Marine shell beads from three inland Later Mesolithic sites in western Britain

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Abstract

Marine shell ornaments in the Mesolithic have often been considered as 'local' products found in locations close to where they occur naturally. In this paper we turn attention to three sites in western Britain where bead ornaments have been found well away from the contemporary shoreline. The shell beads come from recent excavations at King Arthur's Cave, Madawg Rockshelter (Wye Valley, Herefordshire), and at Three Holes Cave (Torbryan Valley, Devon). The molluscan genera are represented by cowrie (Trivia sp.)*, flat periwinkle* (Littorina obtusata) *and a single specimen of dentalium* (Dentalium sp.)*. As well as aspects of bead-making technology, we review the dating evidence at each of the three sites and make broader comparisons with other finds in Britain and adjacent areas of Ireland and France. We also re-examine the issue of bias in the distribution of shell artefacts along the Atlantic façade.*

Introduction

Perforated shell ornaments or beads are amongst the most recognisable artefacts in the European Later Mesolithic. Knowledge of shell beads and their widespread distribution owes much to their early archaeological discovery in shell middens (*køkkenmøddings*) and in human graves close to Holocene marine shorelines. Some of the most celebrated examples come from Mesolithic burials in Brittany (Péquart & Péquart 1929, 1954; Péquart *et al.* 1937), but a substantial number have no obvious funerary associations and derive from middens along the Atlantic façade of western Europe. The rocky and indented coastlines stretching from Portugal to the Outer Hebrides in the far north of Scotland offer especially favourable habitats for edible bivalves, gastropods and other marine foods and for these reasons would have attracted the interest of hunter-gatherer communities (Dupont *et al.* 2009). Erosion of exposed Holocene shorelines particularly in western Britain has increased the potential for finding Later Mesolithic sites in these places (Bell *et al.* 2006). This, in combination with the importance of the coast for supplying raw materials and marine dietary resources, were undoubtedly important factors in the distribution of Mesolithic sites, and were highlighted by Roger Jacobi in his seminal paper on the 'Early Flandrian hunters of the south-west (Britain)' published in 1979.

In the recent literature, much of the interest in shell beads has been focused on their symbolic significance as personal ornaments (D'Errico *et al.* 1993; Nash 2012). Attention has also centred on the contextual associations of these finds (e.g. in graves, middens etc), which has led to a widespread perception that they were particularly important as funerary items in the Mesolithic (Rigaud 2011). At the same time, analogies with the ethnographic record imply everyday decorative uses in necklaces, pendants, headdresses and adornments sown on to clothing, and beads may have served other applications ranging from currency and items of prestige, to markers of group identity (Taborin 1974). Additionally, they have been linked to ceremonial uses in rites of passage to adulthood, marriages and to specialised mortuary practices (Newell *et al.* 1990; Sciama & Eicher 1998). Despite these manifold interpretations, relatively little thought has been given to the spatial distribution of shell beads in the landscape or at an inter-site level. For example it has frequently been assumed that they invariably occur at coastal sites, close to the point of source, with the result that finds from other types of location have often been ignored or neglected.

In this paper, we draw attention to three inland cave localities in western Britain where recent excavations have uncovered evidence of marine shell artefacts. In each case the shell beads are restricted in number and overall are represented by only three genera (*Trivia*, *Littorina* and *Dentalium*). Besides describing the dating evidence and the associated Later Mesolithic artefact assemblages, we also briefly consider the technology of bead making and present preliminary findings of experiments to replicate cowrie shell beads. Finally, we look at the relationship of the three sites to other bead findspots in Britain and Europe and will argue that the predominantly western bias in their distribution reflects genuine patterning in the archaeological record rather than simply arising from taphonomic factors of preservation.

The three inland Mesolithic sites

Madawg Rockshelter, Herefordshire

Location and stratigraphic contexts

Madawg Rockshelter (NGR SO 5474 1527) is located about 1 km southwest of Symonds Yat on the right bank of the River Wye in Herefordshire and about 40 km inland from the nearest coast (Fig. 1). The site is at an elevation of c. 60 m OD, and occurs in limestone bluffs of Lower Crease Limestone known locally as the Seven Sisters rocks. The rockshelter opens high above the river and is crescentic in shape with a shallow overhang covering a floor area of c. 270 m^2 (inside the drip line). It faces almost due west and, under conditions of low vegetation, would have provided good views downstream of the River Wye. Access from the bottom of the valley is possible today via a steep scramble up scree slopes; the plateau above the site is more easily accessible.

The rockshelter was partly excavated in the 1920s (Hewer 1925) but no systematic investigation was undertaken until 1993 (Barton 1993, 1994, 1995). Little is known of the earlier excavations or the collections which do not appear to have included Mesolithic artefacts (Hewer *ibid.*). The more recent programme focused on an area of c. 30m^2 in the northern half of the rockshelter (Barton *et al.* 1997). A relatively simple stratigraphy was observed consisting of a Grey to Brown Tufaceous Earth (BTE) overlying a Brown Stony Cave Earth (BSCE) with large limestone clasts that contained major voids in places. Bedrock was not reached.

Later Mesolithic artefacts including an assemblage of 11 cowrie (*Trivia* sp.) and two flat periwinkle (*Littorina obtusata*) shells were recovered by excavation and fine sieving of the BTE deposits (Fig. 2). The shells were distributed in an area of 2.25 m^2 with a concentration occurring in a zone 50 cm in diameter (in square L6) and within a discrete 10 cm thick band. The only 'feature' in these sediments was an elongate depression (centred on squares K11-K12) which contained well-preserved charcoal and a few charred fruit stones. The upper part of the 30 cm deep depression consisted of charcoal of mixed oak woodland species (Barton 1997, 107). Charred wood was much sparser in the lower part of the depression and consisted of pine (*Pinus*) and yew (*Taxus*). Also identified in the lower levels (Wendy Carruthers pers. comm.) were the seeds and stones of hawthorn (*Crataegus* sp.) and sloe/blackthorn (*Prunus spinosa*). Small mammal remains from this context and the equivalent stratigraphic unit comprised wood mouse (*Apodemus sylvaticus*) and bank vole (*Clethrionomys glareolus*), both of which are compatible with the charcoal evidence and confirm the local presence of deciduous woodland.

Microlith associations

Later Mesolithic artefacts including narrow geometric microliths were recovered from the BTE and top of the underlying BSCE sediments.

Dating evidence

Two AMS radiocarbon dates were obtained on charred specimens from the lower levels of the depression:

OxA-6082	charred hazelnut shell (MDG 528) 6655 ± 65 BP
OxA-6081	charred sloe stone (MDG 527) 8710 ± 70 BP

The sloe stone was recovered in a spit some 7 cm below the hazelnut sample. These dates are slightly difficult to interpret as they do not overlap at one standard deviation and it is likely that they represent different phases of site use and accumulation. On comparative typological grounds, we would suggest that the younger of these two dates is likely to provide an age for the geometric microliths and shell beads.

Figure 1. Distribution of sites with marine shell beads referred to in this paper.
1: Three Holes Cave; 2: Madawg Rockshelter; 3: King Arthur's Cave; 4: Aveline's Hole; 5: Culver Well, Portland; 6: Nanna's Cave, Caldey Island; 7: Prestatyn; 8: Snail Cave; 9: Baylet (Harte site 3); 10-13: Caisteal nan Gillean I and II, Cnoc Coig Cnoc, Sligeach (Oronsay middens); 14: Ulva; 15: Carding Mill Bay 1; 16: Sand; 17: Risga; 18: Le Porteau-Ouest; 19: Hoëdic ; 20: Beg-er-Vil; 21: Téviec; 22: Beg-an-Dorchenn ; 23: Chaussée Tirancourt.

King Arthur's Cave, Herefordshire

Location and stratigraphic contexts

King Arthur's Cave (NGR SO 5458 1558) is one of a series of small caves and rockshelters that open on the west side of Great Doward Hill, about 3 km south of the village of Whitchurch, Herefordshire (Fig. 1). It lies not far from Madawg Rockshelter (350 m to the north-northwest) but at a slightly higher altitude of c. 110 m OD. The cave overlooks a small dry valley that leads down to the River Wye via a sharply dipping slope. The cave itself is formed

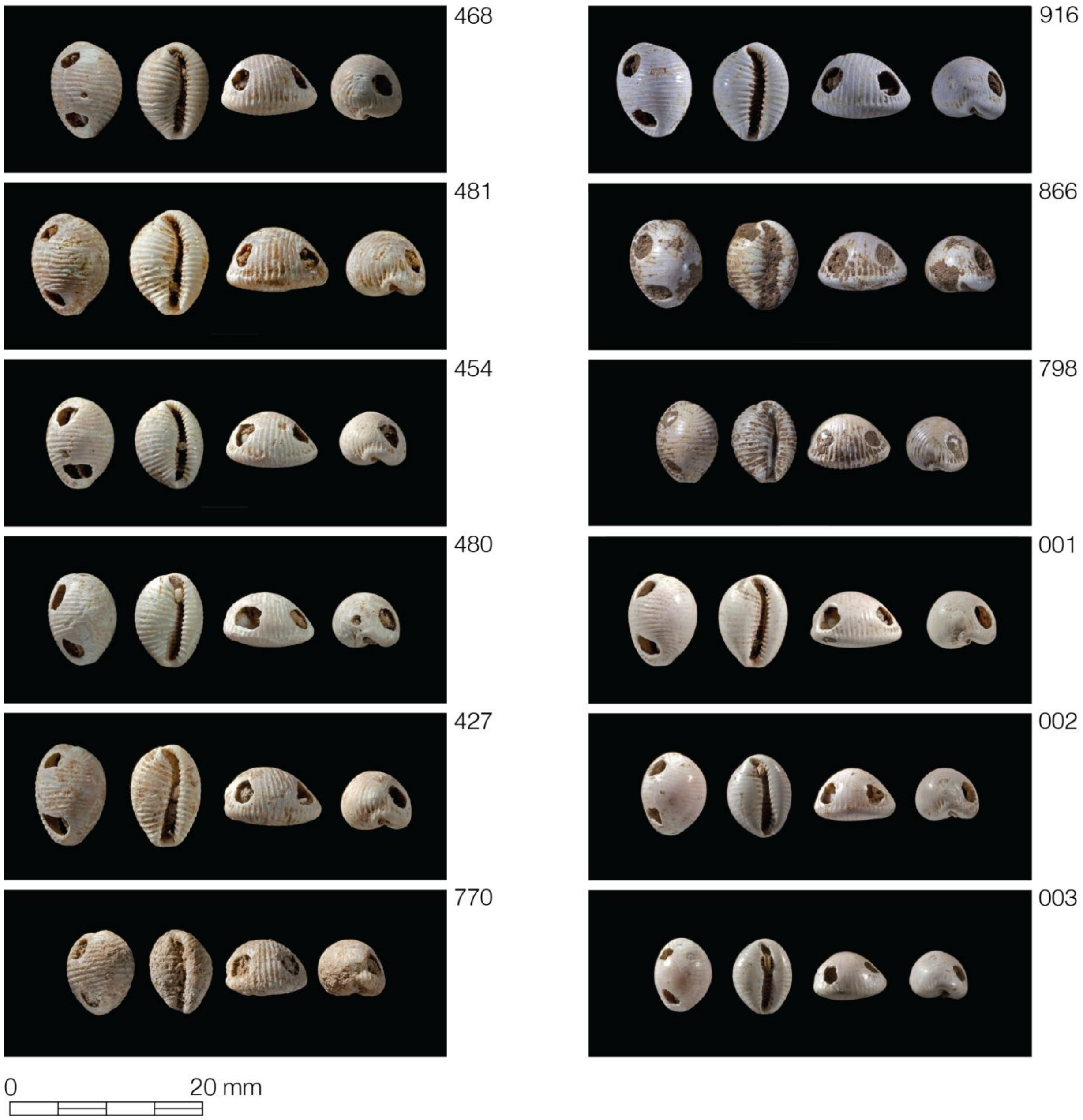

Figure 2. Perforated cowries from Madawg Cave (468, 481, 454, 480, 427, 770), King Arthur's Cave (916, 866, 798), Three Holes Cave (001, 002, 003 courtesy of Torquay Museum). Photo by Ian Cartwright, copyright of the Institute of Archaeology, Oxford.

of Lower Crease Limestone (Welch & Trotter 1961), its roof occurring at the geological junction with the oolitic Upper Crease Limestone. The cave mouth consists of two interconnected entrances that lead back to a small network of shallow chambers and passages little more than 15 m deep. In front of the cave is a broad platform covered by spoil from earlier excavations of the cave.

The cave has a long history of exploration and excavation beginning in 1871 (Symonds 1871, 1872). It was made a Scheduled Ancient Monument in 1952. The most recent phase of excavation took place between 1995 and 1997 as part of the Wye Valley Caves Project (Barton 1995, 1996, 1997). The new work explored the entrance platform and areas beneath the overhang and in the second chamber. *In situ* deposits were found only underneath the spoil tips and to the right of the cave entrance (facing). A small stratified assemblage of Later Mesolithic artefacts and fauna was recorded outside the cave (Barton 1997).

Isolated examples of Mesolithic flints, three cowrie (*Trivia* sp.) and two flat periwinkle (*Littorina obtusata*) shell beads were recovered in a small alcove on the north-west side of the Second Chamber (Figs 2 and 3). Originally it was believed that this area had been undisturbed by mining activities or the 19th century excavations, but it soon became clear from our small test pit of 70 x 50 x 50 cm in the alcove that there was a mixture of Bronze Age pottery, Mesolithic and Later Upper Palaeolithic finds (Barton 1996). Nonetheless, the fact that the shells all came from reddish stony cave

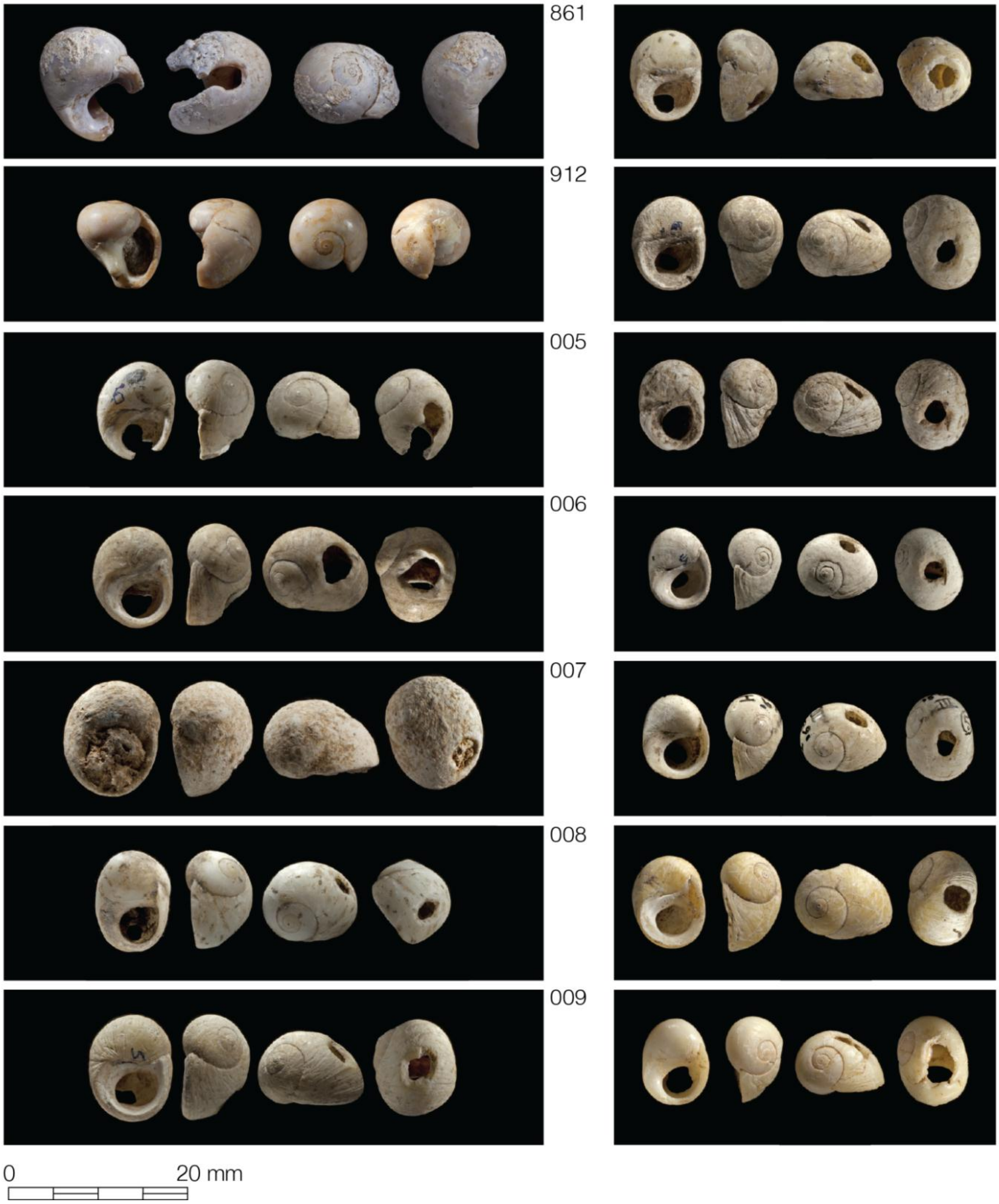

Figure 3. Perforated flat periwinkles from King Arthur's Cave (861, 912) and Three Holes Cave (005-016 courtesy of Torquay Museum). Photo by Ian Cartwright, copyright of the Institute of Archaeology, Oxford.

earth deposits and were found within a few centimetres depth of one another suggests that they derived from within the alcove itself or as localised backfill from the Second Chamber. The discovery of these artefacts provided the first tangible links between human activities at this cave and Madawg Rockshelter. It is also interesting to note that there is a reference to a drilled shell of *Neritoides obtusatus* (*Littorina obtusatus*) amongst finds recorded from the nearby site of Merlin's Cave (Hewer 1926, 220).

Microlith associations

No direct associations with the shells could be proven. The lithic assemblage from outside the cave entrance is an homogeneous example of Later Mesolithic type and includes an elongate backed (rod-like) microlith. Mesolithic artefacts sieved from inside the alcove comprise small obliquely truncated microlithic forms.

Dating evidence

No dating evidence is yet available for the *in situ* assemblage outside the cave entrance.

Table 1. Perforated beads and worked shell from mainly Later Mesolithic sites in Britain and Ireland.

Site	*Trivia*	*Littorina*	*Dentalium*	*Nucella*	*Cerastoderma*	*Ostrea*	*Pecten*	*Hinia*
Three Holes Cave[1]	+	+	+					
Madawg Rockshelter[2]	+	+						
King Arthur's Cave[3]	+	+						
Aveline's Hole[4]		+						
Culver Well, Portland[5]		+		+	+	+	+	
Nanna's Cave[6]	+	+						+
Prestatyn[7]						+		
Snail Cave[8]	+							
Baylet (Harte site 3)[9]	+							
Caisteal nan Gillean I[10]							+1 perf	
Caisteal nan Gillean II[10]	+							
Cnoc Coig[10]	+						+	
Cnoc Sligeach[10]	+					+	+	
Ulva[11]	+							
Carding Mill Bay 1[12]	+							
Sand[13]	+						+	
Risga[14]	+?							

1. Rosenfeld 1964; Roberts 1996; 2. Barton 1994; 3. Barton 1996; 4. Davies 1921, 1923; 5. Palmer 1976, 1999; 6. Leach 1916; 7. Clark 1938, 1939; 8. G. Smith pers. comm.; 9. Milner & Woodman 2007; McCaffrey 2012; 10. Bishop 1914; Mellars 1987; Saville pers. comm.; 11. Connock *et al.* 1992; Bonsall *et al.* 1994; 13. Hardy & Wickham-Jones 2009; 14. Lacaille 1954.

Three Holes Cave, Devon

Location and stratigraphic contexts

Three Holes Cave (NGR SX 8154 6747) is situated in Dyer's Wood on the south-west side of the Torbryan Valley in South Devon, about halfway between the granite uplands of Dartmoor and the coast (Fig. 1). This deeply incised valley (now largely infilled by sediment) is located on the Am Brook, which is linked to the River Dart via the River Hems. The cave is set in a line of low cliffs of Devonian limestone. The main entrance opens to the north-east and lies about 4 m above the level of the present valley floor (68.5 m OD). A short curving passage leads back from the entrance to meet a single 'chamber' partly formed by a cross-fissure in the bedrock that continues upwards until it eventually connects with the surface. The roof is choked with large limestone blocks or bridged by rock and stalagmite, so as to give the impression of three main 'holes' in the chamber roof. Archaeological material has been found at the cave dating from the Lower Palaeolithic, Middle Palaeolithic, Late Upper Palaeolithic (Creswellian and Final Palaeolithic), Later Mesolithic, Neolithic, Bronze Age and Romano-British periods (Roberts 1996). Three Holes is the only one of the 12 known caves in the Torbryan valley to have produced definite evidence of Later Mesolithic artefacts. However, the Torquay Natural History Society collections contain a single-perforated periwinkle shell (A2553) found on 14th September 1936 during the Society's excavations at 'Torbryan 2' (Tornewton Cave), which suggests that Later Mesolithic activities in the valley may have been more extensive.

There is a long history of archaeological work at Three Holes beginning in the mid-19th century (Walker & Sutcliffe 1968), when Holocene deposits with artefacts were discovered by James Lyon Widger digging in front of the cave to expose the entrance. Artefacts recovered during this work and now held by the British Museum include Later Mesolithic geometric microliths. Since then, the cave entrance deposits have been the subject of two separate systematic excavations. The first, by the Institute of Archaeology, University of London from 1955 to 1961 (Rosenfeld 1964), identified Later Mesolithic occupation deposits in stony talus deposits in front of the cave entrance. Most of this work took place in talus deposits to the left of Mr Widger's trench, with a single season of work in 1961 on the right-hand side to obtain charcoal for radiocarbon dating. Subsequently, excavations by a multidisciplinary research team from the British Museum took place between 1989 and 1992 on the right-hand side of the entrance (Roberts 1996). A well-stratified Later Mesolithic assemblage was recorded in a discrete 20-30 cm layer of the Light Brown Stony Talus (LBST), separated from Neolithic deposits by 10-20 cm of overlying archaeologically sterile sediments (*ibid.*, 173). The Mesolithic horizon contained a flint assemblage manufactured on beach pebbles, a sandstone beach pebble rubber and perforated marine shell beads, in association with a predated faunal assemblage. These included the bones of red deer (*Cervus elaphus*), wild pig (*Sus sp.*), roe deer (*Capreolus capreolus*) and probably no more than a single individual of each (identifications by A.P. Currant). Many of the bones were broken and burnt and occasionally preserved cutmarks made by stone tools. The fragmented and sometimes heavily weathered nature of the bone suggests they had been trampled and exposed for some time on a living floor. This interpretation is supported by analysis of the naturally accumulated microfaunal assemblage from the same level, which was in similar condition (Price 2003).

Palaeoenvironmental analyses show that the contemporary environment in the Later Mesolithic was one of mature woodland. The small mammal assemblage, dominated by bank vole (*Clethrionomys glareolus*), with field vole (*Microtus agrestis*) and some wood mouse (*Apodemus sylvaticus*), is indicative of deciduous woodland with no major clearances in the area (Price 1993). The terrestrial mollusca from the same context included species such as *Oxychilus cellarius*, *Aegopinella nitidula* and *Discus rotundatus,* and shows a local presence of shaded habitats, with no open-county preferring species (Seddon 1996, 194).

A total of 30 perforated marine shells can be attributed to the Later Mesolithic horizon at Three Holes Cave (Figs 2 and 3). In the collection from the London Institute of Archaeology excavations, now held by Torquay Museum, we recorded 16 periwinkle (*Littorina obtusata*) shells with a single perforation and nine cowrie (*Trivia* sp.) shells either with a double perforation (6) or broken in the area where perforations might have been located (3). This is the same number (25) listed by Masson-Phillips (1981) although his description of 11 periwinkle and 14 cowrie shells does not match our findings. A further five modified marine shells were recorded during the British Museum work, four periwinkles and a single modified *Dentalium* shell. These were found at the top of the LBST deposit and adjacent to the 1961 excavation area. Several fragments of unmodified mussel shell (possibly freshwater mussel) were also found in this deposit. Most of the modified shells are complete, and the generally good condition of these delicate objects is noteworthy given the otherwise generally trampled nature of the Later Mesolithic archaeological deposit. One possible explanation might be that they were deposited at the end of this phase of use of the cave.

Microlith associations

The microlith assemblage is dominated by small scalene triangles and narrow rods (Roberts 1996, 201), Most of the small scalene triangles are retouched on all three edges but some were retouched on only two sides. Micro-crescents and tip pieces are also represented. Significant numbers of microburins and miss-hits, broken microliths and microdebitage retouch chips in the assemblage indicate that microlith manufacture, presumably for the repair of hunting equipment, was a major activity.

Dating evidence

Two modified bones of red deer were AMS dated and the results indicate that the site was occupied during a relatively restricted period of the early Atlantic, or climatic optimum. This dating is in keeping with the palaeoenvironmental assemblages, including the herpetofaunas, which indicate warmer conditions than the present day (Gleed-Owen 1996).

OxA-4491	*C. elaphus*, proximal end of radius (THRFA 1181) 6330 ± 75 BP
OxA-4492	*C. elaphus*, cubo-navicular (THRFA 896) 6120 ± 75 BP

The Marine Shells

The shell types represented are typical Atlantic genera (Fig. 5). Mapped information available from the Conchological Society of Great Britain and Ireland indicates that today they are widely distributed around the western shorelines of Britain and Ireland (Wilkinson 2011; Conchological Society 2012; Smith 2013a, 2013b), as well as along much of the Atlantic coastal shelf as far south as Spain and Portugal.

*Cowrie (*Trivia sp.*)*

There are two species of cowrie in British waters: *Trivia arctica* (Pulteney 1799) or Northern Cowrie and *Trivia monacha* (da Costa 1788) or Spotted Cowrie, both of which prefer the sublittoral zone of rocky coastline habitats. As fresh shells these can be easily told apart by the appearance of three brown dorsal spots on the shell of *T. monacha* which are absent on *T. arctica*. The shells of both species are pinkish white, with pink to dark pink or buff intervening grooves. In fossil examples coloration is rarely preserved and so it is uncertain to which species the Mesolithic specimens described here belong. Moreover, since they occupy similar environments they cannot be differentiated by habitat except perhaps at extreme ends of their geographic range. Some success has been achieved in separating the species using Fournier analysis on the apical outlines of shells (Dommergues *et al.* 2008) but here the sample sizes are very small and this was not attempted.

Despite their widespread distribution in Britain, local frequencies of species will vary according to coastal geology and morphology. For example, cowries are very common on the west coast of Wales but relatively uncommon or absent in the Bristol Channel, east of Minehead. Thus, the closest modern living population to the Wye Valley sites would appear to be represented by five *T. arctica* and *T. monacha* shells collected from Merthyr Mawr and now curated in National Museum Wales (NMW.1930.242, M. Lewis collection, Ben Rowson pers. comm.). This is a sandy beach and dune system between the rocks at Ogmore and Porthcawl, and is more than 95 km from the Monmouth area by the coast/river route. Examples of *Trivia* are not uncommon along the rocky southern coasts of Devon and Cornwall. Indeed the authors are in the possession of a *T. monacha* shell collected in 1992 by Roger Jacobi from the beach just south of Dartmouth Castle at the mouth of the Dart estuary (SX 886 501), and about 22-24 km by river to the Torbryan Valley.

*Flat periwinkle (*Littorina obtusata*)*

Only one species of periwinkle has been recorded at the Mesolithic sites. Today the flat periwinkle can be found on exposed and semi-exposed rocky shore locations often with a strongly sloping profile, and subject to considerable wave action (Wilkinson 2011). The colour of fresh shells varies from olive-green to yellow or orange and can include surface banded and chequered patterns. They are common around western British coasts and this includes the upper reaches of the Bristol Channel. Perhaps surprisingly, given the similarities in coastal morphology, they appear to be less common in Ireland except in the extreme north-east.

*Dentalium (*Dentalium sp.*)*

These molluscs are sometimes referred to as tooth shells or tusk shells on account of their elongate, conical and curved form. They are usually whitish in colour in their fresh state and when found as dead shells they are hollow and open at both ends. *Dentalium* shells are widely distributed in western Britain but are less common in Ireland except on the north-east coast. Only one record exists, from Three Holes Cave (THR 302), and it is unclear to which species it belongs. As far as we are aware there are no other examples of modified *Dentalium* shells yet known from the British Later Mesolithic.

Characteristics and methods of manufacture of shell beads from the three inland sites

Length and breadth measurements of the cowries (*Trivia* sp.) from Madawg Rockshelter (11) King Arthur's Cave (3) and Three Holes Cave (a sub-sample of 7) show that while the three groups overlap in terms of overall size, the group from Three Holes appears to differ from that of Madawg (Fig. 4). The Madawg shells are tightly clustered within a specific size range (10-11 mm long x 7-8 mm wide). In contrast the dimensions of the Three Holes group have a more normal distribution of shells of different sizes but similar proportions. The reason for the difference is unclear but could be related to deliberate size selection by the Mesolithic collectors, or due to other criteria such as an admixture of the two species. Unfortunately, the sample sizes are at present too small to take such conjecture any further.

The complete *Trivia* specimens display two perforations of more or less equal sub-circular shape and dimension, located on the dorsum of the shell. Low magnification images of the holes indicate that the edges of each perforation are not smoothed as would result from the use of a rotary drill or the actions of a natural marine predator (Fig. 6, No 3) (D'Errico *et al.* 1993; Harper 2005). Instead the inner edges of the holes are fairly jagged (Fig. 6, No 2) and resemble fractures made by direct percussion and scraping using a sharp pointed object such as a microlith tip. Scanning Electron Microscope (SEM) examination of one of the Three Holes Cave *Trivia* beads by AR in 1992 also suggested that the perforations appeared to have been punched through, rather than drilled.

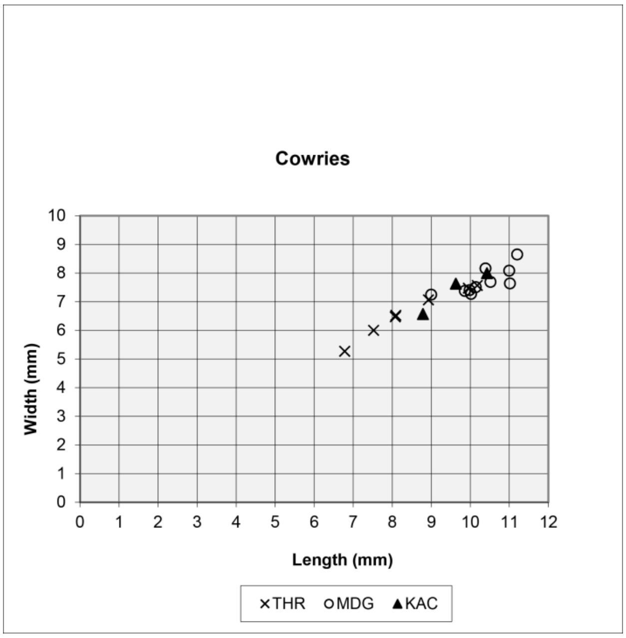

Figure 4. Maximum length vs breadth dimensions of cowrie beads recorded from Three Holes Cave, Madawg Rockshelter and King Arthur's Cave.

A brief experiment was undertaken by NB to replicate the perforations in the cowries. To do this, a fresh shell was placed on a leather pad and secured in place between the thumb and forefinger of one hand, while the tip of an unretouched bladelet held in the other hand was used to gouge a hole in its surface. This experiment was repeated several times. The shells were easy to pierce by first making a tiny incision and then widening it by twisting the bladelet backwards and forwards until the shell was punctured and the hole enlarged. In each case the production of two holes took no more than a few minutes.

Unlike the cowries, the flat periwinkles (*Littorina obtusata*) are characterised by a single hole in their shell (Fig. 3). Relatively few examples come from Madawg Rockshelter (2) and King Arthur's Cave (2), only one of which has a clear perforation. Three Holes offers the largest assemblage with 20 examples. An analysis of a sub-sample of 14 periwinkles from Three Holes revealed that all had a single aperture made fairly centrally in the shell (Fig. 3), although three had breaks across the perforation. Examination of the complete shells showed remarkable uniformity in the size and manufacturing pattern of the hole. The holes were invariably sub-circular in shape and were artificially smoothed around the inner circumference of the aperture (Fig. 3). The sub-circular shape and smoothing was also apparent on the three broken perforations. No formal experiments were carried out but SEM examination of one of the *Littorina* beads in 1992 showed that the perforation was prepared

Figure 5. Shells types used in the Later Mesolithic for bead-making. Modern specimens (left to right): flat periwinkles (*Littorina obtusata*), cowries (*Trivia sp.*) and tusk shells (*Dentalium*). Photo by Ian Cartwright, copyright of the Institute of Archaeology, Oxford.

by initially deeply scoring the surface of the shell, and then reaming out a hole. A small area of abrasion at one side of the perforation suggested that it may once have had a cord or thread rubbing against this edge.

The two periwinkles from Madawg Rockshelter consist of fragments and it is impossible to tell from their present state whether they were broken in manufacture or were indeed perforated at all. Of the two specimens from King Arthur's Cave, one has a perforation which has signs of a fracture across part of the hole. Unless the break is considerably more modern it is plausible that this was accidentally broken during manufacture. The second shell is almost complete but shows a small semi-circular indentation at the point where the end of the shell is broken, again implying a manufacturing accident. Wear traces in the hole of the first example from King Arthur's Cave suggest that the surface of the shell was scraped before the hole was 'punched' through using a hard sharp object such as flint (Fig. 3, Nos 1-2).

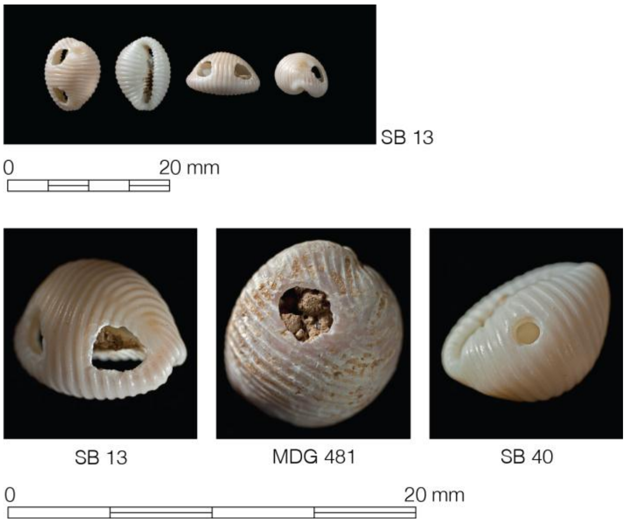

Figure 6. Cowrie bead experiment. Top: SB13 modern shell perforated with flint artefact; Left to right: SB13 close up of perforation; 481 cowrie artefact from Madawg Rockshelter; SB40 cowrie shell with natural perforation made by a marine predator. Photo by Ian Cartwright, copyright of the Institute of Archaeology, Oxford.

A central segment of a single dentalium (*Dentalium* sp.) with openings at both ends was recovered from Three Holes Cave from the same location as perforated *Littorina* shells. Examination by SEM in 1992 showed that the ends were rubbed and abraded, but it was impossible to determine whether the terminals of the original shell had been deliberately removed, or whether a naturally occurring segment had been utilised.

Shell beads from Later Mesolithic coastal sites in Britain, Ireland and northern France

Identical examples to the shell beads described here have been found at other Later Mesolithic sites in western Europe (Fig. 1, Tables 3 and 4). Most of them come from sites along the Atlantic coast or from related estuarine situations. The potential for recovery of Mesolithic sites is particularly high in these locations where shell accumulations occur and Holocene coastal sediments are actively being eroded by rising sea level (Bell *et al.* 2006). A brief overview of some of the main sites to have produced beads is presented below.

Although shell middens are known from many locations in south-west England, marine shell beads have only certainly been recorded at Culverwell on the Isle of Portland, Dorset. Here, shell artefacts have been discovered in association with Later Mesolithic microliths that include small scalene triangles and segments (Palmer 1976). The exact numbers of shell artefacts is unclear but would seem to consist of at least 28 specimens of mainly perforated flat periwinkles (*Littorina obtusata*) and several modified examples of dog whelk (*Nucella lapillus*), cockle (*Cerastoderma glaucum*), oyster (*Ostrea edulis*) and scallop (*Pecten* sp.) that according to Palmer (1999, 65) were used as beads or pendants. The single specimen of the pierced scallop was found in a stone-lined pit with a tranchet axe (Palmer 1976, 325). Suggestions that limpets (*Patella* sp.) were used as pendants have yet to be independently verified.

Table 2. Dates associated with beads and worked shell from Later Mesolithic sites in Britain and Ireland.

Site	Context	Lab ref	Material	^{14}C age BP	Cal BC 95.4%
Three Holes Cave[1]	Light brown stony talus	OxA-4491	*C. elaphus* (cutmarked)	6330 ± 75	5476 – 5078
	Light brown stony talus	OxA-4492	*C. elaphus* (cutmarked)	6120 ± 75	5291 – 4844
Madawg Rockshelter[2]	Top of feature	OxA-6082	Charred hazelnut shell	6655 ± 65	5673 – 5481
	Base of feature	OxA-6081	Charred sloe stone	8710 ± 70	8165 – 7586
Culver Well, Portland[3]	T41/layer 7 upper midden	AA-28213	Monodonta shell	6800 ± 60	5480 – 5260
	T41/layer 8a upper midden	AA-28214	Monodonta shell	6730 ± 55	5470 – 5080
	T41/layer 8b upper midden	AA-28215	Monodonta shell	6410 ± 55	5040 – 4730
	T41/layer 9 lower midden	AA-28216	Monodonta shell	7145 ± 70	5740 – 5480
	T41/layer 12 beneath midden	AA-28217	Monodonta shell	7285 ± 60	5890 – 5640
Prestatyn[4]	Associated with artefact	OxA-2268	Charred hazelnut shell	8700 ± 100	8200 – 7575
	scatter	OxA-2269	Charred hazelnut shell	8730 ± 90	8198 – 7588
Baylet (Harte site 3)[5]	Phase 1 beneath midden	UB-4714	Charred hazelnut shell	6065 ± 40	5200 – 4843
	Phase 1 beneath midden	GrA-21490	Pig bone	6450 ± 50	5486 – 5320
Caisteal nan Gillean I[6]	Midden, layer 3	Q-3011	Charcoal	5450 ± 50	4446 – 4080
	Midden, layer 4 (base)	Q-3007	Charcoal	6120 ± 80	5293 – 4843
	Midden, layer 4 (base)	Q-3008	Charcoal	6190 ± 80	5321 – 4938
Caisteal nan Gillean II[6]	Midden, layer 3 (upper)	Birm-346	Charcoal	5150 ± 380	4843 – 3024
	Midden, layer 4 (base)	Birm-347	Charcoal	5450 ± 140	4582 – 3970
	Midden, layer 4 (base)	Q-1355	Charcoal	5450 ± 50	4446 – 4080
Cnoc Coig[6]	Midden, unit 2	Q-1351	Charcoal	5495 ± 75	4501 – 4076
	Midden, unit 8	Q-1353	Charcoal	5645 ± 80	4684 – 4346
	Pre-Midden	Q-3006	Charcoal	5675 ± 60	4683 – 4368
Cnoc Sligeach[7]	Midden, layer 7	BM-670	Charcoal	5426 ± 159	4668 – 3945
	Midden	GX-1904	Mammal bone	5755 ± 180	5194 – 4246
Carding Mill Bay 1[7]	Early Midden, upper XIV	OxA-3739	Bone artefact	4765 ± 65	3656 – 3372
	Early Midden, upper XIV	GU-2796	Charcoal	5060 ± 50	3965 – 3714
	Early Midden, lower XV	GU-2797	Charcoal	4980 ± 50	3942 – 3653
	Early Midden, lower XV	OxA-3740	Antler artefact	5190 ± 85	4236 – 3796
Ulva[7,8]	Midden, upper (Area C, P5)	GU-2602	Marine shell	5685 ± 65	4689 – 4369
	Midden, upper (Area C, Q2d)	OxA-3738	Antler artefact	5750 ± 70	4778 – 4454
	Midden, lower (Area C, P5)	GU-2600	Marine shell	7655 ± 65	6636 – 6421
Sand[9]	Midden, spit 4 (B25A NE)	OxA-10384	Bone bevel-ended tool	7855 ± 60	7029 – 6572
	Midden, spit 7 (B25B NE)	OxA-10175	Bone bevel-ended tool	7825 ± 55	6999 – 6500
	Midden, spit 8 (B25A NE)	OxA-12096	Bone bevel-ended tool	7744 ± 37	6643 – 6484

1. Roberts 1996 ; 2. Barton 1994; 3. Mannino &Thomas 2001, with marine effect correction; 4. David 2007; 5. Milner & Woodman 2007; 6. Mellars 1987; 7. Bonsall 1996; 8. Russell *et al.* 1995. 9. Hardy & Wickham Jones 2009.

A lack of published detail makes it difficult to interpret the age of the beads but AMS radiocarbon determinations on a stratified sequence of unmodified *Monodonta* (sea snail) shells from trench 41 exhibit ages ranging from 6410 ± 55 BP to 6800 ± 60 BP within the artefactually richest part of the midden and a date of 7285 ± 60 BP from beneath the midden accumulation (Thomas & Mannino 1999, 94; Mannino & Thomas 2001, 1105; Table 2). These indicate the period of midden accumulation and provide likely ages for at least some of the ornaments (Thomas & Mannino 1999). According to these authors, there are rare examples of *Trivia* in the midden but, to our knowledge, no reference to any beads of this kind exists.

Various shell middens are known from Wales. Unfortunately, early work at Nanna's Cave, Caldey Island, Dyfed, did not lead to the systematic recovery of finds. A reference exists to a shell midden containing human bones encrusted with stalagmite (Leach 1916). The latter contained cockle, limpet and oyster shells (David 2007, 34) and may have been the source of a perforated cowrie shell identified with other material from Nanna's Cave among the collections of the National Museums and Galleries of Wales (David & Walker 2004, 328). Microliths from the site include small scalene triangles and oblique points (David 2007, fig. 3.10). Also reportedly from the same cave are perforated examples of a netted dog whelk (*Hinia reticulata*) and a flat periwinkle (*Littorina obtusata*) (David & Walker 2004, 328). In north Wales, two sites have yielded evidence of modified shell ornaments. The first is at Bryn Newydd, Prestatyn, Flintshire where a perforated oyster shell disc is recorded in association with a microlithic industry in tufa deposits (Clark 1938, 1939, 201). The absence of geometric forms other than narrow scalene triangles in the assemblage would suggest that it occupies a chronologically early position in the Later Mesolithic. This is seemingly confirmed by two AMS radiocarbon dates from this site on associated hazelnut shell which yielded ages of 8700 ± 100 BP and 8730 ± 90 BP (David 2007 and Table 2). The second is a new discovery from a shallow rockshelter known as Snail Cave, Great Orme, Llandudno (G. Smith pers. comm.). The find consists of a double-perforated cowrie retrieved from an eroded surface in amongst shell midden debris.

Finds of perforated shell beads have long been associated with Obanian coastal locations in western Scotland (Lacaille 1954), and are extensively reviewed in recent literature (Hardy & Wickham-Jones 2002, Hardy 2010; Saville 2004). Most of the reported examples are restricted to cowrie and pecten shells (Saville 2004), and, except for Carding Mill, Oban (Connock *et al.* 1992) and Sand, Wester Ross (Hardy & Wickham-Jones 2009), originate from off-shore islands. The greatest concentrations of double-perforated cowries come from the middens on Oronsay (Bishop 1914; Mellars 1987), smaller numbers are known from Sand (seven cowrie beads) and Carding Mill Bay 1 (no figure available), while a solitary example has been reported from Ulva Cave (Bonsall *et al.* 1994 and Bonsall pers. comm.). Interestingly, despite the prevalence of *Littorina* shells on Oronsay and even a midden made up almost entirely of *Littorina littorea* (Mellars 1987, 105), these shells seem only to have been rarely used in Mesolithic bead-making.

The dating of the shell beads is relatively well documented on Oronsay where broad ages can be assigned for individual middens in which they were found (Table 2). These suggest that none is likely to be older than the basal age of 6190 ± 80 BP for the midden at Caisteal nan Gillean I, while representative ages for this and other middens on Oronsay appear to cluster between 5700 and 5400 BP. This dating overlaps at 2 sigma with the early shell midden at Carding Mill Bay I in which double-perforated cowrie beads were recovered from contexts VII, XIV, XV and XVII (Connock *et al.* 1992; Table 2). At Ulva Cave, the solitary example of a double-perforated cowrie bead was recovered in Area C, grid square N5, layer 1 (Russell *et al.* 1995). Bulked *Patella* shells from a column in the adjacent grid square P5, though not in direct association, may provide a minimum age of 5685 ± 65 BP for the cowrie bead (Table 2). The only site that seems significantly older is that of Sand where the sole dated context with a cowrie bead was Spit 4 of the midden with an age of 7855 ± 60 BP (Wickham-Jones pers. comm.). It should be noted however that the excavation was in spit units and significantly younger ages have been obtained from the overlying spit 3 (Hardy & Wickham-Jones 2009), so the date should be treated with caution.

Of the 200 or more shell middens known from the coast of Ireland (Milner & Woodman 2007) relatively few can be assigned with certainty to the Later Mesolithic. Exceptions include Ferriter's Cove, Co. Kerry (Woodman *et al.* 1999) and those around Lough Swilly, Co. Donegal, a large fjord on the north coast of Ireland (Harte 1866). Recent surveys along Lough Swilly have located at least 11 shell middens around Inch Island, which lies about 20 km from the sea coast (Milner & Woodman 2007, 105), of which Baylet (Harte site 3) has produced material of Mesolithic age. Excavations there revealed midden deposits no more than 30 cm thick, sealing a buried soil with pits, charcoal spreads and preserved bone (Milner & Woodman 2007). Specimens of pig bone and charred hazelnut shell from beneath the midden have yielded radiocarbon ages of 6450 ± 50 and 6065 ± 40 BP respectively (Milner & Woodman 2007, 105). A double-perforated cowrie bead was also recovered from a 'dark layer' presumed to be the buried land-surface in sample 74, square F9, trench 3 extension collected in 2002 (McCaffrey 2012). This is so far the only known Irish record of a perforated cowrie shell from the equivalent of a Later Mesolithic context.

In Brittany (France), the occurrence of shell bead ornaments (*parure*) has long been recognised in the Late Mesolithic (Péquart & Péquart 1929; Rozoy 1970; Taborin 1974; Marchand 2003). The most famous sites are those of Hoëdic and Téviec in coastal Morbihan (Péquart *et al.* 1937; Péquart & Péquart 1954), where richly adorned burials have yielded prolific numbers of perforated beads in a variety of shell species (Fig. 1 and Table 3). By far the most common forms are double-perforated *Trivia* and single perforated *Littorina obtusata* beads (Dupont 2006). An example of the enormous numbers involved is illustrated by Sepulchre C at Hoëdic, where two infant burials were described as being literally stuffed ('*farcis*') with 2900 *Littorina* beads (Péquart & Péquart 1954, 35). Direct AMS dating of a young male adult associated with this grave (C1(2)) provided an age of 6280 ± 60 BP (OxA-6706) (Schulting & Richards 2001, 320; see Marchand *et al.* 2009 for calibration discussion). At Téviec, finds of double-perforated *Trivia* beads (3839) slightly outnumber those of *Littorina obtusata* (2934) (Dupont 2006, 175). One of the richest burials at Téviec is that of grave H3 which contains beads of diverse shell types including *Nassarius reticulatus*, *Antalis* sp., *Cerastoderma edule* and *Littorina obtusata* (Rigaud 2011). Direct dating of this burial of a young adult female gave an age of 6530 ± 60 BP (OxA-6702) (Schulting & Richards 2001, 320; see Marchand *et al.* 2009 as above). The currently available dating evidence suggests that graves with personal ornaments potentially span a period of around 1400 years at Hoëdic, longer than the nearby site of Téviec (Dupont 2006, but for further discussion see Schulting 2005a).

Table 3. Perforated beads and worked shell from Later Mesolithic sites in north and north-west France.

Site	*Trivia*	*Littorina obtusata*	*Dentalium*	*Nassarius Reticulatus*[a]	*Acanthocardia*	*Antalis*[b]	*Cerastoma*	*Cardium*	*Pecten*
Le Porteau-Ouest[1]	+								
Hoëdic[1*]	+	+	+	+	+		+		+
Beg-er-Vil[1]	+	+							
Téviec[1*]	+	+	+	+	+				+1perf
Téviec Grave C[2]	+	+		+					
Téviec Grave H[2]	+	+		+		+	+?		
Beg-an-Dorchenn[1]	+	+	+	+					
Chaussée Tirancourt F2[3]		+	+					+	

[*] indicative only (for full lists of shells present see Dupont 2006). [a]*Nassarius reticulatus* is a synonym for *Hinia reticulata*, i.e. is the same species. [b]*Antalis* is a genus name often used in place of *Dentalium.* 1. Dupont 2006; 2. Rigaud 2011 and pers. comm.; 3. Ducrocq & Ketterer 1995; Ducrocq 2001.

Table 4. Selected radiocarbon dates for French sites with shell beads mentioned in the text.

Site	Context	Lab ref	Material	^{14}C age BP	Cal BC 95.4%
Beg-er-Vil[1]	Midden	Gif-7180	shell	6020 ± 80	5207-4722
Hoëdic[2]	Sepulchre C	OxA-6706	human bone	6280 ± 60	5461-5057
Téviec[2]	Sepulchre H3	OxA-6702	human bone	6530 ± 60	5616-5371
Beg-an-Dorchenn[1]	Midden	Gif-6859	charcoal	6590 ± 110	5713-5344
Chaussée Tirancourt[3]	Fosse 2	Gif-8913	charcoal	7840 ± 90	7031-6501
Chaussée Tirancourt[3]	Fosse 1	Gif-9329	charcoal	8460 ± 70	7597-7355
Chaussée Tirancourt[3]	Fosse 1	GifA-95471	animal bone	8360 ± 90	7581-7179

1. Dupont 2006; 2. Schulting & Richards 2001; 3. Ducrocq & Ketterer 1995; Ducrocq 2001.

Other Later Mesolithic coastal locations are known at Beg-er-Vil in Quiberon, Morbihan (Bernier 1970), Beg-an-Dorchenn in Finistère (Kayser 1985) and Le Porteau-Ouest (Loire Atlantic), all of which have midden deposits and include examples of shell beads (Table 3). Except for Le Porteau-Ouest which contains no lithic industry, all of these sites including Hoëdic and Téviec have in common various forms of trapezes in their microlithic assemblages (Ghesquière & Marchand 2010). The dating of these other locations also appears consistent with that of Hoëdic and Téviec. The charcoal date of 6590 ± 110 BP (Gif-6859; Dupont 2006, 134) associated with the shell midden at Beg-an-Dorchenn is now supported by a homogenous series of dates on shell (Dupont *et al.* 2010). The age of the midden at Beg-er-Vil is so far confined to a single radiocarbon date on shell of 6020 ± 80 BP (Gif-7180; Dupont 2006, 185); however new work at the site is in progress by Marchand and should clarify the dating.

Inland Later Mesolithic sites with shell ornaments in Britain and northern France

Besides the three sites mentioned above examples of shell beads from inland contexts in Britain are extraordinarily rare. An exception appears to be the small rift cave of Aveline's Hole, Burrington Coombe (Somerset), which lies some 16 km from the present coast but would have been considerably further inland during its use in the Mesolithic. Excavations in 1919 by the University of Bristol Spelaeological Society recovered 'two or three shell beads' from stalagmite while other examples of 'drilled shells of *Neritoides* (*Littorina*) *obtusatus* occurred throughout the (underlying) layer', specifically from the first and second feet (0-30.5 cm) of a red brickearth beneath stalagmite (Davies 1921, 69). Also scattered in the stalagmite were disarticulated human bones and lithic implements. Most of the artefacts are attributable to Later Upper Palaeolithic types, though 'pigmy flints' (Mesolithic microlithic flints) were reported from the first foot of the red brickearth (Davies 1923). Further excavations in 1927 revealed a possible *in situ* 'double ceremonial inhumation', accompanied by grave goods in the form of perforated wild pigs' teeth and seven fossil ammonite cases (Davies 1925, 106). Unfortunately much of the evidence was destroyed or badly damaged in wartime bombing and it is uncertain whether periwinkles were included amongst the grave goods, although a single broken shell bead reportedly came from the general area of the double burial (see Schulting 2005b, 183). One potentially relevant observation is the rarity of diagnostically Later Mesolithic artefacts from the cave. According to Jacobi (2005) only two small scalene triangular microliths were identified in the collections, one of which *could* have come from the burial context. It is also perhaps telling that a recent project to AMS date the surviving human specimens revealed none of the 19 dates to be younger than 8800 BP (Schulting 2005b, 227). It therefore seems likely that this cave was in use as a cemetery during the

Early Mesolithic but the association of shell beads either with the early burials or in relation to Later Mesolithic activity remains enigmatic.

About 5 km away from Aveline's and also about 16 km from the coast, a perforated periwinkle (*Littorina obtusata*) shell was found during work in 1927-28 at Gough's Cave on the left bank of Cheddar Gorge (Somerset) (Parry 1928; Jacobi 1986). Sadly the exact find location and context is unclear, and no link can be proven with specific deposits, including the important Later Upper Palaeolithic deposits, or the 'Cheddar Man' Early Mesolithic skeleton (BM-525 9080 ± 150 BP; OxA-814 9100 ± 100 BP). However, Roger Jacobi believed that the bead was probably related to microliths from Gough's Cave found at the same time and most likely of Mesolithic age (Jacobi 1985, 108 and pers. comm.). In discussion with the authors Roger also mentioned a bead find from a cave in the British Midlands. He recalled that a perforated *Littorina obtusata* shell had been recorded from the upper layers of Pin Hole Cave on the north side of Creswell Crags (Derbyshire) during work by A.L. Armstrong in 1925-32, and was possibly of Mesolithic age. Pin Hole Cave is about 80 km from the coast and if this perforated shell can be shown to be of Mesolithic age then it would be the furthest inland find of such an artefact. However, the age and association of the perforated *Littorina* beads found during the early excavations at all three of these inland cave sites are likely to remain uncertain.

One inland site with possibly better potential in this respect is that of Blashenwell Farm, Corfe Castle, Dorset which occupies a position a few kilometres from the coast. The site was first mentioned by Clement Reid in 1895 and includes *Littorina* shells and geometric Mesolithic microliths from 'kitchen midden' deposits in a tufa (Reid 1896; Clark 1938). The biostratigraphy and dating of this site were re-assessed in 1980 by Richard Preece who obtained dates of 5750 ± 140 BP and 5425 ± 150 BP (BM-1257, 1258) on mammal bone from Reid's midden which were attributed by Preece to the upper levels of the tufa on the basis of mollusca recovered from the sediment inside the bone cavities. Preece proposed that tufa deposition began at the site shortly before 9000 BP and ceased about 5000-4000 BP, providing a Mesolithic age for the whole tufa deposit. A date of 6450 ± 150 BP (BM-89), also on mammal bone from Reid's midden, had previously been attributed to the 'middle zone of the tufa', but is unrelated to the molluscan sequence. The three dates together suggest that the midden perhaps accumulated over about a 1000 year period during the later part of the Mesolithic. Some years ago Roger Jacobi in conversation with the authors suggested that one of the *Littorina* shells from the kitchen midden had been modified into a bead. It has not been possible to confirm this occurrence as yet.

A similar paucity of shell beads has been noted from inland Mesolithic sites in northern France. One important exception is that of 'Petit Marais' at Chaussée Tirancourt which lies in a small side valley of the Somme River in Picardie (Fig. 1). It is located approximately 55 km from the present coast. It consists of 'Middle' Mesolithic (in a French sense) material rather than the Final Mesolithic assemblages of coastal Brittany. At Chaussée Tirancourt the occupation horizons are intersected by a number of large pits (*fosses*) which unusually contain cremated human remains (Ducrocq & Ketterer 1995). *Littorina* beads with a single perforation are widely scattered throughout the site while about 20 perforated *Cardium* shells and a fragment of *Dentalium* have been recorded from Fosse 2 which is dated to 7840 ± 90 BP (Gif-8913) on oak charcoal found in the pit fill (Ducrocq & Ketterer 1995; Ducroq pers comm. and Table 4). The retouched tool assemblage from the site comprises narrow backed geometric microliths that can occur in the British Later Mesolithic but the presence of small points with surface retouch or *feuilles de gui*, is a distinctive feature of such assemblages that date to around 8000 BP (Gob 1985), and is not found in Britain. A second pit, Fosse 1, is partly truncated by Fosse 2 and contains a slightly older assemblage according to carbonised hazelnut and animal bone that have been dated to 8460 ± 70 BP (Gif-9329) and 8360 ± 90 BP (GifA-95471), respectively (Ducrocq & Ketterer 1995). The contents of the older pit include burnt specimens of Tertiary fossil *Bayania* (sea snail) shell beads. A point of potential interest is the use of fossil shell at Mesolithic sites further to east in the Oise valley at Warluis II (around 8800 BP) and at Loschbourg in Luxembourg where *Bayania* shells have been reported from Mesolithic deposits (Ducroq pers. comm.). Examples of fossil *Ampullina* (deep-water sea snail) shells are also known from older Mesolithic contexts in the Île-de-France, implying a gradual change in Mesolithic traditions marked by an increase in use of fresh shell in the later sites, possibly reflecting a greater orientation of activities along coastal zones at a time of rising Holocene sea levels. However, the presence of marine shell ornaments in burials at the early Mesolithic site of La Verne (Charente-Maritime), that would have been about 60-80 km from the contemporary coastline, indicates that the subject is complex (Schulting *et al.* 2008).

Discussion and conclusions

The three inland caves presented here all provide examples of locations where perforated shell beads have been recovered from *in situ* Later Mesolithic contexts. In terms of chronological evidence, the most securely dated is that of Three Holes Cave where the finds can be related to cut-marked animal bone with overlapping ages at 2 sigma of 5476–5078 and 5291–4844 cal BC (Table 2). These dates together with the younger of two radiocarbon ages from Madawg Rockshelter (5673–5481 cal BC) suggest that the manufacture and use of shell beads at the inland sites was broadly contemporary with coastal shell middens such as Culverwell in Dorset, and at sites in Brittany and Ireland (Baylet) that have provided shell beads of similar species to those from the

English sites. The same may not be true for the majority of Scottish coastal middens for which the shell beads appear to be of somewhat younger age (Table 2). However, we would suggest some caution in this interpretation since many of these ages are based on conventionally dated charcoals (and see, for example, dates on bone from Sand).

Whether any chronological significance should be read into changes in the types (and styles) of beads is hard to say. In Britain, in the Early Mesolithic there is certainly a preponderance of perforated beads made of stone and other fossil material (Clark 1954; Barton *et al.* 1995; David 2007), whereas in the Later Mesolithic marine shell seems to have been a preferred medium for beads. In this context, it is interesting to reflect on the finds from Aveline's Hole which would appear to suggest mixed use of fossil ammonites and perforated periwinkle shell in an individual burial. In this case it may be no coincidence that the dated human remains appear to occupy a chronologically young position in the Early Mesolithic (of around 8460–8140 cal BC). The same could also apply to the site of Prestatyn which has a date of 8200–7575 cal BC for the lithic assemblage although the oyster shell disc is probably too large to be considered a 'bead'. A more convincing argument for a gradual transition in the use of stone to shell beads can be put forward to explain the intermediate age of pits with fossil *Bayania* and fresh marine shell at the French Middle Mesolithic site of Chaussée Tirancourt. Here the younger of the two pits (Fosse 2, 7031–6501 cal BC) contained perforated examples of fresh shells, including *Littorina*, while the older pit (Fosse 1: 7597-7355 and 7581–7179 cal BC) also contained fossil *Bayania* shell beads (Ducrocq & Ketterer 1995). In summary, although the dating evidence is sparse, it seems at present that sites with *Trivia* and *Littorina* bead assemblages (Table 2) appear to be younger than sites containing stone or fossil beads. Similarly, there are hints that the use of shell beads only becomes more common towards the end of the Early Mesolithic period, whereas stone beads are known from much older Mesolithic contexts (e.g. Star Carr, North Yorkshire).

Earlier in this paper we noted that marine shell ornaments were incorporated as grave goods in Later Mesolithic burials in Brittany and in association with fragmentary human remains scattered in middens in some of the Scottish coastal Later Mesolithic sites. This is, however, clearly not the case for the three inland locations described here. Three Holes Cave and Madawg Rockshelter both provide examples of beads found in association with domestic occupation debris and there is no evidence of associated human bone. The same may be true for King Arthur's Cave, where no Mesolithic human remains have been recorded either inside or outside the cave. Until proven otherwise the presumption is therefore that they too derived from a domestic setting. If the beads from the three inland sites were not incorporated within burials, then what other reasons might be put forward to explain their presence? One interesting possibility is proposed here for Three Holes Cave where the shells survive in remarkably fresh and undamaged condition, in contrast to the faunal remains in the contemporary layer which are broken and heavily trampled. In particular, the shells from the 1990s collection came from the very top of the Later Mesolithic occupation level and their good condition cannot be explained by any special circumstances such as the proximity of large stones that may have afforded protection from trampling. We would suggest this is plausible evidence that the beads were deposited at the end of the occupation phase. A corollary of this, of course, is the question of whether they were accidentally dropped and lost, or whether they represent a deliberate act perhaps signalling metaphorical closure of the site on leaving, and/or as a marker for future visitors. It is hoped that further work on the spatial analysis of the 1950s assemblage will be able to provide additional data regarding their deposition.

A further clue as to the special significance of these three sites for bead finds may lie in the positions of each of the caves in relation to rivers (Roberts 1987; Barton & Roberts 2004, 352). Three Holes Cave, for instance, is linked to a major river catchment system (River Dart) and lies at an interesting sheltered mid-point between the coast and the upland massif of Dartmoor. Similarly, the Wye Valley sites are situated well inland, affording access to the uplands of the Black Mountains in the west and, looking eastwards, to the wide floodplain of the Severn Valley and the Gloucestershire lowlands. Each of these hinterland areas would have offered ample scope for gathering seasonally available plant foods and for hunting game, while the rivers themselves presented an obvious means by which people could transport food and resources in an upstream direction and towards the coast. In this respect it is also worth remarking that the distance from the shell sources may have been considerably greater than the distance to the nearest coastline. For example, King Arthur's Cave and Madawg Rockshelter lie about 24-32 km upriver from the confluence of the rivers Wye and Severn, but about 104-112 km by the coastal/river route from the nearest sources of cowrie shells today (Ben Rowson pers. comm.). It is not unreasonable therefore to suggest that such cave sites may have acted as 'staging posts' for hunter-gatherers moving along the coast and river valleys. Under these circumstances, it would not be surprising if objects that were carefully 'curated' and carried around were sometimes lost or left behind. The presence of the same shell species at King Arthur's Cave and Madawg Rockshelter also provides strong circumstantial evidence for the contemporary use of the sites by the same or related social groups. The slightly different combination of shells and range of cowrie sizes at Three Holes may imply subtly different selection processes exercised by other groups.

Whatever the explanation for the shell beads at these sites we believe that that such items must have been invested with special meaning even without the presence of burials and irrespective of the low numbers recovered. It is therefore likely in our opinion that their presence signifies a deliberate act of disposal or deposition rather than random loss. We would guess that they were left as intentional markers, perhaps by peoples occupying overlapping territories and exchanging with groups with whom they shared similar symbolic and linguistic systems. The fact that the shells were of marine and not terrestrial origin, may also have been a deliberate reference to the coastal realm.

Finally, one intriguing aspect persistently raised by shell bead finds is whether their western distribution is a proxy for the spread of Later Mesolithic traditions along the Atlantic façade, or whether it simply reflects taphonomic bias and low archaeological visibility of such finds and sites, particularly in eastern Britain. We would suggest that the inland sites presented here may provide a pertinent test of such ideas. For instance, if shell beads were being moved by peoples inland, then this should be manifest elsewhere during the Later Mesolithic in areas proximate to coastlines where the shell species occur. According to present-day mapping, *Trivia* and *Littorina* distributions are not limited to western Britain, but extend around much of the southern and eastern coastlines (Wilkinson 2011; Smith 2013a, 2013b). The absence of shell beads at coastal locations where modern recovery techniques have been used, most notably at Goldcliff (Bell 2007), Prestatyn (Bell 2007), Westward Ho! (Balaam *et al.* 1987) and Ferriter's Cove (Woodman *et al.* 1999), also implies that these items were by no means ubiquitous in the Later Mesolithic. However, we would expect that if shared social networks extended west-east as well as north-south, some evidence of marine shell beads ought to have emerged in eastern Britain by now. This is a situation that may change in the light of new research into the Mesolithic of these areas.

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References

Balaam, N.D., Bell, M., David, A., Levitan, B., Macphail, R.I., Robinson, M.A. & Scaife, R.G. 1987. Prehistoric and Romano-British sites at Westward Ho!, Devon: archaeological and palaeoenvironmental surveys 1983 and 1984. In Balaam, N.D. Levitan, B. & Straker, V. (eds), *Studies in Palaeoeconomy and Environment in South West England*. Oxford: British Archaeological Reports, British Series 181, pp. 163-264.

Barton, R.N.E. 1993. An interim report on the survey and excavations in the Wye Valley, 1993. *Proceedings of the University of Bristol Spelaeological Society* 19(3) 337-346.

Barton, R.N.E. 1994. Second interim report on the survey and excavations in the Wye Valley, 1994. *Proceedings of the University of Bristol Spelaeological Society* 20(1), 63-73.

Barton, R.N.E. 1995. Third interim report on the survey and excavations in the Wye Valley, 1995. *Proceedings of the University of Bristol Spelaeological Society* 20(2), 153-159.

Barton, R.N.E. 1996. Fourth interim report on the survey and excavations in the Wye Valley, 1996. *Proceedings of the University of Bristol Spelaeological Society* 20(3), 263-273.

Barton, R.N.E. 1997. Fifth interim report on the survey and excavations in the Wye Valley, 1997, and new AMS radiocarbon dating results from Madawg Rockshelter. *Proceedings of the University of Bristol Spelaeological Society* 21(1), 99-108.

Barton, R.N.E., Berridge, P.J., Walker, M.J.C. & Bevins, R.E. 1995. Persistent places in the Mesolithic landscape: an example from the Black Mountain uplands of South Wales. *Proceedings of the Prehistoric Society* 61, 81–116.

Barton, R.N.E., Price, C. & Proctor, C. 1997. The Wye Valley Caves Project: recent investigations at King Arthur's Cave and Madawg Rockshelter. In Lewis, S.G. & Maddy, D. (eds), *The Quaternary of the South Midlands and the Welsh Marches*. London: Quaternary Research Association, pp. 63-75.

Barton, R.N.E. & Roberts, A.J. 2004. The Mesolithic period in England: current perspectives and new research. In Saville, A. (ed.), *Mesolithic Scotland and its Neighbours. The Early Holocene Prehistory of Scotland, its British and Irish context, and some Northern European Perspectives*. Edinburgh: Society of Antiquaries of Scotland, pp. 339-358.

Bell, M. 2007. *Prehistoric coastal communities: The Mesolithic in western Britain*. CBA Research Report 149. York: Council for British Archaeology.

Bell, M., Chisham, C., Dark, P. & Allen, S. 2006. Mesolithic sites in coastal and riverine contexts in southern Britain: current research and the management of the archaeological resource. In Rensink, E. & Peeters, H. (eds), *Preserving the Early Past: Investigation, Selection and Preservation of Palaeolithic and Mesolithic Sites and Landscapes*. Amersfoort: NAR Nederlandse Archeologische Rapporten 31, pp. 25-40.

Bernier, G. 1970. Gisement de Beg-er-Vil Nord. *Bulletin de la Société polymathique de Morbihan* 5, 15.

Bishop, A.H. 1914. An Oransay shell-mound – a Scottish pre-Neolithic site. *Proceedings of the Society of Antiquaries of Scotland* 48 (1913–14), 52–108.

Bonsall, C. 1996. The 'Obanian problem': coastal adaptation in the Mesolithic of western Scotland. In Pollard, T. & Morrison, A. (eds), *The Early Prehistory of Scotland*. Edinburgh: Edinburgh University Press, pp. 183-197.

Bonsall, C., Sutherland, D.G., Russell, N.J., Coles, G., Paul, C., Huntley, J. & Lawson, T.J. 1994. Excavations in Ulva Cave, Western Scotland 1990–91: a preliminary report. *Mesolithic Miscellany* 15(1), 8–21.

Clark, J.G.D. 1938. Microlithic industries from tufa deposits at Prestatyn, Flintshire and Blashenwell, Dorset. *Proceedings of the Prehistoric Society* 4, 330-334.

Clark, J.G.D. 1939. Further note on the tufa deposit at Prestatyn, Flintshire. *Proceedings of the Prehistoric Society* 5(1), 201-202.

Clark, J.G.D. 1954. *Star Carr*. Cambridge: Cambridge University Press.

Conchological Society of Great Britain and Ireland, 2012. http://www.conchsoc.org, accessed 14 July 2013.

Connock, K.D., Finlayson, B. & Mills, C.M. 1992. Excavation of a shell midden site at Carding Mill Bay near Oban, Scotland. *Glasgow Archaeological Journal* 17 (1991–92), 25–38.

David, A. 2007. *Palaeolithic and Mesolithic Settlement in Wales, with Special Reference to Dyfed*. Oxford: British Archaeological Reports, British Series 448.

David, A. & Walker, E. 2004. Wales during the Mesolithic period. In Saville, A. (ed.), *Mesolithic Scotland and its Neighbours. The Early Holocene Prehistory of Scotland, its British and Irish context, and some Northern European Perspectives*. Edinburgh: Society of Antiquaries of Scotland, pp. 299-338.

Davies, J.A. 1921. Aveline's Hole, Burrington Combe. An Upper Palaeolithic station. *Proceedings of the University of Bristol Spelaeological Society* 1(2), 61-73.

Davies, J.A. 1923. Second report on Aveline's Hole. *Proceedings of the University of Bristol Spelaeological Society* 1(3), 113-118.

Davies, J.A. 1925. Fourth report on Aveline's Hole. *Proceedings of the University of Bristol Spelaeological Society* 2(2), 104-114.

D'Errico, F., Jardón-Giner, P. & Soler-Mayor, B. 1993. Critères à base expérimental pour l'étude des perforations naurelles et intentionnelles sur coquillages. In Anderson, P.C., Beyries, S., Otte, M., & Plisson, H. (eds), *Traces et fonction : les gestes retrouvés*. Colloque international de Liège. Editions ERAUL 50, pp. 243-255.

Dommergues, E., Dommergues, J-L., Dommergues, C.H. & Payne, S. 2008. Colourblind taxonomy. *Mollusc World* 18, 24-26.

Ducrocq T. 2001. *Le Mésolithique du bassin de la Somme. Insertion dans un cadre morpho-stratigraphique, environnemental et chronoculturel*. CERP.

Ducrocq, T., & Ketterer, I., 1995. Le gisement mésolithique du "Petit Marais", La Chausée-Tirancourt (Somme). *Bulletin de la Société Préhistorique Française* 92, 249-59.

Dupont, C. 2006. *La malacofaune de sites mésolithiques et néolithiques de la façade atlantique de la France*. BAR International Series 1571. Oxford: Archaeopress.

Dupont, C., Marchand, G., Carrión Marco, Y., Desse-Berset, N., Gaudin, L., Gruet, Y., Marguerie, D., and Oberlin, C. 2010. Beg-an-Dorchenn (Plomeur, Finistère):Une fenêtre ouverte sur l'exploitation du littoral par les peuples mésolithiques du sixième millénaire dans l'ouest de la France. *Bulletin de la Société préhistorique française* 107(2), 227-290.

Dupont, C., Tresset, A., Desse-Berset, N., Gruet, Y., Marchand, G. & Schulting, R. 2009. Harvesting the seashores in the Late Mesolithic of Northwestern Europe. *World Archaeology* 22, 93-111.

Ghesquière, E. & Marchand, G. 2010. *Le Mésolithique en France. Archéologie des derniers chasseurs-cueilleurs*. Paris: Coéditions La Découverte/INRAP, collection Archéologie de la France.

Gleed-Owen, C.P. 1996. Amphibian and reptile remains. In Charman, D.J., Newnham, R.M. & Croot, D.G. (eds), *Devon and East Cornwall Field Guide.* London: Quaternary Research Association, pp. 191-2.

Gob, A., 1985. Extension géographique et chronologique de la culture Rhein-Meuse-Schelde (RMS). *Helinium* 25(1), 23-36.

Hardy, K. 2010. Shell as a raw material for tools and jewellery in Mesolithic Scotland. *Munibe Suplemento-Gehigarria* 31, 128-137.

Hardy, K. & Wickham-Jones, C. 2002. Scotland's first settlers: the Mesolithic seascape of the Inner Sound, Skye and its contribution to the early prehistory of Scotland. *Antiquity* 76, 825-833.

Hardy, K., & Wickham-Jones, C.R. 2009. Mesolithic and later sites around the Inner Sound, Scotland: the work of the Scotland's First Settlers project 1998 – 2004. *Scottish Archaeological Internet Reports* 31. http://www.sair.org.uk/sair31/, accessed 13 July 2013.

Harper, E.M. 2005. Recognizing predator–prey interactions in the fossil record. *Geology Today* 21(5), 191-196.

Harte, W. 1866. On the occurrence of Kjökkenmöddins in the County of Donegal. *Journal of the Royal Geological Society of Ireland* 1, 154-158.

Hewer, T.F. 1925. First report on excavations in the Wye Valley. Proceedings of the *University of Bristol Spelaeological Society* 2, 147-55.

Hewer, T.F. 1926. Second report on excavations in the Wye valley. Proceedings of the *University of Bristol Spelaeological Society* 2, 216-228.

Jacobi, R.M. 1979. Early Flandrian hunters of the south-west. *Proceedings of the Devon Archaeological Society* 37, 48–93.

Jacobi, R.M. 1985. The history and literature of Pleistocene discoveries at Gough's Cave, Cheddar, Somerset. *Proceedings of the University of Bristol Spelaeological Society* 17, 102-115.

Jacobi, R.M. 2005. Some observations on the lithic artefacts from Aveline's Hole, Burringdon Combe, North Somerset. *Proceedings of the University of Bristol Spelaeological Society* 23(3), 267-295.

Kayser, O. 1985. A propos de la fin du Mésolithique en Bretagne: l'amas coquillier de Beg-an-Dorchenn (Finistère). Note préliminaire. *Travaux de l'Institut d'art préhistorique* 80-92.

Lacaille, A.D. 1954. *The Stone Age in Scotland*. Oxford: Oxford University Press.

Leach, A.L. 1916. Nanna's Cave, Isle of Caldey. *Archaeologia Cambrensis* 71, 155-180.

Mannino, M.A. & Thomas, K.D. 2001. Intensive Mesolithic Exploitation of Coastal Resources? Evidence from a Shell Deposit on the Isle of Portland (Southern England) for the Impact of Human Foraging on Populations of Intertidal Rocky Shore Molluscs. *Journal of Archaeological Science* 28, 1101–1114.

Marchand, G. 2003. Les niveaux coquilliers du Mésolithique final en Bretagne. Fonctionnement des habitats côtiers et intégrations territoriale. Préhistoires Méditerranéennes 12, 1-15.

Marchand, G., Dupont, C., Oberlin, C. & Delque-Kolic, D. 2009. Entre "effet reservoir" et "effet de plateau": La difficile datation du mésolithique de Bretagne. In Crombé, P., Van Strydonck, M., Sergant, J., Boudin, M. & Bats , M. (eds.) Chronology and Evolution within the Mesolithic of North-

West Europe. Newcastle : Cambridge Scholars Press, 297-324.
Masson-Phillips, E.N. 1981. Archaeological notes II. *Reports and Transactions of the Devon Association for the Advancement of Science* 113, 147-164.
McCaffrey, M. 2012. *Capturing a Meal: An interpretation of Irish Mesolithic subsistence, consumption and preference by means of a mollusc analysis from the Baylet shell midden*. University of York, unpublished MA dissertation.
Mellars, P. 1987. *Excavations on Oronsay. Prehistoric human ecology on a small island*. Edinburgh: Edinburgh University Press.
Milner, N. & Woodman, P. 2007. Deconstructing the myths of Irish shell middens. In Milner, N., Craig, O.E. & Bailey, G.N. (eds), *Shell middens in Atlantic Europe*. Oxford: Oxbow, pp. 101-110.
Nash, G. 2012. Mechanisms of production and exchange: early prehistoric perforated bead production and use in southwest Wales. *Time and mind: the Journal of Archaeology, Consciousness and Culture* 5(1), 73-84.
Newell, R., Kielman, D., Constandse-Westermann, T., Van der Sanden, W., & Van Gign, A. 1990. *An inquiry into the ethnic resolution of Mesolithic regional groups: the study of their decorative ornaments in time and space.* Leiden: E.J. Brill.
Palmer, S. 1976. The Mesolithic habitation site of Culver Well, Portland Dorset: interim note. *Proceedings of the Prehistoric Society* 42, 324-327.
Palmer, S. 1999. *Culverwell Mesolithic Habitation Site, Isle of Portland, Dorset: Excavation and Research Studies*. Oxford: British Archaeological Reports, British Series 287.
Parry, R F. 1928. Excavation at the caves, Cheddar. *Proceedings of the Somerset Archaeological and Natural History Society* 74, 102-121.
Péquart, M. & Péquart, St.-J. 1929. La nécropole mésolithique de Téviec (Morbihan), nouvelles découvertes. *L'Anthropologie* 39(5/6), 373-400.
Péquart, M. & Péquart, St.-J. 1954. *Hoëdic, Deuxième Station-Nécropole du Mésolithique Côtier Armoricain*. Anvers: De Sikkel.
Péquart, M., Péquart, St.-J., Boule, M., & Vallois, H. 1937. *Téviec: Station Nécropole Mésolithique du Morbihan*. Paris: Archives de l'Institut de Paléontologie Humaine 18.
Preece, R. 1980. The biostratigraphy and dating of the tufa deposit at Blashenwell, Dorset, England. *Journal of Archaeological Science* 7, 345-362.
Price, C. 2003. *Late Pleistocene and Early Holocene Small Mammals in South West Britain*. British Archaeological Reports, British Series 347.
Reid, C. 1896. An early Neolithic kitchen-midden and tufaceous deposit at Blashenwell, near Corfe Castle. *Proceedings of the Dorset Natural History and Antiquarian Field Club* 17, 67-75.
Rigaud, S. 2011. *La Parure: Traceur de la Geographie Culturelle et des Dynamiques de Peuplement au Passage Mesolithique-Neolithique en Europe*. Unpublished PhD thesis, Université de Bordeaux I, Talence.
Roberts, A.J. 1987. Late Mesolithic occupation of the Cornish coast at Gwithian: preliminary results. In Rowley-Conwy, P., Zvelebil, M. & Blankholm, H.P. (eds), *Mesolithic Northwest Europe: Recent Trends*. Sheffield: Department of Archaeology and Prehistory, University of Sheffield, pp. 131–8.
Roberts, A. 1996. Evidence for late Pleistocene and early Holocene human activity and environmental change from the Torbryan Valley, south Devon. In Charman, D.J., Newnham, R.M. & Croot, D.G. (eds), *Devon and East Cornwall Field Guide.* London: Quaternary Research Association, pp. 168–204.
Rosenfeld, A. 1964. Excavations in the Torbryan Caves, Devonshire. II. Three Holes Cave. *Transactions of the Devon Archaeological Exploration Society* 22, 3-20.
Rozoy, J.G. 1970. *Les Derniers Chasseurs*. Reims : Société Archéologique Champenoise.
Russell, N., Bonsall, C. & Sutherland, D. 1995. The role of shellfish-gathering in the Mesolithic of western Scotland: the evidence from Ulva Cave, Inner Hebrides. In Fischer, A. (ed.) *Man and Sea in the Mesolithic. Coastal Settlement Above and Below the Present Sea Level*. Oxford: Oxbow Books, pp. 273–288.
Saville, A. 2004. The Material Culture of Mesolithic Scotland. In Saville, A. (ed.), *Mesolithic Scotland and its Neighbours: the Early Holocene Prehistory of Scotland, its British and Irish Context, and some Northern European Perspectives*. Edinburgh: Society of Antiquaries of Scotland, pp. 185–220.
Sciama, L.D. & Eicher, J.B. (eds) 1998. *Beads and beadmakers. Gender, material culture and meaning*. Oxford: Berg.
Schulting, R.J. 2005a. Comme la mer qui se retire: les changements dans l'exploitation des ressources marines du Mésolithique au Néolithique en Bretagne. In: G. Marchand and A. Tresset (eds.), *Unité et Diversité des Processus de Néolithisation sur la Façade Atlantique de l'Europe (7-4ème millénaires avant J.-C.)*: pp. 163-171. Paris: Mémoire de la Société Préhistorique Française 36.
Schulting, R.J. 2005b. '…pursuing a rabbit in Burrington Combe': New research on the Early Mesolithic burial cave of Aveline's Hole. *Proceedings of the University of Bristol Spelaeological Society* 23(3), 171-265.
Schulting, R.J. & Richards, M.P. 2001. Dating women and becoming farmers: new palaeodietary and AMS dating evidence from the Breton Mesolithic cemeteries of Téviec and Hoëdic. *Journal of Archaeological Science* 20, 314-344.
Seddon, M. 1996. Land Mollusca. In Charman, D.J., Newnham, R.M. & Croot, D.G. (eds), *Devon and East Cornwall Field Guide*. London: Quaternary Research Association, pp. 193-195.
Smith, I. 2013a. Trivia arctica (Pulteney, 1799). *Conchological Society of Great Britain and Ireland*. http://www.conchsoc.org/spAccount/trivia-arctica, accessed 13 July 2013.
Smith, I. 2013b. Trivia monacha (da Costa, 1778). *Conchological Society of Great Britain and Ireland*. http://www.conchsoc.org/spAccount/trivia-monacha , accessed 13 July 2013.
Symonds, W.S. 1871. On the contents of a hyaena's den on the Great Doward, Whitchurch, Ross. *Geological Magazine* 8, 433-438.
Symonds, W.S. 1872. *Records of the Rocks; or Notes on the Geology, Natural History and Antiquities of North and South Wales, Devon and Cornwall*. London: John Murray.
Taborin, Y. 1974. La parure en coquillage de l'Epipaléolithique au Bronze ancien en France. *Gallia Préhistoire* 17(2), 307-417.
Thomas, K.D. & Mannino, M.A. 1999. The bioarchaeology of the Culverwell shell midden. In Palmer, S. 1999. *Culverwell Mesolithic Habitation Site, Isle of Portland, Dorset: Excavation and Research Studies*. Oxford: British Archaeological Reports, British Series 287. 94-114.
Walker, H.H. & Sutcliffe, A.J. 1968. James Lyon Widger, 1823-1892, and the Torbryan Caves. *Transactions of the Devonshire Association* 99, 49-110.

Welch, F.B.A. & Trotter, F.M. 1961. *Geology of the Country around Monmouth and Chepstow*. Memoirs of the Geological Survey of Great Britain. One inch sheets 233 and 250. London: HMSO.

Wilkinson, S. 2011. Littorina obtusata (Linnaeus, 1758). *Conchological Society of Great Britain and Ireland*. http://www.conchsoc.org/spAccount/littorina-obtusata, accessed 13 July 2013.

Woodman, P.C., Anderson, E. & Finlay, N. 1999. *Excavations at Ferriter's Cove, 1983–95: Last Foragers, First Farmers in the Dingle Peninsula*. Bray: Wordwell.