This is a Colchester type, popular 25–75AD (Hattatt 1985, 26).

To the north-east of the ditch a layer of compressed clay and chalk may have been a working surface as it contained flecks of burnt clay and charcoal. That surface was cut by a band of bright gingery clay and flint running parallel to the ditch. This band was not excavated as it had the appearance of a modern utility trench. Extending Trench 6 a further 3m north-west, it was hoped to explore the featureless northerly strip on the geophysics. A layer of flint cobbles and clay appeared to form a working surface or trackway, pierced in some places by possible stakeholes. Both the cobble layer and the holes were sterile of dating evidence. The faint anomaly suggesting an inner ditch of the feature to the north of the cobbles was not investigated at this time.

Trench 7

The upper slopes are dominated by a long linear feature that was investigated with a 4m trench. It exposed a V-shaped ditch 3m wide and approx. 1.8m deep (Figure 5).

Figure 5: Trench 7. East-facing section

An initial chalk slump suggests that the ditch may have had a bank on the south side. Coarse pottery, burnt clay or daub, burnt flint and bone fragments from all levels of the fill indicate that this ditch was near an area of habitation. Since no occupation traces appear nearby on the magnetometry plot it is likely that any such features have been ploughed out.

Trench 8

A straight linear feature that appears to cross the present bridleway was sectioned with a narrow 7m trench. At the higher northern end the chalk lies only 25cm below the surface, at the low southern end it lies at 35cm. In-between, a sloping step some 40cm deep descends to an almost horizontal terrace of chalk . This terrace was probably cut by ancient ploughing along the contours of the hill and resembles a lynchet, the bank of which has subsequently been levelled by modern, N-S ploughing. A small piece of post-medieval Verwood ware, brick and a nail were discovered in the layer of flinty clay within the depression: elsewhere on this site similar items have been restricted to the surface and upper levels of soil. These finds may indicate the age of the feature or may have been be redeposited on a chalk surface denuded by cultivation.

If this feature is indeed a lynchet, it seems curious that only one terrace remains rather than several narrow strips. Another possible interpretation is that the bank that forms the northern edge might be the remains of a Roman road, running across the neighbouring field to the known crossing point at Lazerton Farm.

Conclusions

These exploratory excavations have confirmed the magnetometry results, showing this part of Big Ground to be the site of intense human activity from the Bronze Age to Romano-British period. If the features excavated are typical, there was a peak of activity in the late Iron Age, with many examples of Durotrigian pottery and early black-burnished ware.

The serendipitous discovery of this Iron Age settlement raises intriguing possibilities. Was the site a farmstead supporting the hillfort activity, or a refuge for people displaced when the Romans established their camp within the ramparts? A camp for prisoners or slave labour is another, more extreme interpretation. The initial work reported here has stimulated many questions. Only further investigation will answer these questions and establish the exact relationship between activity in Big Ground and the Roman conquest of the hillfort.

Acknowledgements

The author would like to express his thanks to: Mark Pearson for permission to work on his land and his support and interest throughout; Paul Cheetham, Mark Maltby and Miles Russell, Bournemouth University for their advice on the survey and finds; Martin Papworth, National Trust for the loan of the magnetometer; Adam Gallimore and Wendy Stewart who assisted with parts of the excavation.

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FINDS REPORTED TO THE PORTABLE ANTIQUITIES SCHEME IN 2008

Ciorstaidh Hayward Trevarthen (Finds Liaison Officer)

Introduction

The Portable Antiquities Scheme (PAS) has been operating in Somerset and Dorset since 1999. The first pilot schemes were established in 1997 and there are now Finds Liaison Officers (FLOs) recording discoveries of archaeological material over the whole of England and Wales. Its aims are:

- To advance knowledge of the history and archaeology of England and Wales by systematically recording archaeological objects found by the public;
- To raise awareness among the public of the educational value of archaeological finds in their context and facilitate research in them;
- To increase opportunities for active public involvement in archaeology and strengthen links between metal-detector users and archaeologists;
- To encourage all those who find archaeological objects to make them available for recording and to promote best practice by finders; and
- To define the nature and scope of a scheme for recording portable antiquities in the longer term, to access the likely costs and to identify resources to enable it to be put into practice.

From April 2006, local partners and the Department of Culture, Media and port have funded the Scheme, through the Museums Libraries and Archives Council. Because of the way the Scheme has developed in Somerset and Dorset there are two FLOs for the two counties. Anna Booth is based in Somerset and Ciorstaidh Hayward Trevarthen is based in Dorset, but both FLOs record Dorset finds (as do FLOs in other counties). In the period of reporting finds were also recorded by Naomi Payne (previously FLO for Somerset) and volunteers Madeleine Knibb and Philip Knibb.

Overview

In 2008, 1054 finds were recorded from Dorset in 417 Portable Antiquities Scheme database records. In addition to these finds, many more objects were seen and identified, but were too recent (post-1650) or otherwise unsuitable for recording on the database. The finds were discovered by several means, 83% by metal detecting, 8% through field walking and 8% were chance finds or were found during other activities such as gardening or agricultural work.

The recorded objects date from the Mesolithic onwards. Less than 0.5% of the total finds were of Mesolithic or Mesolithic to Neolithic date, 1% were Neolithic, 2% were Neolithic to early Bronze Age, 29% were of securely Bronze Age date, 4% were Iron Age, 9% were Roman, 1.5% were early-medieval, 44% were medieval, 1.5% were medieval to post-medieval, 7% were post-medieval, the remaining less than 0.5% were modern or not closely datable. Copper alloy and other base metal finds account for 48% of the material, with 42% of precious metals, 6% of pottery and other ceramics, 4% of worked stone and flint.

The items which follow have been selected for more detailed reporting because of their relative rarity in terms of material recorded through PAS in Dorset. All the finds are of prehistoric date and are of copper alloy. The PAS database reference number is given for each find and the records and colour images can be accessed on the database website (see http://www.findsdatabase.org.uk).

A middle Iron Age La Tène I brooch from Frampton, Dorset
(DOR-41F0C6)

Cast copper alloy La Tène I brooch. The brooch measures 58.78mm by 14.84mm by 16.21mm and weighs 15.36g. A large one-piece bow brooch which has sustained a break and mend to the pin in antiquity. At the head is the original spring of coiled wire and its external chord. This was drawn from the main body of the brooch. Below this the brooch expands into D-sectioned arching bow, dropping to a tapered foot with a hooked catchplate to the right side. Beyond this the foot continues into a backward hooked tail with a knopped 'snake-head' terminal. There are cast decorative ridges on the tail before the expanded terminal. This may be a Wessex type with separate pin, but as the pin is too short to reach the catchplate, it may also have been re-attached to the brooch by adding the

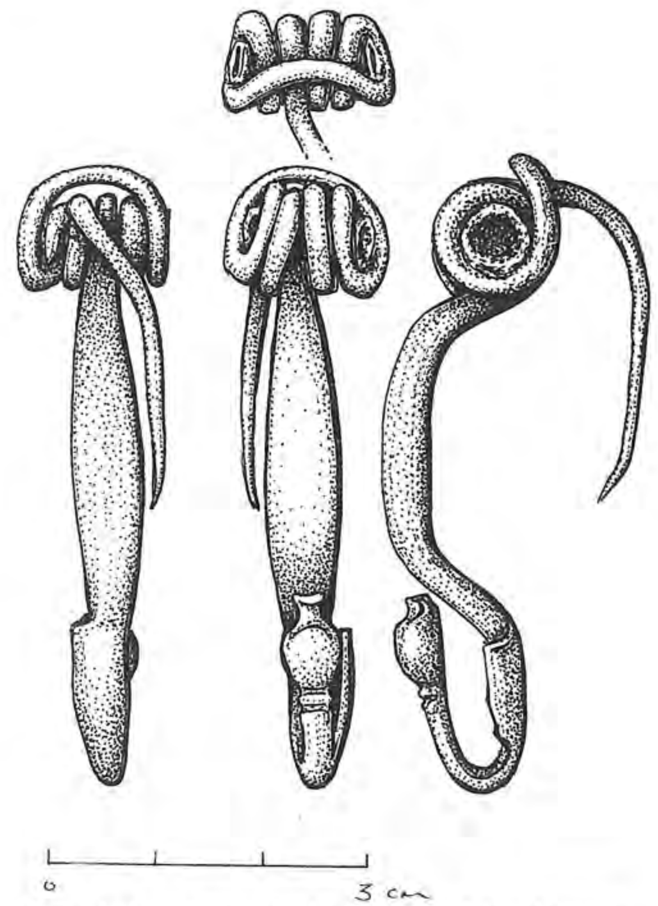

Figure 1: A middle Iron Age La Tène I brooch from Frampton, Dorset (DOR-41F0C6)

hollow, tubular axis bar through the coils and then hooking the broken end of the pin back around it. The other end of the possible break (attached to the spring) has also been shaped to make sufficient space for the attachment of the pin. A similar example has been recorded by Richard Hattatt (Hattatt 2000, 288, Figure 147, No. 725) and is dated to the La Tène I period – *c.* 4th to 3rd century BC.

An Early Bronze Age flat axe
(DOR-422514)

Cast copper alloy flat axehead. It measures 121.27mm by 60.47mm by 11.32mm and weighs 256g. The axe has very slight low flanges on both faces. There is a casting ridge along each side. The axe thins and flares out into a broad cutting edge which is slightly bevelled on both faces. It thins and tapers in the other direction to a rounded butt and the body of the axe is slightly thicker at the centre than it is at the ends. The surface of the axe has several patches of light green corrosion and damage to the cutting edge, sides and butt. The rest of the surface has a smooth, dark green patina. This flanged example is characteristic of the Arreton Park metalwork assemblage dating it to the 16th century BC (Kevin Leahy, pers. comm.).

A Middle Bronze Age palstave axe
(DOR-C5DF32)

A small copper alloy unlooped palstave axe with a very short, flared blade. The axe measures 86.13mm by

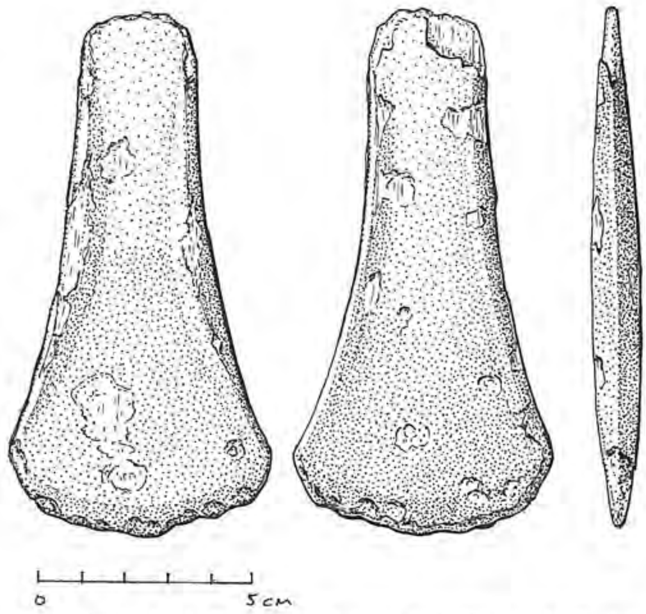

Figure 2: An Early Bronze Age flat axe from Askerswell, Dorset (DOR-422514)

35.56mm by 25.09mm and weighs 159.75g. The cutting edge is crescentic. The axe is undecorated. There is a faint casting ridge along the centre of the sides of the flanges. The flanges are high, with the tops on one side being somewhat more worn and re-shaped than the other side. The blade is truncated compared to most axes of this type and it is smaller than usual overall. It has a rich blackish

Figure 3: A Middle Bronze Age palstave axe from Turnworth, Dorset (DOR-C5DF32)

Figure 4: A Late Bronze Age razor from Winterbourne Steepleton, Dorset (DOR-7FBCE8)

patina, although the parts of the surface are pitted and some of the edges are damaged. The palstave belongs to the Taunton phase of metalworking, dating to the early Middle Bronze Age (*c.* 1400–1300 BC; pers. comm. D. Boughton 2008). Dr Kevin Leahy has noted that this axe is unusual in the ratio between the blade and the septum, which are usually of almost equal length (pers. comm. 2008).

A Late Bronze Age Razor
(DOR-7FBCE8)

An incomplete cast copper alloy razor. The razor measures 53.65mm by 25.33mm by 3.97mm and weighs 17.75g. Probably originally triangular in shape, the main cutting edge and the sides are bevelled to produce a thinned edge. Along the sides on both faces there are cast ridges. There appears to be a curved aperture above the blade, but the razor is broken beyond this point. This is similar to Piggott's class III type (number 95) in terms of its general shape and the central aperture and to a hybrid type II (nos. 44 and 45) for the circular shape of the aperture (Piggott 1946, p34, Figure 8). However the razor is not sufficiently well preserved for its exact shape to be clear. This object dates to the Late Bronze Age (Steve Minnitt, pers. comm.).

Acknowledgements

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Illustrations by Mike Trevarthen. Photographs by Ciorstaidh Hayward Trevarthen.

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The Dorset County Boundary Survey

Launched in April 2006, the Dorset County Boundary Survey is a project which brings together Archaeology and Natural History. So far as we are aware, it is the first of its kind. The survey has seen another interesting year.

*The scale of the subject became plain at a research seminar mounted in September 2008, an occasion which saw the launch of a Digital Boundary Atlas (see vol. **129**, 215) an important first stage in the systematic collection of data assembled by members of the Research Group; not only 'on the ground' material, topography and natural history, but that related to archival sources in the tracing of the history of those estates, those landed interests related to their borderland location. Also in the process of compilation is what has the makings of a unique record of the state of the county boundary in the early years of the twenty-first century.*

*In the last year pilot studies have been conducted along several lengths of the boundary. Andy Poore led a field visit to the Dorset-Somerset border at Perrott and Halstock to which reference was made here in vol. **129**, 205. This length of the border is one to invite further historical enquiry now in preparation to complement the Natural History Report already submitted. A further visit was made to Rushmore on the Wiltshire border and a first visit to that length of the boundary north of Lyme at Lambert's Castle; notes on this length have been compiled by Colin Bowditch with a view to publication in the Digital Boundary Atlas (see above). In October a visit to Hengistbury Head was led by Peter Hawes. The relationship of the early shire boundary with this spectacular natural harbour affording river access deep inland – to both Dorset (Stour) and Hampshire (Avon) – is a subject for further enquiry. A useful introduction here was made by Iain Hewitt in vol. **129**, 212–214. That length of the Dorset-Wiltshire border between Melbury Abbas and Ashmore is the subject of a note by Graham Hoddinott published here together with a complementary report by John Newbould on its Natural History (see below). In preparation, by Jon and Sue Campbell, are notes on the Dorset-Somerset border to the north and north-west of Sherborne around Rimpton, OE* rima tun, *that settlement on a 'rim', 'edge' – or 'border.'*

Katherine Barker

'Lyme Regis is in Dorset, Uplyme is in Devon . . . ' thoughts arising from the research seminar of September 2008

Katherine Barker

In September 2008 members of the Survey hosted a research seminar that took as its subject a short length of the boundary between Lyme Regis [in Dorset] and Uplyme [in Devon] which we know was in existence by AD 774. As noted above, the day saw the launch of the Dorset Digital Boundary Atlas: this takes the south-western corner of the county boundary at Lyme as its starting point and as something of a model on which to build.

*The material discussed was based on that by the writer published in the second County Boundary Survey Report for 2008, vol. **129**, 197–210 complemented with a report by John Newbold (ibid, 209–210). Further to this, the seminar was able to draw upon observations relating to those lengths of the boundary on private land. An important part of the exercise was the attempt to draw a wider picture as to the initial shiring of the county as a whole; a short paper is included below.*

In preparation for the September seminar visits were made to Launcheycroft the 'landshire croft' on the Dorset/Devon border between Lyme and Uplyme respectively at the kind invitation of Trevor Jones and to Ware House at the invitation of Lady Minnie Churchill to explore those lengths of the AD 774/938 Dorset/Devon boundary not accessible to the public. Grateful thanks to all concerned.

The September seminar presented a unique opportunity to conduct a critical examination of a single length of the county boundary which – at least so far – presents the earliest attested historical context and which formed the subject of a paper here by Katherine Barker in vol. **129**, 197–208 (also see above). The hercology of the early Lyme estate, that division between two shires of a single discrete estate based on the catchment area of the River Lim, is echoed in an ostensibly literary work by Aldhelm of Malmesbury who composed – for performance – an epic poetic work known simply as the *Carmen rhythmicum*, which, it is posited, is not only set at Lyme but records the *discrimen in duobus*, the literal 'shiring' in two of this coastal estate. It was sited, Aldhelm states, *usque Domnoniam*, 'on the very limits of *Dumnonia* [Devon]' understood here as that formal 'limit' established by the incoming West Saxon administration.

The seminar brought into focus the coincidence here between the secular and the ecclesiastical – those years which provide us with the earliest references to the *scir* and *scirmen*, 'shire' and 'shiremen' in the Laws of King Ine (Attenborough, 1922, Ine 8; 36:1 and 39) witness the run up to the establishment of the new bishopric based at Sherborne on the division of the great see of Winchester. That is, to the final years of the seventh century, to the years of Aldhelm's *discrimen* 'division' of the Lyme estate which will have seen the apportionment of coastal revenues – harbour and salt dues – not only between two shires, but between crown and early church – and between Glastonbury and Sherborne. Aldhelm's words will imply that Glastonbury was already holding land at Lyme before the foundation of the bishopric and complement evidence presented by two later charters, respectively of 774 and 938 (see vol. **129**, 202 and Figure 3).

The origins of the shiring of Dorset 'A directive'

This length of the Dorset/Devon boundary at Lyme cannot be treated in isolation. It forms part of a boundary which defines the county of Dorset and is seen here as providing something of an insight into the origins of the West Saxon shiring which have hitherto remained obscure. James Campbell noted here that such an event was likely to date from about the year 700 (vol. **129**, 195); evidence as presented here suggests that such could date to a decade earlier. Many of those boundary lengths so-far walked present prominent vantage points. One of the responsibilities of tenth-century bishop Wulfsige of Sherborne was the maintenance of *rogi*, 'beacons;' one of these occupied a site high above a place on the Devon-Somerset border which has retained the Latin designation Holcombe *Rogus* (Barker 1991, 34; 2005, 127; Figures 16, 159, 202). The almost 'frontier significance' of the tenth century episcopal hundreds Sherborne, Yetminster and Beaminster was heightened in the 'militarisation' of the second half of the tenth century (Barker 2005, *ibid*). Vantage points remain constant; those significant in the tenth century will have been so three centuries earlier. And further back still. A notable case in point is that found on the Dorset/Somerset border at Ashland Hill on the 847 charter boundary of Halstock, OE *halgan stoc*, 'holy place, ' held by the Sherborne bishopric along together with Holcombe Rogus (*ibid*, 150, 156). At the headwaters of the River Parret, Ashill provides a spectacular view northwest across the lowlands of Somerset. Suffice to say, a systematic survey of earthwork and other minor manmade features to be found along the Dorset boundary as a whole – on both sides – has yet to be undertaken.

A question posed by the seminar was to whether there had ever been an early 'directive' by which the newly-designated Dorset shire boundary might be recognised. And further, how many lengths may have followed earlier civil – *Durotrigian*/Roman – boundaries and which other lengths may have been strategically adjusted in furtherance of the fiscal and pastoral aims of the new West Saxon administration. Recent work suggests that the boundary as it presents at Lyme, at Sherborne – and probably at Perrott – and all places with a known early association with the Sherborne bishopric will fall into this category. That northern 'salient' of Dorset occupied by the Sherborne home manor, the *predium monasterii*, is likely to represent the placing of the newly-established episcopal estate on 'new ground' in the claiming of 'immunities' (vol. **129**, 205, and Barker 2009; forthcoming). But if there ever were such a 'directive' then subsequent management of the boundary – at least from evidence presented by the preliminary surveys undertaken so far – would imply that such was not left in force for very long. And further, that the management of the shire boundary was – and remains – the responsibility of the local landowner. The county boundary presents today in a variety of man-made forms and supports a range of vegetation from thousand-year old veteran tree stools to hedgerows descended from those of much more recent origin. And found in a state perhaps best described as one of 'benign neglect' (see also vol. **129**, 208).

The shire boundary at Lyme; a wider context

The Devon-Dorset boundary between Uplyme and Lyme [Regis] was in existence by AD 774 when it formed the division between the landed interests of Glastonbury and Sherborne; the latter estate cut out of the former (vol. **129**, 198–201, Figures 1, 2 and 3). Changes in landownership in the centuries since has not, however, disguised the fact that the boundary presents a very similar form along the whole of its length between the *salteforde* on the Lim and the present coastline. Exploration of those lengths of the Uplyme/Lyme boundary not normally accessible has demonstrated that the boundary bank complements that length followed by the public footpath and presents something which is surely the product of a single period of construction (see Plates 1 and 2). A careful reading of the Glastonbury Abbey charter of 938/1516 suggests that the length today on private land running upslope from the A3165 at the old *Black Dog* (vol. **129**, 206, Pl 1) was formerly followed by the course of *Sherelane* – today the name 'Shire Lane' is given to the lane running north from the coast road, A3052 (vol. **129**, 203, Figure 4). A prominent, well-defined – although now largely unmanaged – bank, it invites archaeological investigation and survey. It is not clear whether a path may once have followed the whole of its length; whether it could once have been 'processed around.'

The bank follows what is very clearly a man-made course, carefully defining a wedge of steeply-sloping land on the west bank of the Lim; an estate described as a *mansio* in 774 probably denoting a formal residential function. Aldhelm's words in his *Carmen rhythmicum*, his *discrimen in duobus* 'shiring in two,' make it likely that this boundary dates to sometime in the decade 680–690 which years will present a coincidence with the drawing up of the Laws of Ine dated to between 688 and 694 (Attenborough 1922, 34).

In one of his poetic church dedications, Aldhelm records King Centwine (676–685) made available the means to set up many *baslicas*, 'church/halls,' *plurima basilicas impendens rura novellis* on 'new,' 'newly-acquired estates.' Michael Lapidge has recently demonstrated that Centwine was Aldhelm's father (2007, especially 17–22) and such goes far to suggest that the earliest phases in West Saxon church building activity at Lyme – and indeed at Sherborne – pre-date the founding of the bishopric in 705/6 by some years. The reason for the delay in the setting up of the bishopric remain obscure, but the dedication of Aldhelm's *Carmen* suggests that relations with Glastonbury are likely to have played a part.

The *discrimen* 'division' or 'shiring' of the Lyme estate will have seen the apportionment of lucrative coastal revenues between crown and church. Nothing of this remains in the literature but a category of evidence (so far unexplored) is the incidence of *geat* 'gate' names found in association with early shire boundaries and which may be associated with the collection of border tolls. For Dorset there is Woodyates, a Glastonbury estate on the north-eastern 'corner' of the county at Bokerley Dyke, and for Somerset there is Lamyatt – also a Glastonbury estate – on the border with Wiltshire along Selwood (vol. **129**, 204–5, Figure 5; Barker 2009, 24, Figure 1.8).

A case for early 'border controls' at Lyme

At Lyme, there is the *Weygate*, *waegn geat*, 'wagon gate' of 938 where the road leading up from the harbour crossed the Dorset-Devon border (see vol. **129**, 203, Figure 4). Today this is the site of Ware Farm and Ware House on the Devonshire side of the border and the hamlet of Lower Ware on the Dorset side. The name is represented in the *Werboldiston* of 938. The OE name element *waru* is seemingly found again in an alternative name for the *salteforde* of 938 where the route running up the Lim valley crossed the Dorset-Devon border, and which the 1516 charter notes that was also known as the *Warlackeforde* (Fox 1970, 44). In the given context the coincidence of these two name elements on their respective borders is difficult to ignore. OE *waru*, 'ware', 'merchandise' is suggested here, also with the sense of 'watchful' 'observance' or the 'need to take care.' The word survives in current English in 'hardware' and 'beware.' The name *Werboldiston* may be read as 'Werbold's *tun*, but OE *waru* + *bold* may also be read as 'ware/merchandise + building' literally a 'ware house.' May this not be a reference to an early custom house? A very much later building still stands on the Lyme harbour at the Cobb. With reference to the *warlackeford* OE *lacu* is a pond or pool, given that there is also OE *lac* and *lacan*, which conveys movement; the motion of a ship at sea or a bird in flight. In each case, at *Werboldiston* and at *Warlackeford* it is not improbable that we have a reference here linked with the levying of duty on the early shire border. And which, at least at the *Warlackeforde*, was not solely that related to the movement of salt. The possible relevance here of the name found in Haye Farm just above the ford (in Dorset) has already been noted (vol. **129**, 204; see also Barker 2009, 29–33); this appears at *Little Haye*, *c.* 1832, see Figure 1.

At the point of entry into Devonshire at what is now the *Old Black Dog*, a map of Lyme Regis drawn in response to the great Reform Act of 1832 shows the boundary of the Borough as it was at this date outlined in green (Figure 1). There were also three detached areas belonging to the Borough; three west of the River Lim and one to the east. East of the Lim was the *Forefield*, the 'Fairfield', on the present A3052 running north from Lyme. On rising ground on the other side of the river was a close called *Westfield* on the north western corner of the former Salisbury Prebendal Farm of 1405 (see vol. **129**, 203, Figure 4). Medieval Lyme was the setting for two annual fairs. On the county boundary were a pair of plots labelled *Lanchycroft Mead*, 'landshirecroft mead.' As Fox (*ibid*, 45) notes OE *land-scearu*, 'landshire,' 'boundary,' is a word which frequently occurs in Saxon charters from the west of England and was still being used in its original sense in 17th century Devon. OE *croft*, is a small enclosed field.

The colour-coding on this plan makes it quite clear that the two border *crofts* at *Lanchycroft Mead* were held by the Borough. That lying between the two routes down into Lyme – now Uplyme Road and Haye Lane – was *Lanchy Croft Mead* on the 1842 Lyme Regis Tithe Map and the second, a long narrow plot running up the slope of the county boundary on the Dorset side was *Lanchy Croft Orchard*. But by this date – only a few years later – they were no longer held by the Borough. The location and character of these two plots goes far to suggest that they represent one-time 'holding places' of some kind on the shire boundary for goods – or for stock – and at least until 1832 were held by the burgesses of Lyme for that purpose. A former water source on the border is today represented in name of a house, 'Abbotswell;' we note there was both a spring and watering place on the Dorset/Devon border at Ware in the *wythelake* recorded in 938. Nothing is shown for the Borough at the site of the *salteforde* of 938 where the River Lim crosses the Devon/Dorset border at the bottom of Sleech Wood; by the early nineteenth-century the valley route had clearly long gone out of use. And there is nothing shown at Ware. A copy of this map was published by John Fowles in *A Short History of Lyme Regis* published in 1982. A Cobb harbour duty list surviving from 1490, provides plentiful evidence for Lyme's later medieval trading contacts with the Mediterranean; Fowles (*ibid*, 15) notes that *alyns* 'outsiders', were charged a much higher tariff than those resident in the king's manor, his 'subjects.' By this date the payment of dues clearly took place at the harbour.

The Borough archive may well throw some light on the significance of the two *Lanchycrofts*. The Tithe Map shows the projected course of the proposed railway cutting, but there is no routeway shown along the *Lanchy Croft*/Devon/Dorset boundary. It is not until the mid-twentieth century that *Lancheycroft Orchard* became available for housing development; the boundary bank forming its south western edge (running parallel with the county boundary) is till traceable today. The present houses and gardens have been constructed actually across the county boundary and are served by a lane running up the Devonshire side of the boundary today simply known as 'Launcheycroft.' The county boundary re-emerges in the rapidly steepening slope at end of the lane co-incident with a distinctive 'kink' in its course at approximately SY33009285 (see Plate 1).

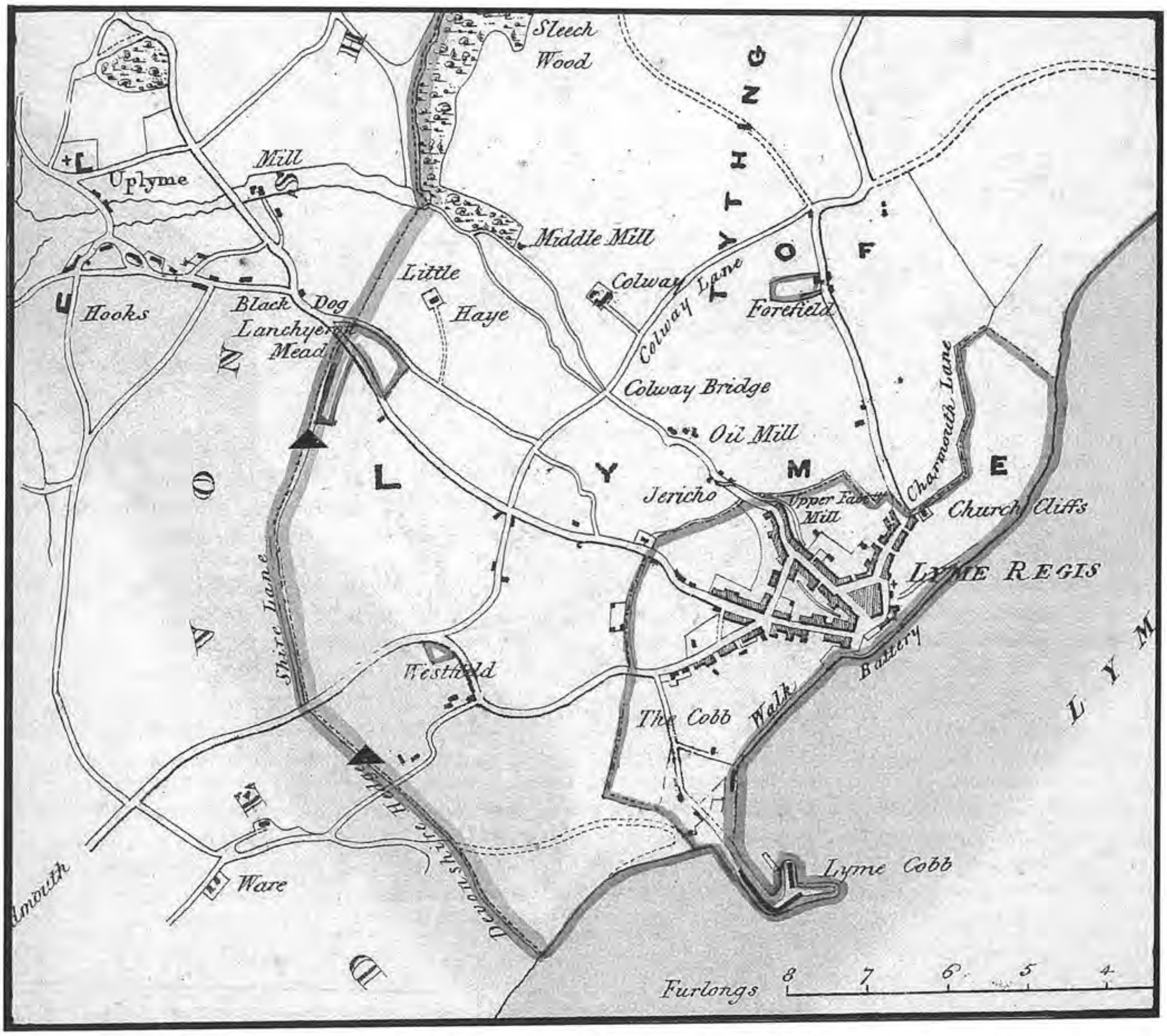

Figure 1: Part of a Map of Lyme Regis from the Ordnance Survey *drawn in response to the Reform Act of 1832 showing the boundary of the Borough which, on the original, is highlighted in green and which here appears as the darker-grey shading. (The proposed much-enlarged borough boundary was shown in red and follows the county boundary;* Devonshire Hedge – Shire Lane – Sleech Wood*). The Borough includes those coastal settlements on both sides of the River Lim, respectively the former 'Lyme Abbots' (west bank) and 'Lyme Regis' (east bank). East of the river is shown is a single Borough plot, the* Forefield *('Fairfield'), and on the west,* Westfield. *Note the pair of Borough plots on the Devon/Dorset border just below the [Old] Black Dog [Inn] at* Lanchycroft Mead. *The triangular symbols show the approximate locations of the boundary bank shown in, respectively, Plates 1 and 2*

Early shire boundaries and revenue collection

Revenue collection on borders could be very lucrative and was often in the gift of the king; such is well-evidenced in a seventh-century Merovingian context on the other side of the Channel but no record seems to survive in England. Control of ports and borders will surely have played a not insignificant part in the apparent wealth of the West Saxon rulers; Aldhelm refers to luxury imported items in his writing, to gold and silver, embroidered fabrics and purple hangings, and to incense from Saba, Arabia. On one occasion he refers to the dishonest merchant watering down wine (Ehwald 1919, 466; Lapidge and Rosier 1985, 164). The very fact that the early Sherborne church/bishopric claimed rights to a carefully defined coastal estate at Lyme – legally attested by the later eighth-century – surely says as much. Salt production was not the only concern.

Those places where Roman roads cross the Dorset shire boundary await closer examination. For Lyme, an east-west Roman road coast route may possibly be represented at Ware. Graham Hoddinott (see below) makes reference to the Bath-Badbury road where it enters at Ashmore. Markyate OE *mearc geat* that 'border gate' which presents along the line of Watling Street on the Hertfordshire-Bedfordshire border and overseen by the outlying cell of a former Benedictine priory (vol. **129**,

204) is represented in Dorset by the Glastonbury Abbey cell at the spring head at Woodyates where the Roman road from Sarum enters the county. Other Roman road 'crossings' await further enquiry.

Aldhelm, first bishop of Sherborne, employs taxation as a powerful metaphor. He compares the obligations of prayer to 'a kind of tax to the state and financial payment' *quasi quoddam rei publicae vectigal et fiscale tributum*. Aldhelm uses two words to describe the class of 'tribute,' *vectigal, vectigalis*, 'toll or tax paid to the State' the *rei publicae*, (expressed in the plural) which could also be that related to 'revenue, rents and income' and second, *fiscalis, fiscale*, that 'relating to the public or the royal treasury (Ehwald 1919, 71; Barker 2009, forthcoming). Such words were clearly understood by his audience who will have been aware of the complementary role played by the establishment of formally recognized territorial boundaries. It was the archaeological discoveries at *Hamwic* [Southampton] which gave rise to the concept of the seventh-century *emporium*, settled places that formed the focus of international mercantile activity on a considerable scale and which included the whole of northern Europe. 'The earliest . . . gateway communities are the fairs which were held on boundaries, mostly in fact on the coast. Foreign traders probably visited these for short periods annually or perhaps seasonally' (Hodges 1982; Griffiths 2003; Barker 2009, forthcoming).

Coincidence of the secular and ecclesiastical

Aldhelm's words – almost by definition – bring together both the secular and ecclesiastical and thus serve to bring into focus the main players involved in the Dorset of the later seventh-century. Significant here is the part played by Theodore of Tarsus, Archbishop of Canterbury, whose term of office embraces those years between 679 and 690. Scholar, diplomat and churchman, Theodore was a refugee from the Arab incursions into the eastern Mediterranean Byzantine empire in the generation after the death of the prophet Mohammed in 632. Appointed by Pope Vitalian, a well-known 'Byzantinist,' Theodore's role in the introduction – and establishment – of a formal continental-style diocesan structure is one that should not be underestimated in the impact it had on the establishment of shire boundaries. Bede notes that Theodore travelled to every district consecrating bishops in appropriate places (*HE*, IV 2; 234–5) the implication being that each was responsible for the proper administration of the district assigned – and that certainly included the regulation of *tributum*, tithe and tax mentioned in Theodore's *Penitential* (Campbell 1986, 50–1). Mediterranean influence on the history of this island during the Roman occupation is well-attested. Less well understood is that of the second half of the seventh-century; its significance was to be far-reaching.

The continental world known to Theodore was characterised by the decline of civil administration and its replacement by those military and ecclesiastical. Constant small-scale warfare was characteristic of the old Roman world in the seventh-century and the result was the concentration of power in the hands of the military. In southern England it was the newly-ascendant West Saxon warlords who took possession of the best lands and who ably complemented both the economic and pastoral activity of the Roman church. As Thomas Noble has noted (1995, 87), 'surely it is no accident that every single area of activity that attracted Theodore's attention in England had a least a rough precedent in Rome . . . unsettled conditions, the military gaining and losing power, dogmatic irregularities, churchmen respected – and abused – linguistic and ethnic diversity . . . by the time Vitalian sent him to England he was also, in a sense, a Lateran professional.'

Further work on this theme, which relates to that area under study, is in preparation.

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Further Borderland Parishes of North Dorset

Graham Hoddinott

Last year's *Proceedings* outlined the initial survey which had been conducted along the county boundary with Somerset and Wiltshire of nine civil parishes in north Dorset (Hoddinott 2008, 209). During 2008 a similar survey was conducted in four further border parishes to the south-east of Cann. These were Melbury Abbas, Ashmore, Tarrant Gunville and Farnham, the adjoining Wiltshire parishes being Donhead St Mary and Tollard Royal (Figure 1). It should be noted that Tarrant Gunville only abuts on the boundary for a mere 120m, and a only small part of the Farnham boundary has so far been considered.

Throughout its complete length – about 8km – this stretch of boundary is on chalk downs, in an area within the outer bounds of Cranborne Chase, and between 140m and 265m above sea level. At least part was within the 'Inner Bounds' of the Chase as recorded in 1280.

Almost all of the boundary was readily accessible, since perhaps three-quarters of its course is along public paths or roads. In fact parts of the border today still appeared to follow routes which were prehistoric or Roman in origin, and might be assumed to have adopted these in Saxon times as convenient boundary markers in the complete absence of watercourses or other obvious natural features.

At that point of the border where the parishes of Cann and Melbury Abbas meet (ST 8912 2129) it is orientated approximately south-east directly away from Shaftesbury, and continues on a roughly similar heading for about a further 2.5km. Today at this location there is no sign of a trackway following the boundary, although where it crosses into the next parish the hedgerows are not aligned (see Plate 3). According to the OS map the border switches from being on the north-east of the Melbury Abbas hedge to being on the south-west of the Cann hedge; the latter hedge is therefore in Wiltshire. It seems probable that the misalignment is a relic of the two sides of an earlier track, which Good (1966, 108) 'strongly suggests' may once have been an important route, headed along the county boundary in the direction of East Knoyle.

Although at first there is no public path or bridleway, as the boundary climbs to the south-east it can be approached from two areas of access land. At ST 8955 2090, where the boundary is some metres wide (and protected by post and wire fencing on both sides, since any hedge appeared to have been mostly grubbed out) it passes straight across an 18m wide bowl barrow, presumably of Bronze Age date, about 220m above sea level, and no doubt once highly visible from the north and north-west (see Plate 4). Shortly after this point the boundary crosses the B3081, just to the east of Zig-Zag

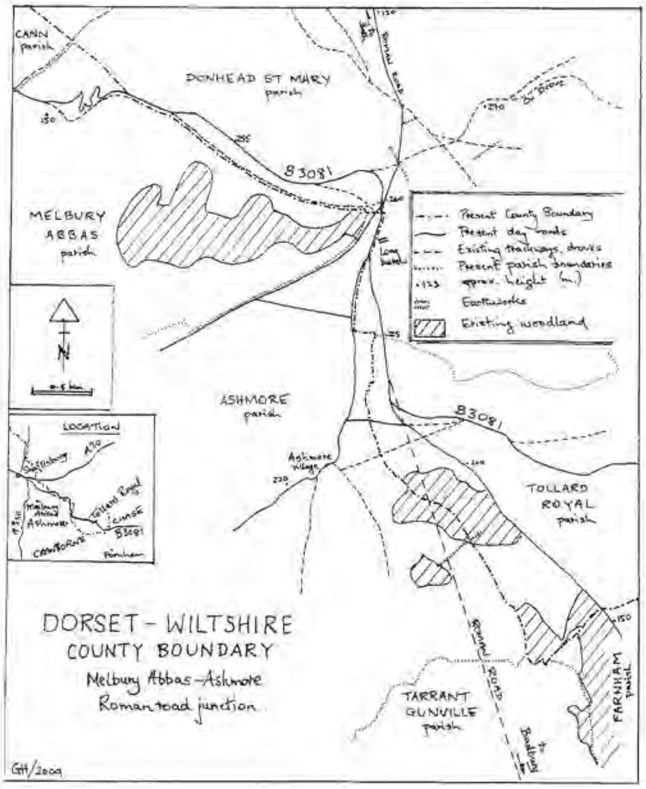

Figure 1:

Hill. This is a latish turnpike road between Shaftesbury and Ringwood, although the series of hairpin bends was apparently not finally constructed or in use until after 1879 (Hawkins 1980, 164). Before this date any traffic had faced an even more steep descent towards Cann Common, still marked by both a holloway and a parallel track cut into the chalk.

The county boundary now joins the climbing holloway, and after a thoroughly overgrown stretch it follows what the modern OS 1:25000 map clearly marks as the 'Ox Drove (Track)', which continues into Wiltshire and subsequently past Win Green. It is generally agreed that this originated as a ridgeway in the prehistoric period, but while its course eastward past Win Green appears clear enough, there is reason to question its OS designation along the county boundary. From approximately ST 918 203, where the Roman road between Bath and Badbury met and crossed it, the Ox Drove might more logically have continued westwards more or less along the line of the present B3081 (*via* a diverted section now marked as a bridleway) which runs a little way to the north of the border.

Indeed some earlier OS editions placed the 'Ox Drove' on just such a line and it is not clear why the change should have been made. However OS maps were also inconsistent in designating the 'Ridgeway', with 1:2500 maps sometimes marking both the Ridgeway and the Ox Drove along the line of the B3091, and at other times showing them following different paths. Across open downland an unmetalled trackway might follow several parallel routes, and perhaps the answer is that west of Win Green the use of the name 'Ox Drove' becomes misleading, and is best abandoned. Good (1966, 13) appears to favour the route of the prehistoric track (which he terms the 'Northern, or Scarp Trackway') after ST 918 203 heading south-west across Ashmore and East Compton Downs. But this at once takes us into the interior of Dorset and away from the county boundary.

Good's trackway to the south in no way eliminates the border path, which nowadays runs for about 2km along the Wiltshire side of the boundary, in the form of a wide bridleway in between East Melbury Downs in Dorset and Charlton Down in Wiltshire. In 1839, the date of the Melbury Abbas Tithe Apportionment, this whole stretch of Dorset downland was numbered as a single enclosure, and bore little woodland: the present Melbury Wood to the south was still not shown as a wooded area on maps of 1930. There are several barrows nearby, at about 250m above sea level, and the route affords fine views to the north. This is a section where so far there is no sign of modification to the county border itself, but further research remains to be done.

The boundary appears to reach the Roman road at ST 9168 1988, but this is preceded by an anomalous dog-leg which at present defies inspection on the ground owing to impenetrable undergrowth and the disappearance of a footpath. Preliminary evidence indicates that the Melbury Abbas parish boundary has been altered here, and may once not have extended quite to the line of the Roman road. A number of tracks converge near here or close by, and to the south of the junction, in Wiltshire, lies a Neolithic long barrow at ST 9169 1964 which might well have been a focal point (Plate 5). In any case this was clearly an important cross-roads (see Plate 6 and Figure 1). Also in Wiltshire, to the north there are several linear features, ditches and substantial cross ridge dykes, undated but some apparently truncated by the Roman road. The border here is at a height of over 260m, so commanding extensive views to the west and north.

Meanwhile the B3081 has looped round and now follows the Roman road south, with the remains of the *agger*, much overgrown and inaccessible at least in summer, appearing to run along the east edge of the modern road, as does the county boundary. At this point older maps record both a boundary post and a boundary stone, neither of which are now to be seen, and a toll house. After only 300m the road divides (at ST 9158 1955) with the B3081/Roman road heading slightly east of south while the boundary instead follows a minor road south towards the centre of Ashmore.

It is possible that this deviation of the boundary at ST 9158 1955 might well not be following its original line, and that it may once have continued on a more direct route. There is evidence that the parish boundary of Ashmore may formerly have crossed the present line of the county boundary in two places. The course of the boundary is now represented by a bank of only minimal height, topped with nothing but nettles, along the east side of North Road (see Plate 7). Then after an unremarkable 700m the boundary turns abruptly east, then south, so regaining the earlier line. This area awaits further investigation, since for about 1km the border is publicly inaccessible. On reaching the outskirts of Ashmore village the boundary emerges onto a road, crosses it and enters a track, continuing in a generally south-east direction for about 2.5km, nearly all along public footpaths or bridleways. This track appears to be part of a route which once went on to Chettle.

Older maps mark two boundary stones along the first 500m of the track, but both have now disappeared. Passing through Hookley Copse (see Plate 8), formerly part of Ashmore Common, the boundary track swings slightly east and crosses the path of the Roman road, which has maintained its earlier heading. In spite of several attempts it proved impossible to detect the road as it crossed through the copse, although in the adjacent Wiltshire Coppice, Wiltshire SMR records patches of rolled flints which formed the metalled surface of the *agger*.

Somewhat further on at ST 9242 1719 the boundary crosses a linear earthwork, once perhaps hundreds of metres in length to judge by the OS 1:25000 map, but now fragmentary, and in the woodland difficult to find because of dense vegetation. However the course of the earthwork and its accompanying ditch could be clearly seen as it crossed a field on the Dorset side. In this field it is also truncated by the Roman road.

Emerging from the woodland the boundary track continues, though much overgrown in summer, until it reaches the boundary between Ashmore and Tarrant Gunville, where there have been some small adjustments between the parishes in the past. There is also a change of direction of the county boundary, first slightly south-east into a wooded area for 120m, followed by a further change to the north-east at the parish boundary between Tarrant Gunville and Farnham. Here the OS records two more boundary stones, but neither has yet been located. Originally the trackway would have continued south-east along the parish boundary, into Farnham Woods and on to Chettle.

Instead the bridleway north-east diverges slightly from the county boundary, and follows the access track to several houses or farms, but past these it was fairly easy to re-enter Farnham Woods and to ascertain where the border meets and crosses the C road to Farnham. As so often a change in colour of the road surfacing was a good confirmation of the boundary, clearly indicating where the respective county council considers its responsibility begins or ends. The present survey stopped at this point, only observing that according to the 1:2500 OS maps it is from here eastwards that the border appears to acquire the name of the 'Shire Rack'.

Plate 1: The Dorset-Devon boundary at approximately SY330928 in the garden at the top of the lane known at Launcheycroft (see also Figure 1). The bank has been cut through here in the linking of two garden plots. The name is found on the 1842 Lyme Regis Tithe Map in Lanchy Croft Mead *occupying that area between the present A3165 and Haye Lane and* Lanchy Croft Orchard *'lining' the Devon border on the Dorset side. The much overgrown boundary bank of today continues up the hill affording a clear view of the coastline to the east. Just out of the picture, upslope, is a very large veteran holly stool; hazel, willow and ash find mention as charter boundary features along this length of the border – but not holly. A natural history report is in preparation*

Plate 2: The Dorset-Devon boundary looking north at approximately SY329919 east of Ware House (see also Figure 1) where it has been cut through by a route running west-east more or less parallel with Ware Lane and which may once have formed part of a coast road linking the Sherborne prebendal farm with Axmouth. This route is represented today by the present A3052 running a little further inland away from the coast (see vol. ***129****, 203, Figure 3). The bank presents a very similar appearance to that in Figure 1; it is heavily overgrown and not easy of access. It forms part of the* Devonshire Hedge *of c. 1832 (see Figure 1)*

Plate 3: Misaligned hedgerows where the parishes of Cann and Melbury Abbas meet, probably a relic of the two sides of an earlier trackway. Wiltshire is to the right and Dorset is to the left, with Cann at the top of the picture, and Melbury Abbas in the foreground

Plate 4: The double line of fencing encloses the county boundary on a low grubbed out hedge bank. Where the fencing suddenly rises it is passing across the remains of an 18m wide bowl barrow. Melbury Abbas parish is to the left, and Donhead St Mary (Wiltshire) to the right. In the background is Shaftesbury. The B3081 road is in the foreground

Plate 5: The Neolithic long barrow at ST 9169 1964, with the trees at Win Green showing beyond. The picture is taken from the county boundary as it runs along the top of the agger *of the Roman road, beside the B3081*

Plate 6: At this junction the B3081 runs across the picture, curving in from Shaftsebury to the west and continuing southwards to Tollard Royal. The road from the north (from the Donheads) is on the line of the Bath/Badbury Roman road, the agger *of which continues south as a hedge along the B3081. The road south-west towards Blandford follows the parish boundary between Melbury Abbas and Ashmore*

Plate 7: The present course of the county boundary, represented by a bank of nettles beside North Road, Ashmore. The view looks north to where the boundary has left the Roman road, now the B3081. It is suggested that the boundary may once have continued on a more direct line to the right of the picture, to meet up with a major trackway to the east of Ashmore

Plate 8: The county boundary passing through Hookley Copse, Ashmore, on the route of a major trackway that once led to Chettle

It has been noted that pre-Conquest a number of estates in Wiltshire and Dorset were in common ownership. Brictric, son of Aelgar, a major land-owner in Wiltshire, was also the lord of Dorset manors including Ashmore and Cranborne, the latter being part of the 'Honour of Gloucester'. By 1086 the Honour had been confiscated and Ashmore and Cranborne were held by Queen Matilda in person, thus bringing Cranborne Chase firmly into royal hands (Hawkins 1980, 30–31; Thorn and Thorn 1983, 1:16–17). The earlier extent or absence of cross-border holdings may of course have played its part in determining the route of the county boundary, and will repay further examination. One question to be addressed is why exactly the boundary loops south at ST 9168 1988, thereby placing Tollard Royal in Wiltshire rather than in Dorset.

Since the theme of this survey is boundaries, it is worth observing that the several cross ridge dykes or prehistoric linear earthworks mentioned above appear to have no more than a coincidental relationship with the present Dorset county boundary. The Royal Commission on Historical Monuments, in its sectional preface to its Inventory for north Dorset, commenting that all the dykes known in the area are on chalk, goes on to state. "It is obvious that all these dykes were originally boundaries, and from their dimensions it is probable that they were peaceful boundaries between estates or units of land. None of them has the dimensions of a frontier work like Combs Ditch or Bokerly Dyke, but some of the cross-dykes may have served to control movement along the spurs and ridges" (RCHM, 1972, xxvii).

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The County Boundary from Melbury Abbas to Ashmore: a natural history report

John Newbould

This piece is written in complement of the above note by Graham Hoddinott

From the A30, east of Shaftsbury, the County Boundary climbs to a hilltop of 205m just east of Cannfield Farm then dropping into a shallow dry valley. The boundary then follows a south easterly direction to the present B3081 at an altitude of 218m. At Zigzag Hill, the Ox Drove forms the County Boundary running along the ridge top to a maximum altitude of 259m. We followed the Ox Drove to the junction of the B3081 and the Roman Road leading to the 'Donheads'. In terms of using natural history with ancient trees or indicator species the area was quite uninteresting. My field notes showed just one coppiced Whitebeam stool measuring 1m just north of Breeze Hill. Neither the Arkwell map of 1618 or the Hardinge map (also 1618) of Cranborne Chase show any woodland in this area. We are left to conclude that historically the boundary in this area passed through open downland. However with longbarrows and the Roman Road following present parish boundaries this was clearly an important area in terms of human occupation of the area over very many years.

We parked in the car park off the B3081 at the summit of Zigzag Hill and climbed onto the Ridge. Initially surveying the summit of Zigzag Hill in square ST8920, there was an area of species rich chalk grassland on what appeared to be an ancient constructed dyke. It was too regular for a quarry. There is some recent Ash, Hawthorn and Sycamore scrub reflecting a reduction in grazing probably by rabbits in recent times. The grassland is good quality Erect Brome (NVC classification **CG4**) with twenty-seven herb species including Quaking Grass *(Briza media)*, Glaucous Sedge *(Carex flacca)*, Harebell *(Campanula rotundifolia)*, Carline Thistle *(Carlina vulgaris)* and Small Scabious *(Scabiosa columbaria)*.

Walking eastwards along the Ox Drove, we encountered rank False Oat-grass (NVC classification **MG1**) grassland together with a Hawthorn hedge (probably dating from the enclosure awards) on the southern boundary. A few other shrubs were noted including Ash and Dogwood. In a walk of a little over 2km across squares ST8920 and ST9020, similar chalk grassland herbs did appear in the species list.

In some ways, this part of the boundary had little to interest the natural historian and there were certainly no ancient coppice stools, old trees or old scrub. With Melbury Down one of the best areas in Dorset for butterflies we did see species such as Dark Green Fritillary. Amongst the birds Green Woodpecker with its requirements for ant hills and Yellowhammer (a red data book species) were important.

NATURAL HISTORY REPORTS

DORSET GEOLOGICAL REPORTS

Review articles and other contributions on the geology of Dorset in Volume 130

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The 'review series', introduced in the 'Geology Report' last year, continues this year with the first of two parts on the Dinosaurs of Dorset by Drs Roger Benson and Paul Barrett (pages 133–147). Their comprehensive review of the Saurischia and Theropoda recorded from the County brings us right up-to-date, drawing attention to the great advances in our understanding of this important and popular group of fossils, and opening our eyes to the directions research might take in the future.

Whilst not strictly a 'review article', the paper by Bob Chandler and Professor John Callomon (pages 99–132) provides an extraordinary insight into the history and continuing evolution of ammonite biostratigraphy, much based on work in Dorset, a mini-review in its own right. This comes about through the discovery of an exceptional and illuminating deposit of fossil ammonites of Middle Jurassic (Aalenian) age in an old quarry near Mapperton.

I am very grateful to all these authors for their enthusiastic support of the *Proceedings of the Dorset Natural History and Archaeological Society*.

In conclusion, I also wish to extend my gratitude to the referees who spend much time and trouble reading and commenting on the various contributions received. This year they are Drs Angela Coe, Jason Hilton, Michael Howarth, David Norman and Ian West.

A dinosaur track from the Wealden Group, (Lower Cretaceous), Worbarrow Bay, Dorset, southern England

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There is one ambiguous, and in any case unsubstantiated, record of the track of a dinosaur from the Wealden Group of Worbarrow Bay. Mansel-Pleydell (1888, 36) stated that 'dissociated remains as well as foot-prints have been recovered in the Wealden beds of Swanage and Worbarrow.' This 'record' is listed as Catalogue No: 8 (Ensom 1995). The author is unaware of any tracks having been observed at the latter location in the last 30 years.

While leading a field trip for the Open University Geological Society (South West Branch) in October 2008, the cast of a single, indifferently preserved, apparently tridactyl track was found on a fallen and partially buried block of fine-grained, pale sandstone at the foot of a cliff in Worbarrow Bay (NGR SY 86949 80313). In addition, a second track is hinted at with a single putative digit preserved on one edge. These were both on one surface

Figure 1: Cast of the apparently tridactyl dinosaur track on the base of the sandstone. Arrow points to putative digit of second track. Scale bars 10cm

interpreted as the base of the bed (Figure 1). The well-defined 'heel' impression is typical of the casts of tracks from similar sandstones of the Wealden Group of Swanage Bay. The digits are less well-preserved and this may be due to the mode of preservation, rather than damage. On the same surface as the track(s) there are distinctive burrow-like structures preserved as convex and concave hyporelief.

Though not *in situ*, the block showed no evidence of beach transport, and was below a degraded cliff exposing sediments of the Wealden Group. Subsequently, an attempt was made to identify the horizon from which the block was most likely to have fallen using a graphic log of the Wealden Group in Worbarrow Bay (Stewart 1978). The conclusion reached was that Stewart's Bed no. 7 (Figures 2 and 3) was probably the source, the *in situ* bed exhibiting some structures similar to the fallen block. Examination of the cliff showed this sandstone overlying a series of thin and impersistent sandstones associated with siderite. The degraded state of the cliff meant that none of these

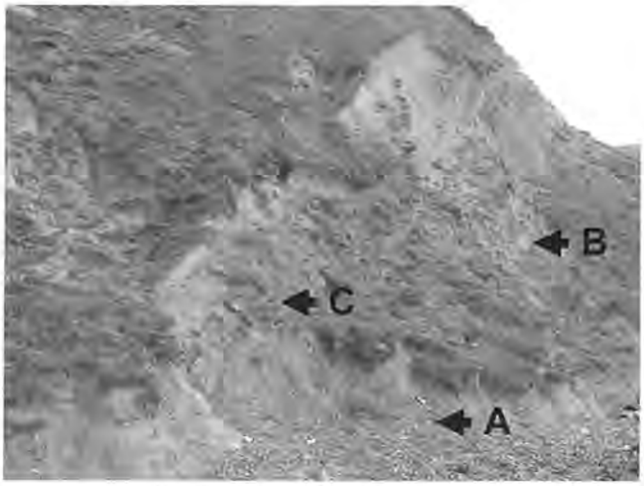

Figure 2: Cliff at Worbarrow Bay looking to the east. A. Find spot of fallen block; B. Yellow sands – Bed no. 5 of Stewart 1978; C. Exposure of Bed no. 7 in Figure 3

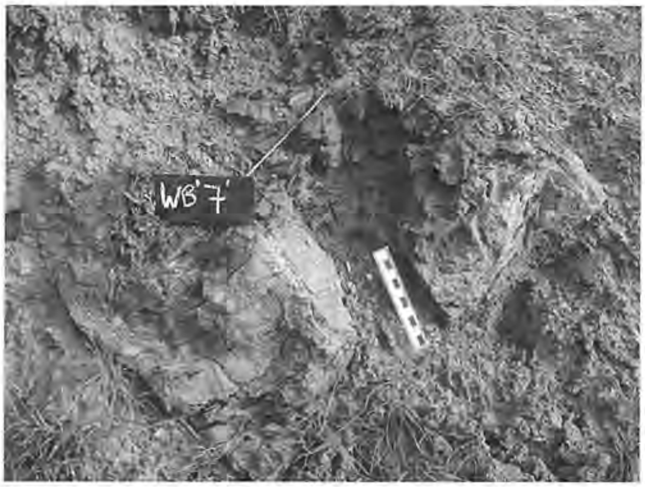

Figure 3: Bed no.7 in situ *showing bedding structures. Scale bar 10cm*

sandstones could be traced laterally with confidence. The sediments appear to represent floodplain deposits.

The specimen was recovered a short while after its discovery and is now in the collection of the Dorset County Museum (accessioned DORCM G 12082). The specimen requires a closer examination to enable a full understanding of its mode of formation.

Acknowledgements

I thank the OUGS (South West Branch) for inviting me to lead the field trip during which, as a result of the vagaries of the tides forcing us to switch our attention to the sediments of the Wealden Group, the specimen was found! Thanks to the Commandant of West Lulworth Gunnery School (RAC), his staff, and especially Rosemary Smith, through whose good offices the specimen was recovered from the shore of Worbarrow Bay. Special thanks to Richard Edmonds for his role in liaising with various organisations and who, with Emma Cockburn, removed the specimen from the beach, and delivered it to the DORCM where Brian Welch and Jenny Cripps provided assistance and curatorial support. Alan Holiday and Richard Edmonds gave valuable support while trying to locate the horizon from which the block had fallen. Jon Radley (Warwickshire Museum) is thanked for his interest and help.

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Conchostracans from the Intermarine Member, Durlston Formation, Purbeck Limestone Group, of Dorset, southern England

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The discovery, in 2008, of conchostracans, *Liograpta subquadrata* (J. de C. Sowerby), in the Intermarine Member, extends the known range of these extant arthropods from the Lulworth Formation into the Durlston Formation of the Purbeck Limestone Group of Dorset, southern England. Specimens referred to in the text are part of the collection of the Dorset County Museum, They are prefixed DORCM.

Location and stratigraphy

Measurement of a temporary section through the Intermarine Member, Durlston Formation, at Turnpike Quarry (NGR SY 98635 78518) on the west side of the Worth Matravers road, near Langton Matravers, Swanage, Dorset, was undertaken during the summer of 2008. During the life of this quarry, beds as low as the Downs Vein (equivalent of Bed DB 113 in Durlston Bay, Clements 1993) to the Laning Vein (equivalent of DB 139–144) have been exposed. An orangey-yellow calcareous silty-clay (Bed T 68 in PCE Field Note Book no. 18, 132–143), resting on the surface of the equivalent of DB 133 (Clements 1993) known as the 'Red Rag', thickened into a lens-like deposit on the undulating surface of this bivalve micrite to micro-sparrudite. DB 133, the 'Red Rag' exhibits substantial cross-bedding in Durlston Bay.

Conchostracans

One layer was especially rich in plant remains (DORCM G 11,720 and 12,079a-b) and also contained numerous ostracods. From this bedding plane, 5 carapaces of at least three conchostracans were recovered. The small size of the carapaces (*c*. 3mm long), the concentric growth lines, and the presence of fine radial lines in the veneer of a carapace preserved in the mould (counterpart) of one of the 'valves' appears to confirm the identity of these specimens as *Liograpta subquadrata* (J. de C. Sowerby) (DORCM G 11,718a-b, 11,719a-b, 12,080, Figure 1).

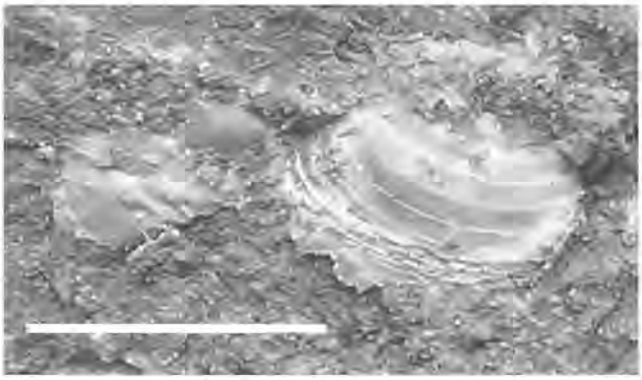

Figure 1: The conchcostracan Liograpta subquadrata *(J. de C. Sowerby). DORCM G 11718a. Scale bar c. 2.6mm*

The distribution of these small, crustaceans (Arthropoda) in the Purbeck Limestone Group was reviewed by Ross and Vannier (2002) based on museum collections and recent field collection. They record conchostracans from various horizons in the Lulworth Formation, ranging from the Caps and Dirt Beds Member, up to the top of the Cherty Freshwater Member, immediately below the base of the Cinder Member (Durlston Formation). Allen (1998) records conchostracans from the 'Middle Purbeck' of the Vale of Wardour and from the 'Upper Purbeck and Wealden' of the Weald. The correlation of these strata between the three separate basins of deposition remains somewhat speculative, though the 'Middle Purbeck' of the Vale of Wardour is almost certainly older and probably the equivalent of strata in the 'Lower Purbeck' of Dorset.

The specimens recovered at Turnpike Quarry are the first to be recorded from the Intermarine Member, extending their range in the Purbeck Limestone Group into the Durlston Formation.

Implications

Extant conchostracans are mostly adapted to strongly seasonal conditions (Ross and Vannier 2002), encompassing seasonal rains followed by drought. The complete life-cycle of the conchostracan is tuned to this, with freshwater influxes triggering the hatching of the encysted egg, supporting their development to maturity and egg-laying, all during the brief existence of an ephemeral pool. This life-style has led to the suggestion that similar conditions existed during the deposition of at least parts of the Lulworth Formation (Francis 1984; Allen 1998; Ross and Vannier 2002). If the conchostracans, represented by the five recovered carapaces, were not washed into this deposit, their presence suggests that after the Red Rag (DB 133; Clements 1993) was deposited, there was a period of exposure and desiccation prior to an incursion of freshwater enabling these conchostracans to hatch.

Allen (1998) weighed the evidence for climate change through the Purbeck Limestone and Wealden groups (late Tithonian to early Aptian) of southern England. He concluded that there was evidence for less pronounced seasonality and increasing humidity in the strata above the Cinder Member. The relative abundance of fragmentary plant remains at various horizons in the Intermarine Member (personal observations) has been seen as evidence for increased rainfall and run-off from the upland areas which supported a terrestrial flora; their remains were washed down to the Purbeck Basin, before coming to rest on the sediment-water interface and being buried (Ensom *et al.* 2009). The lack of conchostracan records in the Durlston Formation could have been seen to support Allen's view. However, the presence of pseudomorphs of gypsum in algal micrites in the Corbula Member (Andrews 1986) is indicative of at least one more arid episode of uncertain duration at this higher level within the Durlston Formation. Allen's (1998) findings are broadly supported and refined by the work of Schnyder *et al.* (2009) on the distribution of organic matter (OM)-rich layers, in the late Tithonian and Berriasian strata of two Dorset sections through the Purbeck Limestone Group. Their evidence indicates that a transitional phase from a semi-arid to a semi-humid climate began at the top of the Soft Cockle Member, Lulworth Formation. This phase is characterised by high OM, ending when, according to their data, OM shows a sharp decrease above DB 130 in the upper part of the Intermarine Member. At this point their semi-humid phase becomes established.

The Turnpike Quarry section revealed a number of limestones with reddened surfaces and less commonly, pinkish-red layers within the limestones, these occurring both below and above the equivalent of DB 130, the point at which the semi-humid climate is believed to have become established. Some of the argillaceous horizons also showed orangey-red colouration. Comparable sediments have been observed at a similar stratigraphic level in Lander's (NGR SY 9825 7895) and Keates' (NGR SY 9869 7806) quarries which lie within a distance of 0.65km of Turnpike Quarry (personal observations, 03.2000 and 09.2006 respectively). Could the reddish coloured sediments observed at certain levels within the Intermarine Member in the area around Turnpike Quarry be indicative of aridity at the time of deposition? This need not be at odds with Allen's (1998) view of increased run-off from upland areas to the west and north which is likely to have been associated with uplift and resultant climate change intimately bound up with the early phases of the Atlantic Ocean's opening. Indeed, without this increased run-off, the iron minerals which would sooner or later be oxidised to hematite, would not have reached this part of the Purbeck Basin. Anderson (2004) proposes that the Purbeck sequence demonstrates strong cyclicity caused by orbital forcing. The possibility that the reddening of strata may in some way be connected with the cyclicity he identifies seems possible, but remains untested at present.

Unless further discoveries show otherwise, conchostracans appear to be a rare component of the fauna of the Durlston Formation of the Isle of Purbeck. Their significance in relation to the proposed cycles of Anderson (2004), and whether their seasonal life-cycle might provide additional insights into the climatic phases of Schnyder *et al.* (2009) requires further research.

Acknowledgements

I am very grateful to Trev, Sue and Mark Haysom for granting me permission to measure the section at Turnpike Quarry, and for their continuing interest and enthusiasm.

Without their support, notes such as this would never appear, and our understanding of these strata would be impoverished. I thank Andrew Ross (National Museums Scotland) for his comments on the conchostracans and Jenny Cripps (Dorset County Museum) for curatorial support. I am most grateful to Jon Radley (Warwickshire Museum) for reading and commenting on an earlier version of this note. Ian West (University of Southampton) has kindly reviewed this note and his constructive comments are gratefully acknowledged.

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DORSET RAINFALL 2008

John Oliver

THE WETTEST YEAR SINCE 2002

The general rainfall across Dorset in 2008 amounted to 1039.4mm and represented 122% of the 1971 – 2000 average. It was marginally wetter than 2007 and the highest annual total since 2002.

The wettest station was Stratton with 1242.6mm and the driest was Portland with 677.0mm. The highest 24-hour rainfall total was recorded at Shaftesbury with 50.8mm credited to May 26th.

There were two lengthy dry spells that affected the whole of Dorset during the year, the first from about February 6th–21st (18 days) and the second from September 13th–29th (17 days).

Snowfalls were limited to upland areas in the north of the county. At Shaftesbury a 3cm snow cover on March 23rd was followed by a 5cm fall on April 6th and a further 2cm on the 7th. Snow on October 28th produced a covering that survived into the 29th – the earliest on record.

Table 1: Monthly Rainfall and Thunder days

Month	Raindays* >0.2mm	Rainfall* (mm)	1971–2000 av. (mm)	% of average	Days of thunder
January	21	126.5	100.1	126	2
February	9	44.6	75.2	59	1
March	20	108.5	74.9	145	1
April	17	63.1	58.2	108	3
May	14	97.2	54.8	177	6
June	9	39.3	57.5	68	0
July	13	108.2	43.1	251	4
August	20	99.3	63.2	157	2
September	11	82.8	80.4	103	1
October	17	110.0	93.8	117	0
November	18	95.5	96.7	99	0
December	12	64.4	111.7	58	0
Year	**181**	**1039.4**	**909.6**	**122**	**20**

*Rainfall and Rainday averages are calculated from the stations that record rainfall to an accuracy of 0.1mm

The monthly distribution of rainfall and days with thunder is given in Table 1.

GENERAL WEATHER SUMMARY

January (wettest for nine years)

Apart from a brief cold interlude from the 2nd–4th it was a very mild and unsettled month with rain or showers on most days and maximum temperatures generally in the range of 9°C–13°C. It was a breezy month overall with a peak gust of 77mph recorded at Weymouth on the 31st. Air frosts were infrequent and mainly slight with the lowest recorded temperature only –2.5°C at Hurn on 6th.

February

A dry and exceptionally sunny month (Weymouth 140hrs–176% of av.) but the clear skies at night resulted in rapid cooling and some sharp frosts. At Hurn, frost was reported on 15 nights and these became quite severe in mid-month with a minimum temperature of –6.8°C recorded at Dorchester on the 17th. Day temperatures were generally a little above average, except for a brief colder interlude in the third week and rainfall was confined to the first four days and the last week.

March (wettest for seven years)

This was the wettest March since 2001 and the windiest since 1995. The gusts of 55mph recorded at Dorchester and 79mph at Weymouth on the 10th were the strongest of the year. The wind blew predominantly from the south-west with temperatures close to the average, but veered to the north from the 21st–24th. This wind change brought a marked fall in temperature and wintry showers, coinciding with the Easter weekend to make it the coldest for ten years.

April

A typical month of 'April showers' and these were accompanied at times by hail and thunder. Daytime temperatures were a little above average generally but a brief invasion of Arctic air on the 6th turned the showers to snow in many places. Frosts were widespread for five nights with the temperature as low as −4.6°C on the 8th. Towards the end of the month a warm southerly airflow raised the mercury to 21°C in Bournemouth.

May

A rather warm but unsettled month with heavy rain at times and this was accompanied by thunder on six days. The weather became quite hot in the second week as air off the near continent drifted west across the UK. On the 11th the temperature climbed to 27.4°C at East Stour and 28.1°C at Wimborne.

A relatively cool period between the 15th and 23rd produced initially some chilly days and then, despite the short nights, some low minima with 0.7°C registered on the latter date at Dorchester.

June

This was a dry month with temperatures just on the warm side of normal. The warmest day was almost exclusively the 9th with maxima of 25°C–28°C. The second half of the month was quite breezy and a gust of 43mph was measured at Dorchester on the 19th to equal the highest speed recorded in June in the last 14 years. At Weymouth the maximum gust was 56mph on the 20th.

July

The first 12 days were generally cool, breezy and wet with some heavy rainfall at times. The wind gusted to 42mph at Dorchester on the 5th to equal the highest July reading in 15 years. The weather became mainly dry from the 13th until nearly month-end and temperatures that had been rather depressed returned to near average values for a week before rising into the hot category from the 23rd–28th. On the latter date the temperature reached 28.7°C at Blandford and 29°C at Thornford.

August (wettest for nine years)

The month was generally unsettled and breezy with heavy rain at times and day temperatures below average. The extreme maximum temperature at Dorchester (23.0°C) and East Stour (25.0°C) was the lowest for August since 1986.

It was also a dull month with the least sunshine at Weymouth (168hrs) for 11 years. The summer period June–August produced the lowest mean maximum temperature since 1998 and over much of Dorset it was the third wettest summer of the last 50 years after 2007 and 1960.

September (coldest for 14 years and wettest for eight years)

The month opened with twelve days of unsettled weather with rain or showers at times and day temperatures a little below expectations. Pressure built strongly across southern England on the 13th heralding a period of generally dry and quite sunny weather that was to last for the remainder of the month. Day temperatures were depressed and unusually uniform, being in the general range of 16°C–20°C. At East Stour the extreme maximum temperature (20.9°C) was the lowest since 1986.

October (coldest for five years)

This was a very changeable month with rain at times and brief drier periods of just one to three days. Temperatures were generally close to average until Arctic air brought day maxima down below 10°C on the last five days. Showers turned to sleet and snow on the 28th and 29th and produced a cover at Shaftesbury on the latter date. The 30th was the coldest day of the month with a maximum temperature of just 5.7°C at Evershot.

November

Apart from the first two and last seven days, the weather was mild and unsettled with rain at times. Day temperatures ranged from a general 'high' of 14°C on the 20th to just 3°C on the 30th. A little sleet and snow was reported on the 29th and 30th. Some slight frosts were noted in the last week.

December (coldest for 13 years and driest for seven years)

The mean temperature for the month was about two degrees celsius below the 30-year average. The 31st was the first general sub-zero day since January 1997 with maxima between −0.1°C and −1.5°C. Frosts were recorded on 17 nights at Evershot and Blandford with the lowest temperature reported as −6.3°C at Dorchester on the 11th. There was a relatively mild period from the 16th–25th with 13.2°C reached at Bournemouth on the 20th.

Most of the rain fell in the first thirteen days of the month and was particularly heavy on the 12th.

THE WETTEST DAYS IN 2008

Rainfall totals exceeding 25mm at one or more stations were recorded on 23 days during the year compared to 25 days in 2007. The most widespread of these 'heavy rainfall' events, where more than half of the reporting stations met the criteria, are detailed below.

15 March (19 stations)

During the afternoon, evening and overnight period, a low pressure centre moved slowly east across southern counties of England (993 millibars Hampshire at 0000hrs 26th). Rainfall was showery in nature during the afternoon and evening but became persistent overnight and heaviest over the north of the county. For six stations this was the wettest day of the year. (36.5mm Marnhull; 35.5mm Stalbridge; 35.2mm Milborne Port and Sturminster Newton)

8/9 July (7 stations 8th; 22 stations 9th; 4 stations both dates)

At 0000hrs on the 9th a complex frontal system (linked to a double centred low (1000mbs) to the west of Ireland) was approaching Cornwall. Rain reached the west of Dorset around 0200hrs GMT and extended quickly east

RAINFALL IN DORSET 2008

Stations marked * record to an accuracy of 0.1mm and are used to compile the county averages.
Rain-day totals in parentheses are generally reading low, as rainfall of less than 0.5mm and in some cases 1.0mm, at these stations are entered as a nil.

STATION		OBSERVER	GREATEST FALL IN 24 HOURS		Days with 0.2mm or more	Days with 25mm or more	DEPTH OF RAINFALL IN MILLIMETERS												TOTAL FOR YEAR
			Depth	Date			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
STOUR BASIN																			
Blandford St Mary (Chettle Way)	*	Mr D Vincent	30.2	15/3	183	5	126.1	45.9	107.9	64.8	87.1	46.7	93.4	89.2	90.3	99.9	91.3	67.4	1010.0
Blandford St Mary (Forebridge Vw)	*	Mr A Fleet	32.0	12/12	194	4	132.5	47.7	113.6	66.3	63.9	47.8	97.3	84.8	80.4	98.4	87.1	72.3	992.1
East Stour	*	Mr R Brown	43.3	25/5	195	3	100.0	36.7	103.2	64.1	122.5	35.1	92.4	83.0	61.1	99.1	93.9	54.7	945.8
Fontmell Magna	*	Mrs J Westgate	37.8	25/5	187	6	111.0	38.3	119.3	66.2	99.2	41.7	106.3	66.5	67.9	87.6	103.7	64.2	971.9
Holwell (Vale View Farm)		Mr P Henshaw	30.0	15/3	(117)	3	95.4	30.5	97.4	60.1	97.3	39.0	84.5	48.0	69.6	77.5	68.1	61.5	706.6
Iwerne Minster		Mr R Benfield	40.8	25/5	171	5	128.1	47.4	134.2	80.3	97.2	44.2	114.2	81.0	95.6	97.1	96.6	73.5	1089.4
Marnhull (Old Mill Lane)	*	Mr A Bradbury	40.5	25/5	170	2	94.8	35.6	94.8	45.0	102.7	33.7	87.9	71.3	52.3	84.0	80.6	51.0	833.7
Motcombe		Mr M Rawlins	30.5	15/3	199	5	115.6	41.1	121.8	73.0	126.3	50.0	105.1	98.0	78.0	105.3	107.4	58.2	1079.8
Shaftesbury (Hilltop)	*	Mr M Maguire-Yorke	50.8	26/5	215	8	115.0	48.2	124.1	82.9	130.9	47.2	127.8	104.6	88.2	123.1	115.6	61.9	1169.5
Sturminster Newton (Rosecroft)		Mrs R Dawes	35.2	15/3	176	4	116.5	40.8	117.6	52.4	98.1	38.1	119.3	68.8	65.6	85.8	85.2	63.1	951.3
Turnworth (Home Farm)		Mr A Yeatman	35.5	12/12	174	4	136.5	45.5	117.0	63.0	92.5	51.5	95.0	90.5	86.0	114.0	87.5	63.0	1042.0
Wimborne (Merley)	*	Mr B Bush	27.6	25/5	170	5	116.7	46.3	103.9	69.0	84.2	40.2	81.5	96.1	85.4	92.0	93.1	43.9	952.3
Winterborne Zelstone		Miss B Hooper	30.0	9/7	(126)	6	120.5	48.0	101.0	59.5	87.0	64.7	76.9	89.2	62.5	107.7	98.2	44.0	959.2
PARRETT BASIN																			
Melbury Sampford (Melbury House)	*	Head Gardener	40.4	12/12	180	9	170.6	49.1	117.4	71.5	108.9	44.5	122.6	101.9	112.0	131.6	98.4	82.0	1210.5
Milborne Port	*	Mr E Evans	37.8	9/7	177	2	88.2	33.7	97.8	56.9	87.1	37.4	132.0	69.9	80.3	104.3	83.3	60.7	931.6
Stalbridge	*	Mrs M Paul	35.5	15/3	187	3	102.7	37.5	109.6	45.3	103.4	35.7	113.3	71.0	66.7	95.2	85.3	61.8	927.5
Thornford		Mrs W Morris	44.0	12/12	202	7	137.9	37.4	141.1	56.2	124.5	52.1	114.2	85.9	103.0	114.0	95.1	89.0	1150.4

STATION		OBSERVER	GREATEST FALL IN 24 HOURS		Days with 0.2mm or more	Days with 25mm or more	DEPTH OF RAINFALL IN MILLIMETRES												TOTAL FOR YEAR
			Depth	Date			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
FROME BASIN																			
Ansty	*	Mrs A Stevens	34.3	12/12	189	3	121.3	40.8	104.6	66.5	89.9	41.2	86.6	88.8	75.0	97.9	82.8	69.1	964.5
Bradford Peverell	*	Mr D Oliver	34.2	8/7	182	6	147.9	54.0	98.4	52.7	95.3	34.3	129.3	120.5	78.1	123.0	92.4	61.0	1087.0
Cerne Abbas	*	Mrs M Boxwell	37.0	Vs	201	5	158.7	51.8	111.8	63.9	84.2	38.8	129.2	97.9	102.6	131.3	104.4	75.4	1150.0
Charminster		Mrs P Eveleigh	35.5	9/8	166	5	151.4	55.5	103.6	54.2	90.7	35.7	127.5	128.8	79.7	131.6	89.7	62.1	1110.5
Dewlish (Parsonage Farm)		Mr C Britton	30.0	Vs	(145)	7	160.0	44.0	89.0	38.0	63.0	43.0	109.0	129.0	91.0	120.0	111.0	71.0	1068.0
Dorchester	*	Mr J Oliver	41.3	8/7	189	5	119.8	54.8	102.1	48.9	97.1	38.2	116.7	140.4	71.4	116.6	90.1	56.3	1052.4
Milborne St Andrew (Coles Farm)	*	Mr A Maitland	38.6	12/12	186	5	136.7	49.1	100.9	58.0	78.9	44.0	95.6	98.8	95.4	113.4	103.9	68.1	1042.8
Milton Abbas	*	Mr K Battrick	35.0	12/12	167	5	132.6	44.9	108.5	75.2	87.7	36.0	85.1	90.5	80.6	104.4	88.0	69.6	1003.1
Owermoigne		Mr A Hodge	44.4	8/7	179	4	108.4	42.4	111.9	66.8	93.7	36.2	109.4	137.7	95.7	116.3	105.8	51.3	1075.6
Puddletown (Bardolf Manor)	*	Mr H Wood-Homer	37.5	12/12	168	5	131.2	51.4	95.2	64.0	79.1	38.3	100.0	106.3	83.0	117.1	97.2	68.0	1030.8
Rampisham	*	Mrs C Parry	41.4	9/7	175	9	172.4	51.4	103.9	67.5	93.8	40.0	120.4	105.7	100.0	148.6	98.6	72.1	1174.4
Stratton	*	Mr W Putnam	38.2	9/7	184	8	170.4	55.9	111.6	64.3	95.7	37.4	146.8	128.2	90.7	153.7	116.8	71.1	1242.6
Sydling St Nicholas	*	Mr C Legg	37.5	12/12	174	7	164.1	50.5	111.3	64.2	91.8	39.0	130.4	98.3	94.1	138.5	103.1	77.4	1162.7
Wareham (Trigon)		Mr G Sturdy	24.7	4/10	156	0	82.7	30.5	70.7	37.6	58.9	41.1	59.7	71.3	61.1	83.3	84.3	37.8	719.0
Winfrith Newburgh		Mr M Ching	35.0	Vs	146	7	138.0	64.0	97.5	91.5	117.0	40.5	121.5	144.0	125.0	121.5	104.5	36.0	1201.0
AXE BASIN																			
Forde Abbey	*	Mr M Roper	50.7	12/12	171	6	133.0	39.3	112.9	64.7	137.4	31.9	114.0	127.9	88.2	130.3	84.5	84.9	1149.0
COASTAL STREAMS																			
Bradpole		Mr G Smith	32.0	9/7	(114)	3	105.6	42.5	76.0	55.8	101.7	17.2	71.0	71.1	78.4	98.4	79.0	58.9	855.6
Osmington Mills (Coastguard Ho)	*	Mr J Hadwin	35.0	9/8	187	2	107.5	47.1	111.4	61.0	91.5	33.9	89.3	127.5	76.7	98.0	104.6	51.3	999.8
Portland Bill (Old Higher Light)		Mrs F Lockyer	22.4	22/5	172	0	83.2	39.9	64.8	22.7	101.4	29.8	51.2	63.7	54.8	57.0	74.7	33.8	677.0
Weymouth	*	Mr R Poots	34.2	9/8	166	3	100.6	25.8	86.2	49.2	111.8	34.7	88.5	111.3	66.8	92.2	89.0	58.0	914.1
Wyke Regis	*	Mr R Poots	23.1	8/7	162	0	87.1	32.3	90.3	43.7	87.2	28.2	74.7	85.9	64.5	70.0	76.9	41.8	782.6
COUNTY AVERAGES			–	–	181	5	126.5	44.6	108.5	63.1	97.2	39.3	108.2	99.3	82.8	110.0	95.5	64.4	1039.4

and persisted for 20 hours. The rain was at its heaviest between 0600hrs and 1100hrs on the 9th and coincided with the observation hour and subsequent cut-off time for the amount credited to the 8th. As this was a single rainfall event and measurement times vary between 0600hrs and 0900hrs GMT a combined total is given.

Thirteen stations, all in the south of the county, recorded in excess of 50mm of rain. (68.2mm Dorchester; 67.7mm Owermoigne; 66.1mm Stratton)

12 December (27 stations)

At 0000hrs on the 13th an occluded front was lying north to south down the west of the UK, linked to a depression 977mbs over Iceland. By this time a secondary low was forming on the front over south Wales slowing its eastward progress and enhancing the rainfall. There was heavy overnight rain across the whole of the county, with the highest totals (over 40mm) in the west. Towards the east, some stations logged less than 20mm of rain. (50.7mm Forde Abbey; 44.0mm Thornford; 40.4mm Melbury Sampford)

THUNDERSTORMS

Thunder was reported as heard on 20 days during the year compared to 32 days in 2007 and this was the lowest total since 1991 with 18 days.

As in 2007, the cool summer with winds of generally Atlantic origin, resulted in a total lack of heat generated long-lasting storms imported from France. There were very few showery days during the year that produced thunder and it was not reported at all after September 12th.

The monthly distribution of thunder days forms a part of the rainfall table.

Twenty-five observers supplied details of thunder in their locality and the main activity was recorded on January 21st (14 stations); April 20th (15); May 4th (13) and August 31st (15).

On March 10th at midday a bungalow at Poole received a direct lightning strike and was burnt out.

MARINE REVIEW 2008

Lin Baldock
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The year 2008 was outstanding for the number of seahorse sightings made off South Beach, Studland. Between June and early October over 40 reports of seahorses were received. The majority of records were for the Spiny seahorse (*Hippocampus guttulatus*) with many being pregnant males. The short snouted seahorse (*Hippocampus hippocampus*) was also recorded, but less frequently, with one report from Steve Trewhella of a pair comprised of a female spiny and a male short-snouted seahorse.

The two British seahorse species were added to Schedule V of the Wildlife and Countryside Act in April 2008 after over five years of campaigning. Efforts are now being made to establish a management plan for a small part of Studland Bay to minimise impacts on the seahorse habitat and to map the full extent of the seagrass in the Bay. The effects of boat anchoring and mooring design on seagrass habitat, the associated diverse biota and the distribution of the seahorses will also be examined. Funding is available for a two year study to commence in the spring of 2009.

After much effort protection has been won for part of Lyme Bay with scallop dredging banned from an area of some 200 square kilometres, representing approximately 10% of the Bay. The ruling was made in order to protect the pink seafan (*Eunicella verrucosa*) and its habitat. The pink seafan is a protected species listed in the EU Habitats Directive and this success demonstrates the importance of such legislation when government departments need to be persuaded of the necessity for controversial action. The real test for this protected zone will be in the effectiveness of the policing of the area and the commitment to its implementation by the local sea fisheries authorities.

A three year monitoring study, headed by research workers based in the Marine Biology and Ecology Research Centre at the University of Plymouth, has been implemented to monitor the recovery of the once rich epifauna following the cessation of scallop dredging. There is some tentative preliminary evidence that the original small voluntary protected areas still do support a slightly more diverse epifauna with more large individuals of branching sponge species (e.g. *Raspailia*, *Stelligera*, *Haliclona*) some seafans, and a longer list of smaller associated fauna including a variety of hydroids, molluscs, bryozoa and ascidians.

During the summer there was an influx of loose clumps of the brown alga *Ascophyllum nodosum* supporting large numbers of stalked barnacles predominantly of two species: the buoy barnacle (*Dosima fascicularis*) and *Lepas pectinata*. The weed rafts of this normally intertidal alga had both an unusual growth form (with many very short adventitious branches giving the floating rafts a spiky appearance) and a striking colour (being a almost mustard-yellow as opposed to the more normal green-brown of local *A. nodosum*). These attributes made it very easy to spot isolated rafts among the flotsam and jetsam along high water mark. The weed also supported dense growths of a common hydroid (*Obelia geniculata*) and bryozoa including extensive mats of *Membranipora membranipora* never found in such abundance on local *A. nodosum*. The dense colonisation by such epibiota is not seen on *Ascophyllum* growing on local Dorset shores and this, together with the presence of the stalked barnacles, suggests that these weed samples may have arrived from very much further afield. Correspondence with Dan Minchin an expert on the arrival of alien species by drift on European shores, revealed that a colleague of his based in the USA had coined the term 'Asco Sea' for an area of Connecticut where large, detached masses of this weed are known to circulate. It is possible that the material found in abundance on Dorset shores this year could have arrived from across the western Atlantic. Studies around Iceland have recorded rafts of *Ascophyllum* occurring up to 120km offshore and the author concluded that here these drifting masses of algae were important in the population dynamics of a number of pelagic species of fish and crustacea (Ingolfsson 2000).

It was of particular interest to note the abundance of the buoy barnacle on this very characteristic growth form of *A. nodosum*. It is generally held that buoy barnacles do not attach to large pieces of flotsam, depending instead on secreting an independent float to maintain their buoyancy. However, Darwin (1851), in his monograph on barnacles, noted that this species did in some cases make use of other floating objects and therefore did not always secrete its own independent float. In 2008 buoy barnacles were observed on a variety of other floating objects stranded on Dorset shores during the summer including wooden crates and large plastic items (Steve Trewhella, pers. comm.).

Studies of the special invertebrate fauna associated with Dorset strandlines have been vigorously promoted by Steve Trewhella during the year with a number of records of rare or under recorded species being made (all records, Steve Trewhella, pers. comm.). Interesting reports have included:

- *Halorates reprobus:* a shore dwelling money spider which has been shown to occur widely in the Kimmeridge Voluntary Marine Reserve.
- *Drusilla canaliculata:* a rare hunting spider with a preference for shingle habitat, previously only recorded in Dorset from Chesil Beach, found in high numbers in 2008 at Warbarrow Bay.
- *Halophiloscia couchi:* an isopod rare in the UK which was recorded at the top of the shore under limestone boulders and was also taken in pit-fall traps.
- *Licinus punctatulus:* a carabid beetle with a restricted distribution found under stones at Kimmeridge. Fowler (1887) recorded this species (as *L. silphoides*) from Dorset at Swanage and on the Chesil Bank.

Efforts are now being made, in collaboration with several national organisations including the Natural History Museum and the countryside agencies, to raise awareness of the ecological importance of this habitat for a very wide range of organisms, many not generally considered to be marine. Study of this habitat has been overlooked, falling as it does between the strictly terrestrial and fully marine environments. Data collected on the impacts of accumulation of anthropogenic rubbish and activities such as beach management on the shore will be used to promote better ways to manage and protect strandlines.

During 2008 a survey of the physical environment of over 800 square kilometres of the near shore seabed of Dorset was undertaken. The project (DORIS- DORset Integrated Seabed Survey) is a collaborative study funded through the Civil Hydrography Programme, Strategic and Coastal Monitoring Programme and the Dorset Wildlife Trust financed through the Landfill Community Fund. Work will continue in 2009 to provide information on the biological and geological veneer associate with the underlying physical data. Data such as these are vital in providing input to other local projects such as Dorset C-SCOPE (Combining Sea and COastal Planning in Europe) which aims to promote integrated, sustainable management on the coast. Data for the 2008 season are currently being analysed but will be widely available in due course.

A recent report commissioned by PLANTLIFE identified five sites in Dorset as Important Plant Areas (IPAs) for marine algae (Brodie *et al.* 2007). The full report may be downloaded from http://www.plantlife.org.uk/uk/plantlife-saving-species-publications.html#algaeareas. The sites were designated using the following four criteria:

Table 1: Reports of other interesting sightings made during 2008 are amplified below

Species	Status	Notes
Red Algae		
Chondria coerulescens	Southern	This species was found to be common on muddy sediments in Poole Harbour in 2006 and 2008
Gelidiella calcicola	Under recorded	There are recent records for this minute species from the sparse maerl beds off Old Harry
Gracilaria bursa-pastoris	Southern	Numerous records from the shallow infralittoral
Polysiphonia devoniensis	Southern	2008 records from several silty reefs west of Durlston
Pterosiphonia ardreana	Rare, southern	Several recent records from Dorset: Chesil Cove, Kimmeridge Ledges, reefs west of Durlston
Brown Algae		
Padina pavonica	Southern	Large populations on the Kimmeridge Ledges, at Chapman's Pool and more limited occurrence to the west of Osmington Mills
Zanardinia prototypus	Southern, declining	This species is recorded regularly on shallow, subtidal rocky reefs from Swanage westwards
Green Algae		
Codium adhaerens	Rare, declining	Recently recorded from two sites in Dorset (Peveril Point, Pondfield in Warbarrow Bay) with additional unpublished, historical records by E.M. Burrows
Codium vermilara	Rare, declining	Recorded in 2008 from Pondfield in Warbarrow Bay and as drift material collected at Ringstead. Additional unpublished, historical records by E.M. Burrows

- **A**: sites with significant populations of one or more species of global or European conservation concern;
- **B**: sites with an exceptionally rich algal flora for their biogeographical zone in a European context;
- **C**: sites which are outstanding examples of a habitat type which is of conservation importance within a global or European framework; and
- **D**: sites for which circumstantial evidence indicates that they are important for algae, but are data deficient.

Only one of the five Dorset sites, the Fleet, has a statutory designation as an SAC (Special Area of Conservation) which provides a degree of protection for the natural environment, all be it minimal. Durlston and Kimmeridge have been designated Voluntary Marine Reserves but this is largely a meaningless concept in relation to any effective protection afforded to the sites. Details of the citations for the five nominated areas are provided below.

Peveril Point to Durlston Head: nominated for both European status and being important in an English context on criterion B. It has been identified as a diversity hotspot with records of many nationally rare species of marine algae. Furthermore, it has a long history of algal study.

Studland: nominated on criterion B for its importance in an English context, this site has areas of chalk cliff, reefs, rock platforms and caves with a diverse algal flora. There is a long history of collecting at the site with excellent collections housed at the Natural History Museum. It is the type locality for *Apoglossocolax pusilla* Maggs and Hommersand a rare parasite of a common red alga *Apoglossum ruscifolium*.

Kimmeridge Ledges: a site of importance in England designated on criteria A and D for the Jurassic limestone ledges which support unusual assemblages of algae. It is one of only two known sites in England for the red alga *Ceramium cercinatum*.

Weymouth: designated on criteria A and D has a long history of study and the type locality for a number of species of marine algae, as a consequence there are good historical records and good collections held in the Natural History Museum. The second known site in England for *Ceramium cercinatum* is in Portland Harbour (Baldock, pers. obs.).

The Fleet: The Fleet is designated on criteria A and C. It is the largest lagoon system in England with a wide range of salinity values and a diverse and well studied algal flora.

In addition to identifying IPAs for algae, the PLANTLIFE report (Brodie *et al.* 2007) lists some interesting algae recorded from Dorset which are rare, have a southern distribution or are in decline. These are listed below with additional notes provided by Baldock (pers. obs.).

Marine Invertebrates

Physalia physalis: Portuguese man o'war. There were several reports of these siphonophores being washed up on beaches from Bournemouth west to Chesil Beach during August (Steve Trewhella, pers. comm.)

Pelagia noctiluca: two records of this potentially harmful jellyfish were received from Kimmeridge (Steve Trewhella, pers. comm.) during August. The records coincided with those for the Portuguese man o'war and the arrival of drift *Ascophyllum nodosum* (see above).

Dosima fascicularis: Buoy barnacle. Large numbers of this species were recorded from various items of flotsam and jetsam on beaches from Chesil east to Highcliffe. Interestingly, none was found attached to the specially secreted float which gives the buoy barnacle its common name, all records were from individuals attached to other floating objects. Of particular interest were large numbers recorded attached to stranded clumps of the intertidal alga *Ascophyllum nodosum* (see discussion above). This barnacle is never found attached to *A. nodosum* growing on Dorset shores.

Periclimenes sagittifer: Anemone shrimp. The first record for a single individual of this species in British mainland waters in September 2007 was reported by Doggett and Whyte (2008). Subsequent searches by the authors assisted by other divers in late 2008 showed that there was a substantial population under Swanage Pier. The proportion of the anemone *Anemonia viridis* inhabited by this shrimp has been studied and it will be interesting to see whether there are further records in 2009 after the relatively low sea water temperatures recorded early in 2009.

Anilocra cf frontalis: Fish louse. There have been increasing numbers of records of this conspicuous parasitic isopod on wrasse in Dorset waters recently, since it was first reported by Julie Hatcher at Swanage in 2005. Sightings since have ranged from east of Southbourne Pier to locations around Kimmeridge. The species occurs most frequently on small Ballan wrasse (*Labrus bergylta*) and corkwing wrasse (*Crenilabrus melops*). Unsuccessful attempts have been made to photograph this species in the wild giving the subjective impression that parasitised fish are more wary than uninfected individuals. Local fishermen have reported isopods on other fish including mackerel (*Scomber scombrus* with *Nerocila orbignyi*) and black bream (*Spondyliosoma cantharus*) which may well be a different species.

Lepas hilli: Goose barnacle. A single specimen was reported by Steve Trewhella on a plastic bucket stranded in Warbarrow Bay. This colourful species is more rarely recorded than either *L. anitifera* or *L. pectinata* which are frequently found on floating debris, though seldom on the same item, the latter species favouring smaller pieces of plastic as well as drift *Ascophyllum nodosum*.

Osilinus linearis: Toothed top-shell. This gastropod mollusc has now been recorded just east of Kimmeridge Bay on the intertidal ledges below Hen Cliff (Steve Trewhella, pers. com.) and it is now common among boulders and in rock crevices at intertidal locations to the west: Brandy Bay, Charnel and Broadbench.

Paludinella littorina: This very small gastropod mollusc was found at the level of the highest tide on the shores of Portland Harbour by Steve Trewhella together with *Truncatella subcylindrica*, and the pulmonate molluscs *Leucophytia bidentata* and *Myosotella denticulata*. Some of

Table 2:

Species	**Location**		
	Chesil Beach	Brandy Bay (four small logs)	Kimmeridge Bay (two logs)
Psiloteredo megatora	7	55, 12, 120, 90	0, 73
Teredora malleolus	865	0, 52, 0, 95	138, 47
Lyrodus pedicillatus	16	0, 0, 0, 0	0, 0
Bankia gouldi	69	0, 0, 0, 0	6, 0
Bankia bipennata	31	0, 0, 0, 0	2, 0
Teredothyra excavata	1	0, 0, 0, 0	6, 0

these species have a limited geographical distribution in England and all are restricted to a habitat at high tide level typically on limestone or other base-rich rock. *P. littorina* is a species protected under the Wildlife and Countryside Act.

Teredinidae: Ship worms (Table 2). A detailed study of shipworms has been carried out by Clifton (2008) on drift wood collected from three sites on the Dorset coast: Chesil Beach, Brandy Bay and Kimmeridge Bay. This resulted in records for a species new to the British Isles (*Bankia gouldi*) and a substantial increase in the number of records for species previously only rarely reported. Of the six species listed below only *Lyrodus pedicillatus* is considered to be a species native to British waters, the other five typically occur in drift wood either throughout the north Atlantic (*Psiloteredo*, *Teredora*) or centred in the Caribbean (*Bankia* spp). Records from Clifton's report for the Dorset strandings (as numbers of shells) are provided below (data from Clifton (2008). These unusual bivalve molluscs are rarely reported in part because of the inherent difficulties of identification which requires careful dissection from often large pieces of relatively solid timbers. For example the Chesil Beach log was over eight feet long with a square cross section of about 40cm being made of a solid hardwood.

Fish

Balistes carolinensis: Grey trigger-fish. Very few grey trigger fish were reported during the year. No records were received from divers and local fishermen noted that relatively few had been caught in pots compared with recent years.

Cetorhinus maximus: Basking shark. A single sighting off Portland Bill in July (DMP 2008).

Mola mola: Sunfish. A record from mid-July in Warbarrow Bay, two records in mid-August: Brandy Bay (DMP, 2008) and Poole Bay (Mark Golding pers. com.) and one off Tilly Whim caves to the west of Durlston at the end of August (DMP 2008).

Capros aper: Boar-fish. A single specimen was found by a member of the public stranded on one of the Kimmeridge Ledges in February. This species is normally found sublittorally in water depths of over 20m, though it occasionally strays into shallower water.

Algae

The reader is referred to the list above for records from Dorset for 2008 of interesting algae identified by the PLANTLIFE report as being either rare, declining of with a restricted southern distribution within Britain. Additional notes on two more widely distributed species are given below.

Asparagopsis armata: Harpoon weed. The gametophyte of this alien red alga has been recorded routinely from sites in Dorset during late summer in recent years, the sporophyte has long been a very common component of shallow intertidal and subtidal algal communities. However, in 2008 records were made of the gametophyte occurring frequently in shallow rock pools at Kimmeridge well into mid-winter (Steve Trewhella, Julie Hatcher, Lin Baldock, pers. obs.). It has been generally accepted that the gametophyte of this species does not occur in Britain and Ireland so late in the season (S. Krahn, pers. comm.).

Bifurcaria bifurcata: this species of brown alga was included in the list of climate change species monitored by the MarClim team who reported a large population on exposed intertidal rock on Portland Bill in 2002 (Mieszkowska *et al.* 2005). These authors considered that this represented a considerable easterly extension of range for the species. In the autumn of 2008 Steve Trewhella and Julie Hatcher discovered a very small, stunted population of *B. bifurcata* in a shallow rock pool on Broad Bench, Kimmeridge. A careful search of adjacent, apparently similar rock pools failed to find any other plants. E.M. Burrows had recorded this species from the Kimmeridge area in the 1980s (John Hawkins pers. comm.) but there have been no further reports until this one in 2008.

Marine Mammals

Records of cetacean sightings in Dorset waters are kept at Durlston Country Park near Swanage (DMP 2008) with a diary of marine mammal sightings available online at http://www.durlston.co.uk/

- **Bottlenose Dolphin** *(Tursiops truncatus):* 22 sightings spread throughout the year made up of groups of not more than four individuals.
- **Common Dolphin** *(Delphinus delphis):* four records from January and February.
- **Pilot Whale** *(Globicephala melaena):* an unconfirmed report from Portland of two individuals in March.

- **Harbour Porpoise** *(Phocoena phocoena):* three reports over a period of four days in November off Canford Cliffs. Probably the same individual.
- **Grey seal** *(Halichoerus grypus):* several records through the year of a single individual from Portland Bill, likely to be of the same animal. Other sightings of solitary individuals were received from the north side of Durlston Bay, Seacombe, Swanage, Ringstead (Baldock, pers. obs.) and West Bay.

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MICROLEPIDOPTERA REPORT 2008

Phil Sterling

Records of a number of nationally-rare and nationally-scarce species (mostly provisional statuses only) have been included, together with records of other interesting species such as rarer immigrants and those not recently recorded in the county. Nomenclature is taken from Bradley, J.D. (2000) 'Checklist of Lepidoptera recorded from the British Isles. Second Edition (Revised)'. Records of a number of nationally-scarce species and of some immigrants/partial residents regularly recorded in Dorset, have been omitted from this report. Data for all species are held at DERC.

Records were gratefully received from:

AF – Andy Foster
BE – Bryan Edwards
BN – Bernadette Noake
BPH – Barry Henwood
CMM – Chris Manley
CP – Clive Pinder
DE – David Evans
DG – David Gibbs
DGG – Dave Green
EP – Ted Pratt
HWH – Hugo Wood Homer
JC – John Cheney
JF – Julian Francis
LH – Les Hill
MC – Martin Cade
MD – M. Deans
MJ – Mike Jeffes
MSP – Mark Parsons
PAD – Peter Davey
PC – P. Clarke
PDMC – Peter Costen
PHS – Phil Sterling
RE – Roy Eden
RH – Robin Harley
RL – Ricky Lambert
RS – Bob Steedman
JH – Jeff Higgott
JMcG – James McGill
JRL – John Langmaid
JS – Jenny Spence
JW – Jim White
SMP – Steve Palmer
SP – Sue Philp
SR – Stuart Reid
TM – Tom Morris
ZR – Zoë Randle

Other abbreviations

gen. det. – genitalia determined by; conf. – confirmed by; vc = vice-county

Ectoedemia minimella Puddletown, tenanted mines in *Betula pendula* on 24.8 (HWH)
Trifurcula immundella Haymoor Bottom, 1 tenanted and few vacated mines in *Sarothamnus scoparius* on 21.3 (PHS)
Stigmella ulmariae Trig Point Field, Sopley (vc11), 2 tenanted, 3 vacated mines in *Filipendula ulmaria* on 25.9 (PHS)
Stigmella assimilella Puddletown, vacated mines in *Populus tremula* on 30.7 (HWH, conf. PHS)
Stigmella incognitella Puddletown, vacated mine in *Malus domestica* on 25.7 (HWH, PHS)
Opostega crepusculella Stubhampton Bottom, 3 at MV on 26.7 (PAD)
Pachythelia villosella Merritown Heath (vc11), 2 tenanted & 1 vacated cases on 13.5 (PHS, BPH)
Eudarcia richardsoni Penn's Weare, Portland, cases on 13.2 (MSP); Cheyne Weare, Portland, case on 20.3 (MSP); East Weare, Portland, cases on 27.2 (MSP, BN, BE); West Weare, Portland, case on 27.2 (MSP, BN, BE); Blacknor, Portland, case on 29.2 (MSP)
Leucoptera spartifoliella Haymoor Bottom, few vacated mines in *Sarothamnus scoparius* on 21.3 (PHS)
Caloptilia populetorum Puddletown, at MV on 24.7 (HWH)
Parectopa ononidis Tidmoor Range, Chickerell, tenanted mine in *Trifolium fragiferum* on 24.9 (PHS)
Argyresthia glabratella Chedington Wood, 2 at MV on 23.5 (PAD, 1 gen. det. PHS)
Yponomeuta rorrella (all records at MV) Shapwick, on 23.7 (PAD); Verwood, on 24.7 (SMP); Weymouth, 2 on 24.7 & 6 on 27.7 (PHS); Puddletown, 6 on 24.7, 8 on 25.7, 24 on 26.7, 16 on 27.7, 11 on 28.7, 2 on 29.7, 10 on 30.7, 2 on 2.8, 2 on 4.8, 3 on 7.8, on 24.8 & 6 on 26.8 (HWH); West Bexington, 3 on 25.7, 2 on 26.7, 10 on 27.7, on 30.7, 6.8 & 7.8 (RE) & 3 on 26.7 (PHS); Portland Bird Observatory, at MV on 26.7 (MC); Beaminster, at MV on 27.7 (SP); Trigon Heath, at MV on 28.7 (SR, JH, CMM, PAD); Kilwood, 3 at MV on 30.7 (PAD)
Plutella porrectella Chickerell, at actinic on 14.7 & 15.7 (CP); Verwood, at MV on 28.7 (SMP); Puddletown, at MV on 3.8 (HWH)
Epermenia aequidentellus Durlston, at MV on 29.1 (PAD); Dungy Head, 5 larvae on *Daucus carota* on 17.2 (PHS, BPH)
Metriotes lutarea Broadwindsor, few by day on 10.5 (MSP)
Coleophora badiipennella Puddletown, at MV on 10.7 (HWH, gen. det. PHS)
Coleophora binderella Chickerell, 2 cases on *Carpinus betulus* on 26.5 (PHS)
Coleophora conyzae Gad Cliff, case on *Inula conyza* on 25.4(PHS)

Coleophora solitariella Swineham, 4 cases on *Stellaria holostea* on 25.4 (HWH); Hengistbury Head (vc11), several cases on *Stellaria holostea* on 12.5 (JRL)
Coleophora niveicostella Badbury Rings, dead case beneath *Thymus* on 13.5 (PHS, BPH)
Coleophora lassella Puddletown, at MV on 29.5 & on 1.6 (HWH, both gen. det. PHS); Verwood, at MV on 26.7 (SMP, gen. det.)
Coleophora adjunctella Tidmoor Cove, by day on 3.6 (PHS, gen. det.)
Coleophora clypeiferella Weymouth, at MV on 23.7 (PHS, gen. det.)
Elachista alpinella Puddletown, 2 tenanted mines in *Carex acutiformis* on 2.7 (PHS, HWH); Maiden Newton, very many tenanted mines in *Carex acutiformis* on 7.7 (PHS, PDMC)
Elachista adscitella Pryme Plantation, Chedington, at MV on 1.7 (PHS)
Elachista bisulcella Chedington Woods, at MV on 23.7 (PHS, gen. det.)
Telechrysis tripuncta Chedington Woods, at MV on 1.7 (PAD)
Agonopterix atomella Cogden, 3 larvae on *Genista tinctoria* on 12.5 (PHS, BPH) & 3 larvae on 23.5 (MSP)
Agonopterix capreolella Winspit, at MV on 29.8 (PAD, gen. det. PHS)
Mirificarma lentiginosella Cogden, 4 larvae on *Genista tinctoria* on 12.5 (PHS, BPH)
Dichomeris alacella Verwood, at MV on 25.7 (SMP, gen. det.)
Helcystogramma lutatella Duncecroft Quarry, Portland, 12 larvae on *Brachypodium sylvaticum* and *Dactylis glomeratus* on 11.5 (PHS, BPH)
Scythris siccella Ferrybridge, larva on 3.5 (MSP, PHS)
Scythris empetrella Worgret, by day on xx.6 (DG)
Mompha lacteella Stubhampton Bottom, at MV on 10.6 (PAD, gen. det. PHS)
Phtheochroa sodaliana Stubhampton Bottom, at MV on 10.6 (PAD)
Spatalistis bifasciana Holt Heath, at MV on 24.6 (PAD); Aunt Mary's Bottom, at MV on 26.6 (DGG); Puddletown, at MV on 26.6 (HWH); Chedington Woods, at MV on 1.7 (PAD) & 4 at MV on 23.7 (PHS); Pryme Plantation, at MV on 1.7 (PHS)
Acleris shepherdana Verwood, at MV on 26.7 (SMP)
Acleris umbrana West Bexington, at MV on 26.7 (PHS)
Celypha aurofasciana Stubhampton Bottom, at MV on 10.6 (PAD, conf. PHS)
Olethreutes arcuella Chetterwood, by day on 17.5 (PAD)
Bactra lacteana Corfe Common, 2 larvae in *Carex panicea* on 18.4, 1 adult emerged 26.5, 1 died in pupa and gen. det. (PHS, JW); Verwood, at MV on 23.7 (SMP, gen. det.) & at MV on 24.7 (SMP); Godlingston Heath, on 22.7 (MSP, AF, gen. det. MSP)
Ancylis geminana East Lulworth, at MV on 26.6 (LH)
Epinotia nisella f. cinereana Merritown Heath, larva in shoot *Populus tremula* on 13.5, adult emerged 17.6 (PHS, BPH)
Epinotia nanana Chedington Woods, at MV on 23.7 (PHS)
Clavigesta sylvestrana Bovington, at actinic on 30.7 (MSP, ZR)
Pammene populana Merritown Heath (vc11), larva on *Salix repens* on 13.5, adult emerged 26.7 (PHS, BPH)
Pammene germmana Shapwick, at MV on 23.5 (PAD, conf. PHS); Holt Heath, at MV on 2.6 & 24.6 (PAD); Boys Wood, in flight between 8am and 9am on 7.6 (PAD)
Pammene ochsenheimeriana Chedington Woods, beaten from *Picea abies* by day on 16.5 (PHS, BPH) & at MV on 23.5 (PAD, conf. PHS)
Grapholita tenebrosana Chickerell, larva in hip of *Rosa canina* on 11.10 (PHS); Puddletown, 3 vacated larval workings in hips of Rosa canina on 20.10 (HWH, conf. PHS)
Grapholita lathyrana Cogden, 3 larvae on *Genista tinctoria* on 12.5 (PHS, BPH)
Cydia strobilella Chedington Woods, many larvae in cones of *Picea abies* on 4.9 (PHS, BPH, PAD)
Cydia servillana Puddletown, vacated gall in *Salix cinerea* on 12.3 (PHS, HWH)
Cydia amplana Portland Bird Observatory, 2 at MV on 26.7 & 1 at MV on 8.8 (MC); Verwood, at MV on 27.7 (SMP); Hurn (vc11), at MV on 29.7 & 18.8 (MJ); Alderholt, at MV on 27.8 (TM)
Cydia illutana Stubhampton Bottom, at MV on 10.6 (PAD, conf. PHS)
Dichrorampha senectana Gad Cliff, few larval workings in stem bases of *Leucanthemum vulgare* on 25.4, 2 adults emerged 5.6 (PHS, MSP)
Euchromius ocellea Durlston, 4 at MV on 23.1 & 5 at MV on 29.1 (PAD); Portland Bird Observatory, 2 at MV on 24.1, at MV on 28.1, 5 at MV on 29.1, at MV on 30.1 (MC); Dancing Ledge, flushed from short-turf grassland at 2pm in warm sunshine on 9.2 (PAD); Walditch, at MV on 23.1 & 29.1 (MSP)
Evergestis extimalis West Bexington, at MV on 6.8 & 16.8 (RE, both conf. PHS); Portland Bird Observatory, at MV on 7.8 (MC); East Lulworth, at MV on 8.9 (LH)
Cynaeda dentalis Winspit, at MV on 22.7 (PAD)
Sitochroa palealis Winspit, 2 at MV on 22.7 (PAD)
Phlyctaenia perlucidalis Tidmoor Range, Chickerell, larva on lower leaf of *Cirsium arvense* on 24.9 (PHS)
Udea fulvalis Strouden Park, Bournemouth (vc11), at MV on 10.7, 22.7, 23.7 & 1.8 (DE); Swanage, at MV, 14 recorded between 15.7 and 27.8, peak count 4 on 30 Jul (EP); Hurn (vc11), at MV on 16.7, 24.7, 28.7, 29.7 & 31.7 (MJ); Beaminster, 2 at MV on 22.7 (SP, conf. PHS); Wimborne, at MV on 2.8 (RS)
Mecyna flavalis Puddletown, at MV on 25.7 (HWH); West Bexington, at MV on 26.7 (PHS); Portland Bird Observatory, at MV on 26.7 (MC)
Antigastra catalaunalis Portland Bird Observatory, at MV on 15.9 (MC)
Spoladea recurvalis Eype's Mouth, at MV on 13.10 (MSP)
Palpita vitrealis Portland Bird Observatory, at MV on 7.8 & 13.10 (MC); West Bexington, at MV on 26.8 & 13.9 (RE); Durlston, at MV on 18.10 (MD, PC, JC, JS)
Agrotera nemoralis West Bexington, at MV on 24.6 (RE)
Conobathra tumidana Preston, Weymouth, at MV on 25.7 (RL); Portland Bird Observatory, at MV on 25.7 (MC)
Oncocera semirubella West Bexington, at MV on 26.7 (PHS); Trigon Heath, at MV on 28.7 (SR, JH, CMM, PAD); Kilwood, at MV on 30.7 (PAD); Bovington, 2 at actinic on 30.7 (MSP, ZR)

Elegia similella Alderholt, at MV on 26.6 (TM); Puddletown, at MV on 26.7 (HWH)
Epischnia bankesiella Gad Cliff, larva on *Inula crithmoides* on 25.4 (MSP, PHS)
Assara terebrella Chedington Woods, 3 at MV on 1.7 (JMcG, PAD) & 40 at MV on 23.7 (PAD, PHS); Stubhampton Bottom, 4 at MV on 26.7 (PAD); East Lulworth, at MV on 28.7 (MSP); Trigon Heath, at MV on 28.7 (SR, JH, CMM, PAD); Wareham Forest, 1 adult emerged on 3.5 from cones *Picea abies* collected on 30.1 (MSP)
Nephopterix angustella Puddletown, at MV on 10.6 (HWH); West Bexington, at MV on 13.10 (RE); Walditch, at MV on 15.10 (MSP)
Ancylosis oblitella Portland Bird Observatory, at MV on 31.8 (MC)
Ephestia elutella Tolpuddle, adult found indoors on 12.11 (JF, gen. det. PHS)
Homoeosoma nebulella Alderholt, at MV on 1.6 (TM); Stanpit Marsh (vc11), at MV on 8.6 (PAD, RH)
Platyptilia isodactylus Stanpit Marsh (vc11), 100 mainly at dusk but also at MV on 8.6 (PAD, RH) & 10 at MV on 15.8 (PAD)

MACROLEPIDOPTERA REPORT 2008

Peter Davey

Records were gratefully received from:

AB	Arthur Bryant	MD	M. Deans
AH	Andrew Hodgson	MHa	M. Hammett
AR	Amber Rosenthal	MHe	Mike Hetherington
BC	Butterfly Conservation	MJ	Mike Jeffes
BH	Barry Henwood	MPl	Mike Plaxton
BN	Bernadette Noake	MS	Mark Sterling
BP	Beryl Parramore	MSP	Mark Parsons
BY	Bridgit Young	MW	Martin Warren
CC	Chris Court	NS	Nigel Spring
CM	Chris Manley	OW	Oliver Woodland
CP	Clive Pinder	PAD	Peter Davey
D&JK	David and Jan Kingman	PBe	Paul Benham
		PB-J	Peter Bruce-Jones
D&MG	David and Margaret Godfrey	PBO	via Portland Bird Observatory website
DA	Danny Alder		
DE	D. Emery	PBu	Paul Butter
DF	Dave Foot	PC	Peter Costen
DG	Dave Green	PE	Phyl England
DLa	Dave Law	PG	Penny Goodwin
DLe	David Leadbetter	PHS	Phil Sterling
DP	David Pickett	PT	Peggy Taylor
EC	Emma Cockburn	R&LL	Richard and Lyn Lambert
FT	Fran Taylor		
GC	Gordon Cryer	R&TH	Richard and Theresa Hughes
GM	Graham Masters		
GRH	Gordon Hopkins	RA	Richard Adams
GS	Geoffrey Sell	RC	Richard Caldow
HWH	Hugo Wood Homer	RE	Roy Eden
JCl	Julian Clarke	RG	Roy Goff
JCo	Jonathan Cox	RH	Robin Harley
JD	John Down	RL	Ricky Lambert
JF	Jim Fradgley	RRC	Ray Cook
JH	Jeff Higgott	RSm	Roger Smith
JK	John Knowler	RSt	Bob Steedman
JM	James McGill	SA	Sue Anderson
JN	John Newbould	SE	Sam Ellis
JRC	Rees Cox	SMP	Steve Palmer
JW	John Winterbottom	SPh	Sue Philp
KH	Ms Kathy Henderson	SR	Stuart Reid
KMc	Kevin McCabe	TP	Ted Pratt
LdW	Lawrie de Whalley	VG	Vince Giavarini
LH	Les Hill	WGS	Bill Shreeves
LS	Lee Southall	WR	Bill Raymond
MB	Maurice Budden	ZR	Zoë Randall

Unless otherwise stated, all records are of adult moths observed at light traps. Where no quantity is given, a single moth is assumed.

16 *Hepialus hecta* **GOLD SWIFT** Chedington Woods, 1.7 (JM)

161 *Zeuzera pyrina* **LEOPARD** West Bexington, 29.6, 21.7, 22.7 (RE); Broadmayne, 1.7 (PB-J); Gillingham, 1.7 (GRH); Kingston, 3 on 14.7 (PBe); Verwood, 14.7, 25.7 (CC); Chedington Woods, 23.7 (PAD); Alners Gorse, 2 on 2.8 (GRH *et al*); Turnworth, 5.8 (D&JK, LdW, PAD, PBu)

162 *Cossus cossus* **GOAT** Charmouth, 10.6 (GS)

163 *Adscita statices* **FORESTER** Melbury Down, by day in good numbers on 17.6 (MSP, RRC)

164 *Adscita geryon* **CISTUS FORESTER** Black Hill, by day on 8.6 (SA), 4 by day on 15.6 (KH)

170 *Zygaena trifolii palustrella* **FIVE-SPOT BURNET** ssp. *palustrella* Iwerne Minster, 3 by day on 4.6 (WR); Melbury Down, by day in good numbers on 17.6 (MSP, RRC)

170 *Zygaena trifolii decreta* **FIVE-SPOT BURNET** ssp. *decreta* West Moors, 7 by day on 29.6, 8 by day on 8.7 (RRC)

170 *Zygaena sp.* **'FIVE-SPOT BURNET'** Bindon Hill, 2 by day on 9.6.2006 (SE); Corfe Mullen, by day on 15.7 (R&LL); Durdle Door, 2 during evening on 29.6 (KMc); Purewell Meadows, by day on 20.6 (RH); Shaftesbury, 6 by day on 20.7 (WGS)

173 *Apoda limacodes* **FESTOON** Broadmayne, 31.5, 2 on 9.6, 14.7 (PB-J); Poole, 8.6 (VG); Spetisbury, 24.6, 5.7 (D&JK); Holt Heath, 4 on 24.6 (PAD); Ashington, 25.6 (JF); Puddletown, 28.6, 1.7, 3 on 14.7 (HWH); East Holme, 1.7 (JCo); Verwood, 1.7 (CC); Wareham, 1.7 (RA); Ringwood Forest, 2.7 (RG); Hurn, 4.7 (MJ)

371 *Sesia bembeciformis* **LUNAR HORNET** Haymoor Bottom, many holes at base of trees of *Salix cinerea* on 21.3 (PHS); Kilwood, many tunnels in cut sallow stumps on 20.4 (PAD); Rampisham, tunnels in *Salix* trunks on 26.6 (DG)

373 *Synanthedon tipuliformis* **CURRANT CLEARWING** Verwood, by day on 8.6 (CC)

374 *Synanthedon vespiformis* **YELLOW-LEGGED CLEARWING** Alners Gorse, to pheromone on 26.6 (D&JK)

378 *Synanthedon andrenaeformis* **ORANGE-TAILED CLEARWING** Spetisbury, to pheromone on 3.7 and on 23.7 (D&JK)

380 *Synanthedon formicaeformis* **RED-TIPPED CLEARWING** Verwood, 13.6 (CC); Alners Gorse, to pheromone on 26.6 (D&JK); Corfe Common, 2 to pheromone on 1.7 (D&JK); Ringwood Forest, to pheromone on 2.7 (RG)

381 *Synanthedon culiciformis* **LARGE RED-BELTED CLEARWING** Verwood, sitting on *cotoneaster* flowers on 7.5 (M Weaver)

382 *Bembecia scopigera* **SIX-BELTED CLEARWING** St Alban's Head, 11 to pheromone on 1.7 (D&JK)

1632 *Trichiura crataegi* **PALE EGGAR** West Bexington, 21.8, 22.8, 3 on 24.8, 4 on 25.8, 8 on 26.8, 5 on 28.8, 2 on 29.8, 3 on 30.8, 3 on 31.8, 3 on 1.9, 3 on 2.9, 5.9, 6.9, 6 on 7.9, 7.9 (MS), 4 on 8.9, 9.9, 10.9, 2 on 11.9, 12.9, 13.9, 16.9, 17.9, 18.9 (RE); Puddletown, 26.8, 27.8, 29.8, 8.9, 13.9 (HWH); Kingston, 28.8, 13.9, 17.9 (PBe); Puncknowle, 29.8 (MHe); Walditch, 7.9, 2 on 8.9 (MSP); Spetisbury, 8.9, 10.9 (D&JK); Shaggs, 11.9 (LH); Winterborne Stickland, 2 on 12.9, 3 on 13.9 (LdW)

1633 *Eriogaster lanestris* **SMALL EGGAR** Puddletown, 30.3, 2 on 1.4, nest on 7.6 (HWH); West Bexington, 30.3, 4 on 31.3, 1.4, 4 on 2.4, 3.4, 2 on 4.4 (RE); Dorchester, 3.4 (JD); Marnhull, larva on 22.6 (DLa)

1642 *Gastropacha quercifolia* **LAPPET** Chickerell, 25.6 (PHS); West Bexington, 27.6, 28.6, 2 on 30.6, 2 on 1.7, 8.7, 2 on 10.7, 12.7, 13.7, 2 on 15.7, 16.7, 3 on 17.7, 2 on 18.7, 3 on 19.7, 23.7 (RE); Puddletown, 1.7, 8.7, 12.7, 16.7 (HWH); Swanage, 25.7 (PE)

1643 *Pavonia pavonia* **EMPEROR** Hurn, 26.4, 7.5 (MJ); Puddletown, 7.5 (HWH); Merritown Heath, freshly emerged on 13.5 (BH, PHS)

1647 *Drepana cultraria* **BARRED HOOK-TIP** Turnworth, 8.5 (LdW), 5.8 (D&JK, LdW, PAD, PBu); West Bexington, 10.5 (RE) Lewesdon Hill, 11.5 (BH, PHS); Puddletown, 12.5, 24.7, 27.7, 2.8, 2 on 6.8 (HWH); Shaggs, 27.5 (LH); Spetisbury, 18.7 (D&JK)

1659 *Achlya flavicornis* **YELLOW HORNED** Shaggs, 5 on 27.2 (LH), 5 on 5.3 (BC), 2 on 6.3 (LH); Hurn, 2 on 27.2, 3 on 1.3, 2 on 2.3, 4 on 6.3, 4 on 14.3, 2 on 21.3 (MJ); Ameysford, 2 by day on 5.3 (PHS); Ashington, 2 on 15.3 (JF); Portland, 15.3 (PBO); Puddletown, 25.3 (HWH); Wareham, 25.3 (RA); Wimborne, 15.3 (D&MG)

1660 *Polyploca ridens* **FROSTED GREEN** Hurn, 2.4, 3.4, 27.4, 29.4, 3.5 (MJ); Alners Gorse, 8 on 3.4 (PAD), 2 on 2.5 (GRH *et al*), 5 on 3.5 (PAD); Kilwood, 20.4 (PAD); Kingcombe, 21.4 (NS); Wareham, 21.4 (RA); Ashington, 3 on 22.4, 2 on 26.4 (JF); Kingston, 22.4, 3.5, 2 on 8.5 (PBe); Wimborne, 2 on 22.4, 25.4 (D&MG); East Holme, 25.4 (JCo); Winterborne Stickland, 4.5 (LdW); Puddletown, 26.4 (HWH)

1667 *Comibaena bajularia* **BLOTCHED EMERALD** Hurn, 7.6, 4 on 10.6, 19.6, 29.6 (MJ); Ashington, 11.6, 25.6 (JF); Colehill, 11.6 (RSt); Wimborne, 15.6 (D&MG); Holt Heath, 6 on 24.6 (PAD); Chedington Woods, 2 on 1.7 (JM, PAD); Ringwood Forest, 2.7 (RG)

1670 *Chlorissa viridata* **SMALL GRASS EMERALD** Swanage, 2 on 11.7, 3 on 12.7, 3 on 13.7 (JRC)

1674 *Jodis lactearia* **LITTLE EMERALD** Stubhampton Bottom, 12 on 10.6 (PAD); Holt Heath, 5 on 24.6 (PAD); Ringwood Forest, 2.7 (RG)

1675 *Cyclophora pendularia* **DINGY MOCHA** Hurn, 25.5 (MJ); Higher Hyde, 2 on 11.7 (DF); Winfrith heath, late 4th instar larva on 29.6, late 3rd instar larva on 30.6 (MHa), 3 larvae beaten on 27.8 (BN, MSP); Bryants Puddle Heath, larva beaten on 29.8 (MSP); Tadnoll Heath, larva beaten on 29.8 (BN, MSP); Throop Heath, 2 larvae beaten on 29.8 (BN, MSP), larva beaten on 29.8 (BN, MSP), larva beaten on 29.8 (MSP); Bloxworth Heath, larva beaten on 1.9 (BN, MSP); Deadmoor Common, larva beaten on 3.9 (BN, MSP); Alners Gorse, larva beaten on 3.9 (BN, MSP); Rooksmoor, larva beaten on 3.9 (BN, MSP); Parley Common, 7 larvae beaten on 4.9 (JCl); Holt Heath, 4 larvae beaten on 4.9 (JCl), larva beaten on 4.9 (BN); Parley Common, 3 larvae beaten on 4.9 (BN), 2 larvae beaten on 10.9 (RRC); Warmwell Heath, larva beaten on 8.9 (MSP)

1676 *Cyclophora annulata* **MOCHA** Wyke Wood, 11.5 (BH, PHS); Chedington Woods, 7 on 23.5 (PAD), 23.7 (PHS); Garston Wood, 2 on 18.7 (AH); Puddletown, 7.8 (HWH)

1677 *Cyclophora albipunctata* **BIRCH MOCHA** Beacon Hill, 8.5 (RSt); Hurn, 2 on 8.5, 10.5, 11.5, 26.5, 21.7, 22.7, 24.7, 29.7, 4.8, 10.8, 18.8, 29.8 (MJ); Wareham, 31.5 (BY); Ashington, 1.6, 3.8 (JF); Holt Heath, 2 on 2.6 (PAD), 24.6 (PAD); Verwood, 8.6, 14.7, 7.8 (CC), 27.7, 28.7 (SMP); East Holme, 24.7 (JCo); Trigon, 28.7 (CM, JH, PAD, SR), 28.7 (CM, JH, PAD, SR); Kilwood, 3 on 30.7 (PAD); Canford Heath, 30.7 (JK); Shaggs, 7.8 (LH); Morden Bog, 26.8 (PAD)

1678 *Cyclophora puppillaria* **BLAIR'S MOCHA** Poole, 5.5 (VG)

1678.1 *Cyclophora ruficiliaria* **JERSEY MOCHA** Chickerell, 2.8 (CP); Walditch, 3.8 (MSP)

1689 *Scopula marginepunctata* **MULLEIN WAVE** Winspit, 2 on 9.5 (PAD); East Holme, 22.6, 8.9 (JCo); Wareham, 31.5, 2.6, 9.6 (BY), 3.7 (RA), 17.7 (RA), 27.7 (BY), 4 on 7.8 (RA), 7.8, 2 on 21.8, 29.8 (BY); Beacon Hill, 12.6 (RSt); Fortuneswell, 14.6 (EC); Swanage, 21.6, 26.7 (JRC); Wyke Regis, 23.6, 2 on 12.9 (DF); Creech Bottom, 29.6 (KMc); West Bexington, 1.7, 25.7 (RE); Canford Cliffs, 29.8 (PT)

1692 *Scopula immutata* **LESSER CREAM WAVE** Trigon, 28.7 (CM, JH, PAD, SR); Ashington, 31.7 (JF); Puncknowle, 1.8 (MHe, LS); Chickerell, 3.8 (CP)

1693 *Scopula floslactata* **CREAM WAVE** Broadmayne, 13.5 (PB-J); Corfe Castle, 16.5 (RC); Chedington Woods, 23.5 (PAD); Puddletown Forest, 26.5 (HWH); Verwood, 30.5 (CC); Ashington, 1.6 (JF); Bere Heath, 7.6 (DF, PHS); Stubhampton Bottom, 10.6 (PAD)

1698 *Idaea muricata* **PURPLE-BORDERED GOLD** Creech Bottom, during evening on 23.6 (KMc), 5 in early morning sunshine on 4.7 (KMc); Studland, by day on 16.7 (JN)

1699 *Idaea vulpinaria atrosignaria* **LEAST CARPET** Weymouth, 23.7 (PHS); Spetisbury, 25.7 (D&JK); Wyke Regis, 1.8 (DF)

1701 *Idaea sylvestraria* **DOTTED-BORDER WAVE** Ringwood Forest, 2.7 (RG); Higher Hyde, 11.7 (DF); Lytchett Matravers, by day on 19.7 (LdW); Trigon, 28.7 (CM, JH, PAD, SR); Canford Heath, 30.7 (AR, LH), 30.7 (JK)

1705 *Idaea fuscovenosa* **DWARF CREAM WAVE** Hurn, 26.6, 1.7, 10.7, 12.7, 20.7 (MJ); Poole, 27.6, 2 on 29.6, 19.7, 22.7 (VG); Shaggs, 2 on 14.7, 15.7 (BC); Colehill, 5 on 16.7 (RSt); Spetisbury, 26.7 (D&JK); Verwood, 26.7, 27.7, 28.7 (SMP); Bagmore Wood, 29.7 (MPl); Canford Heath, 30.7 (AR, LH)

1709 *Idaea subsericeata* **SATIN WAVE** West Bexington, 22.5, 31.5 (RE); Creech Bottom, 2 on 24.6, 25.6 (KMc); Ashington, 25.6 (JF); Higher Hyde, 11.7 (DF); Puddletown, 3.8 (HWH); Winterborne Stickland, 6.8 (LdW); Wareham, 21.8 (BY); Shaggs, 28.8 (BC)

1712 *Idaea emarginata* **SMALL SCALLOP** Gillingham, 17.7 (GRH); Hurn, 24.7 (MJ); Canford Heath, 30.7 (AR, LH)

1714 *Idaea degeneraria* **PORTLAND RIBBON WAVE** Winspit, 31.5 (PAD); Osmington, by day on 15.7 (JN); Highcliffe, to porch light on 12.9 (BP); West Bexington, 13.9 (RE); Charmouth, 15.9 (GS)

1715 *Idaea straminata* **PLAIN WAVE** Creech Bottom, 30.6, 3 on 2.7, 3.7, 4.7 (KMc); Ringwood Forest, 2.7 (RG); Higher Hyde, 11.7 (DF); Ashington, 14.7, 15.7, 3 on 31.7 (JF); Merley, 15.7 (RSt); Colehill, 2 on 16.7 (RSt); Highcliffe, 25.7 (DLe); Verwood, 27.7 (SMP); East Holme, 28.7 (JCo); Trigon, 28.7 (CM, JH, PAD, SR); Bovington, 30.7 (MSP, ZR); Wareham, 7.8 (BY)

1716 *Rhodometra sacraria* **VESTAL** Winterborne Stickland, 7.8 (LdW); Gillingham, 9.9 (GRH); Portland, 2 on 15.9, 16.9, 5 on 14.10, 15.10 (PBO); Kingston, 10.10 (PBe); Puddletown, 2 on 12.10, 17.10 (HWH); Walditch, 12.10 (MSP); Corfe Castle, 12.10 (RC); East Holme, 13.10 (JCo); Spetisbury, 13.10 (D&JK); Wareham, 13.10 (RA), 14.10 (BY)

1718 *Phibalapteryx virgata* **OBLIQUE STRIPED** Portland, 19.5 (PBO)

1719 *Orthonama vittata* **OBLIQUE CARPET** Stanpit Marsh, 8.6 (PAD, RH)

1720 *Orthonama obstipata* **GEM** Puddletown, 2.7, 8.7, 6.8, 21.8, 2 on 27.8, 25.10 (HWH); Portland, 24.8, 16.9 (PBO); Dorchester, 27.8 (JD); Wareham, 29.8 (BY); Walditch, 10.10 (MSP), 12.10 (MSP); West Bexington, 3 on 11.10, 12.10 (RE); Swanage, 11.10 (PE); Burton Bradstock, at dusk and on ivy blossom on 12.10 (MSP)

1725 *Xanthorhoe ferrugata* **DARK-BARRED TWIN-SPOT CARPET** Hurn, 5.5, 10.5, 14.7, 2 on 22.7, 23.7, 24.7, 3 on 28.7, 2 on 29.7, 30.7, 4.8, 6.8, 10.8, 2 on 11.8, 13.8, 2 on 15.8, 2 on 16.8, 17.8, 18.8, 20.8, 22.8 (MJ); Wimborne St Giles, 10.5, 3 on 25.7 (JW); Wareham, 22.7, 27.7 (BY); Verwood, 4.8, 8.8 (CC), 28.7 (SMP)

1731 *Scotopteryx bipunctaria cretata* **CHALK CARPET** Winspit, 22.7 (PAD); Compton Down, by day on 26.7 (SE); Worth Matravers, 27.7, 29.7 (JK); Lyme Regis, by day on 26.8 (OW)

1733 *Scotopteryx mucronata* **LEAD BELLE** Black Down, 30.5 (PHS), 12 flushed from gorse on 31.5 (PAD)

1734 *Scotopteryx luridata plumbaria* **JULY BELLE** Chickerell, 25.6 (PHS), 29.7, 30.7 (CP); Trigon, 28.7 (CM, JH, PAD, SR); Canford Heath, 30.7 (AR, LH), 30.7 (JK)

1735 *Catarhoe rubidata* **RUDDY CARPET** Spetisbury, 3.7 (D&JK); Holditch, 7.7 (DP); Puddletown, 23.7 (HWH)

1736 *Catarhoe cuculata* **ROYAL MANTLE** Charmouth, 15.7 (GS)

1739 *Epirrhoe rivata* **WOOD CARPET** Loscombe, 7.6 (OW); Puddletown, 22.6, 25.6, 30.6, 5 on 1.7, 13.7, 3 on 14.7 (HWH); Swanage, 25.7 (PE); West Bexington, 21.8, 30.8 (RE)

1740 *Epirrhoe galiata* **GALIUM CARPET** Beaminster, 2 on 8.5, 2 on 5.8 (SPh); Winspit, 11 on 31.5, 22.7 (PAD); West Bexington, 9.6, 27.7, 29.8, 30.8 (RE); Swanage, 5 on 19.6 (TP), 10.8 (PE), 16.9 (TP); Preston, 25.7 (RL)

1745 *Larentia clavaria* **MALLOW** Portland Bill, 12 larvae in torchlight at night sitting on *Malva sylvestris* leaves on 12.5 (BH, PHS); West Bexington, 8.10, 11.10 (RE), 12.10 (PHS), 12.10, 16.10, 17.10, 18.10, 23.10, 24.10 (RE); Walditch, 10.10, 13.10 (MSP); Burton Bradstock, 12 at dusk and on ivy blossom on 12.10 (MSP); Eype's Mouth, 13.10 (MSP)

1748 *Mesoleuca albicillata* **BEAUTIFUL CARPET** Verwood, 1.7 (CC); West Bexington, 19.7 (RE)

1749 *Pelurga comitata* **DARK SPINACH** Portland, 25.7 (PBO); Puddletown, 30.7 (HWH)

1750 *Lampropteryx suffumata* **WATER CARPET** Puddletown, 14.3, 30.3 (HWH); Warre Wood, 2 on 14.3 (DF, PHS); Motcombe, 3.4 (PBu); Alners Gorse, 3.4, 3.5 (PAD); Lewesdon Hill, 11.5 (BH, PHS); Wimborne St Giles, 3 on 16.5 (JW); Chedington Woods, 23.5 (PAD)

1751 *Lampropteryx otregiata* **DEVON CARPET** Wimborne St Giles, 16.5 (JW); Chedington Woods, 7 on 23.5 (PAD); Trigon, 28.7 (CM, JH, PAD, SR)

1755 *Eulithis testata* **CHEVRON** Powerstock Common, 11.7 (PHS)

1766 *Plemyria rubiginata* **BLUE-BORDERED CARPET** West Bexington, 11.6, 21.6, 22.6, 25.6, 28.6, 29.6, 30.6, 1.7, 12.7, 14.7 (RE); Creech Bottom, 24.6 (KMc); Gillingham, 28.6 (GRH); Puddletown, 1.7, 3.7, 13.7, 2 on 15.7, 24.7 (HWH); Wareham, 24.7 (BY)

1771.1 *Thera cupressata* **CYPRESS CARPET** West Bexington, 15.5, 19.5, 22.5, 28.5, 29.5, 30.5, 2 on 31.5, 3 on 1.6, 3 on 2.6, 2 on 3.6, 4 on 7.6, 2 on 9.6, 2 on 10.6, 14.6, 15.6, 24.6, 8.10, 12.10 (PHS), 3 on 13.10, 14.10, 15.10, 16.10, 17.10, 3 on 13.11, 15.11, 2 on 18.11, 2 on 19.11, 26.11 (RE); Swanage, 23.5 (PE), 9.6 (TP), 18.10 (PE); Chickerell, 29.5 (CP); Preston, 29.5, 24.6 (RL); Highcliffe, 31.5, 1.6, 10.6, 13.6, 2 on 14.6, 20.6, 24.6, 25.6, 29.6 (DLe); Bournemouth, 7.6 (AB, CC, GRH, *et al*); Poole, 2 on 7.6, 8.6, 13.10 (VG); Broadmayne, 8.6, 11.6, 12.6, 24.6, 21.7 (PB-J); Spetisbury, 9.6, 10.6 (D&JK); Charmouth, 10.6, 2.7, 8.7 (GS); Wareham, 10.6 (BY), 17.6 (RA); Canford

Cliffs, 10.6 (PT); Merley, 11.6 (RSt); Puddletown, 14.6, 30.6, 1.7, 2.7, 26.11 (HWH); Creech Bottom, 22.6, 23.6, 29.6 (KMc); Wimborne, 22.6, 8.7 (D&MG); Walditch, 24.6, 15.11 (MSP); Lyme Regis, 15.10 (OW); Sutton Poyntz, 18.10 (DE); East Holme, 15.11 (JCo)

1775 *Colostigia multistrigaria* **MOTTLED GREY** Portland, 17.1 (PBO), 2 by day, one in the open, the other under a stone on 29.2 (MSP); Broadmayne, 23.2 (PB-J); Kingcombe, 21.4, 22.4 (NS)

1778 *Hydriomena impluviata* **MAY HIGHFLYER** Hurn, 5.5, 11.5, 12.5, 4 on 21.5, 4 on 22.5, 2 on 26.5, 2.6, 4.6, 12.6 (MJ); Bagmore Wood, 9.5 (MPl); Kingcombe, 2 on 10.5 (NS); Puddletown, 10.5, 2 on 22.5, 10.6 (HWH); Poole, 11.5 (VG); Beaminster, 12.5, 22.5, 4 on 27.5, 7.6 (SPh); Shaggs, 15.5 (BC); Bridport, 23.5 (MB); Chedington Woods, 8 on 23.5, 1.7 (PAD); Broadmayne, 25.5 (PB-J); Gillingham, 25.5 (GRH); East Holme, 11.6 (JCo)

1779 *Hydriomena ruberata* **RUDDY HIGHFLYER** Seatown, by day, at toilet block light on 5.5 (MSP)

1789 *Rheumaptera undulata* **SCALLOP SHELL** Holt Heath, 2.6 (PAD); Creech Bottom, 28.6 (KMc), 2.7 (KMc); Shaggs, 1.7 (LH), 14.7, 15.7, 22.7, 23.7, 24.7 (BC); Puddletown, 14.7 (HWH); Charmouth, 18.7 (GS); Chedington Woods, 23.7 (PHS); Motcombe, 25.7 (PBu); Stubhampton Bottom, 26.7 (CC, MW, PAD); Trigon, 28.7 (CM, JH, PAD, SR); Kilwood, 2 on 30.7 (PAD); Colehill, 2.8 (RSt)

1791 *Philereme vetulata* **BROWN SCALLOP** Chedington Woods, 23.7 (PAD); Hurn, 4.8 (MJ)

1792 *Philereme transversata* **DARK UMBER** Charlton Marshall, 3 larvae on *Rhamnus catharticus* on 15.5 (BH, PHS); Spetisbury, 7.7, 22.7 (D&JK); Puddletown, 16.7, 18.7, 2 on 23.7, 2 on 26.7, 2 on 27.7 (HWH); Gillingham, 23.7 (GRH); Stubhampton Bottom, 26.7 (CC, MW, PAD); Sutton Poyntz, 5.8 (DE)

1793 *Euphyia biangulata* **CLOAKED CARPET** Puddletown, 24.6, 28.6, 12.7, 17.7 (HWH); Stone's Common, 28.6 (DF); Pryme Plantation, 1.7 (PHS); Shaggs, 2 on 14.7, 30.7 (BC); Ashington, 16.7 (JF); Chedington Woods, 23.7 (PAD); Walditch, 25.7 (MSP); Kilwood, 2 on 30.7 (PAD); Swanage, 10.8 (PE)

1794 *Euphyia unangulata* **SHARP-ANGLED CARPET** Beaminter, 4.6 (SPh), 7.6 (SPh), 3 on 10.6 (SPh), 17.6 (SPh), 5.8 (SPh); Kingston, 1.7 (PBe); Turnworth, 2 on 3.7 (LdW); Holditch, 6.7 (DP), 7.7 (DP)

1804 *Perizoma bifaciata* **BARRED RIVULET** West Bexington, 14.8, 20.8 (RE)

1807 *Perizoma albulata* **GRASS RIVULET** Verwood, 8.6 (CC); Ashington, 11.6 (JF)

1811 *Eupithecia tenuiata* **SLENDER PUG** Wimborne St Giles, 11.7 (JW); Puddletown, 13.7, 14.7, 17.7, 23.7, 2 on 24.7 (HWH); Hurn, 22.7, 24.7 (MJ); Chedington Woods, 13 on 23.7 (PAD, PHS); Verwood, 23.7 (SMP); West Bexington, 26.7 (PHS); Kilwood, 15 on 30.7 (PAD)

1812 *Eupithecia inturbata* **MAPLE PUG** Puddletown, 24.7, 25.7, 27.7, 30.7, 1.8, 6.8 (HWH); Kilwood, 5 on 30.7 (PAD); Dorchester, 2.8 (JD); West Bexington, 7.8 (RE)

1815 *Eupithecia abietaria* **CLOAKED PUG** Chedington Woods, 2 on 1.7 (JM, PAD)

1816 *Eupithecia linariata* **TOADFLAX PUG** West Bexington, 29.6, 27.7 (RE); Fortuneswell, 1.7, 2 on 28.7 (EC); Puddletown, 4.8 (HWH)

1818 *Eupithecia irriguata* **MARBLED PUG** Alners Gorse, 3.5 (PAD); Kingston, 8.5 (PBe)

1821 *Eupithecia valerianata* **VALERIAN PUG** Winspit, more than 80 flying around red valerian at dusk on 9.5, 8 on 31.5 (PAD); Stubhampton Bottom, 10.6 (PAD); Puddletown, 1.7 (HWH)

1826 *Eupithecia trisignaria* **TRIPLE-SPOTTED PUG** Chedington Woods, on 23.7 (PHS), 12 larvae in seedheads Angelica sylvestris on 4.9 (BH, PAD, PHS)

1827 *Eupithecia intricata* **FREYER'S PUG** Swanage, 15.5, 2 on 21.5, 2 on 22.5, 23.5 (JRC), 25.5 (TP), 28.5, 2 on 29.5 (JRC), 30.5 (TP), 4 on 31.5 (JRC); Hurn, 21.5 (MJ); Wareham, 29.5, 2 on 7.6, 2 on 17.6 (RA); Holt Heath, 2.6 (PAD); Spetisbury, 5.6 (D&JK); Highcliffe, 8.6 (DLe); Gillingham, 12.6 (GRH)

1828 *Eupithecia satyrata* **SATYR PUG** Stubhampton Bottom, 10.6 (PAD)

1830 *Eupithecia absinthiata* **WORMWOOD PUG** Wareham, 8.5 (BY); Shaggs, 2 on 13.5 (LH), 30.7 (BC), 14.8 (LH); Chickerell, 31.5, 30.6, 14.7, 23.7, 25.7, 2 on 6.8, 4 on 7.8 (CP); Wimborne, 2 on 31.5, 8.6 (D&MG); West Bexington, 11.7, 18.7 (RE), 26.7 (PHS), 31.7, 6.8, 7.8, 8.8 (RE); Spetisbury, 17.7 (D&JK); Broadmayne, 18.7, 21.7, 22.7 (PB-J); Winspit, 5 on 22.7 (PAD); Swanage, 24.7 (TP), 25.7 (JRC), 29.7 (TP), 2.8, 7.8 (JRC); Walditch, 2 on 24.7, 6.8 (MSP); Trigon, 28.7 (CM, JH, PAD, SR); Alners Gorse, 2.8 (GRH *et al*); Ashington, 2 on 3.8 (JF); Hurn, 20.8, 29.8 (MJ)

1831 *Eupithecia goossensiata* **LING PUG** Canford Heath, 30.7 (AR, LH); Puddletown, 30.8 (HWH)

1832 *Eupithecia assimilata* **CURRANT PUG** Gillingham, 4.5 (GRH); Verwood, 9.5, 31.5 (CC); Wimborne, 10.5 (D&MG); Chickerell, 13.5, 26.7, 2 on 6.8 (CP); Dorchester, 14.5, 27.7 (JD); Swanage, 16.5, 17.5, 23.8 (JRC); Bridport, 21.5, 10.6 (MB); West Bexington, 11.6, 15.7, 16.7, 19.7, 8.8, 22.8, 30.8 (RE); Broadmayne, 11.6 (PB-J); East Holme, 4.8, 8.8, 21.8 (JCo); Hurn, 2 on 7.8 (MJ); Puddletown, 2 on 7.8 (HWH); Kingston, 28.8 (PBe)

1838 *Eupithecia icterata* **TAWNY-SPECKLED PUG** Poole, 3 on 7.6, 8.6 (VG); Ashington, 22.6 (JF); Swanage, 29.6, 29.8 (JRC); Winspit, 8 on 22.7 (PAD); Hurn, 24.7 (MJ)

1839 *Eupithecia succenturiata* **BORDERED PUG** Ashington, 2.7 (JF); Kingston, 14.7 (PBe)

1840 *Eupithecia subumbrata* **SHADED PUG** West Bexington, 14.5 (BH, PHS); Winspit, 7 on 31.5 (PAD); Puddletown, 9.6, 26.6, 28.6 (HWH)

1841 *Eupithecia millefoliata* **YARROW PUG** West Bexington, 26.7 (RE)

1842 *Eupithecia simpliciata* **PLAIN PUG** Hurn, 10.5 (MJ); Wimborne St Giles, 12.7 (JW); West Bexington, 22.7 (RE); Winspit, 2 on 22.7 (PAD); Spetisbury, 26.7 (D&JK)

1844 *Eupithecia indigata* **OCHREOUS PUG** Verwood, 9.5 (CC); Chedington Woods, 23.5 (PAD)

1845 *Eupithecia pimpinellata* **PIMPINEL PUG** Winspit, 22.7 (PAD); Spetisbury, 5.8, 2 on 21.8 (D&JK)

1848 *Eupithecia innotata* **ANGLE-BARRED PUG** Puddletown, 6.5, 2 on 9.5, 28.7 (HWH); Ashington, 10.5 (JF)

1855 *Eupithecia phoeniceata* **CYPRESS PUG** Swanage, 1.6, 9.6, 5 on 13.8, 21.8, 27.8 (JRC), 27.8 (TP), 30.8, 13.9 (JRC); Poole, 12.7, 15.8, 14.9 (VG); Charmouth, 11.8, 26.9 (GS); Wareham, 19.8, 4 on 21.8 (RA), 29.8 (BY); West Bexington, 26.7 (PHS), 14.8, 21.8, 22.8, 23.8, 1.9, 11.9, 13.9, 14.9, 19.9, 21.9, 22.9, 23.9, 25.9, 12.10 (RE); Wimborne, 28.8 (D&MG); Highcliffe, 2 on 29.8, 12.9, 26.9 (DLe); Lyme Regis, 15.10 (OW); Chickerell, 4.11, 6.11 (CP)

1855.1 *Eupithecia ultimaria* **CHANNEL ISLAND PUG** West Bexington, 24.6, 6.8, 8.8 (RE)

1856 *Eupithecia lariciata* **LARCH PUG** Ashington, 4.5 (JF); Puddletown, 7.5, 9.5, 28.5 (HWH); Broadmayne, 2 on 1.6, 4.6, 9.6, 21.6, 30.6 (PB-J); Stubhampton Bottom, 3 on 10.6 (PAD)

1857 *Eupithecia tantillaria* **DWARF PUG** Hurn, 4.5, 7.5, 8.5, 2 on 21.5, 2 on 22.5 (MJ); Puddletown, 9.5, 10.5, 15.5, 16.5, 20.5, 27.5, 29.5, 9.6, 11.6 (HWH); Avon Heath, beaten from roadside *Abies grandis* trees on 13.5 (BH, PHS); Poole, 15.5 (VG); Chedington Woods, 85 on 23.5 (PAD), 1.7 (JM); Stubhampton Bottom, 2 on 10.6 (PAD)

1859 *Chloroclystis chloerata* **SLOE PUG** Swanage, 30.5 (PE); Winspit, 8 on 31.5 (PAD); Spetisbury, 9.6 (D&JK); West Bexington, 9.6, 10.6, 11.6, 16.6, 22.6 (RE); Kingston, 10.6 (PBe); Puddletown, 24.6 (HWH)

1863 *Anticollix sparsata* **DENTATED PUG** Wimborne St Giles, 18.7 (JW)

1864 *Chesias legatella* **STREAK** Ferndown, 12.10 (RRC)

1865 *Chesias rufata* **BROOM-TIP** Wimborne St Giles, 16.5 (JW)

1867 *Aplocera plagiata* **TREBLE BAR** Swanage, 25.5 (TP), 8 on 30.5, 5.6 (PE); Creech Bottom, 24.6 (KMc); Wareham, 19.8 (RA); Puddletown, 29.8 (HWH)

1868 *Aplocera efformata* **LESSER TREBLE-BAR** Merritown Heath, 2 by day on 13.5 (BH, PHS); Hurn, 23.6, 24.6, 23.8, 1.9 (MJ)

1874 *Euchoeca nebulata* **DINGY SHELL** Hurn, 10.5, 10.6, 3 on 11.6, 15.7, 31.7, 4.8 (MJ); Verwood, 14.7 (CC); Colehill, 16.7 (RSt); Chedington Woods, 3 on 23.7 (PAD, PHS); East Holme, 24.7 (JCo)

1878 *Minoa murinata* **DRAB LOOPER** Stubhampton Bottom, 2 by day on 22.7 (WR)

1879 *Lobophora halterata* **SERAPHIM** Shapwick, 7.5 (PAD); Bagmore Wood, 9.5 (MPl); West Bexington, 11.5 (BH, PHS); Hurn, 12.5 (MJ)

1881 *Trichopteryx carpinata* **EARLY TOOTH-STRIPED** Shaggs, 2 on 27.2, 2.4 (LH); Hurn, 31.3, 3 on 2.4, 3.4, 11.4 (MJ); Alners Gorse, 3 on 3.4, 2 on 3.5 (PAD); Puddletown, 3.4, 11.4, 13.4 (HWH); Walditch, 4.4 (MSP); Swanage, 12.4 (PE); Kilwood, 3 on 20.4 (PAD)

1888.1 *Stegania trimaculata* **DORSET CREAM WAVE** Southwell, 12.5 (PBO)

1889 *Semiothisa notata* **PEACOCK** Kilwood, 30.7 (PAD)

1901 *Cepphis advenaria* **LITTLE THORN** Wareham, 2.6 (BY); Shaggs, 23.6 (BC)

1903 *Plagodis pulveraria* **BARRED UMBER** Beaminster, 8.5, 12.5 (SPh); Chedington Woods, 23.5 (PAD)

1905 *Pachycnemia hippocastanaria* **HORSE CHESTNUT** Durlston, 30.7 (JK); Spetisbury, 2.8 (D&JK)

1907 *Epione repandaria* **BORDERED BEAUTY** Hurn, 23.6, 2 on 29.6, 30.6, 1.7, 18.7, 24.7, 4.8, 10.8, 20.8 (MJ); West Bexington, 12.7, 14.7, 15.7, 21.9, 26.9 (RE); Puddletown, 3 on 14.7, 16.7, 25.7, 26.7, 27.7, 2 on 30.7, 3 on 2.8, 3 on 7.8, 24.8, 29.8 (HWH); Broadmayne, 15.7, 1.8, 4.8, 12.8, 13.8 (PB-J); Shaggs, 17.7 (LH), 30.7, 7.8 (BC), 14.8, 9.9 (LH); Chickerell, 25.7 (CP); Gillingham, 25.7, 27.7, 7.8 (GRH); Walditch, 27.7 (MSP); Trigon, 28.7 (CM, JH, PAD, SR); Alners Gorse, 2 on 2.8 (GRH *et al*); Beaminster, 24.8 (SPh); Ashington, 25.8 (JF); East Holme, 8.9 (JCo); Winterborne Stickland, 30.9 (LdW)

1909 *Pseudopanthera macularia* **SPECKLED YELLOW** Bindon Hill, by day on 8.5 (SE); Lewesdon Hill, 11.5 (BH, PHS); Black Down, by day on 31.5 (PAD)

1910 *Apeira syringaria* **LILAC BEAUTY** Hurn, 10.6, 3.7 (MJ); West Bexington, 16.6, 27.6, 1.7 (RE); Broadmayne, 2 on 24.6 (PB-J); Creech Bottom, 24.6 (KMc), 2.7 (KMc); Puddletown, 29.6, 1.7, 15.7, 16.7 (HWH); Spetisbury, 24.6, 27.6, 16.7 (D&JK); Chedington Woods, 1.7 (JM); Swanage, 3.7 (JRC); Turnworth, 2 on 22.7 (LdW)

1912 *Ennomos quercinaria* **AUGUST THORN** Spetisbury, 29.7 (D&JK); Wimborne, 2.8, 6.8, 11.8 (D&MG); Turnworth, 5.8 (D&JK, LdW, PAD, PBu), 4.9 (GRH)

1915 *Ennomos erosaria* **SEPTEMBER THORN** Hurn, 29.6, 5.7, 12.7, 29.7, 11.8, 16.8 (MJ); Verwood, 23.7, 28.7 (SMP); Kingston, 26.7, 15.9 (PBe); Alners Gorse, 2.8 (GRH *et al*); Wareham, 2.8 (RA); Swanage, 8.8 (JRC); Bagmore Wood, 15.8 (MPl)

1918 *Selenia lunularia* **LUNAR THORN** Chedington Woods, 23.5 (PAD); Portland, 25.7 (PBO)

1924 *Angerona prunaria* **ORANGE** Chedington Woods, 1.7 (JM)

1925 *Apocheima hispidaria* **SMALL BRINDLED BEAUTY** Kingston, 22.2, 23.2 (PBe); Alners Gorse, 5 on 1.3 (PAD)

1927 *Lycia hirtaria* **BRINDLED BEAUTY** Walditch, dead in a puddle on 1.4, 23.4, 3.5 (MSP); Hurn, 2.4, 4 on 15.4, 4 on 20.4, 3 on 21.4, 3 on 22.4, 2 on 23.4, 26.4, 3 on 2.5, 4.5 (MJ); West Bexington, 3.4, 4.4, 15.4, 19.4, 22.4 (RE); Shaggs, 17.4, 2 on 22.4, 23.4 (LH); Broadmayne, 20.4, 23.4 (PB-J); Swanage, 21.4 (JRC), 26.4 (PE); Kingcombe, 23 on 22.4, 4 on 5.5, 2 on 10.5 (NS); Kingston, 22.4 (PBe); Spetisbury, 22.4, 30.4, 2.5 (D&JK); Gillingham, 25.4, 5.5, 9.5 (GRH); Wimborne St Giles, 25.4 (JW); Wimborne, 26.4 (D&MG); Alners Gorse, 2 on 2.5 (GRH *et al*); Bridport, 5.5, 6.5 (MB); Beacon Hill, 8.5 (RSt); Winterborne Stickland, 10.5 (LdW)

1932 *Agriopis leucophaearia* **SPRING USHER** Motcombe, 11.1 (PBu); Puddletown, 26.1, 27.1, 8.2 (HWH); Corfe Mullen, 6.2 (R&LL); East Holme, 2 on 7.2 (JCo); Hurn, 11.2, 27.2 (MJ); Alners Gorse, 18 on 1.3 (PAD), 2 on 8.3 (GRH, LdW, PBu)

1933 *Agriopis aurantiaria* **SCARCE UMBER** Hurn, 11.11 (MJ); Ashington, 15.11 (JF); East Holme, 16.11 (JCo); Portland, 20.11 (PBO)

1939 *Cleora cinctaria* **RINGED CARPET** Hurn, 21.4 (MJ); Verwood, 25.4, 2.5, 9.5 (CC); Spetisbury, 7.5 (D&JK)

1940 *Deileptenia ribeata* **SATIN BEAUTY** Shaggs, 2.6, 28.7, 28.8 (BC); Kingston, 10.6 (PBe); Holt Heath, 4 on 24.6 (PAD); Chedington Woods, 2 on 1.7 (JM, PAD), 15 on 23.7 (PHS), 9 on 23.7 (PAD); Puddletown, 15.7, 23.7 (HWH); Broadmayne, 17.7 (PB-J); Beaminster, 2 on 19.8 (SPh); Bagmore Wood, 26.8 (MPl)

1944 *Serraca punctinalis* **PALE OAK BEAUTY** Hurn, 15.5, 2 on 25.5, 2.6, 9.6, 2 on 10.6, 11.6 (MJ); Shapwick, 23.5 (PAD); Puddletown, 31.5 (HWH); Verwood, 31.5 (CC); Holt Heath, 3 on 2.6, 24.6 (PAD); Stubhampton Bottom, 2 on 10.6 (PAD)

1948 *Ectropis crepuscularia* **SMALL ENGRAILED** Puddletown, 15.5, 16.5, 31.5 (HWH); Hurn, 1.7 (MJ)

1950 *Paradarisa extersaria* **BRINDLED WHITE-SPOT** Stubhampton Bottom, 10.6 (PAD); Hurn, 18.6 (MJ); Holt Heath, 3 on 24.6 (PAD)

1951 *Aethalura punctulata* **GREY BIRCH** Hurn, 7.5, 20.5, 21.5 (MJ); Kingston, 11.5 (PBe); Puddletown, 11.5 (HWH); Shapwick, 23.5 (PAD)

1954 *Bupalus piniaria* **BORDERED WHITE** Canford Cliffs, 30.5 (PT); Hurn, 9.6 (MJ); Ashington, 2.7 (JF); Ringwood Forest, 2.7 (RG); Trigon, 28.7 (CM, JH, PAD, SR)

1957 *Lomographa bimaculata* **WHITE-PINION SPOTTED** Lewesdon Hill, 11.5 (BH, PHS); West Bexington, 11.5 (BH, PHS); Broadmayne, 23.5, 10.6 (PB-J); Chedington Woods, 10 on 23.5 (PAD); Puddletown, 25.5, 29.5 (HWH); Highcliffe, 2.6 (DLe); Holt Heath, 2.6 (PAD)

1962 *Hylaea fasciaria* **BARRED RED** Wareham, 29.5 (RA), 31.5 (BY); Hurn, 4.6, 17.6, 1.7 (MJ); Canford Cliffs, 10.6, 25.7, 6.8 (PT); Highcliffe, 10.6, 27.7, 28.7, 3.8, 8.8, 11.8 (DLe); Puddletown, 19.6, 30.7, 6.8 (HWH); Creech Bottom, 2 on 23.6, 2 on 24.6, 2 on 30.6 (KMc); Holt Heath, 24.6 (PAD); West Bexington, 24.6 (RE); Shaggs, 26.6 (BC), 7.8 (LH); Chedington Woods, 11 on 1.7 (JM, PAD), 12.7 (DF), 11 on 23.7 (PAD, PHS); Ringwood Forest, 2.7 (RG); Swanage, 19.7, 25.7 (TP); Chickerell, 24.7, 28.7 (CP); Corfe Mullen, 25.7 (R&LL); Trigon, 28.7 (CM, JH, PAD, SR); Walditch, 5.8 (MSP)

1964 *Gnophos obscurata* **ANNULET** Bovington, 6 on 30.7 (MSP, ZR); Canford Heath, 30.7 (AR, LH)

1968 *Aspitates ochrearia* **YELLOW BELLE** Portland, 27.4 (PBO); West Bexington, 3 on 9.5, 11.5 (BH, PHS), 11.5, 12.5, 15.5, 2 on 16.5, 2 on 17.5, 20.5, 3 on 21.5, 6 on 22.5, 3 on 23.5, 24.5, 25.5, 27.5, 2 on 28.5, 3 on 29.5, 2.6, 3.6, 4.6, 6.6, 22.8, 27.8, 28.8, 29.8, 30.8, 31.8, 1.9, 2.9, 7.9 (MS), 7.9, 8.9, 14.9, 10.10, 11.10 (RE); Hurn, 13.5 (MJ); Chickerell, 26.5, 28.5, 29.5, 31.5, 22.9, 23.9 (CP)

1969 *Dyscia fagaria* **GREY SCALLOPED BAR** Bagmore Wood, 9.5 (MPl)

1972 *Agrius convolvuli* **CONVOLVULUS HAWK** Puddletown, 19.8, 2 on 24.8 (HWH); Portland, 2 on 22.8, 23.8, 11.9, 15.9, 22.9 (PBO); West Bexington, 22.8, 24.8, 27.8, 28.8, 30.8, 8.9, 11.9, 20.9, 21.9, 3 on 22.9, 28.9 (RE); Wyke Regis, 15.9 (DF); Charmouth, 16.9 (GS); Spetisbury, 28.9 (D&JK); Wimborne St Giles, 30.9 (JW)

1982 *Hemaris tityus* **NARROW-BORDERED BEE HAWK** Fontmell Down, by day on 24.5 (WR)

1983 *Hemaris fuciformis* **BROAD-BORDERED BEE HAWK** Verwood, by day on 30.5 (CC)

1984 *Macroglossum stellatarum* **HUMMING-BIRD HAWK** Portland Castle, by day on 11.2 (PG); Fortuneswell, by day on 3.4 (GM); Shaggs, by day on 11.7 (BC); Corfe Mullen, by day on 15.7 (R&LL); Sutton Poyntz, 2 by day on 15.7 (JN); Ashington, 1.8 (JF); Portland, 7.8 (PBO); Lyme Regis, by day on 12.9, 11.10 (OW); Holnest, by day on 15.9 (RSm); Southwell, 28.9 (PBO); Corfe Castle, by day on 24.10 (RC)

1987 *Hyles galii* **BEDSTRAW HAWK** Portland, 31.7 (PBO)

1996 *Furcula bicuspis* **ALDER KITTEN** Chedington Woods, 9 on 23.5 (PAD)

1998 *Furcula bifida* **POPLAR KITTEN** Bridport, 11.5 (MB); Spetisbury, 22.5 (D&JK); Kingston, 23.5 (PBe); West Bexington, 30.5, 9.6 (RE); Gillingham, 1.6 (GRH); Holt Heath, 2.6 (PAD); Portland, 10.6 (PBO)

2010 *Odontosia carmelita* **SCARCE PROMINENT** Verwood, 28.4, 2.5, 7.5 (CC)

2019 *Clostera curtula* **CHOCOLATE-TIP** Wyke Regis, 26.4 (DF); Ashington, 4.5, 10.5 (JF); Hurn, 4.5, 12.5, 24.5, 25.5 (MJ); Puddletown, 4.5, 10.5, 12.5, 16.5, 26.7, 27.7, 3.8 (HWH); Spetisbury, 7.5, 15.5 (D&JK); Kingcombe, 10.5 (NS); West Bexington, 11.5 (BH, PHS), 17.5, 20.5, 22.5, 26.5 (RE), 26.7 (PHS), 26.7 (RE); Bridport, 12.5 (MB); Shaggs, 15.5 (BC); East Holme, 16.5, 24.7 (JCo); Chedington Woods, 2 on 23.5 (PAD); Kingston, 23.5 (PBe); Chickerell, 25.7 (CP); Broadmayne, 27.7 (PB-J); Winterborne Stickland, 6.8 (LdW)

2020 *Diloba caeruleocephala* **Figure OF EIGHT** West Bexington, 24.9, 3.10, 9.10, 11.10, 2 on 12.10, 2 on 13.10 (PHS), 2 on 13.10, 14.10, 15.10, 2 on 16.10, 7.10, 20.10, 2 on 21.10, 22.10, 6 on 24.10, 25.10, 26.10, 2.11, 3.11, 5.11, 6.11 (RE); Walditch, 18.10 (MSP); Winterborne Stickland, 4 on 23.10 (LdW); Puddletown, 24.10 (HWH)

2027 *Dicallomera fascelina* **DARK TUSSOCK** Canford Heath, 30.7 (AR, LH)

2031 *Leucoma salicis* **WHITE SATIN** Motcombe, 25.7 (PBu); Spetisbury, 17.7 (D&JK)

2034 *Lymantria dispar* **GYPSY** Dorset, 25 larvae on scrub oak trees on 13.5, and 9 larvae on 30.5

2035 *Thumatha senex* **ROUND-WINGED MUSLIN** Wareham, 2.6 (BY); Puddletown, 23.6, 7 on 28.6, 30.6, 1.7, 2.7, 7.7, 5 on 14.7, 17.7, 2 on 22.7, 26.7, 2 on 27.7, 28.7, 30.7, 2 on 2.8 (HWH); Hurn, 30.6 (MJ); Gillingham, 17.7 (GRH); Trigon, 28.7 (CM, JH, PAD, SR)

2038 *Nudaria mundana* **MUSLIN FOOTMAN** Gad Cliff, 6 larvae on 25.4 (MSP, PHS); Walditch, 24.6 (MSP); West Bexington, 25.6, 12.7, 15.7, 16.7 (RE), 26.7 (PHS); Chedington Woods, 12.7 (DF), 23.7 (PAD); Broadmayne, 16.7 (PB-J); Winspit, 22.7 (PAD); Gillingham, 25.7 (GRH)

2039 *Atolmis rubricollis* **RED-NECKED FOOTMAN** Chedington Woods, 2 on 23.5 (PAD); Stanpit Marsh, 8.6 (PAD, RH); Stubhampton Bottom, 2 on 10.6 (PAD); Ringwood Forest, 2.7 (RG)

2049 *Eilema deplana* **BUFF FOOTMAN** Durlston, 18.10 (MD, *et al*), 19.10 (JCl)

2051 *Lithosia quadra* **FOUR-SPOTTED FOOTMAN** Wyke Wood, larva found in moth trap in morning on 11.5 (BH, PHS); Hurn, 20.6, 29.6, 29.7, 30.7 (MJ); West Bexington, 20.6, 25.7, 2 on 26.7 (PHS), 26.7, 3 on 27.7, 3 on 28.7, 4 on 6.8, 7.8, 2 on 29.8, 2 on 30.8, 14.9 (RE), 2 on 12.10 (PHS), 2 on 12.10 (RE), 13.10 (PHS); Puddletown, 21.6, 3 on 14.7, 3 on 23.7, 24.7, 2 on 25.7, 26.7, 3 on 27.7, 7 on 28.7, 4 on 30.7, 2 on 1.8, 4 on 2.8, 3.8, 4 on 4.8, 5.8, 7 on 6.8, 4 on 7.8, 2 on 15.8, 20.8, 3 on 21.8, 24.8, 2 on 25.8, 26.8, 27.8, 28.8, 29.8, 8.9, 9.9, 11.9, 13.9, 4 on 14.9, 18.10 (HWH); Spetisbury, 15.7, 30.7, 2.8, 5.8 (D&JK); Shaggs, 15.7, 24.7, 30.7, 7.8 (BC), 9.9, 10.9, 13.10, 15.10 (LH); Winspit, 22.7 (PAD); Broadmayne, 25.7, 27.7, 28.7, 2 on 30.7, 31.7, 4.8, 7.8, 8.8, 22.8 (PB-J); Swanage, 25.7 (JRC); Portland, 26.7, 6.8, 7.8, 8.8, 2 on 9.8, 29.8, 2 on 13.10, 2 on 14.10, 17 between 27.8 and 30.8 (PBO); Preston, 3 on 26.7, 4 on 28.7, 29.7 (RL); Weymouth, 27.7 (PHS); Wyke Regis, 27.7, 28.7, 6.8 (DF); Walditch, 27.7, 31.7, 3 on 2.8, 2 on 3.8, 4.8, 6.8 (MSP); Fortuneswell, 3 on 28.7 (EC); Trigon, 28.7 (CM, JH, PAD, SR); Kilwood, 30.7 (PAD); Chickerell, 2 on 30.7, 5.8, 2 on 6.8, 7.8, 8.8 (CP); Charmouth, 2 on 31.7, 3.8, 8.8, 15.9 (GS); Beaminster, 5.8, 30.8 (SPh); Wimborne, 6.8, 10.9 (D&MG); Ashington, 7.8 (JF); Dorchester, 7.8, 12.10 (JD); Verwood, 14.9 (CC); Shapwick, 11.10 (PAD)

2053 *Coscinia cribraria bivittata* **SPECKLED FOOTMAN** Dorset, singles on 14.7 and 27.7 in two known localities

2056 *Parasemia plantaginis* **WOOD TIGER** Cattistock, 30 larvae on 14.5 (NS)

2058 *Arctia villica britannica* **CREAM-SPOT TIGER** Gillingham, 31.5 (GRH); Hurn, 2.6 (MJ)

2059 *Diacrisia sannio* **CLOUDED BUFF** Creech Bottom, during evening on 23.6, 30.6, 1.7, 2.7 (KMc)

2067 *Euplagia quadripunctaria* **JERSEY TIGER** Chickerell, 14.7, 21.7, 22.7, 2 on 25.7, 3 on 26.7, 2 on 27.7, 29.7, 3 on 30.7, 31.7, 6.8, 3 on 7.8, 8.8, 4 on 15.8 (CP); West Bexington, 16.7, 19.7, 2 on 22.7, 23.7, 24.7, 3 on 25.7, 26.7, 2 on 27.7, 28.7, 2 on 29.7, 3 on 30.7, 31.7, 3 on 1.8, 2.8, by day on 3.8, 4 on 6.8, 4 on 7.8, 2 on 8.8, 2 by day on 12.8, 2 on 14.8, 16.8, 19.8, by day on 20.8, 9 on 21.8, by day on 22.8, 24.8, by day on 25.8, 27.8 (RE); Wyke Regis, 17.7, 23.7 (DF); Preston, 21.7, 24.7, 2 on 25.7, 3 on 26.7, 27.7, 14.8, 19.8, 21.8, 22.8, 25.8, 27.8, 28.8 (RL); Walditch, 24.7, 26.7, 2 on 27.7, 28.7, 29.7, 2 on 30.7, by day on 2.8, 4.8, 5.8, 4 on 6.8, 7 on 24.8, by day on 24.8, 18 on 25.8, 9 on 26.8, 13 on 27.8, 9 on 28.8, 2 on 29.8, 30.8, 31.8 (MSP); Weymouth, 23.7 (PHS); Worth Matravers, 30.7 (JK); Bridport, 24.7, 29.7, 10.8, 14.8, 19.8, 25.8, 28.8 (MB); Sutton Poyntz, by day on 29.7, 5 on 14.8 (JN); Durlston, 30.7 (JK); Puncknowle, 2 on 1.8 (MHe, LS), 2 on 9.8, 3 on 14.8, 2 on 22.8, 4 on 24.8, 2 on 29.8 (MHe); Puddletown, 4.8 (HWH); Broadwey, by day on 6.8 (FT); Lyme Regis, by day on 13.8 (JN); Burton Bradstock, by day, yellow form on 24.8 (MSP); Swanage, 30.8 (PE)

2068 *Callimorpha dominula* **SCARLET TIGER** Hurn, by day on 24.5 and on 10.6 (MJ); West Bexington, by day on 10.6 and on 29.6 (RE); Ashmore, 3 by day on 30.6 (GC); Ringstead, 3 by day on 1.7 (KMc); Sherborne, by day on 3.7 (RSm); Stubhampton Bottom, by day on 16.7 (WR), 26.7 (CC, MW, PAD); Fontmell Wood, by day on 19.7 (WR)

2076 *Meganola albula* **KENT BLACK ARCHES** Chickerell, 25.6 (PHS), 2.7, 4.7, 16.7, 17.7, 3 on 21.7, 22.7, 2 on 23.7, 24.7, 4 on 25.7, 26.7, 27.7, 30.7, 2 on 31.7, 2.8, 4.8, 7.8 (CP); West Bexington, 29.6, 14.7, 15.7, 20.7, 21.7, 24.7, 25.7, 26.7 (PHS), 26.7, 27.7, 3.8, 4.8, 5.8, 6.8 (RE); East Holme, 1.7 (JCo); Creech Bottom, 1.7, 2.7 (KMc); Broadmayne, 7.7, 11.7, 22.7, 23.7 (PB-J); Puddletown, 8.7, 10.7, 11.7, 13.7, 14.7, 4 on 15.7, 16.7, 17.7, 2 on 23.7, 24.7, 4 on 25.7, 26.7, 28.7, 29.7, 2 on 2.8 (HWH); Chedington Woods, 12.7 (DF); Verwood, 14.7, 22.7 (CC); Ashington, 15.7 (JF); Hurn, 2 on 17.7 (MJ); Shaggs, 17.7 (LH), 24.7, 3 on 28.7, 30.7 (BC); Garston Wood, 18.7 (AH); Wareham, 22.7, 24.7 (BY); Winspit, 2 on 22.7 (PAD); Weymouth, 24.7 (PHS); Swanage, 25.7 (JRC); Spetisbury, 27.7 (D&JK); Trigon, 28.7 (CM, JH, PAD, SR); Durlston, 30.7 (JK); Kilwood, 3 on 30.7 (PAD); Canford Heath, 30.7 (AR, LH)

2080 *Euxoa obelisca grisea* **SQUARE-SPOT DART** Swanage, 30.8 (TP)

2081 *Euxoa tritici* **WHITE-LINE DART** Hurn, 4.8, 5.8, 10.8, 15.8, 16.8 (MJ); Morden Bog, 2 on 26.8 (PAD)

2082 *Euxoa nigricans* **GARDEN DART** Weymouth, 24.7 (PHS); Wareham, 27.7, 27.8 (BY)

2084 *Agrotis cinerea* **LIGHT FEATHERED RUSTIC** Winspit, 16 on 9.5, 31.5 (PAD); Swanage, 10.5 (PE)

2085 *Agrotis vestigialis* **ARCHER'S DART** Hurn, 6.8, 25.8, 29.8 (MJ); Morden Bog, 3 on 26.8 (PAD); East Holme, 27.8 (JCo)

2090 *Agrotis trux lunigera* **CRESCENT DART** West Bexington, 27.6, 12.7, 13.7, 8.8 (RE); Charmouth, 8.7, 26.7 (GS); Preston, 14.7, 15.7, 27.7 (RL); Winspit, 6 on 22.7 (PAD); Walditch, 22.7, 26.7, 2 on 6.8 (MSP); Chickerell, 30.7, 31.7, 1.8, 2.8, 3.8, 4.8 (CP); Bridport, 7.8 (MB); Durlston, 19.10 (JCl)

2094 *Agrotis crassa* **GREAT DART** Swanage, 30.7 (JRC); Portland, 16.8 (PBO)

2102.1 *Ochropleura Leucogaster* **RADFORD'S FLAME SHOULDER** West Bexington, 22.10 (RE)

2110.1 *Noctua janthina* **LANGMAID'S YELLOW UNDERWING** West Bexington, 1.7, 13.9, 20.9, 22.9 (RE)

2117 Paradiarsia glareosa glareosa **AUTUMNAL RUSTIC** Wimborne St Giles, 29.8 (JW); Hurn, 5.9, 7.9, 8.9, 11.9, 18.9, 25.9 (MJ); Shaggs, 22.9 (LH); Rampisham, 7 on 30.9 (DG); Puddletown, 6.10 (HWH); Swanage, 11.10 (PE); Durlston, 2 on 18.10 (MD, *et al*); Bridport, 20.10 (JCl)

2130 *Xestia baja* **DOTTED CLAY** Hurn, 29.7, 3.8, 2 on 6.8, 12.8 (MJ), Verwood, 14.8 (CC)

2132 *Xestia castanea* **NEGLECTED RUSTIC** Hurn, 31.8, 10.9, 14.9 (MJ); Verwood, 8.9, 14.9, 23.9, 29.9 (CC); East Holme, 24.9 (JCo)

2135 *Xestia agathina* **HEATH RUSTIC** Morden Bog, 26.8 (PAD); Ashington, 29.8 (JF); West Bexington, 31.8 (RE); Hurn, 12.9, 2 on 14.9 (MJ)

2136 *Naenia typica* **GOTHIC** Fortuneswell, 3.7, 14.7, 16.7, 17.7, 23.7, 2 on 28.7 (EC); East Holme, 11.7, 17.7 (JCo); Weymouth, 24.7 (PHS); Motcombe, 26.7 (PBu); Hurn, 4.8 (MJ); Puddletown, 7.8 (HWH); Chickerell, 8.8 (CP); Sutton Poyntz, 11.8 (JN)

2142 *Anarta myrtilli* **BEAUTIFUL YELLOW UNDERWING** Holt Heath, 2.6 (PAD); Ashington, 11.6 (JF); Creech Bottom, larva on 24.6 (KMc); Trigon, 28.7 (CM, JH, PAD, SR); Bovington, 30.7 (MSP, ZR); Canford Heath, 30.7 (AR, LH); Morden Bog, 26.8 (PAD)

2145 *Discestra trifolii* **NUTMEG** Portland, 27.4 (PBO); Beacon Hill, 8.5 (RSt); Wimborne, 10.5 (D&MG); West Bexington, 11.6, 13.8, 22.8, 23.8 (RE); Gillingham, 25.6 (GRH); Puddletown, 1.7, 2 on 6.8 (HWH); Winspit, 22.7 (PAD); Bridport, 24.7 (MB); Verwood, 24.7, 25.7 (SMP); Wareham, 24.7 (BY); Canford Heath, 30.7 (JK); Ashington, 3.8 (JF); Swanage, 5.8 (JRC); Hurn, 1.9 (MJ)

2150 *Polia nebulosa* **GREY ARCHES** Broadmayne, 15.6, 21.6, 24.6 (PB-J); Puddletown, 21.6, 22.6, 2 on 23.6, 27.6, 1.7, 12.7 (HWH); Holt Heath, 2 on 24.6 (PAD); Creech Bottom, 27.6 (KMc); Portland, 1.7 (PBO); Ringwood Forest, 2.7 (RG); Turnworth, 4 on 3.7 (LdW); Kingcombe, 11.7 (PHS); Trigon, 28.7 (CM, JH, PAD, SR)

2156 *Lacanobia contigua* **BEAUTIFUL BROCADE** Verwood, 31.5, 21.6, 7.7 (CC); Holt Heath, 6 on 2.6, 24.6 (PAD); Ashington, 25.6 (JF); Ringwood Forest, 2.7 (RG)

2158 *Lacanobia thalassina* **PALE-SHOULDERED BROCADE** Wareham, 2.6 (BY); Swanage, 21.6 (PE)

2159 *Lacanobia suasa* **DOG'S TOOTH** Wareham, 31.5 (BY), 30.7 (RA), 2 on 7.8 (BY); Stanpit Marsh, 14 on 8.6 (PAD, RH), 13 on 15.8 (PAD); Puddletown, 28.7 (HWH); Trigon, 28.7 (CM, JH, PAD, SR)

2163 *Ceramica pisi* **BROOM** Shaggs, 22.5 (LH); Wareham, 2.6 (BY), 3.7 (RA); Corfe Castle, 2 on 7.6 (RC); Gillingham, 14.6 (GRH); Creech Bottom, 27.6 (KMc); Puddletown, 28.6 (HWH); Hurn, 29.6 (MJ); Ringwood Forest, 2.7 (RG); Higher Hyde, 11.7 (DF)

2164 *Hecatera bicolorata* **BROAD-BARRED WHITE** Swanage, 24.6 (TP), 25.6 (JRC), 13.7 (TP); Wareham, 1.7 (RA); Dorchester, 14.7 (JD)

2167 *Hadena perplexa* **TAWNY SHEARS** West Bexington, 23.4, 25.4, 26.4, 10 on 9.5, 10.5 (BH, PHS), 12 on 10.5, 7 on 11.5, 3 on 12.5, 13.5, 14.5, 3 on 15.5, 16.5, 19.5, 20.5, 21.5, 25.5, 2 on 30.5, 2 on 1.6, 3.6, 3 on 4.6, 7.6, 2 on 8.6, 10.6, 12.6, 13.6, 25.6, 29.6, 30.6, 8.7, 12.7, 2 on 13.7, 3 on 14.7, 5 on 15.7, 2 on 16.7, 17.7, 3 on 19.7, 5 on 20.7, 2 on 25.7, 26.7 (PHS), 3 on 28.7, 29.7, 11.8, 30.8 (RE); Winspit, 31.5 (PAD); Wyke Regis, 27.8 (DF)

2172 *Hadena albimacula* **WHITE SPOT** Shaggs, 7.5 (LH); Portland, 2 on 15.5 (PBO)

2176 *Cerapteryx graminis* **ANTLER** Sutton Poyntz, 21.9, 3 on 25.9 (JN)

2177 *Tholera cespitis* **HEDGE RUSTIC** Wimborne St Giles, 23.8 (JW); Walditch, 26.8 (MSP); Puddletown, 3 on 27.8, 14 on 22.9 (HWH); Ashington, 29.8 (JF); Hurn, 29.8, 2 on 3.9, 8.9 (MJ)

2178 *Tholera decimalis* **FEATHERED GOTHIC** Ashington, 27.8, 3 on 8.9 (JF); Hurn, 31.8, 2 on 8.9, 10.9, 13.9 (MJ); Turnworth, 3 on 4.9 (GRH); Shaggs, 8.9 (LH); Sutton Poyntz, 22.9 (DE)

2183 *Orthosia miniosa* **BLOSSOM UNDERWING** Alners Gorse, 8.3 (GRH, LdW, PBu), 11 on 3.4, 3.5 (PAD); Kingston, 2 on 3.4 (PBe)

2184 *Orthosia opima* **NORTHERN DRAB** Gillingham, 5.5, 6.5 (GRH); West Bexington, 10.5 (BH, PHS)

2185 *Orthosia populeti* **LEAD-COLOURED DRAB** Alners Gorse, 7 on 1.3 (PAD), 2 on 8.3 (GRH, LdW, PBu), 6 on 3.4 (PAD); Hurn, 2 on 1.3, 6.3, 9.3, 2 on 10.3 (MJ); Kingston, 2.4 (PBe)

2192 *Mythimna conigera* **BROWN-LINE BRIGHT EYE** Swanage, 13.7 (PE); West Bexington, 26.7 (PHS); Shaggs, 28.7 (BC)

2195 *Mythimna vitellina* **DELICATE** Winterborne Stickland, 20.6, 4.7 (LdW); Puddletown, 30.6, 10.7, 24.7, 28.7, 9.10, 12.10, 14.10, 26.10 (HWH); Chickerell, 1.7 (CP); West Bexington, 26.7 (PHS), 7.9, 18.9, 2 on 28.9, 8.10, 10.10, 20.10, 21.10, 4 on 5.11 (RE); Preston, 29.7 (RL); Alners Gorse, 2.8 (GRH *et al*); Swanage, 6.9 (PE), 15.10 (TP), 2 on 18.10 (PE); Portland, 8.9, 2 on 10.9, 4 on 12.9, 3 on 14.9, 16.9, 18.9, 22.9, 2 on 27.9, 29.9, 9.10, 11.10, 2 on 12.10, 2 on 13.10, 2 on 14.10, 2 on 15.10, 17.10, 3 on 18.10, 2 on 19.10, 24.10, 13.11 (PBO); Walditch, 9.9 (MSP); Spetisbury, 29.9 (D&JK); East Holme, 6.10 (JCo); Durlston, 18.10 (MD, *et al*), 19.10 (JCl); Merley, 26.10 (RSt)

2196 *Mythimna pudorina* **STRIPED WAINSCOT** Holt Heath, 24.6 (PAD); Rampisham, 2 on 26.6 (DG); Creech Bottom, 27.6, 28.6, 4.7 (KMc); Stone's Common, 28.6 (DF); Higher Hyde, 11.7 (DF); Kingston, 14.7 (PBe); Ashington, 2 on 15.7 (JF); Trigon, 28.7 (CM, JH, PAD, SR)

2197 *Mythimna straminea* **SOUTHERN WAINSCOT** Hurn, 30.6 (MJ); Powerstock Common, 11.7 (PHS);

Dorchester, 14.7, 22.7, 24.7, 26.7 (JD); Wareham, 24.7, 2 on 7.8 (BY), 7.8 (RA), 27.8 (BY); West Bexington, 26.7 (PHS), 28.7, 30.7, 31.7, 1.8, 2.8, 3.8, 6.8, 8.8, 15.8, 19.8, 24.8 (RE); Puddletown, 7.8 (HWH); Stanpit Marsh, 12 on 15.8 (PAD); Broadmayne, 19.8, 29.8 (PB-J)

2200 *Mythimna favicolor* **MATHEW'S WAINSCOT** Stanpit Marsh, 8.6 (PAD, RH)

2201 *Mythimna litoralis* **SHORE WAINSCOT** Canford Cliffs, 1.7 (PT)

2202 *Mythimna l-album* **L-ALBUM WAINSCOT** Puddletown, 14.6, 8.10, 18.10 (HWH); Spetisbury, 22.6 (D&JK); Wareham, 2 on 11.9 (RA), 14.10 (BY); Hurn, 22.9 (MJ); Dorchester, 24.9 (JD); Shapwick, 10.10 (PAD); East Holme, 3.11 (JCo)

2203 *Mythimna unipuncta* **WHITE-SPECK** West Bexington, 19.1, 20.1, 14.9, 26.9, 6.10, 10.10, 15.10, 2.11, 3.11, 4.11, 15.11 (RE); Puddletown, 6.8, 2 on 26.10, 14.11 (HWH); Ashington, 25.8 (JF); Wyke Regis, 12.9 (DF); Portland, 15.9, 17.9, 18.9, 15.10, 16.10, 20.10, 22.10, 3 on 23.10, 2 on 27.10, 29.10, 3.11, 5.11, 2 on 13.11, 2 on 14.11, 15.11, 2 on 16.11, 2 on 18.11, 19.11, 27.11 (PBO); Hurn, 25.10 (MJ); Chickerell, 7.11 (CP); Preston, 15.11 (RL); Broadmayne, 19.11 (PB-J)

2204 *Mythimna obsoleta* **OBSCURE WAINSCOT** Stanpit Marsh, 8 on 8.6 (PAD, RH); Ashington, 22.6 (JF)

2208 *Mythimna loreyi* **COSMOPOLITAN** Portland, 14.9 (PBO)

2214 *Cucullia chamomillae* **CHAMOMILE SHARK** Winterborne Stickland, 13.5 (LdW); West Bexington, 25.5, 27.5 (RE)

2225 *Brachylomia viminalis* **MINOR SHOULDER-KNOT** Hurn, 20.6 (MJ); Holt Heath, 24.6 (PAD); Ringwood Forest, 2.7 (RG); Powerstock Common, 11.7 (PHS); Chedington Woods, 12.7 (DF), 4 on 23.7 (PAD,PHS); Kingston, 14.7 (PBe); Beaminster, 27.7 (SPh); Puddletown, 30.7 (HWH)

2226 *Leucochlaena oditis* **BEAUTIFUL GOTHIC** Portland, 26.8 (PBO); Swanage, 6.9, 9.9, 10.9, 2 on 12.9, 13.9, 2 on 14.9, 2 on 15.9, 4 on 16.9, 4 on 17.9, 2 on 19.9, 4 on 20.9, 6 on 21.9, 4 on 22.9 (JRC); Durlston, 2 on 18.10 (MD, *et al*), 19.10 (JCl)

2227 *Brachionycha sphinx* **SPRAWLER** West Bexington, 4.11, 5.11, 11.11, 12.11, 8 on 13.11, 2 on 14.11, 2 on 15.11, 2 on 16.11, 26.11 (RE); West Blagdon, 15.11 (DG); Walditch, 15.11 (MSP)

2230 *Aporophyla australis pascuea* **FEATHERED BRINDLE** Portland, 26.8 (PBO); West Bexington, 7.9 (MS), 11.9, 14.9, 20.9, 22.9, 23.9, 24.9, 25.9, 26.9, 27.9, 28.9, 29.9, 30.9, 1.10, 2.10, 3.10, 4.10, 6.10, 7.10, 8.10, 10.10, 11.10 (RE), 12.10 (PHS), 12.10, 13.10, 14.10, 15.10 (RE); Swanage, 2 on 18.9 (PE), 19.9 (JRC), 27.9 (PE), 30.9 (TP); Broadmayne, 9.10 (PB-J)

2231 *Aporophyla lutulenta* **DEEP-BROWN DART** Hurn, 29.9 (MJ); Carey Camp, 30.9 (DA, PHS); Shapwick, 11.10 (PAD)

2235 *Lithophane semibrunnea* **TAWNY PINION** West Bexington, 13.3, 8.4, 14.4, 11.10 (RE); Puddletown, 14.3, 25.3, 27.3, 2.4, 3.4, 12.4, 24.4, 2 on 28.4, 26.11 (HWH); Preston, 15.3 (RL); Spetisbury, 31.3, 3.10 (D&JK); Gillingham, 7.5 (GRH); Durlston, on ivy blossom on 18.10 (MD, *et al*)

2236 *Lithophane hepatica* **PALE PINION** Hurn, 14.3, 2.4, 21.4, 2.5, 2 on 3.5, 7.5 (MJ); Broadmayne, 25.3 (PB-J); Walditch, 2 on 1.4 (MSP); Wareham, 4.4 (RA); East Holme, 4.4, 25.4 (JCo); Spetisbury, 24.4, 6.5 (D&JK); Swanage, 3.5, 10.5 (PE); Winterborne Stickland, 10.5, 12.5 (LdW); West Bexington, 15.5 (BH, PHS), 2 on 17.5, 21.5 (RE); Kingston, 23.5 (PBe)

2237 *Lithophane ornitopus lactipennis* **GREY SHOULDER-KNOT** Shaggs, 5.3 (BC), 14.10 (LH); Wimborne, 8.3 (D&MG); Ashington, 15.3 (JF); Walditch, 2.4, 3.5 (MSP); Corfe Mullen, 4.4, 9.10 (R&LL); West Bexington, 2 on 10.4 (RE); Broadmayne, 19.11 (PB-J)

2241 *Xylena vetusta* **RED SWORD-GRASS** Puddletown, 31.3, 22.10 (HWH); Hurn, 7.4 (MJ)

2246.1 *Dryobota labecula* **OAK RUSTIC** Durlston, 2 on 12.10 (PAD), 6 on 18.10 (MD, *et al*), 19.10, 5 on 2.11 (JCl); Swanage, 25.10, 2 on 1.11, 2 on 8.11 (PE)

2246.2 *Dryobota tenebrosa* **SOMBRE BROCADE** Durlston, 12.10 (PAD)

2251 *Trigonophora flammea* **FLAME BROCADE** Cheyne Weare, 12.10 (PBO); Durlston, 12.10 (PAD)

2252 *Polymixis flavicincta* **LARGE RANUNCULUS** Puncknowle, 15.9, 2 on 26.9 (MHe); Walditch, 16.9 (MSP); West Bexington, 24.9, 1.10, 13.10 (RE)

2255 *Eumichtis lichenea lichenea* **FEATHERED RANUNCULUS** Wareham, 2 on 17.9, 10 on 1.10, 9 on 13.10 (RA), 14.10 (BY), 3 on 17.10, 5.11 (RA); Puddletown, 21.9, 23.9, 12.10, 18.10, 19.10, 24.10 (HWH); Dorchester, 24.9, 25.9, 12.10 (JD)

2259 *Conistra ligula* **DARK CHESTNUT** Puddletown, 10.1, 22.2, 6.3, 26.10, 6.11, 15.11 (HWH); Durlston, 23.1, 3 on 29.1 (PAD); Portland, 24.1, 15.11, 24.12 (PBO); Preston, 27.1 (RL); West Bexington, 6.2, 21.2, 23.10, 4 on 25.10, 26.10, 27.10, 3.11, 7.11, 13.11 (RE); Wimborne, 24.2 (D&MG); Winterborne Stickland, 24.2 (LdW); Broadmayne, 26.2 (PB-J); Kingston, 4.11 (PBe); West Blagdon, 2 on 15.11 (DG)

2260 *Conistra rubiginea* **DOTTED CHESTNUT** Puddletown, 27.2, 13.3, 30.3, 2 on 3.4 (HWH); West Bexington, 13.3 (RE); East Holme, 14.3 (JCo); Poole, 4.4 (VG)

2264.1 *Agrochola haematidea* **SOUTHERN CHESTNUT** Hurn, 29.9 (MJ), 13.10 (MJ); Verwood, 29.9, 13.10 (CC); Ferndown, 12.10 (RRC)

2265 *Agrochola helvola* **FLOUNCED CHESTNUT** Walditch, 6.11 (MSP)

2266 *Agrochola litura* **BROWN-SPOT PINION** Spetisbury, 5.10, 23.10 (D&JK)

2268 *Parastichtis suspecta* **SUSPECTED** Trigon, 28.7 (CM, JH, PAD, SR); Kilwood, 30.7 (PAD)

2271 *Xanthia citrago* **ORANGE SALLOW** Puddletown, 12.9, 15.9, 2 on 16.9, 20.9, 2 on 21.9, 23.9, 3 on 27.9, 28.9, 12.10 (HWH); Walditch, 30.9 (MSP)

2272 *Xanthia aurago* **BARRED SALLOW** Bagmore Wood, 12.9 (MPl); Merley, 19.9 (RSt); Walditch, 23.9, 8.10 (MSP); Rampisham, 6 on 30.9 (DG); West Bexington, 3.10, 6.10 (RE); Gillingham, 9.10, 11.10, 15.10 (GRH); Kingston, 17.10 (PBe); Broadmayne, 17.10 (PB-J); Sutton Poyntz, 18.10 (DE); Durlston, 2.11 (JCl)

2277 *Moma alpium* **SCARCE MERVEILLE DU JOUR** Verwood, 8.6 (CC)

2280 *Acronicta leporina* **MILLER** West Bexington, 10.5 (BH, PHS), 26.7 (RE); Holt Heath, 2.6 (PAD); Hurn, 10.6, 1.7 (MJ); Stubhampton Bottom, 10.6, 26.7 (CC, MW, PAD); Beaminster, 10.6, 17.6 (SPh); Loders, 11.6 (MSP); Merley, 11.6 (RSt); Poole, 2.7 (VG); Ringwood Forest, 2.7 (RG); Higher Hyde, 11.7 (DF); Ashington, 15.7 (JF); Spetisbury, 18.7 (D&JK); Wareham, 22.7 (RA); Chedington Woods, 23.7 (PAD); Trigon, 28.7 (CM, JH, PAD, SR); Kilwood, 30.7 (PAD)

2281 *Acronicta alni* **ALDER** Kingston, 8.5, 23.5 (PBe); Chickerell, 13.5 (CP); West Bexington, 15.5 (RE); Broadmayne, 23.5 (PB-J); Chedington Woods, 16 on 23.5 (PAD); Shaggs, 27.5 (LH); Puddletown, 9.6 (HWH); Stubhampton Bottom, 10.6 (PAD)

2290 *Simyra albovenosa* **REED DAGGER** Hengistbury Head, 25.7, 2 on 26.7 (MJ); Portland, 26.7 (PBO)

2299 *Amphipyra tragopoginis* **MOUSE** Verwood, 26.7 (SMP); Hurn, 29.7 (MJ); Motcombe, 3.8 (PBu); Winterborne Stickland, 4.8, 19.8, 22.8, 29.9 (LdW); Shaggs, 7.8 (LH); Wimborne St Giles, 8.8, 3 on 23.8, 6 on 29.8, 4.9 (JW); Spetisbury, 17.8 (D&JK)

2300 *Mormo maura* **OLD LADY** Verwood, 14.7, 10.8, 27.8, 8.9 (CC); Wareham, 21.8, 29.8 (BY); Winterborne Stickland, 22.8 (LdW); Merley, 2 on 26.8, 14.9 (RSt); East Holme, 27.8 (JCo); Wimborne, 28.8 (D&MG); Sutton Poyntz, 29.8 (JN); Swanage, 29.8 (JRC); Canford Cliffs, 29.8 (PT); Corfe Mullen, 2 on 29.8 (R&LL); Hurn, 29.8 (MJ); Ashington, 8.9 (JF)

2301 *Dypterygia scabriuscula* **BIRD'S WING** Poole, 22.5 (VG); Hurn, 2.6, 10.6 (MJ); Shaggs, 6.6 (LH), 10.6 (BC), 1.7 (LH), 15.7 (BC); Ashington, 11.6, 1.7, 18.7 (JF); Puddletown, 25.6 (HWH); Swanage, 30.6 (JRC); Wareham, 1.7, 3.7, 10.7, 15.7, 2 on 17.7, 3 on 22.7 (RA); Wimborne, 16.7, 18.7 (D&MG); Colehill, 16.7 (RSt); Corfe Mullen, 25.7 (R&LL); Verwood, 12.7, 22.7 (CC), 25.7, 26.7 (SMP)

2311 *Ipimorpha retusa* **DOUBLE KIDNEY** Powerstock Common, 11.7 (PHS); Broadmayne, 19.7 (PB-J); Hurn, 22.7, 5.8 (MJ); Swanage, 24.7 (TP); Motcombe, 25.7 (PBu); Alners Gorse, 4 on 2.8 (GRH *et al*)

2312 *Ipimorpha subtusa* **OLIVE** Hurn, 10.7, 16.7, 18.7, 22.7, 23.7, 6 on 24.7 (MJ); Winspit, 22.7 (PAD); Chedington Woods, 4 on 23.7 (PHS); Kingston, 26.7 (PBe); West Bexington, 5 on 26.7 (PHS); Puddletown, 2.8 (HWH)

2314 *Parastichtis ypsillon* **DINGY SHEARS** Wimborne, 2.7 (D&MG); Spetisbury, 8.7 (D&JK); Puddletown, 17.7, 22.7, 2 on 26.7 (HWH); Chedington Woods, 23.7 (PHS); Bagmore Wood, 3 on 15.8 (MPl); Sutton Poyntz, 21.8 (JN)

2319 *Cosmia pyralina* **LUNAR-SPOTTED PINION** Gillingham, 13.7, 26.7 (GRH); Kingston, 2 on 14.7 (PBe); Motcombe, 14.7 (PBu); Alners Gorse, 3 on 2.8 (GRH *et al*)

2323 *Apamea sublustris* **REDDISH LIGHT ARCHES** Wimborne St Giles, 2 on 23.5, 5.7 (JW); West Bexington, 27.5 (RE)

2327 *Apamea epomidion* **CLOUDED BRINDLE** Loscombe, 7.6 (OW); Swanage, 8.6, 19.6, 21.6 (JRC); Holt Heath, 2 on 24.6 (PAD); West Bexington, 27.6 (RE); Spetisbury, 27.6, 2.7 (D&JK); Broadmayne, 1.7, 8.7, 11.7, 14.7, 25.7 (PB-J); Chedington Woods, 2 on 1.7 (JM, PAD); Turnworth, 3.7 (PB-J); Kingcombe, 11.7 (PHS); Gillingham, 17.7 (GRH); Bagmore Wood, 21.7 (MPl); Stubhampton Bottom, 3 on 26.7 (CC, MW, PAD)

2331 *Apamea unanimis* **SMALL CLOUDED BRINDLE** Wimborne, 24.5, 1.6, 5.6 (D&MG); Gillingham, 27.5 (GRH); Spetisbury, 31.5 (D&JK); Puddletown, 2 on 1.6, 7.6, 9.6, 30.6 (HWH); West Bexington, 2.6, 5.6, 8.6, 9.6, 10.6 (RE); Wimborne St Giles, 2 on 6.6 (JW); Stanpit Marsh, 8.6 (PAD, RH); Creech Bottom, 21.6 (KMc); Ashington, 1.7 (JF); Hurn, 2 on 5.7, 2 on 24.7 (MJ)

2334 *Apamea sordens* **RUSTIC SHOULDER-KNOT** Portland, 27.4 (PBO); Dorchester, 5.5, 9.5, 10.5, 30.5, 31.5 (JD); Spetisbury, 6.5, 8.5, 14.5, 25.5, 29.5, 31.5, 5.6, 6.6, 10.6 (D&JK); Kingcombe, 8.5 (NS); West Bexington, 9.5 (RE), 11.5 (BH, PHS), 11.5, 12.5, 23.5, 24.5, 27.5, 3.6, 4.6, 5.6, 11.6, 12.6, 13.6, 25.6 (RE); Winspit, 11 on 9.5, 8 on 31.5 (PAD); Broadmayne, 12.5, 27.5, 31.5, 2 on 1.6, 17.6 (PB-J); Fortuneswell, 13.5, 2.6 (EC); Poole, 22.5 (VG); Gillingham, 2 on 29.5, 4.6, 5.6 (GRH); Walditch, 11.6 (MSP); Bagmore Wood, 15.6 (MPl)

2335 *Apamea scolopacina* **SLENDER BRINDLE** Kingcombe, 11.7 (PHS); Winspit, 22.7 (PAD); Chedington Woods, 9 on 23.7 (PAD, PHS); Shaggs, 24.7 (BC); Puddletown, 25.7, 30.7 (HWH); Verwood, 25.7 (SMP); West Bexington, 26.7 (PHS), 26.7 (RE); Motcombe, 26.7 (PBu); Kilwood, 3 on 30.7 (PAD); Alners Gorse, 2.8 (GRH *et al*); Turnworth, 2 on 5.8 (D&JK, LdW, PAD, PBu)

2336 *Apamea ophiogramma* **DOUBLE LOBED** Puddletown, 28.6, 2 on 14.7, 15.7, 17.7, 23.7, 28.7, 29.7 (HWH); West Bexington, 28.6, 11.7 (RE); Gillingham, 14.7 (GRH); Hurn, 28.7, 6.8 (MJ); Kilwood, 30.7 (PAD)

2342 *Mesoligia literosa* **ROSY MINOR** Bagmore Wood, 2 on 14.7 (MPl); Wareham, 22.7 (RA); Winspit, 3 on 22.7 (PAD); West Bexington, 26.7 (PHS), 26.7, 27.7, 28.7, 29.7, 3.8, 4.8, 6.8, 8.8 (RE); Worth Matravers, 28.7 (JK); Durlston, 2 on 30.7 (JK); Walditch, 2.8 (MSP); Spetisbury, 21.8 (D&JK)

2349 *Photedes fluxa* **MERE WAINSCOT** Powerstock Common, 11.7 (PHS)

2358 *Amphipoea fucosa paludis* **SALTERN EAR** Canford Cliffs, 13.7, 23.7, 31.8 (PT); Gillingham, 19.7, 14.8 (GRH); Puddletown, 23.7, 2 on 25.7, 28.7, 2.8, 4.8, 6.8, 7.8, 19.8, 21.8, 25.8, 26.8 (HWH); Poole, 24.7 (VG); Dorchester, 27.7 (JD); Weymouth, 27.7 (PHS); Wyke Regis, 28.7 (DF); Kilwood, 30.7 (PAD); West Bexington, 30.7, 4.8, 6.8, 8.8, 14.8, 15.8, 16.8, 19.8, 21.8, 25.8, 5.9 (RE); Hurn, 10.8 (MJ)

2360 *Amphipoea oculea* **EAR** Hurn, 5.7, 7 on 12.7, 5 on 18.7, 16 on 29.7, 11 on 10.8, 6 on 11.8, 3 on 12.8, 13 on 16.8, 5 on 17.8, 3 on 20.8, 9 on 23.8, 9 on 25.8, 2 on 28.8, 5 on 29.8, 5.9 (MJ); Puddletown, 23.7, 6.8, 20.8, 26.8 (HWH); Charmouth, 26.7 (GS); Trigon, 28.7 (CM, JH, PAD, SR), Kilwood, 30.7 (PAD); Ashington, 31.7, 7.8, 25.8 (JF); Wareham, 2.8 (RA), 7.8, 21.8 (BY); Corfe Mullen, 11.8 (R&LL); Monkton Wyld, 11.8 (OW)

2369 *Nonagria typhae* **BULRUSH WAINSCOT** Puddletown, 14.7, 6.8 (HWH); West Bexington, 22.7, 6.8 (RE); Kilwood, 30.7 (PAD); Alners Gorse, 2.8 (GRH *et al*); Stanpit Marsh, 2 on 15.8 (PAD); Walditch, 26.8, 27.8 (MSP); Wimborne St Giles, 29.8 (JW)

2370 *Archanara geminipuncta* **TWIN-SPOTTED WAINSCOT** Hurn, 4.8 (MJ); Stanpit Marsh, 15.8 (PAD); Dorchester, 27.8 (JD)

2371 *Archanara dissoluta* **BROWN-VEINED WAINSCOT** Portland, 9.8 (PBO); Sutton Poyntz, 14.8 (JN); Stanpit Marsh, 15.8 (PAD)

2373 *Archanara sparganii* **WEBB'S WAINSCOT** Wareham, 24.7 (BY); Kilwood, 30.7 (PAD); Stanpit Marsh, 2 on 15.8 (PAD); Portland, 30.8 (PBO)

2375 *Rhizedra lutosa* **LARGE WAINSCOT** West Bexington, 24.9, 27.9, 11.10, 12.10, 13.10, 15.10, 16.10, 17.10, 18.10, 20.10, 21.10, 22.10, 24.10, 4.11, 6.11, 7.11, 17.11, 26.11 (RE); Walditch, 6.10 (MSP); Eype's Mouth, 6 on 13.10 (MSP); Wareham, 17.10 (RA); Hurn, 18.10 (MJ); Chickerell, 21.10, 3.11 (CP)

2376 *Sedina buettneri* **BLAIR'S WAINSCOT** Maiden Newton, larva in *Carex acutiformis*, several vacated workings on 7.7 (PC, PHS), 10 at dusk on 27.9 (RRC)

2377 *Arenostola phragmitidis* **FEN WAINSCOT** Charmouth, 25.6 (GS); West Bexington, 2 on 15.7, 6.8 (RE); Portland, 26.7 (PBO); Wareham, 7.8 (BY)

2379 *Coenobia rufa* **SMALL RUFOUS** West Bexington, 11.7, 16.7, 19.7, 23.7, 24.7, 30.7, 30.8 (RE); Shaggs, 15.7 (BC); Trigon, 28.7 (CM, JH, PAD, SR); Puddletown, 6.8 (HWH)

2385 *Spodoptera exigua* **SMALL MOTTLED WILLOW** Portland, 12.5, 8.8 (PBO); Dorchester, 14.5 (JD)

2387.1 *Platyperigea kadenii* **CLANCY'S RUSTIC** Hurn, 16.8 (MJ); Wyke Regis, 16.9 (DF); Portland, 29.9, 9.10, 4 on 11.10, 12.10, 4 on 13.10, 4 on 14.10, 15.10, 16.10, 18.10, 20.10, 21.10, 24.10 (PBO); Shaggs, 8.10 (LH); West Bexington, 5 on 10.10, 5 on 11.10, 5 on 12.10 (RE), 6 on 12.10 (PHS), 10 on 13.10 (RE), 19 on 13.10 (PHS), 2 on 14.10, 16.10, 3 on 17.10, 2 on 19.10, 20.10, 2 on 22.10, 24.10 (RE); Swanage, 10.10 (TP), 11.10, 12.10, 5 on 13.10 (JRC), 18.10 (PE), 22.10 (TP); Preston, 10.10, 14.10, 16.10, 3 on 18.10 (RL); Corfe Castle, 11.10 (RC); Eype's Mouth, 13.10 (MSP); Wareham, 14.10 (BY); Chickerell, 16.10, 17.10 (CP); Durlston, 6 on 18.10 (MD, *et al*), 4 on 19.10 (JCl)

2391 *Chilodes maritimus* **SILKY WAINSCOT** Puddletown, 15.7, 16.7 (HWH); Stanpit Marsh, 2 on 8.6 (PAD, RH)

2392.1 *Proxenus hospes* **PORTER'S RUSTIC** Portland, 29.5, 30.5, 8.6, 31.8, 12.9, 2 on 14.9, 16.9 (PBO)

2396 *Elaphria venustula* **ROSY MARBLED** Hurn, 7.6 (MJ); Verwood, 8.6 (CC); Ringwood Forest, 2.7 (RG)

2397 *Panemeria teandrata* **SMALL YELLOW UNDERWING** Corfe Mullen, by day on 7.5 and on 8.5 (D&MG); Broadwindsor, by day on 10.5 (MSP)

2399 *Pyrrhia umbra* **BORDERED SALLOW** Fortuneswell, 11.6 (EC); West Bexington, 30.6, 8.7, 25.7 (RE); Winspit, 22.7 (PAD)

2400 *Helicoverpa armigera* **SCARCE BORDERED STRAW** Portland, 7.8, 6.9, 16.9, 18.9 (PBO); Puddletown, 7.8 (HWH); West Bexington, 30.8, 7.9 (RE); Wyke Regis, 12.9 (DF)

2403 *Heliothis peltigera* **BORDERED STRAW** Puddletown, 6.8 (HWH); Swanage, 28.6 (JRC)

2412 *Deltote uncula* **SILVER HOOK** Holt Heath, 4 on 2.6 (PAD)

2418 *Earias clorana* **CREAM-BORDERED GREEN PEA** West Bexington, 29.5, 9.6, 17.6, 20.6, 2 on 24.6, 7.8 (RE); Swanage, 30.5 (TP); Holt Heath, 4 on 2.6, 3 on 24.6 (PAD); Puddletown, 9.6, 10.6, 4 on 24.6, 2 on 28.6, 1.7, 2.7, 23.7, 2.8, 7.8 (HWH); Beacon Hill, 12.6 (RSt); Creech Bottom, 2 on 24.6, 28.6 (KMc); Shaggs, 1.7, 7.8 (LH); Walditch, 1.7 (MSP); Ringwood Forest, 2.7 (RG); Higher Hyde, 11.7 (DF); Chickerell, 23.7 (CP)

2430 *Ctenoplusia limbirena* **SCAR BANK GEM** West Bexington, 10.10 (RE)

2436 *Macdunnoughia confusa* **DEWICK'S PLUSIA** Winspit, 22.7 (PAD); Portland, 26.7, 13.9 (PBO); West Bexington, 15.9 (RE); Swanage, 30.9 (TP); Durlston, 18.10 (MD, *et al*)

2439 *Plusia festucae* **GOLD SPOT** Puddletown, 31.5, 2 on 15.8, 3 on 21.8, 23.8, 24.8, 25.8, 2 on 26.8, 2 on 27.8, 28.8, 19.10 (HWH); Wareham, 10.6, 6 on 7.8, 3 on 21.8, 2 on 29.8 (BY); Spetisbury, 17.6, 29.7, 1.8, 11.8, 21.8, 23.8 (D&JK); Creech Bottom, 27.6 (KMc); Preston, 23.7, 31.7, 1.8, 8.8, 14.8, 21.8, 25.8 (RL); West Bexington, 24.7, 2 on 29.8 (RE); Wyke Regis, 27.7 (DF); Trigon, 28.7 (CM, JH, PAD, SR); Winterborne Stickland, 6.8, 2 on 7.8 (LdW); Shaggs, 7.8 (LH); Ashington, 7.8 (JF); Portland, 2 on 7.8, 31.8 (PBO); Broadmayne, 7.8, 10.8 (PB-J); Dorchester, 7.8, 27.8 (JD); Hurn, 11.8, 13.8, 2 on 17.8, 23.8, 28.8, 29.8 (MJ); Stanpit Marsh, 15.8 (PAD); Wimborne St Giles, 29.8 (JW)

2449 *Abrostola trigemina* **DARK SPECTACLE** Puddletown, 16.5, 19.5, 23.5, 27.5, 29.5, 1.6, 12.6, 21.6, 24.6, 1.7, 3.7, 2 on 7.7, 8.7, 3 on 14.7, 2 on 15.7, 18.7, 20.7, 24.7, 2 on 25.7, 28.7, 2.8, 3.8, 6.8, 21.8, 24.8, 2 on 28.8, 2 on 29.8, 8.9, 12.10 (HWH); Kingston, 23.5 (PBe); West Bexington, 1.6, 17.7, 21.7, 3 on 26.7 (PHS), 29.7, 29.8, 31.8, 11.9, 19.9, 21.9, 23.9 (RE), 2 on 13.10 (PHS); Hurn, 12.6, 18.6, 5.7, 16.8, 25.8, 28.8, 29.8, 12.9 (MJ); Stone's Common, 28.6 (DF); Wyke Regis, 1.7 (DF); Spetisbury, 4.7, 16.7, 22.7, 15.8 (D&JK); Portland, 11.7, 11.9, 1.10, 19.10 (PBO); Higher Hyde, 11.7 (DF); Holditch, 14.7 (DP); Broadmayne, 14.7 (PB-J); Shaggs, 15.7 (BC), 10.9 (LH); Dorchester, 17.7, 24.9 (JD); Walditch, 21.7, 3 on 25.7, 9.9 (MSP); Winspit, 22.7 (PAD); Weymouth, 24.7 (PHS); Preston, 23.8, 24.8, 27.8 (RL); Corfe Mullen, 29.8 (R&LL); Swanage, 2 on 27.9 (PE); Verwood, 29.9 (CC); Durlston, 18.10 (MD, *et al*)

2451 *Catocala fraxini* **CLIFDEN NONPAREIL** Shaggs, to house-lit first-floor window whence netted on 7.9 (LH); Spetisbury, 7.9, 7.10 (D&JK)

2452 *Catocala nupta* **RED UNDERWING** West Bexington, 9.8, 19.8 (RE), 7.9 (MS); Puddletown, 25.8, 26.8, 28.8, 30.8 (HWH); Walditch, 26.8, 7.9, 8.10 (MSP); Hurn, 3.9, 12.9 (MJ); Wareham, 10.9 (PAD); Swanage, 18.9 (PE); Spetisbury, 22.9 (D&JK); Shaggs, 1.10 (LH)

2462 *Callistege mi* **MOTHER SHIPTON** Bindon Hill, by day on 9.6.2006 (SE); Holnest, by day on 20.5 (RSm); Cogden Beach, by day on 23.5 (MSP); Merley, 29.5 (RSt); Rooksmoor, 3 by day on 29.5 (RSm); Iwerne Minster, 3 by day on 4.6 (WR); Lydlinch Common, 2 by day on 8.6 (R&TH); Alners Gorse, by day on 8.6 (R&TH); Hog Hill, by day on 9.6 (MSP); Holes Bay, 11.6 (D&MG); Broadcroft Quarry, by day on 22.6 (NS)

2465 *Tyta luctuosa* **FOUR-SPOTTED** Isle of Portland, 22.5 (PBO)

2466 *Lygephila pastinum* **BLACKNECK** Chickerell, 25.6 (PHS); Chedington Woods, 1.7 (JM); Puddletown, 1.7 (HWH); Broadmayne, 16.7 (PB-J); Wimborne St Giles, 25.7 (JW)

2476 *Hypena crassalis* **BEAUTIFUL SNOUT** Puddletown, 28.6, 3.7, 14.7 (HWH); Charmouth, 30.6 (GS); Ringwood Forest, 2.7 (RG); Verwood, 7.7 (CC)

2478 *Hypena obsitalis* **BLOXWORTH SNOUT** Shaggs, 28.8, 29.8 (LH); West Bexington, 14.9 (RE)

2480 *Hypena rostralis* **BUTTONED SNOUT** Winspit, 9.5 (PAD); Spetisbury, 12.5 (D&JK); Verwood, 31.5 (CC); Hurn, numerous feeding signs on hop all around garden on 31.7, 31.8 (MJ)

2485 *Hypenodes humidialis* **MARSH OBLIQUE-BARRED** Verwood, 23.7, 27.7 (SMP); Weymouth, 24.7 (PHS); Trigon, 28.7 (CM, JH, PAD, SR); Morden Bog, 4 on 26.8 (PAD); Shaggs, 22.9 (LH); Carey Camp, 30.9 (DA, PHS)

MOTH IMMIGRATIONS TO DORSET IN 2008 PLUS POTENTIAL SOURCES OF ORIGIN

Peter Davey

Overview

Cooling of large areas of the tropical Pacific Ocean persisted through 2008 and extended the duration of the El Ninã ocean-atmosphere coupled system that became established in the early part of 2007. To recap, this phenomenon displaces southwards the usual path of the jet stream over the North Pacific and North Atlantic, and causes high rainfall in western temperate regions of North America and northern Europe, respectively. In many ways, 2008 was a re-run of the 2007 season and memorably afforded one of the direst summers in recent years in terms of high rainfall and lack of sunshine. Amazingly, the annual average temperature was above normal for the twentieth consecutive year; and, as in 2007, just two months in 2008 had below average monthly temperatures.

Notable immigration events and associated weather conditions

Up until the middle of January, the weather remained unsettled with strong south-westerly winds prevailing. Pressure then rose over Spain and France, and introduced tropical air originating over Western Sahara. Uniquely, this weather pattern persisted up to the end of February. During this six-week period dust plumes erupted continuously from the region of the Sahara and were blown out into the Atlantic on persistent south-easterly winds. On four occasions these plumes reached England. The first of these crossed Dorset on 23 January and with it, the first *Euchromius ocellea*, a sub-tropical pyralid species that is rarely observed in the UK. Subsequent dust plumes brought additional waves of *Euchromius ocellea* and a total of twenty-three were recorded across the county by the end of the period. Other than a single *Udea ferrugalis* and a single *Nomophila noctuella*, no immigrant macromoth species were seen, however Large Tortoiseshell butterflies were seen on no less than four occasions on Portland during this period. A full account of this remarkable immigration appears in the bi-annual insect immigration magazine *Atropos* (Issue 34 Spring 2008).

March continued the mild theme until mid-month when colder north-westerly airflows held sway. A short-lived southerly airflow on March 15 delivered a Dark Sword-grass to Ashington, and a second example to Broadmayne plus a very early Large White butterfly to Portland several days later. Apart from the first few days and the fourth week of April, the month tended to be cyclonic with cold polar winds from between north-west and north-east. During the second warm spell with south-west winds originating over Iberia, a Silver Y was trapped at Chickerell on 23 April and a Dark Sword-grass at Wareham plus a Painted Lady butterfly to Portland several days later. There was little else of note.

Pressure rose over Scandinavia and Germany in early May introducing a very warm south-easterly airflow to England having originating over the Mediterranean before passing across central Europe. The airflow veered slowly to north-east by mid-month. Many dispersive and immigrant examples were noted:

- *Plutella xylostella* at Alners Gorse on 3 May (8), on Portland on 5 May (8), and at West Bexington on 9 May (9)
- Painted Lady butterfly on Portland on 4 May (2)
- Red Admiral butterfly on Portland on 4 May (2)
- Blair's Mocha at Poole on 5 May (a very rare first brood individual; most UK examples arrive during the autumn)
- Ruddy Highflyer at Seatown on 5 May
- Ringed Carpet at Spetisbury on 7 May

- Nutmeg on Beacon Hill on 8 May and at Wimborne on 10 May
- Wormwood Pug at Wareham on 8 May and at Shaggs on 13 May
- Angle-barred Pug at Puddletown on 6 and 9 May, and at Ashington on 10 May
- Buttoned Snout at Winspit on 9 May
- Grey Scalloped-bar at Bagmore Wood on 9 May
- Miller at West Bexington on 10 May
- Northern Drab at West Bexington on 10 May
- Silver Y at Wimborne on 10 May
- Dorset Cream Wave on Portland on 12 May (second Dorset record and third UK record)
- Small Mottled Willow on Portland on 12 May and at Dorchester on 14 May
- White Spot on Portland on 15 May
- Oblique-striped on Portland on 19 May.

The remainder of May was cool and cyclonic with mainly north-easterly winds, and consequently negligible immigrant activity. The cyclonic theme persisted right through much of June with cool winds, mainly from the north-west. A brief spell of south-easterlies occurred during the fourth week of June, before giving way to a stormy south-westerly that lasted until the end of the month:

- Four-spotted Footman at West Bexington and Hurn on 20 June, Puddletown on 21 June
- L-album Wainscot at Spetisbury on 22 June
- Channel Island's Pug at West Bexington on 24 June
- *Agrotera nemoralis* at West Bexington on 24 June (first Dorset record)
- Bordered Straw at Swanage on 28 June.

Apart from the first day of July (winds very temporarily blew from France, when the following were seen: a Grey Arches on Portland, a Langmaid's Yellow Underwing at West Bexington, and a Gem at Puddletown) the first three weeks of July followed the summer's unsettled trend with Atlantic-sourced west to north-westerly airflows for the mostpart. A dramatic change in the weather occurred on 21 July as pressure at last began to rise over the UK. This region of high pressure transferred across the Low Countries to Scandinavia, introducing a hot (29°C) south-easterly airflow from the Mediterranean across Europe to the UK. This warm airflow veered to between east and north-east by the end of the fourth week and back through south-east to south by the end of the month. Many immigrant and dispersive species appeared at this time:

- L-album Wainscot at Spetisbury on 22 July
- Four-spotted Footman, many recorded during this spell
- Dewick's Plusia at Winspit on 22 July and on Portland on 26 July
- Least Carpet at Weymouth on 23 July, at Spetisbury on 25 July, and at Wyke Regis on 1 August
- *Plutella xylostella* on Portland on 25 July (51) and on 27 July (71)
- *Conobathra tumidana* on Portland 25 July
- *Mecyna flavalis* at Puddletown on 25 July, on Portland on 26 July, and at West Bexington on 26 July
- White Satin at Motcombe on 25 July
- Lunar Thorn on Portland on 25 July (a rare example of a Continental second brood)
- Reed Dagger at Hengistbury Head on 25 and 26 July and on Portland on 26 July (third, fourth and fifth Dorset records)
- Dark Spinach on Portland on 25 July and at Puddletown on 30 July
- *Yponomeuta rorella* at Shapwick on 23 July, at Puddletown on 24 July and 25 July (38), at Weymouth on 24 July (2) and 27 July (6), at West Bexington on 25 July (3), 26 July (5), 27 July (10), 30 July, on Portland on 26 July, at Trigon on 28 July, and at Kilwood on 30 July (3)
- *Acleris umbrana* at West Bexington on 26 July (first Dorset record for well over half a century)
- *Elegia similella* at Puddletown on 26 July
- *Cydia amplana* on Portland on 26 July (2)
- Yarrow Pug on Portland on 26 July (second Dorset record)
- *Dioryctria abietella* at West Bexington on 27 July
- Bedstraw Hawk on Portland on 28 July
- Peacock at Kilwood on 30 July
- Great Dart at Swanage on 30 July
- Jersey Tiger at Durlston on 30 July
- Jersey Mocha at Chickerell on 2 August and at Walditch on 3 August (fourth and fifth Dorset records)

Apart from very brief southerlies around 6, 16 and 30 August, the third summer month in a row suffered from persistent and often windy westerly airflows from off the Atlantic. A few immigrant species were observed on these three occasions:

- *Yponomeuta rorella* at West Bexington on 6 and 7 August
- Bordered Straw, at Puddletown on 6 August
- White-speck, at Puddletown on 6 August
- Channel Island's Pug at West Bexington on 6 and 8 August
- *Evergestis extimalis* on Portland on 7 August
- *Palpita vitrealis* on Portland on 7 August
- Vestal at Winterborne Stickland on 7 August
- Scarce Bordered Straw on Portland and at Puddletown on 7 August, and at West Bexington on 30 August
- *Cydia amplana* on Portland on 8 August (2)
- Small Mottled Willow on Portland on 8 August
- *Pediasia contaminella* on Portland on 9 August
- Clancy's Rustic at Hurn on 16 August
- Great Dart on Portland on 16 August
- Jersey Tiger at Swanage on 30 August
- Webb's Wainscot on Portland on 30 August
- *Ancylosis oblitella* on Portland on 31 August

The mobile and often cyclonic westerly flow that characterised much of the summer, continued into the first fortnight of September, apart from a brief southerly on 5 September. The weather pattern then changed dramatically around mid-month, with pressure rising in a broad belt between the Azores and Scandinavia. The resulting north-easterly airflow lasted until the end of the month.

- Scarce Bordered Straw on Portland on 6, 16 and 18 September, at West Bexington on 7 September and at Wyke Regis on 12 September

- Clifden Nonpareil at Shaggs and Spetisbury on 7 September
- Vestal at Gillingham on 9 September, and on Portland on 15 and 16 September
- Portland Ribbon Wave at Highcliffe on 12 September, at West Bexington on 13 September, and at Charmouth on 15 September
- *Palpita vitrealis* at West Bexington on 13 September
- Dewick's Plusia on Portland on 13 September, at West Bexington on 15 September and at Swanage on 30 September
- Langmaid's Yellow Underwing at West Bexington on 13, 20 and 22 September
- Cosmopolitan on Portland on 14 September
- Bloxworth Snout at West Bexington on 14 September
- *Antigastra catalaunalis* on Portland on 15 September
- *Nomophila noctuella* on Portland on 15 September (20)
- Gem on Portland on 16 September

A stormy west or north-westerly that developed at the very end of September persisted into the first week of October. Winds backed into the south temporarily on 6 October before veering once more into the west ahead of a large area of high pressure intensifying over Biscay. This anticyclone crossed the country before moving east into central Europe by 10 October. This process caused warm winds (21°C) to be drawn in from the Mediterranean via France to the UK from this date and ushered in an impressive array of immigrant species. Conditions remained warm and largely anticyclonic until 19 October. Atlantic westerly winds dominated the fourth week before being displaced by a cold north-westerly by month-end.

- Clifden Nonpareil at Spetisbury on 7 October
- Scar Bank Gem at West Bexington on 10 October (fourth Dorset record)
- Gem at Walditch on 10 and 12 October, at West Bexington on 11 and 12 October, at Swanage on 11 October, at Burton Bradstock on 12 October, at Puddletown on 25 October
- White-speck at West Bexington on 6, 10 and 15 October, on Portland on 15, 16, 20, 22, 23 (3), 27 and 29 October, Hurn on 25 October, at Puddletown on 26 October
- Vestal at Walditch on 12 October, at Puddletown on 12 (2) and 17 October, at Corfe Castle on 12 October, at Spetisbury on 13 October, at Wareham on 13 and 14 October, at East Stoke on 13 October, and on Portland on 14 (5) and 15 October
- *Ostrinia nubilalis* on Portland on 12 October
- Sombre Brocade at Durlston on 12 October (new species to mainland Britain)
- Flame Brocade at Durlston and on Portland on 12 October
- *Palpita vitrealis* on Portland on 13 October
- *Stenoptilia zophodactylus* at West Bexington on 14 October
- Dewick's Plusia at Durlston on 18 October
- Buff Footman at Durlston on 18 and 19 October
- Crescent Dart at Durlston on 19 October
- Radford's Flame Shoulder at West Bexington on 22 October (sixth Dorset record)

Polar airflows, mainly from the north-west but occasionally from the east or north-east dominated the final two months of the year; no significant immigrations were observed.

DORSET HOVERFLY REPORT 2008

D.A. and E.T. Levy

This year proved to be much better than expected for Syrphidae in Dorset, with 120 species listed, including two 'new' to the County. Wareham Forest (F.C.) again proved a prolific site where several scarce species were found. Dave was particularly pleased to find a colony on Microdon analis/major (previously M. eggeri); our third record of this scarce hoverfly since the 80's (the last of which, were singles found at Studland), at Wareham Forest it was recorded between May 10th and 27th.

Listed below are a selection of records we consider worthy of special mention. Our thanks are due to Ken Dolbear who submitted several photographic records.

Syrphidae (Diptera)

Chrysotoxum elegans	Bottomcombe, Portland 18.9.08 (KD)
Chrysotoxum festivum	Wareham Forest 23.8.08
Didea intermedia	Wareham Forest – 6 records between 29.6.08, 21.9.08
Epistrophe diaphana	Wareham Forest 15.8.08 (scarce)
Epistrophe nitidicollis	Wareham Forest – 5 records between 2.5.08 and 24.5.08
Epistrophella euchroma	Wareham Forest 18.5.08, 20.7.08 (3rd Dorset locality record)
Eupeodes bucculatus	Wareham Forest – 4 records between 2.5.08 and 30.8.08
Eupeodes goeldlini	Wareham Forest 22.6.08, 20.7.08
	Puddletown Forest 13.7.08 (2nd Dorset locality record)
Eupeodes nitens	Wareham Forest 22.7.08, 24.8.08
Lapposyrphus lapponica	Puddletown Forest – 3 records between 13.7.08 and 27.7.08 (rare)
Parasyrphus malinellus	Yellowham Wood 3.5.08 (3rd Dorset locality record)
Platycheirus europaeus	Wareham Forest 27.5.08 New Dorset record
Platycheirus splendidus	Wareham Forest 9.5.08, 17.5.08, 18.5.08
	Holt Hill Woods, Bishops Caudle 5.5.08
Platycheirus tarsalis	Yellowham Wood 22.4.08, 5.5.08 (6th Dorset locality record)
	Holt Hill Woods, Bishops Caudle 5.5.08 (7th Dorset locality record)

Scaeva selenitica	Wareham Forest 23.3.08, 1.4.08, 4.4.08
Sphaerophoria batava	Wareham Forest – 15 records between 23.4.08 and 30.8.08 Puddletown Forest – 3 records between 13.7.08 and 10.8.08
Sphaerophoria fatarum	Puddletown Forest – 6 records between 23.4.08 and 9.5.08 Yellowham Wood 19.4.08
Sphaerophoria interrupta	Wareham Forest 24.4.08, 24.5.08, 24.8.08
Sphaerophoria philanthus	Wareham Forest 9.5.08
Sphaerophoria taeniata	Wareham Forest 23.8.08 (scarce)
Sphaerophoria virgata	Wareham Forest – 5 records between 23.4.08 and 11.5.08
Xanthandrus comtus	Brackett's Coppice DNT 8.7.08
Xanthogramma citrofasciatum	Portland 25.5.08 (scarce, on Alexanders)
Arctophila superbiens	Bridport (Loders) 15.8.08 (KD) Powerstock Common DNT 13.9.08 (on Fleabane)
Chalcosyrphus nemorum	Wareham Forest – 5 records between 24.4.08 and 23.8.08
Cheilosia lasiopa	Wareham Forest 9.5.08, 18.5.08
Cheilosia scutellata	Powerstock Common DNT 23.7.08 Puddletown Forest 13.7.08
Cheilosia soror	Holt Hill Woods 22.8.08
Cheilosia vulpina	Puddletown Forest 27.7.08
Chrysogaster virescens	Wareham Forest 2.5.08 (scarce)
Helophilus hybridus	Powerstock Common DNT 13.9.08
Microdon analis/major	Wareham Forest – 7 records between 9.5.08 and 27.5.08
Neocnemodon latitarsis	Puddletown Forest 13.7.08
Parhelophilus frutetorum	Wareham Forest 24.5.08
Orthonevra geniculata	Wareham Forest – 4 records between 4.4.08 and 2.5.08
Pelecocera tricincta	Wareham Forest – 11 records between 22.6.08 and 24.9.08
Pipiza bimaculata	Wareham Forest 10.5.08 (8th Dorset locality record)
Pipiza lugubris	Holt Hill Woods 22.8.08
Sericomyia lappona	Wareham Forest – 7 records between 24.4.08 and 22.6.08. Late record 23.8.08
Sphegina sibirica	Wareham Forest 27.5.08 (on Water Dropwort). New Dorset record
Volucella inflata	Little Bredy 20.7.08
Volucella zonaria	Portland 17.8.08 (on Fennel)

PLANT GALL REPORT 2008

J.A. Newbould
3 Brookmead Close, Sutton Poyntz, Weymouth DT3 6RS

Seventy-two species of plant galls were found on a total of forty-five plant species during 2008. This resulted in some 270 records being made available to Dorset Environmental Records Centre, mostly with good six-figure or better grid references. Many of the records were generated during Society field meetings. In addition, I was able to work with Bryan Edwards of DERC on a hedgerow survey project in the Powerstock and Kingcombe areas.

Figure 1: Diplolepsis rosae *Robin's Pin Cushion gall (© Tom Higgingbottom 2008)*

A gall is an abnormal growth produced by a plant or other host under the influence of another organism. It involves enlargement and/or proliferation of host cells, and provides both shelter and food or nutrients for the invading organism (Redfern and Shirley 2002). Some well-known types of gall are Oak-apples, Robin's Pincushions and Witches' Brooms.

Tom Higgingbottom (Chairman of the British Plant Gall Society) sent me this note: "The oak gall wasps have a life cycle involving a fixed alternation between two different generations each year. One generation is the sexual generation, which produces male and female gall wasps, while the agamic generation produces only females. One of the easier galls to observe in both generations is *Neuroterus quercusbaccarum*. The spring generation, the sexual generation, forms currant-like galls on either the catkins or leaves of oak and both male, and female gall wasps emerge from these galls. The females of this generation lay eggs in oak leaves which induce the formation of the flat, disk-like spangle galls on the under surface of the leaf later in the summer. The adults, which emerge from the larvae from this generation are all females and over winter in the leaf litter once the leaves have fallen in autumn.

When recording the oak gall wasps for the BPGS, we are indicating which generation e.g. the spring generation *Neuroterus quercusbaccarum* (Sx) the sexual generation while the summer gall, the disk as *N. quercusbaccarum* (Ag) This is indicated in the FSC Key for *N. quercusbaccarum* by ♀♂ for the sexual (p. 416) and *N. quercusbaccarum* ♀♀ for the agamic (p. 412)."

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To the following landowners for permission to survey: The National Trust (Purbeck and West Dorset estates), Wessex Water (Sutton Poyntz), The Commander, Lulworth Gunnery School, Dorset Wildlife Trust; to Bryan Edwards and Dorset Environmental Records Centre for arranging a number of permissions in respect of the Defra hedgerow survey.

Host species	Gall causer	Notes
Acer pseudoplatanus	*Aceria cephaloneus*	Just two records from east Weymouth
	Aceria macrorhynchus	Just one record Preston Rd, Weymouth
Acer campestre	*Aceria aceriscampestris*	Nine records. Two from Sutton Poyntz and the balance from West Dorset
	Aceria eriobius	South Poorton (SY521981) Powerstock Common (SY546974)
	Aceria macrochelus	Fifteen records including Pistle Hill (SU088119) and St Gabriel's (SY402905)
	Dasineura irregularis	Wytherstone (SY531970)
Alnus glutinosa	*Eriophyes laevis*	Kingcombe (SY556997), Hooke (ST523004)
	Taphrina tosquinetii[1]	Wytherstone (SY529871)
Arrhenatherum elatus	*Aceria tenuis*[3]	ST915198 on Wiltshire/Dorset Border
Betula pendula	*Taphrina betulina*[1]	A witch's broom common
	Cecidophyopsis betulae	Preston Road verge (SY695821)
Betula pubescens	*Cecidophyopsis betulae*	Pistle Down (SU090115) & Spur Bog (SZ026842)
Buxus sempervirens	*Eriophyes canestrinii*	Compton old churchyard (ST876187)
	Monarthropalpus flavus	Compton old churchyard (ST876187)
Centaurea nigra	*Urophora jaceana*	Three records from Toller Porcorum and one from Westhay Farm (SY385926)
Centaurea scabiosa	*Aceria centaureae*	Fontmell (ST880188) Zigzag Hill (ST895208)
Clematis vitalba	*Aceria vitalbae*	Ox Drove (ST914199), South Poorton, (SY509976) Powerstock (SY519964)
Cornus sanguinea	*Phyllocoptes depressus*	East Wears **(BE)** (SY7072), Ox Drove (ST899206), South Poorton (SY509976) & Sutton Poyntz (SY710840)
Crataegus monogyna	*Aceria crataegi*	Creech (SY904827)
	Phyllocoptes goniothorax	Seven records across the county but surprisingly difficult to spot in Hawthorn hedges
	Rhopalosiphum insertum	Sutton Poyntz SY705835, Litton Cheney SY555897
Dactylis glomerata	*Aceria tenuis*	Toller Porcorum (SY552983)
Euonymus europaeus	*Cediophyes psilonotus*	Loscombe area (SY499971)
Fagus sylvatica	*Hartigiola annulipes*	Hooke (SY527999), Ox Drove (ST903204) and Toller Porcorum (SY546977)
Filipendula ulmaria	*Dasineura pustulans* *Dasineura ulmaria*	Both species common in wet ditches
Fraxinus excelsior	*Aceria fraxinicola*	Lyme Regis (SY331929)
	Dasineura acrophila	Six records from Weymouth and West Dorset
	Dasineura fraxini	Six records from Weymouth and West Dorset
	Psyllopsis fraxini	Four records – Weymouth and West Dorset
Galium aparine	*Cecidophyes galii*	Considering the amount of the host in Dorset, there were just three records for this species
Galium palustre	*Dasineura hygrophila*	Corfe Common (SY964809)
Genista tinctoria	*Jaapiella genisticola* **(BE)**	Toller Porcorum (SY546977)
Glechoma hederacea	*Dasineura glechomae*	Kingcombe (SY552989)
	Rondaniola bursaria	Loscombe (SY498975)
Ilex aquifolium[4]	*Phytomycer ilicis*	Common but not many records in 2008
Juglans regia	*Aceria erineus*	Sutton Poyntz (SY704832)
Juncus bufonius	*Livia juncorum*	All records from Dorset Heath. Pistle Down (SU088111), Godlingston Heath (SZ026830) & Creech (SY904827)
Lonicera pericylmenum	*Macrolabis lonicerae*	Mount Pleasant (SY537989)
Malus sylvestris	*Phyllocoptes mali*	Loscombe (SY499970)
	Dysaphis plantaginea	Wytherstone (SY531971)

Host species	Gall causer	Notes
Prunus domestica	*Aculus fockeui*	Kingcombe (SY553990)
	Eriophyes similis	Hooke (SY529990), Sutton Poyntz (SY710841)
	Taphrina wiesneii[1]	Four records across the County – common
Prunus spinosa	*Eriophyes padi*	Common five records across the County
	Eriophyes prunuispinosae	Povington (SY886828), Lyme Regis (SY328921) & Powerstock (SY545974)
	Taphrina wiesneii[1]	Five records across the County – common
	Taphrina pruni[1]	South Poorton (SY510975). This gall, occasionally, is found on every Blackthorn bush, then becoming quite scarce
Pteridium aquifolium	*Chirosia grossicauda*	Hooke (SY528997) and Toller Porcorum (SY546977)
	Dasineura filiciana	Hooke (SY528997)
	Paltodora cytisella	Toller Porcorum (SY559982)
Pulicaria dystentrica	*Myopites inulaedyssentericae* **(BE)**	Toller Porcorum (SY556985). Uncommon found mainly in SE England (Redfern 2002)
Pyrus communis	*Dasineura pyri*	On an old Pear Sutton Poyntz (SY705836)
Quercus robur	*Andricus kollari*	Common seven records across the County
	Andricus quercuscalicis	Common twelve records across the County
	Andricus quercusramuli	Pistle Hill (SU088119), Litton Cheyney (SY555897)
	Biorhiza pallida	Pistle Hill (SU088119), Ramipsham (ST551986)
	Neuroterus anthracinus	Wytherstone (SY530597), Toller Porcorum (SY553978)
	Neuroterus numismalis	Common eleven records across the County
	Neuroterus quercusbaccarum	Povington (SY887826), Wytherstone (SY530970) & Stonebarrow (SY389933)
Rosa canina	*Blennocampa phyllocolpa*	Kingcombe (SY550987) Litton Cheney (SY555897)
	Diplolepsis rosae (Robin's Pin Cushion gall)	Ox Drove (Wiltshire border) (ST899206). Toller Porcorum (SY646976). This normally common gall was only seen twice during the year
	Dasineura eglanteriae	South Poorton (SY509976). Powerstock Common NR (SY546974)
	Wachtliella rosarum	Sutton Poyntz (SY705826)
Salix alba	*Pontania proxima*	Sutton Poyntz waterworks (SY707842)
Salix cinerea	*Aculus laevis*	Knoll Beach (SZ032837), Creech (SY903827) Kingcombe (SY552990)
	Hexomyza simplicoides[2]	Povington ((SY887821), Ware Cliff (SY333914), Stonebarrow (SY382933)
	Pontania erculata[5]	Corfe Common (SY967812)
	Pontania pedunculi	Toller Porcorum (SY559982)
	Pontania tuberculata	Six Records across the County
	Rabdophaga salicis	Ware Cliff (SY332914)
On both *Salix cinerea* and *Salix x multinervis*	*Iteomyia capreae*	Common – Thirteen records across Dorset
	Iteomyia major	Common – Fifteen records across Dorset
	Pontania bridgmanii	Four records across Dorset
Salix fragilis	*Pontania proxima*	Tincleton (SY768910)
Salix viminalis	*Pontania proxima*	Loscombe (SY499974)
Sambucus nigra	*Epitrimerus trilobus*	An in-rolled leaf edge gall being one of only two found on Elder. Three records
Sorbus aucuparia	*Eriophyes sorbi*	Creech (SY904826) Rowan is mainly found on the acid soils of east Dorset (Bowan 2000). I suspect that this gall has been considerably under recorded in 2008

Host species	Gall causer	Notes
Tilia x europaea	*Eriophyes tiliae*	Dorchester (SY688905) on recently introduced trees. Creech (SY903823)
Tragopgon pratensis	*Puccinia hysterium*[1]	Ackling Dyke (SU019170) One of just two fungal galls on Goat's-beard
Ulmus glabra	*Tetraneura ulmi*	A club-shaped gall on Wych Elm. West Milton (SY492961)
Urtica dioica	*Dasineura urticae*	Considering the amount of nettle under the hedges of the County, this gall was surprisingly difficult to find with five records
Veronica chamaedrys	*Jaapiella veronicae*	Sutton Poyntz (SY706842), Hooke (ST5200) and North Poorton (SY523981)

[1]Indicates a fungal gall
[2]The identification of this rare gall was confirmed by W.A. Ely, (Biological Records Officer, Rotherham MBC)
[3]*Aceria tenuis* is an Eriophyoidea gall in the stalk of a panicle on a wide variety of grasses, said to be common, but galls on grasses are difficult to find and are not commonly recorded
[4]*Phytomyza ilicis* on holly: Margaret Redfern regards as a leaf mine
[5]*Pontania crculata* might be *P. tuberculata*. This group is under review at the moment by the sawfly experts
Records from **(BE)** Bryan Edwards determined J.A. Newbould. None attributed records are all J.A. Newbould.

To Tom Higgingbottom (Chairman British Plant Gall Society) who drew my attention to the galls on ferns and during a day in the field in the North York Moors National Park; peer reviewed my identifications; and checked nomenclature in the report.

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The Dorset Coast

Medieval Seamarks around the Dorset Coast

A seamark can be defined as an object on land, either natural or artificial, which is visible from the sea and which is used by sailors as a guide to enable them to avoid hazards and navigate a safe passage. Seamarks can work in several ways, they can help identify a particular part of the coast, for example the chapel on St Aldhelm's Head (Barker and Le Pard 2004) or they can be used to indicate a safe route for vessels, as the Chantry at Bridport may do (Le Pard 2008).

Almost anything can be used as a seamark, modern sailors (the elder ones especially) will still fix a position by means of them, using trees, houses shapes of hills, indeed anything clearly visible from the water. To work out what seamarks were used in the past, we have to know what objects were visible in the past, and surviving medieval buildings are obvious candidates.

We know that medieval churches were used as seamarks, in the 'Lansdown Manuscript[1], a rare example of surviving medieval sailing directions, the mariner is instructed to use churches as guides in navigating the Essex coast:

> Bring your marks together so that the parish steeple be out by the east of the Abbey of St Hosies (St Osyth) [Hutchinson (op cit)]

Indeed it is probable that some churches were deliberately sited in the best position to help seafarers. They were frequently the largest building in an area and, particularly when they had a tower, were easily recognisable. In addition the use of a church building as a guide to protect from danger might be considered as the physical equivalent of the spiritual function of the building.

Given that almost anything can be used as a seamark, it just has to be in the right position, how can medieval seamarks be identified? The simplest way is by examining early charts; accurate charts of the Dorset coast date from 1693. These early charts make extensive use of seamarks and, if they are ancient buildings, or natural features, it is possible that they may have been used as such for a very long time, perhaps from the time when they were originally built.

Christchurch Priory and St Catherine's Chapel

Running south-east from Hengistbury head is Christchurch ledge. Lt Murdoch Mackenzie, in his chart of 1785 gives these directions for avoiding the eastern side of the ledge:

> Christ Church Tower will open to the right of Christ Church Head [Hengistbury Head], leads to the Eastward of the Ledge

The chart shows that Mackenzie means the south-eastern corner of Warren Hill as the seamark. Whilst for the western side of the ledge:

> Keep Christ Church Tower just open to the Westward of Warren Summer House, or of the Brow of the Hill on which the Summerhouse stands, and you are to the Westward of Christchurch Ledge,

On the chart the Summerhouse is clearly marked at the western end of Warren Hill on Hengistbury Head (Hoodless 2008). A medieval sailor could easily have used the tower of Christchurch Priory together with Warren hill to avoid Christchurch Ledge, but he may have had an additional marker. To the north of Christchurch is St Catherine's Hill, which forms a backdrop to the view of the town. This flat-topped hill takes its name from a chapel to St. Catherine, which formerly stood at the southern end. If the line between the western end of Warren Hill and Christchurch Priory is projected northwards it passes through the site of the chapel.

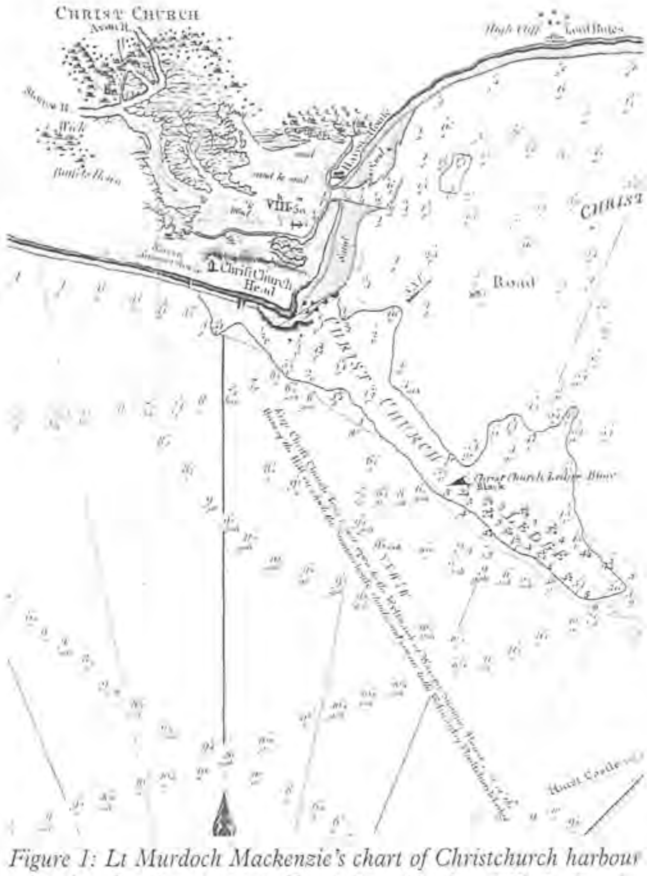

Figure 1: Lt Murdoch Mackenzie's chart of Christchurch harbour showing the alignments on Hengistbury Head and Christchurch Priory

Wareham

Wareham was an important port from Saxon times until the early Middle Ages. The large church of St Mary is clearly shown on Sir John Russel's map of 1539. A sailor rounding the northern end of the Arne peninsular had only to steer for St. Mary's to follow the deep Wareham channel up to the mouth of the Frome. This is exactly the same sort of alignment as Hutchinson (1994) proposes for the Saxon church as Bosham in Sussex. The lower reaches of the river have been extensively altered by land reclamation schemes, in the seventeenth and early eighteenth centuries, sixteenth century maps suggest that the Frome below Wareham was much wider, and perhaps straighter, than it is today.

Figure 2: The Wareham Channel showing how a ship steering for St Mary's church would keep to the deeper water

St Aldhelm's (St. Alban's) Head

There can be very little doubt that this chapel was originally designed as a seamark. It is in a perfect position, on the top of a headland at the southernmost tip of the Isle of Purbeck. The earliest recorded named shipwreck in Dorset, that of the *Le Cristofre* took place here on 23rd April 1306. The chapel is a small square building with a pyramidal roof, crowned by a modern cross. It's role as a seamark has been recently discussed in detail (Barker and Le Pard 2004).

Preston Church and Portland Castle

This is marked on Sir John Russel's map as 'Sutton Church' it lies at the head of a small stream, the Jordan, which runs down into Weymouth bay at Bowleaze cove. Drawing a line from the church, down the valley and across the bay identifies the best anchoring ground in Weymouth bay as defined by Murdoch Mackenzie in 1787. Mackenzie didn't use Preston church as a seamark, rather he advised sailors to take a bearing on Portland castle. The anchorage lies to the north-west of the line.

Wyke Church and Sandsfoot Castle

To the south-east of Portland lie the Shambles, a particularly treacherous area of shoals. Vessels approaching

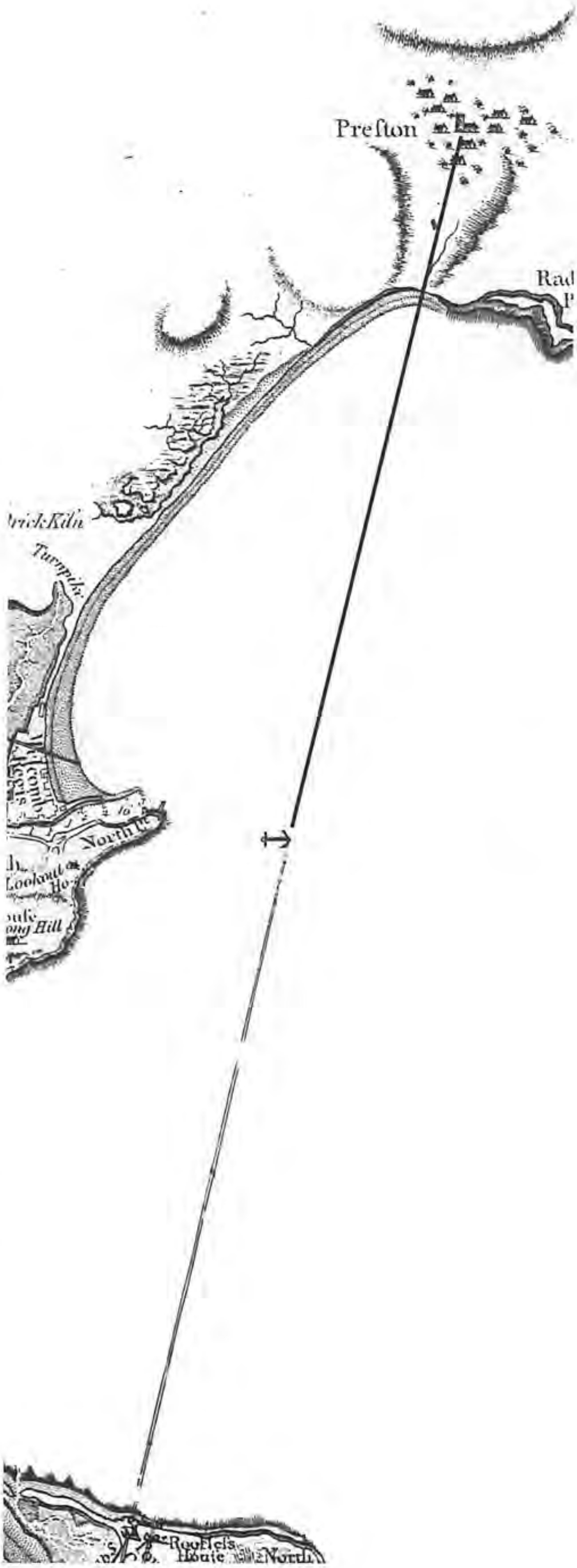

Figure 3: Lt Murdoch Mackenzie's chart of Weymouth bay (simplified) showing both his alignment on Portland castle and the alignment on Preston Church

Weymouth have always had to take care to avoid these treacherous waters. Eighteenth century charts seem to have had two seamarks used to avoid the north western end. Wyke Regis church and Sandsfoot castle. Indeed, it has been suggested that the siting of the castle was partly determined by its potential value as a seamark.

> The local seamen must have been consulted about the position for Sandsfoot because, as it was placed, it leads in line with the north-east point of the isle of Portland, over the Shambles in four fathoms, this affording a sailing mark for the navigation into the Roads and to Weymouth. [Page 1908]

Whether local seamen were involved in the siting of Sandsfoot castle or not, it certainly was used as a seamark, in conjunction with the north-east point of Portland on the chart of Weymouth and Portland (by Captain Greenvile Collins 1693). However this seamark had to be used with considerable caution, indeed Captain Collins shows that a bearing line taken on Sandsfoot castle would take a ship onto the edge of the Shambles, the vessel would only be safe if it lay slightly to the east of this line. J. Bailey, in his chart of the same area (1773) pointed this out and advocated taking Wyke Regis Church as a bearing which would take the sailor: 'Clear of the Shambles'.

Wyke church was used as a seamark by Lt Murdoch Mackenzie in 1787, and there can be little doubt that it was used by medieval sailors approaching Weymouth or Melcombe, indeed the location of the church may have been selected after consultation with 'local seamen'.

St. Catherine's Chapel, Abbotsbury

This 14th century chapel stands on top of a hill above Abbotsbury. It is a prominent seamark and probably owes its survival to its value as a navigational aid. As with St. Aldhelm's Chapel it has been suggested that it might have acted as a lighthouse. In this case there is a stair rising to the roof, the staircase ending in a short octagonal tower which rises just above the roofline. Whilst there is no physical evidence for a light, it is at least possible that St. Catherine's chapel was a medieval lighthouse. How the chapel would work as a seamark is less certain, it could have identified the beach at Abbotsbury so that a vessel bringing goods to the Abby by sea would know where to land, however it has a wider function, still useful today, in locating yourself off Chesil beach. Offshore the beach is fairly uniform and it can be difficult to locate oneself along it. Seeing St. Catherine's chapel enables a sailor to decide where he is on the beach. Important on this dangerous stretch of coast.

The Chantry Bridport

This remarkable medieval building is almost certainly a seamark, and possibly a lighthouse. These functions have recently been discussed in detail (Le Pard 2007).

Eggardon Hill

This sea mark is not of medieval date, rather it is eighteenth century, however the story is so unusual it is worth giving in full. Within the hill fort on Eggardon Hill:

> There is a small earthwork found by a low bank within the area (Warne 1872).

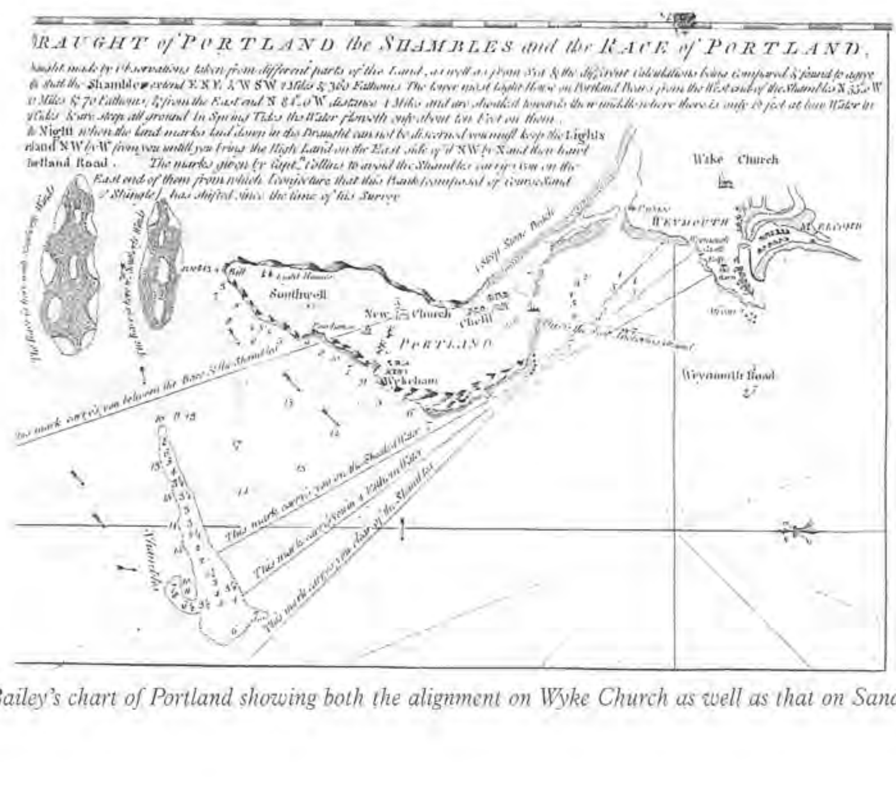

Figure 4: Bailey's chart of Portland showing both the alignment on Wyke Church as well as that on Sandsfoot Castle

Warne goes on to discuss the feature:

> To spare further antiquaries the mortification of being led into error, it is incumbent on me to give some account of this small enclosure, about three-fourths of an acre in extent, and octangular in design, with its surface covered by small depressions.
>
> The history is soon told – it was prepared for a plantation, to serve as a land mark from the channel, for the direction of certain vessels engaged in the contraband trade, when homeward bound.
>
> Roberts in his 'Social History of the Southern Counties' speaking of the extent to which this contraband trade attained, says 'a smuggler named Gulliver kept forty or fifty men constantly employed, who wore a kind of livery, powdered hair, and smock frock, from which they attained the name of "White Wigs," Gulliver amassed a large fortune and lived to a good old age.'
>
> A part of Eggar-Dun was his property, and the enclosure alluded to was made by him. He became celebrated as a contrabandist, and of his 'dealings and darings,' so many anecdotes are still remembered, that although he has long passed away, his deeds are likely to remain traditionary in Dorset for many generations.

Later versions of this story claim that it had been destroyed, 'by the revenue' in order to prevent its use by the smugglers. However it is more likely to have failed as a plantation owing to the very shallow soil on the hill top.

These few examples are perhaps, the most likely candidates for former seamarks along the coast, however there will have been many others. Local fishermen and sailors will have used a multiplicity of objects, both natural and artificial as seamarks, as indeed they still do. Recent work by Frances Griffiths and Eileen Wilkes (2006) on the south Devon coast has shown how some place names were given to features because of their visibility from the sea, or their importance as seamarks. This raises interesting possibilities for further work.

Finally the use of natural features as sea marks has been mentioned several times, the most bizarre use of such features appears on a chart of the Dorset coast by Joseph Avery (1794), he advised recognising the coast east of Durlston by the 'High Down on which sheep are fed'.

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Gordon Le Pard

Recently discovered wreck off Portland

In the spring of 2008 a team of divers working out of Weymouth discovered a previously unrecorded shipwreck in Weymouth Bay, to the south west of the Portland Breakwater. Initial observations on the sonar image suggested a very broken metal wreck, however on diving it was found that the vessel had been a wooden sailing vessel, with a cargo of railway lines.

The rails are mostly in an ordered stack, although some are badly bent. It is thought that these have been bent subsequent to the wrecking, possibly as a result of an anchor snagging on the wreck. Details of the vessel are still uncertain but it was apparently a wooden sailing vessel which incorporated iron knees (framing elements), typical of the nineteenth century.

Initially a search of the shipwrecks recorded in the maritime section of the Historic Environment Record maintained by Dorset County Council failed to identify any candidate for the wreck. However late in 2008, Sheilah Openshaw researching other Dorset shipwrecks came across an entry in Lloyds list for 1908.

> **AUTUMN** – *Portland*, July 8 10.9 a.m. – Ketch Autumn from London for Newport, cargo rails, sprang a leak and foundered two miles SE of Portland Breakwater: Crew landed Portland in own boats.

Other accounts had given the position of the *Autumn* as lying South East of Portland Bill, which is why it had not been identified as a possible candidate during the initial archive search. Further work is need to prove, or disprove, this identification, it is hoped that this will take place during 2009.

Gordon Le Pard

Ship timbers on Studland Beach: an interim note?

Fragments of old ship timbers are occasionally washed up on the beach, for the most part they are heavily eroded fragments. It is usually possible to identify them as coming from a ship, rather than some other source, through such features as trenails, wooden pegs which were common in shipbuilding. However the majority of these timbers can give little more information.

Figure 1: The transom washed up in 2001

In 2001 a substantial timber was washed up towards the northern end of Studland Beach (Figure 1). It was immediately recognised as not only a ship timber, but one of some interest. It is probably a transom, part of the frame of the ship which gives shape to the stern of the vessel. Normally discoveries of this nature are 'one off' events, however in this case a second timber was washed up in the same area the following year.

The second timber was a knee (Figure 2), a right angled timber that connects the deck timbers to the hull. This was immediately recognise as unusual as it comes from a clinker built ship. Clinker building techniques, in which the strakes, the hull planks, overlap was the normal method of ship construction in north western Europe until the later middle ages. It was then generally superseded, apart from in small boats, by carvel construction, where the strakes are laid side by side on the frame.

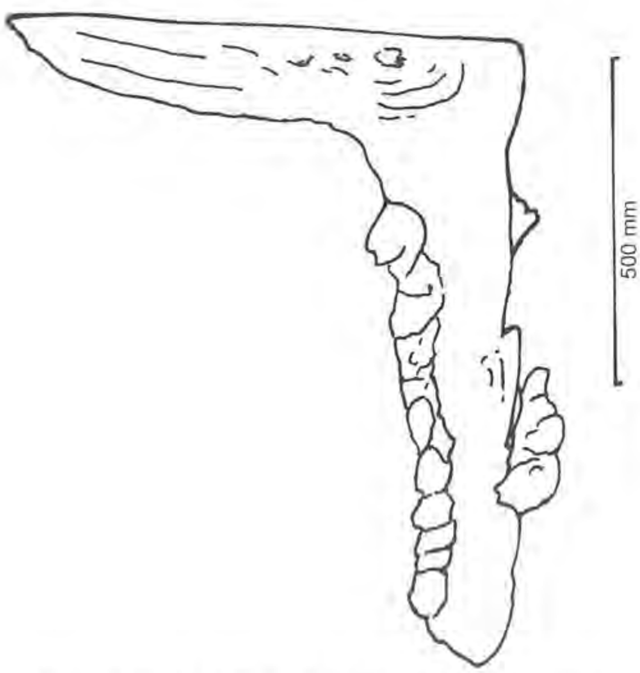

Figure 2: Studland Timber 2. The knee washed up in 2002

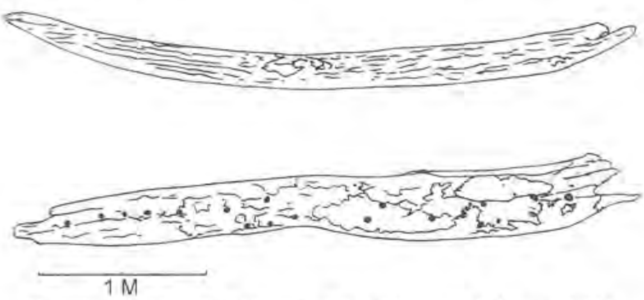

Figure 3: Studland Timber 3. The timber washed up in 2008

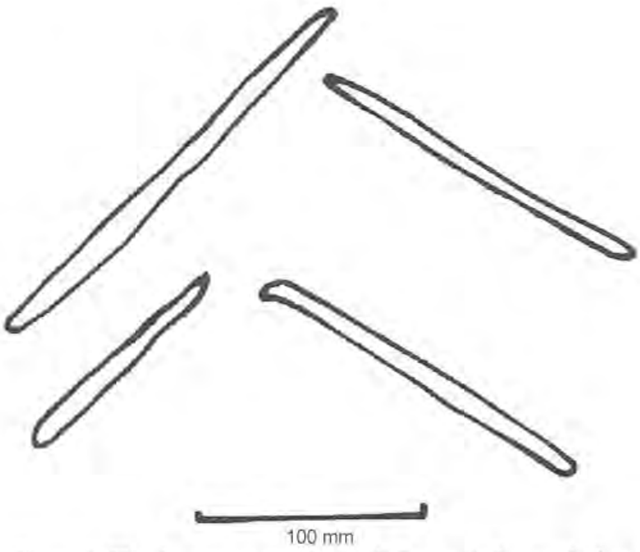

Figure 4: The chevron carpenters mark from a timber washed up in 2004

In subsequent years a complete strake was washed up, with a section removed for a hatch or gangway. This showed considerable evidence of wear. There were several small pieces of timber, one with a carpenters mark in the form of two chevrons (Figure 4).

Most recently, in December 2008, another massive framing element was washed up (Figure 3). The precise location of this timber in a ship is still under dispute, however it is large enough, and sufficiently well preserved with surviving sapwood, to be suitable for dendrochronological dating. This will be carried out, hopefully during 2009. It is for this reason that the title of this note has a question mark. There are still a number of questions to be answered. How old is the timber, do the timbers come from one wreck or several, and where is it?

I would like to thank Nancy Grace of the National Trust who not only brought these timbers to my attention, but has been instrumental in placing them in secure storage.

Gordon Le Pard

Obituaries

GEORGE NEIL AITKEN (1906–1985) and GERTRUDE MABEL [TRUDY] AITKEN (1907–2006)

Without H.S.L. Dewar, who did so much for the Society from 1957 until his death in 1976 (PDNHAS, 97, 6), Neil and Trudy Aitken would probably not have travelled over the Somerset border to excavate in Dorset. Stephen Dewar had got to know Janice Aitken and her parents through their mutual friend James Stevens Cox (1910–1997 PDNHAS, 119, 213–215) and Hon. Editor of the PDNHAS for 25 years) who, with them, was a member of Yeovil Archaeological Society.

The Dewars moved to Dorchester in 1957, when the Somerset County Museum was taken over by the County Council. Once in Dorset, he immediately volunteered his services to our Society and, besides card indexing the archaeological collections and sites, he needed experienced excavators to help him with small excavations around Dorchester. Having experienced the Aitkens' skills and temperaments (an understanding of Dewar's quirks and quiddities was essential for a trouble-free life) it was not surprising that he turned to the Aitkens.

At the time, Neil was Headmaster at East Coker School (1952–1972) and Trudy was his assistant as part-time secretary and part-time English and French teacher, full-time jobs to say the least, but somehow they found time, in school holidays, to excavate and prepare interim reports for publication. From 1961–1963, for example, they were at work on the site of the former stables at Colliton Park, Dorchester, before the building of the County Library. A fortnight each year in the school holidays 'and on fine Saturdays from Easter until mid-December' would be the pattern. The voices of both Neil and Trudy can be heard in their report at the time 'before we were able to excavate, the County Council stripped off about two feet of soil . . . and distributed it over various flower beds in Dorchester . . . practically all post-Roman levels were removed without being examined . . .' as their quizzical, dead-pan expressions recalled. Often they would make a statement leaving the hearer to draw their own conclusions.

Neil's father was a seaman and ship-builder. It was from him, probably, that he inherited his skills of draughtsmanship. Trudy, although born in Islington, daughter of a master butcher and gold embroiderer, spent most of her early years living in Canterbury where she ran the family home throughout her teens, after her mother's early death, and where she became deputy-head girl at the Simon Langton School for Girls (where she was awarded the Margaret Shaxby prize, the school's highest honour). From there she had a scholarship to the University of London, where she met Neil.

They married in 1934 and Trudy was evacuated to Yeovil at the start of World War II, where they later became active members of Yeovil Archaeological Society.

Neil taught at Banbury, Yeovil and Chichester, and also as a radar instructor for the R.A.F. at Woolwich, before being appointed to Crewkerne Grammar School from 1945–1952, and then to East Coker School. He was a born teacher with a deep understanding of children.

In 1963, with H.S.L.Dewar, they worked at Somerleigh Court, Dorchester, on the site for a premature babies' unit for Dorchester Hospital. In 1964, they recorded an area at the back of Handel House (now Williams House), part of the Society's property on High West Street, an area now part of the Brawne extension of the Museum, containing the multi-purpose gallery, the archaeology gallery and the work rooms.

1963 had been an archaeologically interesting year for the Society. In the autumn, John White, blacksmith at Hinton St. Mary, came upon a waterpipe when digging a post-hole for a shelter for his daughter's pony. He worked carefully round the pipe and thereby did not dig his way through a significant pair of mosaic pavements, which the Society uncovered. Earlier that year, a ploughman at work in Great Emlays Field, across the road from Whitcombe Church, near Dorchester, hit a substantial stone object, a Roman equestrian relief sculpture, on land belonging to Mr Kenneth Paul. Neil and Trudy, with a useful band of volunteers, worked on the site for the three Augusts from 1965–1967. Their report is published in PDNHAS, 112. A neighbouring farmer made particular comment about the 'excellent way in which the field had been re-instated and the minimum amount of inconvenience the whole excavation caused', a trademark of all their work.

This was not the end of the Society's cause for gratitude. In 1969, the Society's Council started considerable discussions with the County Council about the Society's service for schools. Up until this time, the Society's Curator and Assistant Curator had looked after all school parties, and in the 1960s educational parties increased each year from 163–343, and the number of students from 5,628–10,046. In 1972, the year when Neil retired from his headship at East Coker, the Education Department of Dorset County Council agreed there was an immediate need for a suitable teacher to be seconded to the museum to '. . . consolidate the work being done for schools. Mr G.N. Aitken and Miss M. Jackson, both of whom happen to be Society members, have

Colliton Park, Easter (1963) 'Teatime' at tent headquarters, Trudy on the left and Neil serving the tea

been appointed . . . .' our report for that year states. By 1972, 11,629 students had visited the County Museum that year and the figures rose further in the next years. Neil set the scheme on its way, thanks to his enthusiasm and his willingness to work in the school holidays, and to join in the Society's activities. Modern attempts to define fixed hours for work and duties in professional life would have appalled Neil and Trudy as a contradiction of what a profession means. They are survived by Jan Hebditch and Ross Aitken and loving grandchildren who recall the inspiring times they enjoyed together.

Roger Peers

Publications

Publications in the Proceedings of the Dorset Natural History and Archaeological Society (PDNHAS). Although more often than not the reports listed below are ascribed to G., G.N.A. or G.M. Aitken (Neil and Trudy) they did everything together, a firm characteristic of their marriage:

1962. Excavations at Colliton Park, Dorchester, PDNHAS, **84**, 101. (G.M. Aitken).

1963. Excavations at Colliton Park, Dorchester, PDNHAS, **85**, 96. (G. Aitken).

1964. An Excavation at Handel House, Dorchester, PDNHAS, **86**, 107–108. (G. Aitken).

1964. Excavations at Somerleigh Court, Dorchester, PDNHAS, **86**, 155–157. (G.N.A. and. H.S.L.D.)

1965. Interim reports on Excavations at Whitcombe, Dorset, PDNHAS, **87**, 96.

1966. G.M. Aitken, PDNHAS, **88**, 113.

1967. G.M. Aitken, PDNHAS, **89**, 126–127.

1982. Excavations of the Library site, Colliton Park, Dorchester, PDNHAS, **104**, 93–106. (G. and N. Aitken).

1990. Excavations at Whitcombe 1965–1967, PDNHAS, **112**, 57–94 (G.M. and G.N. Aitken).

At Yeovil:

Excavations at West Coker Villa site – Notes of Yeovil Archaeological Society for 1958.

Excavations at Nash Lane, West Coker – Notes of Yeovil Archaeological Society for 1959.

CATHERINE OULESS (1879–1961)
Her life, passions, and motivation to enhance
Dorset County Museum's collections and displays

Summary

Although Catherine Ouless lived and worked as an artist in London, she became very attached to the area of south Dorset around Ringstead, and spent many summer holidays in a house rented there. Catherine used this time energetically: sailing small yachts; scouring the coastline for fossilised evidence of ancient life; and painting the local landscape. Her fondness for the area, which she captured in her landscapes, led her to volunteer at the Dorset County Museum, donate objects there, and become a life member of its Society. Possessing a strong character, Catherine drove forward Museum projects she became involved in. The legacy of her achievements remains apparent today in the Museum's geology and art collections, and its Jurassic Coast Gallery.

Catherine Ouless' background and family life

Catherine, always known as 'Kitty' to her family and friends, was the eldest of the three daughters of Walter Ouless, a successful and prosperous portrait-painter in late-Victorian times, and his wife Lucy. Walter, born in Jersey, had moved to London in the 1860s. By the late 1870s his reputation as a painter was well established. He had become a member of the Royal Academy in his thirties (ARA in 1877; RA in 1881). In Oxbridge colleges, in Pall Mall clubs, in livery company halls, episcopal palaces, old-fashioned banking halls and insurance offices, and very many dim country houses up and down the land there may be seen his accomplished and elegant portraits – nowadays tending to be overlooked by their owners. The family's origins, though, were much less bourgeois and much more colourful: the name Ouless is of French origin; Walter's great-grandfather, a native of Paris, had found a wife, and fathered a son, during a stay in the Channel Islands in the late 1780s. Thence he was expelled to France and had a short and exciting career among the *montagnards* in the course of the French revolution. He was lucky to escape with a prison sentence when the *montagnards* were purged. He never returned to his wife and son, who had stayed in Jersey.

By 1879 this rackety background was forgotten. Walter Ouless's London home was a large and stately terrace house in Bryanston Square with a studio at the back. Here Kitty and her two younger sisters grew up. Walter became a member of the Council of the Royal Academy and of the Athenaeum Club and had a wide circle of artistic, though far from bohemian, friends. The girls were well-educated; Kitty went to Miss Wyatt's well-known school for girls – Queens Gate, in London – which moved in 1899 to Ascot and became known as Heathfield (now Heathfield St. Mary's). After leaving school Kitty studied art at the Royal Academy Schools where she carried off several prizes.

Figure 1: Kitty and her niece in the garden of Fordington House, Dorchester, the home of her sister and brother-in-law, about 1920

Kitty never married and lived until 1933 at home in Bryanston Square with her parents. She established herself as a sound rather than a brilliant painter in oils of portraits and landscapes, exhibiting regularly at the Royal Academy. Her portraits on smaller canvasses are perhaps the most successful: her lines are precise, her palette of colours is bright and she is attentive to the shifting shades of light on her sitters' skin, hair and clothes. In her work she was probably helped and advised by her father Walter. In her portrait that is of greatest significance to Dorset County Museum, the sitter is Captain J.E. Acland FSA. She painted this in 1949, after Acland had been Curator of the Museum, a position which he held from 1904 until 1932.

The Ouless family was active and sociable. Kitty travelled widely in Europe and further afield with her parents and sisters. Her long connection with Dorset began before WW1 when the family rented Holworth House on White Nothe, near Ringstead, and spent their summer holidays there for a number of years. She had a neat, active, wiry frame, played a good deal of aggressive lawn tennis, ski-ed in Switzerland, and became a keen small-boat sailor at Ringstead. She was interested in geology, joining the Dorset Natural History and

Antiquarian Field Club in 1911 and remaining a member for the rest of her life. Her youngest sister Daisy married Robert Hayne, of Fordington and Springbottom near Ringstead, in 1914 and this gave Kitty yet another connection in Dorset (Figure 1).

Kitty's father Walter died in 1933. Her mother had died in 1931. The Bryanston Square house was closed and Kitty then acquired a large house on Campden Hill, Kensington – a *quartier* with, perhaps, rather more artistic pretensions than Bryanston Square. When the second World War broke out in 1939 Kitty, aged sixty, joined the ARP and was active as a warden throughout the Blitz. This saved her life: while she was on duty in the London streets during the night of October 15–16 1940, a bomb fell on her house, totally destroying it, killing all her servants and wrecking most of her possessions.

On losing her home Kitty moved into a flat in a very old-fashioned block of 'chambers' on Campden Hill, whose windows overlooked the ruin of her bombed-out house. There she spent the rest of her life. One of the present writers (T.P., Kitty's great-nephew) remembers this establishment well. You would find your shoes polished in the morning if you left them outside your front door at night. You could order meals sent up if your cook had been given a day off. And if you had more guests staying than your flat could accommodate in comfort, then spacious, old-fashioned bedrooms could be provided for them in the basement.

From the end of WW2 until her death in 1961 at the age of 82 Kitty lived quietly in her Kensington flat. She was still in demand for portraits from family and friends and many of these portraits have great charm. She also painted street-scenes in Kensington in those remote, traffic-free days. She kept alive her father's memory and followed the fortunes of his portraits. She was quite unlike the conventional idea of a Kensington-dwelling maiden aunt: she was active and energetic, she had a sharp temper and wide intellectual interests; and she used to choose and send to her great-nephews, at Christmas and on birthdays, the most excellent and exciting books for small boys – usually about sailing or other adventures in the open air; exactly what boys need to stimulate a life-long interest in reading.

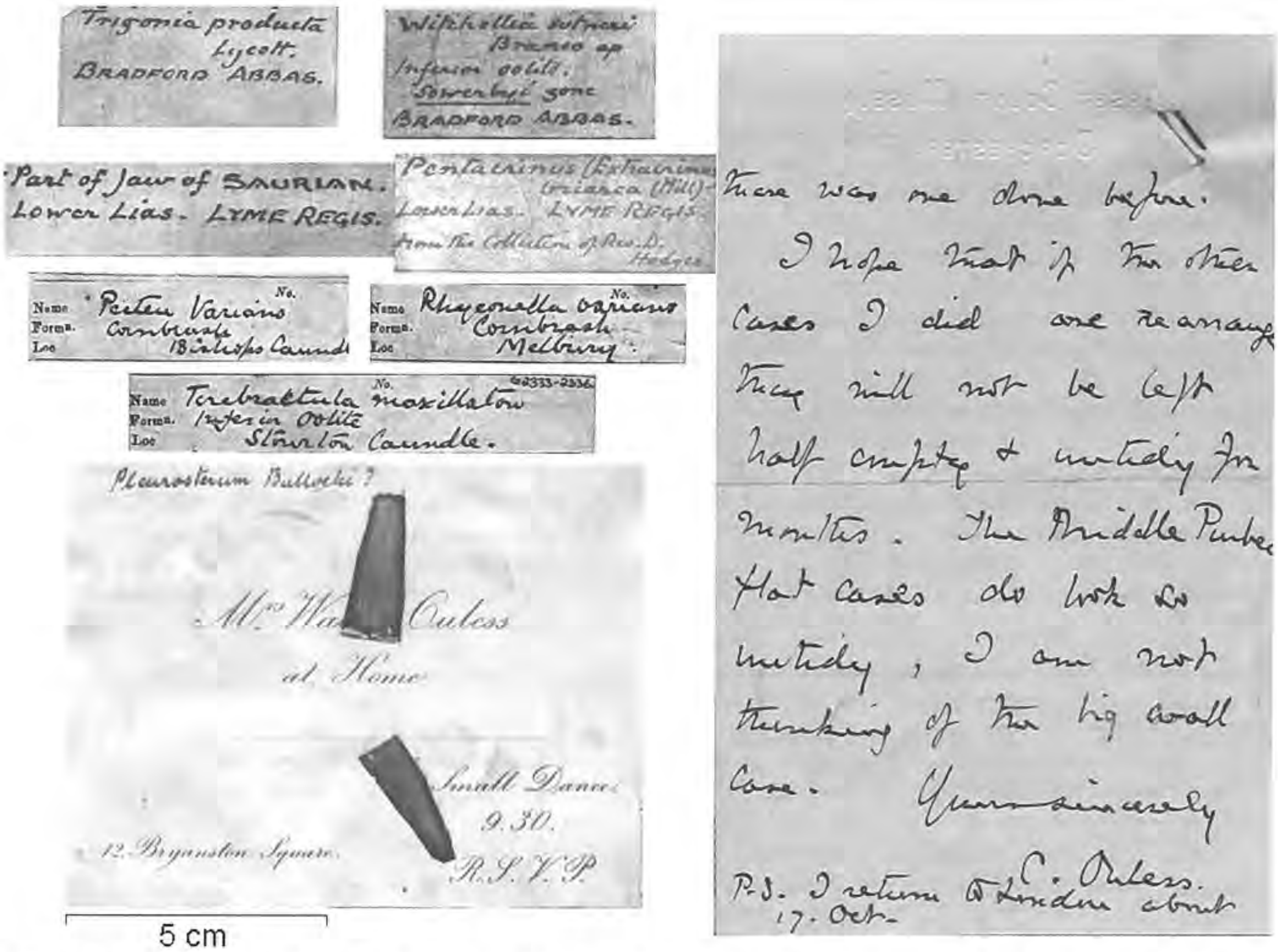

Figure 2: A selection of labels in the hand of Catherine Ouless, and the last page of one of her letters to Colonel Drew (right). A dinner invitation (bottom left) from Walter Ouless was used to write a speculative specimen identification

Table 1: Table listing fossils donated to Dorset County Museum by Catherine Ouless

Specimen	Accession number	Stratigraphy	Location	Notes	Date
Macropterygius sp. (ichthyosaur)	DORCM G.120a-k	Upper Kimmeridge Clay	Ringstead Bay	Originally 10 vertebrae, may not be associated	Unknown
Macropterygius thyreospondylus (ichthyosaur)	DORCM G.130aandb	Upper Kimmeridge Clay	?Ringstead Bay	–	Unknown
Pliosaurus macromerus (pliosaur)	DORCM G.117i-x	Kimmeridge Clay	East of Ringstead cottages, Ringstead Bay	–	Donated April 1912
Pliosaurus sp. (pliosaur)	DORCM G.129	Kimmeridge Clay	Ringstead Bay	Cervical vertebra	Donated 1935
Steneosaurus sp. (crocodilian)	DORCM G.96/1-75	Kimmeridge Clay	East of Ringstead cottages, Ringstead Bay	Snout, skull fragments, vertebrae, scute part, ribs, limb bone end and bone fragments. Associated with G.116	Collected August 1912; donated 1933/1934
Steneosaurus sp. (crocodilian)	DORCM G.114/1-6	Kimmeridge Clay	West of Ringstead cottages, Rinstead Bay	Imperfect mandibulae and part of skull. Associated with G.114a	Collected 1901
Steneosaurus sp. (crocodilian)	G.114a1-a3	Kimmeridge Clay	West of Ringstead cottages, Rinstead Bay	Associated with G.114	Collected 1901
Steneosaurus sp. (crocodilian)	DORCM G.115aandb	Kimmeridge Clay	West of Ringstead cottages, Rinstead Bay	Two lower jaw rami	Collected 1901
Steneosaurus sp. (crocodilian)	DORCM G.116/1-4	Kimmeridge Clay	East of Ringstead cottages, Ringstead Bay	Parts of lower jaw and associated bone fragments. Associated with G.96	Collected April 1913; donated 1933/1934

Catherine Ouless' legacy to the Dorset County Museum

In the summer of 2008, two of Catherine Ouless' 1922 landscape oil paintings were transferred from storage in the Museum's reserve art collection to display positions either side of the entrance to the Jurassic Coast Gallery.

The paintings were chosen because they were well suited for the Gallery's entrance, as they lead the visitor into the World Heritage coastline, specifically at White Nothe, Ringstead. Only when research for their labels was undertaken did the serendipity of their choice, and their painter's fervour for local geology, become apparent to Museum volunteers and staff.

Catherine cared deeply about geology and the care of geological specimens, and was a dedicated volunteer at Dorset County Museum during her summer sojourns in the county. In the Museum's geological archives there is mention of Catherine becoming involved in protecting specimens against 'Enemy actions'. Sadly, further details giving an explanation to this intriguing note have been lost in the mists of time. She donated important reptile fossils that she unearthed to this Museum, including crocodilian skull and jaw remains, pliosaur jaws and vertebrae, and ichthyosaur vertebrae, all from the Kimmeridge Clay of Ringstead Bay (Table 1). One *Pliosaurus* sp. neck vertebra, DORCM G.129, is exhibited currently in the central column cabinet of the Jurassic Coast Gallery.

It seems particularly apt for Catherine's landscapes to bracket the entrance to the Museum's most recent geology gallery, because she helped organise its original 'Geological Room', a room designated specifically to the display of geological specimens, in the same space in the 1930s. During this decade, severe letters were exchanged between her and the then Curator, Colonel Charles Drew, about the how fossils were exhibited. Indeed, his letters of reply tended to be defensive. This was a time when Peter Colley Sylvester-Bradley from

Langton Herring, a young geologist who later became an eminent Professor, was making occasional visits to redisplay the Museum's geology collection in the Museum's Hall. He emptied cases Catherine had filled, but could not commit to returning regularly, and left specimens in disarray on the floor for durations that distressed her. Consequential to Catherine's disapproving missives, and an incident of a turtle type specimen on the floor breaking, Sylvester-Bradley withdrew his services with apologies, and her labours continued.

Catherine's working relations with Colonel Drew appear to have improved after the completion of the Geological Room; their correspondences when she donated a sheep bell to the Museum in 1940s, and a handmade 'prawn pot' in 1950s, were warm and congenial. Until recently, many of the Museum's geological specimens were still accompanied by her hand-written labels. These now form part of the archive relating to the geology collection (e.g. Figure 2).

In her Undercliff landscape at the Gallery's entrance, Catherine has paid particular attention to detail to a jumble of fallen vegetation and rock rubble at the foot of unstable slopes. This meticulous observation can be appreciated fully in the light of her fascination with, and enthusiasm for, local geology and its relationship to landscape.

Acknowledgements

Many thanks to Gwen Yarker for alerting us to the potential for a short paper after hanging Ouless' landscapes outside the Jurassic Coast Gallery. We would like to thank Paul Ensom for offering useful thoughts and amendments when editing the text, and to Katherine Barker for supporting the idea.

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ELIZABETH WATKINS (1923–2008)

The only child of Jack and Barbara Watkins, Elizabeth was born at Coopers Hall, Cusop, near Bradwardine, Herefordshire, when her father was working in the branch of the National Provincial Bank at Hay-on-Wye which, in those days, was in Brecknockshire. Elizabeth was educated at Malvern Girls' School; her first connection with this part of the world came at the start of World War II when her school was evacuated to Hinton House, the home of the Powletts of Hinton St George.

By 1941 she had begun on her nursing career at University College Hospital, London, her parents having moved to 356 Dorchester Road, Weymouth (her Dorset base for many years until she moved to 10 Thornhill Close, Castle Park, Dorchester). Jo Draper remembers Elizabeth saying that she was about to take her finals just as the Normandy landings took place in 1944. Instead of sitting in an examination room she, and her fellow candidates, were sent to Portsmouth to be ready to care for the first casualties. Later, between 1947–1949, she served in Queen Alexandra's Royal Naval Nursing Service.

After two and a half years as Second Theatre Sister at the Woolwich Memorial Hospital, the surgeon who was her boss wrote in her *curriculum vitae* she "had immense experience of theatre work of all descriptions. Not only is she a first rate Theatre Sister but . . . an exceedingly able surgical assistant." In April 1954 she came home, so to speak, when she took up the appointment of Theatre Sister at the Dorset County Hospital (DCH) in Dorchester. In the first of a number of letters from her in the Society's files is one that throws a perhaps not unexpected light on the history of medicine in Dorset. On 13 December 1963 she wrote "I looked up the [hall] marks on one of our [DCH] instruments which we use almost daily . . . and it was made in 1835!" – perhaps belonging to the fitting-out of the first Dorset County Hospital, opened in 1847.

In 1952 she joined the Dorset Natural History and Archaeological Society. Elizabeth's contribution to archaeological work started, quite some time before she retired, most appropriately on a DCH site, in the spring of 1963, before the Special Care Baby Unit was built at Somerleigh Court. Between then and 1984 she was active at the following Dorchester sites: Glyde Court 1966; 23 High West Street 1966 and 1967; the allotments of Somerleigh Court 1967; Wadham House 1968; another DCH site 1969; Greenings Court 1970; Fordington Old Vicarage 1971; 34 Trinity Street 1975; The Plume of Feathers, Princes Street 1975; North Square 1977; Church Street and Durngate Street 1982: a remarkable list. For much of this time she served on the Society's Archaeological and Dorchester Excavation committees. During these 21 years Elizabeth more and more would be referred to for her special knowledge of clay tobacco pipes and their manufacture from the 16th century onwards. Her contribution to the study of the subject is acknowledged in the specialised reports of the Society's *Monographs* as well as in the papers of the *Proceedings* listed below; all of which she illustrated. She identified, and recorded with her tidy hand, accurate 1/1 scale ink drawings, the steady flow of clay tobacco pipe fragments, stems and bowls brought to the Museum for identification; with many subsequently given to the DCM collections by the pleased enquirers, rewarded by report and, on occasion, a drawing. "Elizabeth regularly corresponded with Dr David Higgins of Liverpool University during his research into the Dorset pipe-making industry and his compilation of a national catalogue of the maker's marks found on clay tobacco pipes. Copies of their correspondence can be found in the National Pipe Archive, which is currently housed in the School of Archaeology, Classics and Egyptology at the University of Liverpool."

Elizabeth Watkins, 1992, at home

A further use of her skills came about when the new Archaeological Gallery was built in 1983. Elizabeth, with her knowledge of anatomy, was called upon to re-assemble the skeletons of the Whitcombe Warrior and the Maiden Castle burials in a reconstruction of the graves and their settings.

When the time came, a number of her contemporaries, in their retirement, were recruited by her to help with the Society's work in a multitude of different ways, from coffee-making and cooking for lectures and events, to proof-reading and page make-up, packing the quarterly budgets of information to members, and coping with emergencies. As a Society we are indeed beholden to Sisters Dot Peel, Marion Makinson, Geraldine Rignall, Dot Courage and Miss Treasure (as Miss T. or Treasure) for their decades of voluntary help at a time when the Society was running at full steam in the field and in the Museum. As Sister Mak says, "Elizabeth marshalled myself, and no doubt our other colleagues, to form what used to be known as the 'Travellers' Tales Group'", started in 1984 by Mick Shepherd, to raise money for the Society and its collections, and took place until recently, in unbroken sequence, every first Wednesday evening from October to March, with regular audiences of 150 or more.

Elizabeth's next major contribution to the Society, and it certainly was mighty work, came when in 1980 Dée Lang retired from the post of Hon. Field Secretary. This coincided with the timing of Elizabeth's retirement from DCH. She held the post until 1995, after which she was made a Vice-President. In these fourteen years she planned, reconnoitred in detail, and administered 92 day meetings in Dorset, Wiltshire, Hampshire, Oxfordshire, Berkshire, Gloucestershire, Somerset, Devonshire, Cornwall, London, Powys, Gwent, Glamorgan; five meetings lasted a whole week in the Cotswolds, Norfolk, Kent, East Sussex, Cheshire and Co. Durham. All of these visits together took in country-houses, castles, palaces, churches, abbeys, neolithic, bronze age, iron age and roman sites and excavations, windmills, watermills, ruins, potteries, oilfields, SS Great Britain, and a journey up the spire of Salisbury Cathedral, via a scaffolding lift, when restoration was underway. Additionally there were numerous natural history meetings and walks along the Dorset coast and across the county.

Latterly she helped with the Society's great collection of photographs, the Dorset Photographic Record. She had been used to developing the photographs taken by her father, a keen photographer, and so in 1995 she came to assist in a wide variety of jobs, including accessioning, after the death of Doris Bateman. When Elizabeth was there that department was always known for its laughter.

She was enthusiastic for all things of the Dorset Natural History and Archaeological Society, serving on the Society's Council for 20 years, rarely missing a meeting or AGM. This enthusiasm rubbed off on those around her, contributing much indeed to a *floruit* of Society and Museum activities, output and growth. In all her ways, professionally and in retirement, she was dedicated, thorough, firm, kindly, knowledgeable, efficient and sweet-natured.

Valerie Dicker, Marion Makinson,
Roger Peers and Peter Woodward

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