Assessment of the archaeological potential of the sieved middle Saxon molluscs sieved from Lyminge, Kent.

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December 2010

Introduction

Archaeological investigations were carried out from 2007-2010 at Lyminge, a village in southeast Kent. A sizable assemblage of marine and terrestrial shells recovered by sieving to 6mm all contexts of the Minster period excavated in 2008 and 2009, was assessed. This assemblage provides shells with a better archaeological context than those from the test-pitting of the 2007 season, which were not included. The shells sieved from the pre-Minster deposits, mainly *grubenhaus* fills, were not included; the archaeological context for these shells will be available later in the project. This recovery method is a significant advance over the usual hand-retrieval, since it minimises the usual bias in archaeological assemblages towards large intact shells and deposits rich in shell. Therefore a considerably more objective sample of the range of shell varieties, the size ranges of a variety, and the range of shell density in the deposits can be examined for Lyminge than for most other Saxon sites, or ecclesiastical centres of any age.

Archaeological Context

The village of Lyminge is 17 km. south and 1½ km. east of Canterbury, 8½ km. northwest of Folkestone Harbour, and 15½ km. west of Dover Harbour. Cartography (O.S. 2008) and geological survey (B.G.S. 2010) show that Lyminge sits 7 km. north of the coast at Hythe, and 100 m. above sea level, on the dip-slope of the Cretaceous Chalk of the North Downs; the chalk surface, which drops gently to the northeast, is incised by broad shallow valleys aligned broadly down-slope, their bases filled with solifluction deposits (head). Lyminge sits at the top of one of the larger of these, the Elham Valley; excavations have concentrated around the church, on the northeast end of a chalk ridge overlooking the modern village. The River Little Stour rises on the east side of this ridge-end as a nailbourne (Smart *et al.* 1966, 5). The bourne is associated with a narrow band of alluvium in the base of the Valley, which drops gently NNE for 10 km until it meets, at Barnham, the broad WNW-ESE valley at the base of the dip-slope. The Roman road, Watling Street, took an almost-straight course from Canterbury to Dover along this WNW-ESE valley (Codlington 1903, 42). To the south and southwest of Lyminge the dip-slope rises for 2 km towards the chalk escarpment 180 m. above sea level and aligned broadly WNW-ESE, which marks the edge of the North Downs; much of this higher ground is capped with Clay-with-Flints. Some 3 km. southwest of the village the escarpment edge curves north, and southeast of the village, the escarpment is incised by a narrow valley some 2½ km. long, which drops to the southeast to the Lower Greensand terrace, about 2½ - 3½ km wide, at the base of the chalk escarpment and broadly parallel with it. The sea inundates the Lower Greensand terrace at Folkestone (forming the harbour), reaching the base of the chalk escarpment.

Lyminge lies 2½ km. east of the course of Stone Street, the Roman road aligned almost exactly south from west Canterbury (Codlington 1903, 48-50); Stone Street continued 7 km. south to the Roman fort at Stutfall Castle (*Portus Lemanis*) near Lympne, on the long bluff of Hythe Bed ragstone and standstone which marks the SSW edge of the Lower Greensand terrace. The bluff is unstable and its SSW-facing slope is made up of landslips (Smart *et al.* 1966, 291).

Stutfall Castle overlooks the eastern limit of the large wetland, Romney Marsh. The Marsh, on tidal mud, is separated from the sea to the southeast by a long and complex raised shingle bank. During the early Roman period this part of the Marsh below Stutfall Castle was the extensive estuary of the River Rother (formerly the *Limen*) with its mouth constricted by the north end of the shingle bank. From the middle Saxon period the estuary silted up as longshore drift extended the shingle bank north, closing off the estuary mouth (Cunliffe 1980, 258; Gardiner *et al.* 2001, 265-267; Long *et al.* 2007, 195-200). However, much of the lower reaches of the *Limen* remained fully marine throughout the Saxon period, since salt production at was recorded in Domesday at Bilsington (Campbell 1962, 540), 8 km. upstream from Stutfall Castle. The sea-coast along this part of Kent is almost entirely flint shingle beach, with rocky shores common around and east of Folkestone.

While there are early Saxon burials in the vicinity of Lyminge, occupation of the excavated area began in the Middle Saxon period, in the 7th Century A.D. (Thomas 2009, 5), which agrees with hagiographical evidence for a monastic community being founded at Lyminge in A.D. 633 (Thomas 2005, 1). The monastery was founded under Kentish royal patronage with a Kentish princess and widow of a king as its first abbess, which suggests it was placed within an already-existing *villa regalis* (or royal estate) (Thomas 2005, 2).

The site of Lyminge is characteristic of minsters (monasteries founded under royal patronage during the Conversion of all the English to Christianity). These were usually set on high visible points with easy access to long-distance transport routes, such as roads and navigable rivers (Blair 2005, 193), consciously located so they could be found easily, could be moved between easily, and the materials a Christian life required (wine, sacramental silverware, sacred texts) could be moved between them easily. Since these materials (and those who knew how to use them) had to be imported from the Continent in the early stages of the Conversion, coastal landing places had to be included in this network from the very beginning. Because they were locally prominent and regionally well-connected, minster sites were often used subsequently for the establishment of planned defended urban centres (*burghs*) in the late 8th Century under Offa of Mercia, and in the late 9th Century under Alfred of Wessex (Haslam 1985, 19 & 31; Blair 2005, 331).

Occupation of the minster ended in the 9th Century (Thomas 2009, 5). It is traditional to assume occupations ended around this time due to the Scandinavians, whose incursions into England were increasing from piratical raiding, through armed clan immigration, to full-blown military conquest. This explanation is reasonable for the minster: it was probably attacked (but not necessarily destroyed) in the 850s (Blair 2005, 298), and the large raiding force which sailed up the *Limen* and overwintered at Appledore in A.D. 893-4 (*Anglo-Saxon Chronicle*: Swanton 2000, 84) would have been the least desirable neighbours imaginable. However, Viking raiding was not the only reason for a minster to contract or disappear at the time. By A.D. 850 the foundation of the Minster would have been as remote from the people of Lyminge as the Battle of Waterloo is from us. As the English changed from pagan to Christian, the requirement for a network for conversion waned, and a requirement for a network for pastoral care of the faithful burgeoned: minsters needed to provide fewer and fewer evangelising monks and more and more ‘parish’ priests. Also, minsters had been land-owning institutions from their outset, and many minster communities had enriched themselves by the buying and selling of their lands (Campbell 2000). As the English changed gradually and fitfully from a society of pagan clannish peripatetic warriors to Christian landed agriculturalists, minsters became increasingly anachronistic, and the taking over during the 9th Century of smaller or less well-administered minsters by locally powerful landowners, whether royal, aristocratic or ecclesiastic (Campbell 2000; Blair 2005, 323) was probably inevitable.

Methods

Whole shells, and quantifiable elements of broken shells (umbones of bivalve shells, and apices or the bases of apertures of gastropod shells) were assigned to genus rapidly and without reference to identification guides, and counted for each context. Numbers were estimated by scaling up a 50% sample for deposits which had over 100 shells, and a 25% sample for deposits with over 200 shells. Left and right valves of bivalves were not counted separately.

Results

Quantity and density

Some 10,430 identifiable marine shells were sieved from 438 deposits. The shells were distributed unevenly. Over half the shell-bearing deposits (222 contexts) had less than 5 shells, and 273 had less than 10 shells; only 64 deposits had over 40 shells and only 20 had over 100. There were also 616 terrestrial gastropods (land-snails) from 186 deposits. Almost all deposits produced only one or two land-snails, with 178 of the 186 deposits having a dozen or less. Only seven deposits produced 15 or more, with one deposit producing 28 sizable snails, and one producing over 100 (most of which were less than 10mm).

Marine Species

Mussels: The most common shell, forming 47% of the marine assemblage. The vast majority were common mussel (*Mytilus edulis*), with no warm-water French mussels (*M. galloprovincialis*). In 32 deposits mussels were the overwhelming majority of the shells, and 33 contexts had over 100 shells. Preservation was as usual for this thin fragile shell, very poor: only four contexts contained a statistically valid number of measurable shells. Mussels are common on wave-washed inter-tidal rocks (Seed 1969) and on stable beds on most sediments from low tide to 40m depth (Buschbaum & Saier 2001). They form dense mats which can expand into large beds reefs when not harvested (Seed & Suchanek 1992, 138).

Cockles: Valves of cockles (*Cerastoderma* sp.) made up 25% of the shells, and were found in about a quarter of the deposits (119 contexts). Usually they were found in ones and twos in deposits containing other shells, but were common in some deposits (19 contexts had over 15) and occasionally they were the principal shell (seven contexts had over 100 valves). Preservation was good, with about 70% measurable. In the 11 deposits rich in cockles where species could be separated easily into common cockles (*Cerastoderma edule*) and lagoon cockle (*C. glaucum*), lagoon cockles seemed to be more common. These bivalves live just below the surface from mid-tide to a few metres depth in near-shore gravelly sand, and from low to high tide in estuarine sandy muds (Ducrotoy *et al*. 1991, 173). Lagoon cockles are more common in more muddy sediments near the shore and in bays, and common cockles in coarser beds and more fully marine conditions (Boyden & Russell 1972; Barnes 1973). Population densities are often very high (hundreds per square metre), and are harvested easily by hand-raking or digging.

Oysters: A common shell, making up 17% of the assemblage. Oyster valves were found frequently (319 contexts had oysters), but not often in dense masses (only 17 contexts had more than 20 valves, and only five had over 40; the most in any single context was 95). Preservation was typically poor, with about 10% measurable; oysters are far more fragile than pottery fragments of the same size, and are easily damaged during retrieval. About 85% of the hinges were preserved well enough to be identified to species, and all were those of the native oyster (*Ostrea edulis*). Native oysters are common on stable moderately wave-beaten and sheltered low inter-tidal shores and on stable sub-tidal beds to about 50m depth, where they can form extensive beds and reefs when not harvested. Of the 231 bases whose forms could be categorised according to the criteria of Campbell (2009, 6-8), most (47%) were the round small-hinged form of sheltered waters and bays, with a third being oval large-hinged deeper-water forms and 20% the irregular faceted forms of oyster reefs. Some 33 bases were unusually shallow and oddly curved (the outer surfaces were concave and smooth). The cause for this unusual form is not clear: they may have grown on large rocks, poles, or the upper shells of large oysters.

Traces of encrusting or burrowing organisms were uncommon, and most were barnacles and the burrows of the sponge *Cliona*, with infrequent burrows of the tubeworm *Polydora*; two shells were thickly covered by tubes of keelworms (*Triqueter* sp.), a sub-tidal species. Traces of the substrate on which the oysters grew (their cultch) were rare, with one cultched on spiny cockle, one on mussel, one on oyster, and one on rounded flint shingle.

Limpets: These conical gastropods of inter-tidal rocks are uncommon in historic periods, but made up 6.2% of this assemblage, and were found in 31% of the deposits with shells. They could be fairly common in some deposits (five had over 30) where mussels also seemed common (59 limpets were found in a mixed but mussel-dominated deposit). Limpets are difficult to identify to species on shell alone, but almost all were the widely-distributed common limpet (*Patella vulgata*), with only one likely to be china limpet (*P. ulyssiponensis*), of damp sheltered rocks.

Periwinkles: The common or edible periwinkle (*Littorina littorea*) made up 2.7% of the shells, and were found in 23% of the deposits with shells, usually in ones and twos with other shells, especially limpets (the most found in any deposit was 19, in a mixed but cockle dominated context). Preservation was good; all could be identified to species, and most were intact enough to measure. Almost all were small, with only three contexts bearing one or two that were of modern legal landing size. A widely distributed grazer of moderately wave-beaten or sheltered shores from high-tide line to about 10m depth, it is common on inter-tidal solid shores amongst sea-weed, especially wracks (*Fucus* sp.) or amongst mussels (Saier 2000).

Common Whelks: Some 58 shells of common whelk (*Buccinum undatum*) were found, usually from deposits with other shells; a dozen were found on their own in deposit 1065. This carnivore-scavenger of muddy sands and stony beds from extreme low tide to 100m depth is fished by potting or less successfully by dredging (Hancock 1967). All were broken but most were large (over 25mm).

Small gastropods: Several species of gastropod were found in numbers or sizes too small for them to have been consumed. There were 16 examples of dog-whelk (*Nucella lapillus*), a widely-distributed inter-tidal carnivore which feeds mainly on barnacles, common amongst mussels and limpets. The four small dog-whelks were probably all netted dog-whelk

(*Nassarius* cf. *reticulatus*), might include other species of small dog-whelk, which scavenge on inter-tidal or shallow sub-tidal mud or muddy sand. The single sting-winkle (*Ocenebra erinacea*), a carnivore of sedentary molluscs from mid-tide to 150m depth, is a common pest of oyster beds. The two rough winkles (*Littorina saxatilis*) are a small shell plentiful on stable inter-tidal shores amongst mussels and periwinkles.

Small bivalves: Small number of small bivalves were also recovered. Shells common in sandy or muddy intertidal or shallow sub-tidal beds included 17 Baltic tellins (*Macoma balthica*), eight spiny cockles (*Acanthocardia* sp.), four peppery furrowshell (*Scrobicularia plana*), two possible trough-shells (*Mactra* sp.) and a possible hatchet-shell (cf. *Loripes lucinalis*). Common in and near cockles, at Lyminge these were not common in deposits with cockles, and may have been sorted from cockles prior to cooking, and discarded separately. Preservation was not good, so identifications would require comparisons with a reference collection.

There were only two examples of saddle-oyster (*Anomia ephippium*), which colonises hard substrates and which is found regularly attached to oysters. There were also only 75 one- and two-year-old oysters (classified here as 'spat'), a small number given the number of oysters in the assemblage, suggesting oysters were cleaned and sorted before being brought to the site.

Land-snails

Nearly three-quarters of the 616 terrestrial shells were *Helix* sp., with many *Cepaea* sp. (19%), and 35 *Monacha* sp. All three main are relatively large and common around human habitations, especially on chalk geology (Beedham 1972, 114). Some had the dark grey colour and brittle texture of burnt shell or sooted patches in about the same proportions as the marine shells.

Shellfish in middle Saxon Archaeology

Marine molluscs are not well reported for middle Saxon excavations. A search of the British Environmental Archaeology Bibliography (Hall 2008) revealed only two reports of middle Saxon date that were more than brief notes: The Royal Opera House, London (Malcolm *et al.* 2003) and Flixborough, Lincs. (Dobney *et al.* 2007). Marine shells are well-reported from early Christian ecclesiastical sites in Ireland (McCormick & Murray 2007, 222, 241-243, 265), and their place in feeding this type of community has begun to be inferred (Murray *et al.* 2004). In contrast, there seems to have been no attempt to make substantial interpretation of the shells from any English Conversion-period monastic site. Shells were 'ubiquitous' at Hartlepool, but records were inadequate for reporting (Daniels 2007, 110). The only exception is the recent analysis of the marine shells from the later Saxon (8th - to late 10th - early 11th -Century) deposits at the occupation site with an ecclesiastical component at Bishopstone, Sussex (Somerville, in press). Some 2,500 identified shells, a sample of the assemblage, were analysed; limpets were the most common shellfish (39%), with mussels common (27%) and oysters and periwinkles less so (15% each); cockles were rare (3%). The early Saxon shells from nearby, at Rookery Hill, were overwhelmingly mussels, with occasional periwinkles and rare oysters and limpets (Bell 1977, 285).

Shellfish from middle Saxon coastal trading emporia (*wics*) have fared slightly better. The late 7th – mid 9th Century craftsmen's tenements at *Lundenwic* (Malcolm *et al.* 2003) produced a large number of shellfish by sieving substantial samples (Malcolm *et al.* 2003, 315), principally of oyster middens of A.D. 730-770 (Malcolm *et al*. 2003, 102). Total numbers and species recovered were not reported; full analysis (Winder & Gerber-Parfitt 2003) was restricted to the oysters from two midden layers. *Hamwih* (middle Saxon Southampton) produced 14,800 shells by hand-collection (Winder 1980). Almost all were oysters, with some winkles and rare cockles and whelks. This oyster bias was due to hand retrieval, with mussels greatly under-represented: only 40 mussels were retrieved even though some contexts were layers of mussel shell (Winder 1980, 125). The early 8th-mid 9th Century trading emporium at Dorestad, Holland produced only 443 shells, with mussels more common than oysters in both the hand-retrieved and sieved assemblages (Prummel 1983, 76 & 90-91).

Shells from middle Saxon high-status sites have done even more poorly. There is no report of shells from the Saxon occupation of Portchester Castle (Cunliffe 1976). Staunch Meadow, Brandon, Suffolk, awaits full analysis; the interim report notes oysters present (Carr *et al.* 1988, 375). The only substantial report is for mid- to late-Saxon Flixborough (Dobney *et al.* 2007, xxii) where shells were surprisingly sparse (Dobney *et al.* 2007, 37-40). Much of the shell had decayed during storage (Dobney *et al.* 2007, 35) so the remains were reported principally by weight rather than number. Hand-retrieval from middle Saxon deposits produced 28 kg of oysters, with rare whelks, winkles and mussels; bulk-sieving of charred-remains samples produced a wider range of species, but numbers and weights were not reported (Dobney *et al.* 2007, 48-54). The suggestion that oysters dominated at Flixborough because of the high status of its occupants does not hold: The *Hamwih* assemblage was also overwhelmingly oysters due to hand-retrieval (Winder 1980, 125), and the *Lundenwic* assemblage, while sieved from craftsmen's tenements, was also overwhelmingly oysters (Malcolm *et al.* 2003, 102).

The beachfront trading- and fishing-hamlet of *Sandtun*, in the *Limen* estuary, occupied from c. A.D. 700 to A.D. 850-875 (Gardiner *et al.* 2001), produced a large number of shells (the exact number is not reported) by hand-retrieval and some sieving (Gardiner *et al.* 2001, 189-191). Most shells were terrestrial gastropods (mainly *Helix* [sic] *nemoralis*), with a few freshwater gastropods. The marine shells (slightly less than half the assemblage) were overwhelmingly cockles (approximately 65%: Murray 2001, Fig. 52), with appreciable numbers of oysters (approximately 16% of the marine shells) and periwinkles (11%), and occasional whelks and limpets. Mussels were rare (approximately 4%). Many of the other types found at Lyminge were also recovered at *Sandtun*. This assemblage is particularly helpful for interpreting Lyminge shells, since *Sandtun* may have been the harbour for Lyminge: a charter of A.D. 732 grants the abbot of Lyminge property at *Sandtun*, and resources for salt-production there (Sawyer 1968, No. 23; Gardiner *et al.* 2001, 166).

Contrasts between middle Saxon and earlier, Roman, shellfish use cannot be drawn, since Roman marine shell reports for Kent are restricted to a dozen brief notes (Hall 2008). The small assemblage from Stutfall Castle (Rouillard 1980, 260) was principally oysters, with mussels and winkles also gathered for food; rough winkles, common cockles, spiny cockles, and limpets were so rare they may have been part of beach gravel used for mortar.

Research Aims and Tasks

Lyminge is not at the seaside, so marine shells were not available locally. A high proportion of any shellfish is inedible shell, so almost any locally available animal, domestic or wild, represented a better yield of meat to waste than shellfish. Shellfish cannot survive for long out of sea-water, so almost any locally available animal also represented a lower risk of spoiling. Since individual shellfish are small and shellfish are not present in vast numbers at minsters, calculating meat yields (always approximate) would reveal what is clear: shellfish's contribution to the diet is usually so small that it would be more economically sensible to use almost any locally available animal. Therefore time, money and effort spent acquiring shellfish must have come from foods which were better in cost-benefit terms. Lyminge Minster's subsistence economy is better understood if its marine shells are not regarded simply as a minor component of the diet, but as its best evidence for imported perishable luxuries. In middle Saxon Lyminge shellfish, economically, were more like wine than mutton.

A regional and national benchmark

As outlined above, shellfish for Conversion-era sites are under-retrieved, and seriously under-reported. Several sensible questions which require comparisons and contrasts to be drawn with contemporary sites (e.g.: 'Was more use made of shellfish in early minsters than contemporary unconverted communities because shellfish were considered 'fish', which could be consumed on fast-days?') cannot be answered. Lyminge shells can form the basis for reconstructing the use of shellfish in Conversion-era minsters across England, a process already under way for similar sites in Ireland (Murray *et al.* 2004).

Sensible questions about continuity with earlier periods within Kent (e.g.: 'How different is middle Saxon use and management of shellfish from Roman or early Saxon inland Kent sites?') also cannot be answered at present, since (as discussed above) Kent shellfish are also under-retrieved and under-reported. Lyminge shells will form the basis for comparing and constrasting the shells from other sites in the region, so these sensible questions can be answered in the future.

Status

The place of Lyminge in the economic hierarchy would be reflected by the proportion of consumable shells to waste (inedibly small shells and inedible types of shell). A low proportion of waste to edible shells would indicate that Lyminge took shellfish which others had already sorted, rather than being involved in collection and cleaning themselves. The range and density of waste shells were used to show the inhabitants of late Saxon Southampton got their oysters cleaned and packed, but gathered their own cockles and winkles (Campbell 2009, 15). The identifications in this assessment were preliminary. To reconstruct the proportion of waste to edible shells, those 64 deposits with over 40 shells, and the further 25 deposits with unusual shells, should have those shells identified to species, using recognised keys and reference collections.

Coastal-inland relationships

Since shellfish had to be imported to Lyminge from the coast, they mirror the extent of the Minster's economic connections with the coast. Since shellfish have to be consumed quickly, they mirror the day-to-day connections with the coast better than artefacts which lasted in use at the Minster for some time, such as imported pottery. The extent of the economic influence of the Minster along the coast can be reconstructed from the proportions of shells from the various habitats exploited. Evidence can come from four sources: mussels and their associated shells; oyster shape; cockle species, growth rates and shape trends; and limpet shape trends.

Mussel associates: The most common shellfish, mussels are very common in both wave-washed inter-tidal rocks (where periwinkles and limpets are also common), and wave-sheltered low inter-tidal and near-shore stable surfaces on any sediment. Too few mussels survived intact for shape or growth rate to help reconstruct the shores exploited directly. However, there seem to be two types mussel-rich deposit at Lyminge: those with a small component of rocky-shore types, such as limpets and periwinkles (which may therefore have been gathered from inter-tidal rocks), and those lacking these types (which may have been gathered from deeper water). Some multi-variate discrimination techniques used in ecology and paleontology to distinguish shellfish assemblages into habitats, such as hierarchical clustering analysis or nonparametric analysis of variance (Hammer & Harper 2006, 67-75 & 221-223), could be applied to the shellfish evidence to confirm or refute this impression. Landslips from the Lower Greensand terrace edge into the *Limen* estuary would have provided only small patches of rocky shore, so middle Saxon rocky shores were probably only common around Folkestone, as they are today. It is possible that the shellfish show that economic connections between Lyminge and Folkestone were greater than the charter evidence suggests.

Oysters: Often thought to be a rocky-shore species, oysters can occupy a wide range of habitats, from muddy beds in harbours to coarse beds in deeper water and fast tidal currents.

However, oysters can be assigned to habitat based on shape: irregular faceted forms from reefs (Campbell 2009, 6-7), round small-hinged forms from sheltered bays, and oval large-hinged forms from off-shore (Winder 1992, 197; Campbell 2010). While reef-forms can appear even in small reefs, reefs (even small ones) are gradually destroyed by fishing for oysters and gradually rebuild if left un-fished, so the proportion of reef forms in a deposit is a proxy for the intensity of oyster exploitation. The oysters were assigned to the round, oval, reef and shallow concave forms during the assessment. The proportions of these should be analysed and the contribution of the various habitats reconstructed.

The habitat which produced the shallow concave oysters from Lyminge is not known, and may have been produced by the oysters being managed by being grown on a chosen substrate (large rocks, poles, clay tiles, or oyster top cultch). Oysters with this form should be extracted and examined to determine its cause, and any management implications discussed.

Cockles: Both species of British cockle were observed. Assigning cockles to species in the seven deposits with more than 100 cockles should indicate the balance between easily accessible cockles in sheltered waters (*C. glaucum*), and slightly less accessible cockles from open water (*C. edule*).

Cockles also exhibit different growth-rates and shape trends in different habitats, and growth-rate and height-length allometry of archaeological cockles can reconstruct a detailed picture of the shores being exploited (Campbell 2009, 9-10). Measuring the whole cockles from these seven cockle-rich deposits and reconstructing their growth-rate and allometry should refine the picture of exploited shore types given by the balance of cockle species.

Limpets: There were five deposits which produced thirty or more common limpets. This species is well known to take different trends of shell shape with size in different habitats, being relatively more pointed with increasing height on the shore (Graham 1988, 77). This allometry has been used to reconstruct harvesting of archaeological limpets (Cabral & da Silva 2003). Analysing this allometry in Lyminge limpets has the potential to determine whether the rocky shore exploitation was targeted at a particular tidal height, or was more evenly distributed. The allometry of limpets that are found by multi-variate discrimination techniques to be mussel associates can be used to infer the tidal height at which mussels were exploited.

Escargots

Sieving produced significant numbers of terrestrial shells of consumable size. Since the same proportion were burnt and sooted as the marine shells, it is very likely that land-snails were consumed. Archaeological evidence has shown that land-snails have been consumed by humans since prehistory (e.g.: Lubell 2004). However, such an interpretation is almost unheard of in British archaeology. Most British archaeological land-snails are considered an incidentally-recovered part of the local natural fauna. The land-snails were dismissed in this way at contemporary coastal *Sandtun*, despite being the majority of the shells (Murray 2001, 261). It is also possible (if improbable) that Lyminge's land-snails are simply the larger shells of a natural population with a wide size range, selected by the sieving. The main genus recovered, *Helix* sp., congregate naturally to aestivate in the summer and hibernate in winter (Beedham 1972, 114).

If the Lyminge land-snails are to be accepted generally as middle Saxon *escargots*, further supporting evidence will be required. The blackened areas on some of the shells will have to be subjected to chemical and microscopic examination to confirm they are soot and not post-depositional mineralisation. The land-snails from the seven land-snail-rich deposits should be checked for the apple snail (*Helix pomatia*). Rarer and larger than the garden snail (*H. aspersa*), it would reinforce the view that snails were consumed. The charred remains samples for those seven deposits with over 15 land-snails should be scanned by a mollusc specialist for the smaller remains of the potential *escargot* species, to see whether the large forms are likely to represent too great a proportion to be natural. If so, the evidence confirming middle Saxon *escargot* consumption should be reported. The charred remains samples for *escargot*-rich deposits should be sorted for these species, these shells measured, and the size distributions reported and discussed.

References

BARNES, R. S. K. 1973. The intertidal lamellibranchs of Southampton Water, with particular reference to *Cerastoderma edule* and *C. glaucum. Proceedings of the Malacological Society of London* 40, 413-433.

BEEDHAM, G. E. 1972. *Identification of the British Mollusca.* Amersham: Hulton.

BELL, M. 1977. Resources of the seashore, 285-287 in Bell, M., Excavations at Bishopstone. *Sussex Archaeological Collections* 115, 1-299.

B.G.S. 2010. 1:50 000 British Geological Survey Sheet data viewed via B.G.S. Geology of Britain Viewer (http: //maps.bgs.ac.uk/geologyviewer/). Accessed 11 December 2010.

BLAIR, J. 2005. *The Church in Anglo-Saxon Society.* Oxford: Oxford University Press.

BOYDEN, C. R. & P. J. C. RUSSELL. 1972. The distribution and habitat range of the brackish-water cockle (*Cardium* [*Cerastoderma*] *glaucum*) in the British Isles. *Journal of Animal Ecology* 41(3), 719-734.

BUSCHBAUM, C. & B. SAIER. 2001. Growth of the mussel *Mytilus edulis* L. in the Wadden Sea affected by tidal emergence and barnacle epibionts. *Journal of Sea Research* 45, 27-36.

CABRAL, J. P. & A. C. F. DA SILVA. 2003. Morphometric analysis of limpets from an Iron-Age shell midden found in northwest Portugal. *Journal of Archaeological Science* 30, 817–29.

CAMPBELL, E. M. J. 1962. Kent, 483-562 in H. C. Darby & E. M. J. Campbell (eds.), *The Domesday Geography of South-East England.* Cambridge: Cambridge University Press.

CAMPBELL, J. 2000. The sale of land and the economics of power in early England: problems and possibilities, 227-245 in J. Campbell, *The Anglo-Saxon State*. London: Hambledon & London.

CAMPBELL, G. 2009. Southampton French Quarter 1382 Specialist Report Download E3: Marine Shell, in R. Brown (ed.), *Southampton French Quarter 1382 Specialist Report Downloads* (Oxford: Oxford Archaeology OA Library EPrints) http://library.thehumanjourney.net/42/1/SOU_1382_Specialist_report_download_E3.pdf

CAMPBELL, G. 2010. Oysters ancient and modern: potential shape variation with habitat in flat oysters (*Ostrea edulis* L.), and its possible use in archaeology, in E. Álvarez-Fernández & D. Carvajal Contreras (eds.), "Not Only Food: Proceedings of the 2nd ICAZ Archaeomalacology Working Group Meeting, Santander, 2008", *Munibe* 31, 176-187.

CARR, R. D., A. TESTER & P. MURPHY. 1988. The Middle-Saxon settlement at Staunch Meadow, Brandon, *Antiquity* 62, 371-377.

CODLINGTON, T. 1903. *Roman Roads in Britain*. London: Society for Promoting Christian Knowledge.

CUNLIFFE, B. 1976. *Excavations at Portchester Castle II: Saxon.* London: Society of Antiquaries of London Research Report 33.

CUNLIFFE, B. 1980. Excavations at the Roman fort at Lympne, Kent, 1976-8. *Britannia* 11, 227-288.

DANIELS, R. 2007. *Anglo-Saxon Hartlepool and the Foundations of English Christianity: An Archaeology of the Anglo-Saxon Monastery.* Hartlepool: Tees Archaeology.

DUCROTOY, J. P., H. RYBARCZYK, J. SOUPRAYEN, G. BACHALET, J. J. BEUKEMA, M. DESPREZ, J. DORJES, K. ESSINK, J. GUILLOU, H. MICHAELIS, B. SYLVAND, J. G. WILSON, B. ELKAIM AND F. IBANEZ. 1991. A comparison of the population dynamics of the cockle (*Cerastoderma edule* L.) in northwestern Europe, 173–184 in M. Elliott & and J. P. Ducrotoy (eds.), *Estuaries and Coasts: Spatial and Temporal Intercomparisons*. Fredensborg: Olsen and Olsen.

DOBNEY, K., D. JAQUES, J. BARRETT & C. JOHNSTONE. 2007. *Farmers, Monks and Aristocrats: the Environmental Archaeology of Anglo-Saxon Flixborough* (Excavations at Flixborough 3). Oxford: Oxbow Books.

HALL, A. 2008. *Environmental Archaeology Bibliography* (updated 2008). http://ads.ahds.ac.uk/catalogue/specColl/eab_eh_2004/ (accessed 20 Nov. 2010).

HAMMER, Ø. & HARPER, D. 2006. *Paleontological Data Analysis*. Oxford: Blackwell.

GARDINER, M., R. CROSS, N. MACPHERSON-GRANT & I. RIDDLER. 2001. Continental trade and non-urban ports in mid-Anglo-Saxon England: excavations at *Sandtun*, West Hythe, Kent. *Archaeological Journal* 158, 161-290.

GRAHAM, A. 1988. *Molluscs: Prosobranch and Pyramidellid Gastropods* (Synopses of the British Fauna (New Series) 2). Leiden: Brill and Backhuys for the Linnean Society of London.

HANCOCK, D. A. 1967. *Whelks*. Fisheries Laboratory Leaflet (New Series)15. Burnham-on-Crouch: Ministry of Agriculture, Fisheries and Food.

HASLAM, J. 1985. *Early Medieval Towns in Britain c.700 to 1140.* Princes Risborough: Shire.

LONG, A. J., M. P. WALLER & A. J. PLATER. 2007. The late Holocene evolution of the Romney Marsh/Dungeness Foreland depositional complex, 189-207 in A. J. Long, M. P. Waller & A. J. Plater (eds.), *Dungeness and Romney Marsh: Barrier Dynamics and Marshland Evolution.* Oxford: Oxbow.

LUBELL, D. 2004. Prehistoric edible land snails in the circum-Mediterranean: the archaeological evidence, 77-98 in J-J. Brugal & J. Desse (eds.), *Petits Animaux et Sociétés Humaines: Du Complément Alimentaire Aux Ressources Utilitaires* (24eme Rencontres Internationales d'Archéologie et d'Histoire d'Antibes). Antibes: Éditions APDCA.

MALCOLM, G., D. BOWSHER & R. COWIE. 2003. *Middle Saxon London: Excavations at the Royal Opera House 1989-99.* London: Museum of London Archaeological Studies 15.

McCORMICK, F. & E. MURRAY. 2007. *Excavations at Knowth 3: Knowth & the Zooarchaeology of Early Christian Ireland.* Dublin: Royal Irish Academy.

MURRAY, E. 2001. Shellfish, 261-264 in M. Gardiner, R. Cross, N. Macpherson-Grant & I. Riddler, Continental trade and non-urban ports in mid-Anglo-Saxon England: excavations at *Sandtun*, West Hythe, Kent. *Archaeological Journal* 158, 161-290.

MURRAY, E., F. McCORMICK & G. PLUNKETT. 2004. The food economies of Atlantic island monasteries: the documentary and archaeo-environmental evidence. *Environmental Archaeology* 9(2), 179-188.

O. S. 2008. *O. S. Landranger (1: 50 000 scale) Map 189: Ashford and Romney Marsh*. Edition D2. Southampton: Ordnance Survey.

PRUMMEL, W. 1983. *Early Medieval Dorestad: An Archaeozoological Study (Excavations at Dorestad 2).* Amersfoort: Rijksdienst voor het Oudheidkundig Bodemonderzoek.

ROUILLARD, M. 1980. The mollusca, 260 in B. Cunliffe, Excavations at the Roman fort at Lympne, Kent, 1976-8. *Britannia* 11, 227-288.

SAIER, B. 2000. Age-dependent zonation of the periwinkle *Littorina littorea* (L.) in the Wadden Sea. *Helgoland Marine Research* 54, 224-229.

SAWYER, P. H. 1968. *Anglo-Saxon Charters: An Annotated List & Bibliography.* London: Royal Historical Society.

SEED, R. 1969. The ecology of *Mytilus edulis* L. (Lamellibranciata) on exposed rocky shores I: breeding and settlement. *Oecologia* 3, 277-316.

SEED, R. & T. H. SUCHANEK. 1992. Population and community ecology of *Mytilus*, 87–171 in E. Gosling (ed.), *The Mussel* Mytilus*: Ecology, Physiology, Genetics and Culture* (Developments in Aquaculture and Fisheries Science 25). Amsterdam: Elsevier.

SMART, J. G. O., G. BISSON & B. C. WORSSAM. 1966. *Geology of the Country around Canterbury and Folkestone* (Memoir of the Geological Survey of Great Britain). London: Her Majesty's Stationery Office.

SOMERVILLE, E. M. in press. Marine molluscs from Bishopstone, in G. Thomas, *The Later Anglo-Saxon Settlement at Bishopstone: A Downland Manor in the Making.* York: Council for British Archaeology Research Report 163.

SWANTON, M. (transl.) 2000. *The Anglo-Saxon Chronicles.* London: Phoenix.

THOMAS, G. 2005. *Lyminge: An Archaeological Research Agenda for the Pre-Viking Minster and its Associated Settlement.* Reading: University of Reading Archaeology Dept.

THOMAS, G. 2009. *Uncovering an Anglo-Saxon Monastery in Kent: Interim Report on the University of Reading Excavations at Lyminge, 2008.* Reading: University of Reading Archaeology Dept.

WINDER, J. M. 1980. The marine molluscs, 121-127 in P. Holdsworth, *Excavations in Melbourne Street, Southampton, 1971-76.* London: Council for British Archaeology Research Report 33.

WINDER J.M. 1992. The Oysters, 194-200 in Horsey, I. P. (Ed.): *Excavations in Poole 1973-1983*. Dorchester: Dorset Natural History & Archaeological Society Monograph 10.

WINDER, J. & S. GERBER-PARFITT. 2003. The oyster shells, 325-332 in G. Malcolm, D. Bowsher & R. Cowie, *Middle Saxon London: Excavations at the Royal Opera House 1989-99*. London: Museum of London Archaeological Studies 15.

Post-Excavation Analysis Tasks

Identify shells to species in 64 deposits with over 40 shells, and the further 25 deposits with unusual shells: [12 days]

Examine shallow concave oysters for surface features to determine cause, and possible management [3 days]

Analyse proportions of round, oval, reef and shallow concave oysters to reconstruct oyster beds: [2 days]

Measure limpets in five limpet-rich deposits; analyse shape, reconstruct shore positions [6 days]

Identify cockles to species in seven cockle-rich deposits: [2 days]

Measure the whole cockles from seven cockle-rich deposits; reconstructing growth-rate and allometry: [11 days]

Employ multivariate discrimination techniques (hierarchical clustering analysis or nonparametric analysis of variance) to reconstruct habitats exploited for mussels: [8 days]

Microscopic and chemical testing of sooting on land-snail shells: [3 days]

Scanning, sorting and measuring of seven land-snail-rich deposits' soil samples: [7 days]

Specialist time required: [54 days for tasks, 14 days to report: total 68 days]