

Mesolithic middens and molluscan ecology: a view from southern Britain

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Large accumulations of marine shells are characteristic of mesolithic coastal sites in northwest Europe, but how intensively shellfish were exploited remains controversial. Excavation of a midden on the Isle of Portland and ecological study of present-day molluscs suggest that prehistoric human exploitation may have had a significant impact on local shellfish populations.

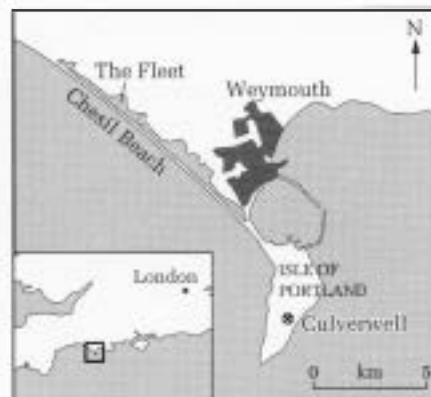


Figure 1 Location of the Isle of Portland and the Culverwell midden site.

Human subsistence in the mesolithic period (c. 10,000–5000 bc) of western Europe has been characterized as broadly based. It is thought that people lived by hunting large game animals, fishing, gathering wild plant foods and foraging for other food resources, such as shellfish in coastal and estuarine environments. Large accumulations of the remains of shellfish, often in the form of shell mounds or middens, are a characteristic feature of the coastal archaeological record for this period. Within Britain, the distribution of coastal midden sites is markedly biased to the north, because uplift of the land in the north following the melting of the most recent ice sheet outpaced the post-glacial rise of sea level. For example, in both eastern and western Scotland, many mesolithic middens have been preserved.¹ However, in southern Britain the post-glacial rise of sea level coincided with downwarping of the Earth's crust; as a result, many coastal areas were drowned, and it is likely that many mesolithic sites were likewise submerged. The shell midden site of Westward Ho! in north Devon,

which is accessible to archaeologists only at very low spring tides,² is an example of this process. On the high cliffs of the Isle of Portland (Dorset) there are shell-midden sites that are exceptional in southern Britain, being both well preserved and easily accessible for archaeological investigation. One such is the large midden site of Culverwell³ (Fig. 1), which has been excavated over many years, although our investigations began there only in the summer of 1995.

The Culverwell shell midden

Culverwell shell midden is located some 230m from the eastern cliffs of the island and at about 30m above mean sea level. The mesolithic deposits date, by radiocarbon, to c. 7000 bp and are preserved under a medieval field system. Excavations at the site by Susann Palmer since 1967 have revealed the presence of a very extensive shell midden. Its full dimensions are not yet known, but trenches show that it extends over an area of at least 700m². Although extensive, the midden is not very thick over most of its extent, except at the western end of the site where

it reaches 50–60cm in thickness. Our work has focused on this thick midden, which is located in a deep underlying feature that may be a natural gully. In the summers of 1995 to 1997 we excavated a 1.3m-deep trench through the deposits in this area (Fig. 2) and revealed an upper sequence of deposits (known as colluvium) that had been moved down slope, sealing the dark midden beneath (Fig. 3). Column samples of midden material were collected and processed in the Wolfson Archaeological Science Laboratories at the Institute of Archaeology. The main objective of this work, in addition to the field investigation of the gully-like feature, was to gain an understanding of the composition of the midden, and especially to quantify the assemblages of shellfish (mollusc) remains in the various stratigraphic layers. This would in turn provide information about the range of species exploited (presumably for food); the nature of the coastal environments exploited by mesolithic foragers; and perhaps other information such as whether shellfish were exploited at one season or more frequently through the year and the possible impact of exploitation on the shellfish and other resources.

The shellfish remains

We recovered from the midden the shells of marine bivalves (two-shell molluscs such as mussels) and of marine snails (gastropods) that had been collected in mesolithic times from both rocky and sandy shores, although gastropods from rocky shores were by far the most abundant in all layers of the midden. The three dominant species are limpets (*Patella* spp.), edible periwinkles (*Littorina littorea*) and the toothed top shell (*Monodonta lineata*), followed by the dog whelk (*Nucella lapillus*). All these are intertidal species of rocky shores and they have overlapping distributions on the shore. Apart from molluscs, other marine resources recovered from the midden include many fragments of claws of the edible crab (*Cancer pagurus*), but only two fishbones. A few small highly fragmented pieces of mammal bone were also found. Thus, in bioarchaeological terms, the

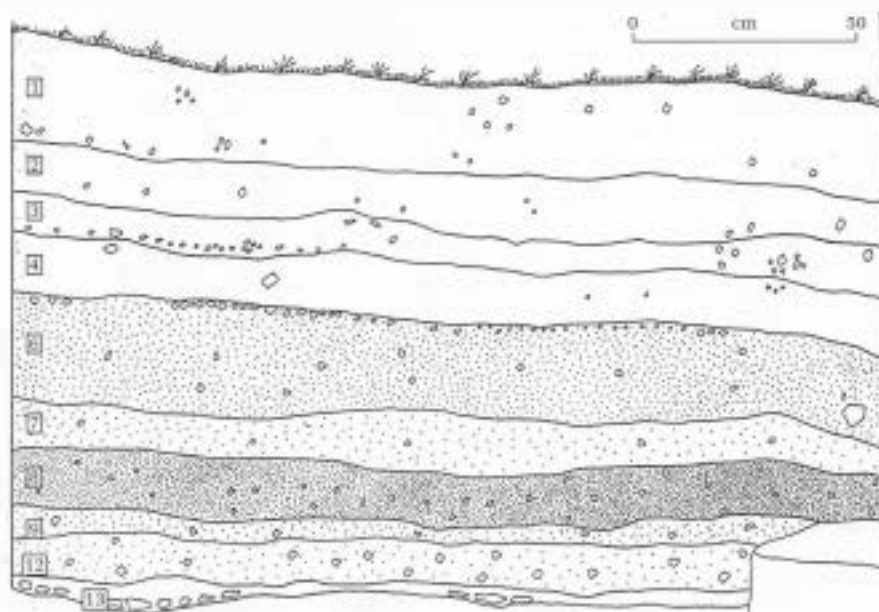


Figure 2 Culverwell mesolithic site: schematic stratigraphic section of the east-facing side of trench 41, showing the buried midden deposits (layers 7–13) and the overlying colluvial deposits (layers 1–6).



Figure 3 View of the stratigraphic sequence in the Culverwell midden, showing, below the dashed white line, the darker shell-rich midden deposits beneath the overlying lighter colluvial deposits (scale bar 15 cm).

midden contents are overwhelmingly dominated by shellfish, especially gastropods.

The three most abundant species show significant changes in frequency through the midden (Fig. 4). The decline in all three species through the samples from layer 8 and into layer 7, which together represent the most intensive phase of human occupation at the site, is particularly interesting. These changes could be interpreted as the result of environmental change, of the impact of human exploitation, of changes in human food choice, or possibly of more complex interactions of these factors.

As an explanation for the parallel decline in the three main mollusc species, environmental change (involving either climatic change or local shore changes associated with rising sea levels) is unlikely for the following reasons:

- *Monodonta lineata* is a southern species near the northern edge of its range at Portland, yet the other two (more northerly) species decline by at least as much and sometimes more.
- If rising sea levels during the occupation of the site had led to shore morphologies similar to those of today, *Monodonta* and *Littorina* would have declined, but *Patella* would have remained unaffected.
- If rising sea levels had led to greater exposure of shores to wave action, *Patella*, again, should have been less affected and other species, such as the dog whelk, whose shell morphology is known to vary according to shore exposure, might also reflect this. In fact, changes in the morphology of shells of

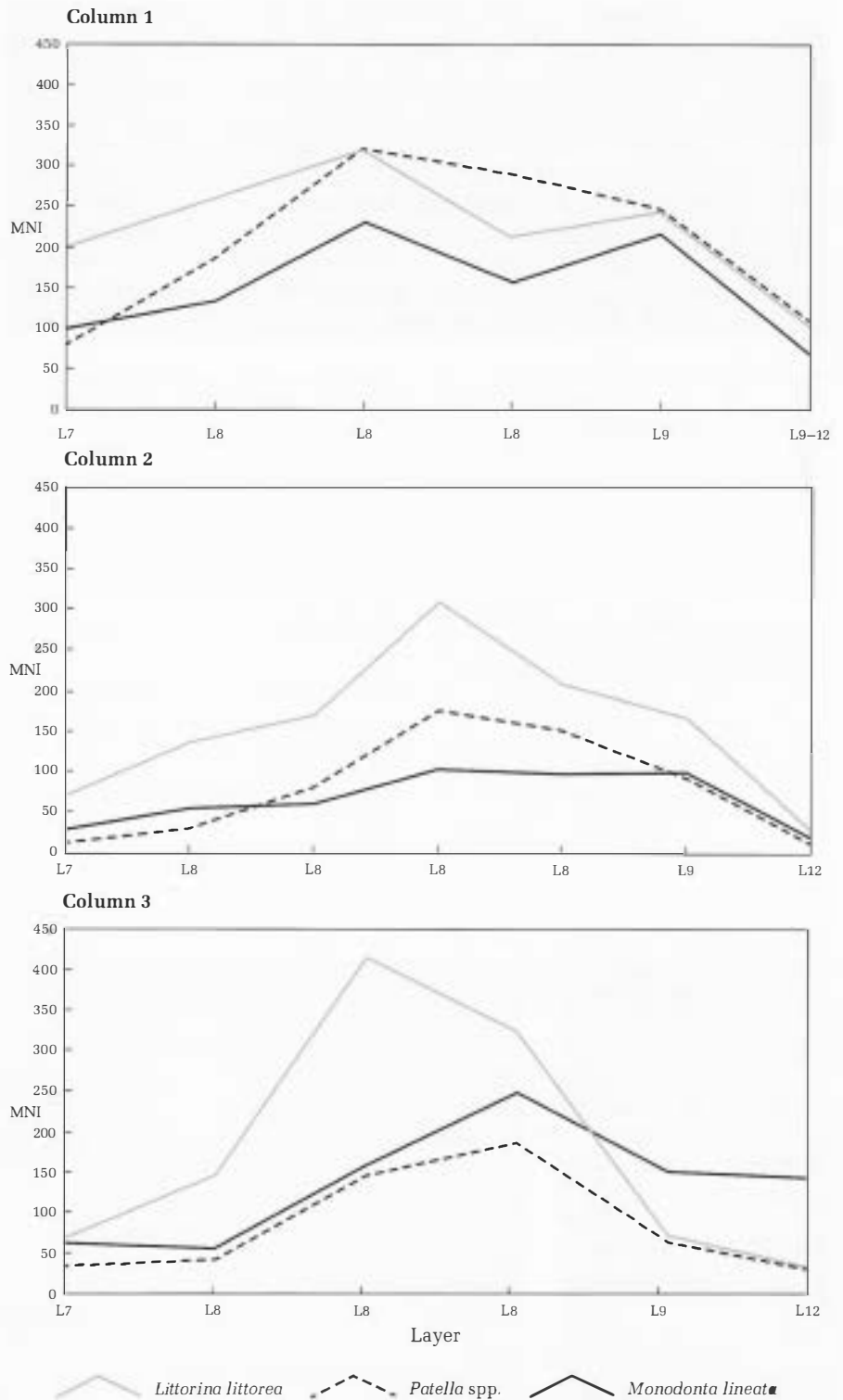


Figure 4 Changes in the abundance of the three main mollusc species through the midden deposits at Culverwell (sample columns 1, 2 and 3); MNI = minimum number of individual shellfish.

dog whelk from the midden show that, if anything, shores became progressively less exposed during this period. If human exploitation had led to a decline in these species, one might expect this to result in changed age profiles in the midden samples. Of the three main species only the age of *Monodonta* shells can be

determined (by counting the annual growth lines). Age-profile histograms of this species, for one series of samples (sample column 1) through the midden (the other two series are still being analyzed), show a progressive shift from older to younger age groups (Fig. 5). These results are consistent with the overexploitation resulting from

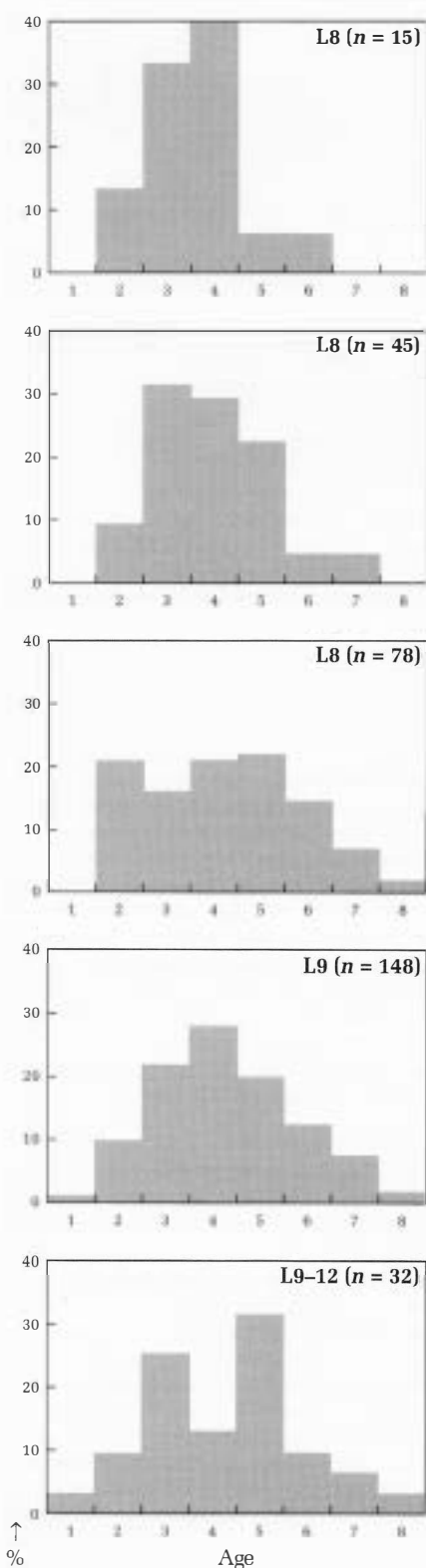


Figure 5 Changes in the age profiles of the top shell (*Monodonta lineata*) through the midden deposits at Culverwell (sample column 1) from the top of layer 8 (L8) down to layers 9–12; n = the number of shells analyzed in each sample.

foragers initially gathering the larger (therefore older) snails living on the shore, leading to a shift in the age distribution of the living shore population towards the younger age categories, which ultimately become the dominant age categories in the midden.

Of course, it could be argued that the decline in abundance of the three gastropod species through the midden reflects a progressive shift away from shellfish and towards other dietary items (although few other food resources were found preserved in the midden). The role of human food choice as a factor that might cause change in the representation of species is notoriously difficult to demonstrate archaeologically and therefore should not be dismissed out of hand. But the changes in abundance, coupled with the progressive shifts in the age profiles of *Monodonta* described above, are difficult to account for solely on the basis of changing human food preferences.

We believe, therefore, that we have demonstrated that, during the period of most intense occupation at the midden site, human foraging in the shore zone is likely to have had a significant impact on molluscan food resources, causing at least three species to decline in local abundance. As yet, we do not know the time period represented by the series of samples, although radiocarbon dates on them are awaited, but it seems clear that exploitation of intertidal molluscs from the site was sufficiently intensive, in scale and frequency, to prevent the local shore populations of them from reverting to their natural age structures.

Further research

Our investigations of the molluscs from the Culverwell midden have led us to undertake research on four related topics that we hope will make valuable contributions to the archaeological study of shell middens, as well as to molluscan ecology:

- Morphological analyses of the archaeological material, including changes in the average sizes of shells in different age classes over time.
- Analyses of the oxygen-isotope composition of shell carbonates of *Monodonta* from the midden, to gain palaeotemperature data and evidence of season of collection, based on the ratio of the lighter to the heavier oxygen isotopes, which varies with seawater temperature.
- Ecological studies of modern populations of *Monodonta lineata* to provide information on population age structures, recruitment of young individuals to the shore populations from the plankton, and their movements and seasonal patterns of aggregation on the shore.
- Oxygen-isotope analyses of modern shells, collected from various locations (at various times in the year) with known seawater temperatures, to provide a “calibration curve” for interpreting, in terms of past sea temperatures, the oxygen-isotope ratios in the archaeological shells.

Conclusions

With much work still in progress, few firm conclusions can be reached at this stage. The most interesting conclusion to be drawn from the data collected so far is that human exploitation of shellfish resources on Portland may have been sufficiently intensive and frequent to have had significant impacts on the local shore populations of molluscs. It will be interesting to find out whether these patterns of intensive exploitation had a seasonal component – whether the shellfish were gathered at particular seasons or throughout the year. This, in turn, will yield insights into how people exploited intertidal resources in southern Britain, in comparison with other studies of shellfish exploitation in Britain and along the Atlantic coastline of western Europe.

Notes

1. See, for example, J. M. Coles, “The early settlement of Scotland: excavations at Morton, Fife”, *Proceedings of the Prehistoric Society* 37, 284–366, 1971; and P. Mellars, *Excavations on Oronsay: prehistoric human ecology on a small island* (Edinburgh: Edinburgh University Press, 1987).
2. See N. D. Balaam, M. G. Bell, A. G. U. David, D. B. Levitan, R. I. Macphail, M. Robinson, R. G. Scaife, “Prehistoric and Roman-British sites at Westward Ho!, Devon”. In *Studies in palaeoeconomy and environment in Southwest England* N. D. Balaam, B. Levitan, V. Straker (eds), 163–264 (Oxford: BAR British Series, 1987); and D. M. Churchill, “The kitchen midden at Westward Ho!, Devon, England: ecology, age and relation to changes in land and sea level”. *Proceedings of the Prehistoric Society* 31, 74–84, 1965.
3. See, for example, S. Palmer, “Mesolithic sites of Portland and their significance”, in *The Mesolithic in Europe*, C. Bonsall (ed.), 254–7 (Edinburgh: John Donald, 1989).
4. We thank Mrs Susann Palmer for allowing us to work at Culverwell and for providing facilities and encouragement. English Heritage kindly granted permission for us to excavate a new trench at the site. The research is supported by an NERC Research Studentship (to M. M.), the NERC Radiocarbon Laboratory (East Kilbride), the NERC Isotope Geosciences Laboratory (Keyworth), the UCL Graduate School Research Fund, the Institute of Archaeology (UCL) Research Fund, and the University of London Central Research Fund. We also thank the UCL Department of Chemistry for use of its X-ray diffraction facilities.