Coastal exploitation in the Mesolithic of western France: la Pointe Saint-Gildas (Préfailles)

Catherine Dupont and Grégor Marchand

Following surveys carried out over many years, three Mesolithic sites have been identified at the 'Pointe Saint-Gildas' near the Loire estuary. They are situated in proximity to more than 20 indications of the presence of Mesolithic populations. Two of the three excavated stations provide the only evidence of the subsistence of these Late Mesolithic populations. These excavations were carried out in 1994 at station 1a, and in 2003 and 2004 at station 1b, and revealed a lithic industry based on blades and small concentrations of shells. The dominant arrowhead types are large scalene triangles, but with some asymmetrical trapeze-shaped points. They are associated with industries based on blades and bladelets with non-parallel edges. The analysis of shells indicates the exploitation of resources on a muddy shore, whereas these sites currently overlook a rocky zone. The Holocene transgression has masked the trace of a noticeable estuarine influence, according to studies of the bathymetry and underwater sedimentary cores. Dating of the shells yields ages between 6600 and 6400 BC at Saint-Gildas 1b. The marked deterioration of these sites by erosion and the inaccurate calibration of the dates lead to uncertainties in the interpretation. Nevertheless, these assemblages are the first example of the emergence of Late Mesolithic industries on the Armorican Massif.

Keywords: Paleoenvironment, coastal populations, Mesolithic, subsistence, lithic industry, mollusc shells

Introduction

On the rocky coasts of the Armorican Massif there are numerous archaeological traces of Mesolithic populations during the 6th millennium cal. BC, with fundamental sources of data such as the shellmiddens of Téviec, Hoëdic, Beg-an-Dorchenn and Beg-er-Vil. However, the coastal Mesolithic sites of the previous millennia were submerged, destroyed or buried under sediments during the Holocene transgression. Only two sites, established on the Pointe Saint-Gildas, provide some evidence for the subsistence economy of coastal populations during the 7th millennium BC (Fig. 1). The results of recent archaeological surveys on three sites allow us to re-address the question of prehistoric economies in coastal areas, by combining the analysis of seashells and stone tools. The shellfish consumed by the Mesolithic inhabitants of the Saint-Gildas headland, along with the paleoenvironmental surveys carried out in the vicinity, enable us to propose a reconstruction of the coastal environment in which these populations existed.

Archaeological context

Discovery of sites and use of archaeological data

The three Mesolithic sites at Saint-Gildas were discovered in 1954, on a headland separating the southern flank of the Loire estuary from the Bourgneuf bay (Fig. 1). At this locality, the mica schist cliffs are relatively low (6 to 8 m) and their upper parts are being constantly degraded by human and natural erosion. The repeated observations of Mr Tessier have made it possible to collect a great amount of information about the siting of human activities. He has identified two shell deposits, a shelly layer at Saint-Gildas 1b and a shell pocket at

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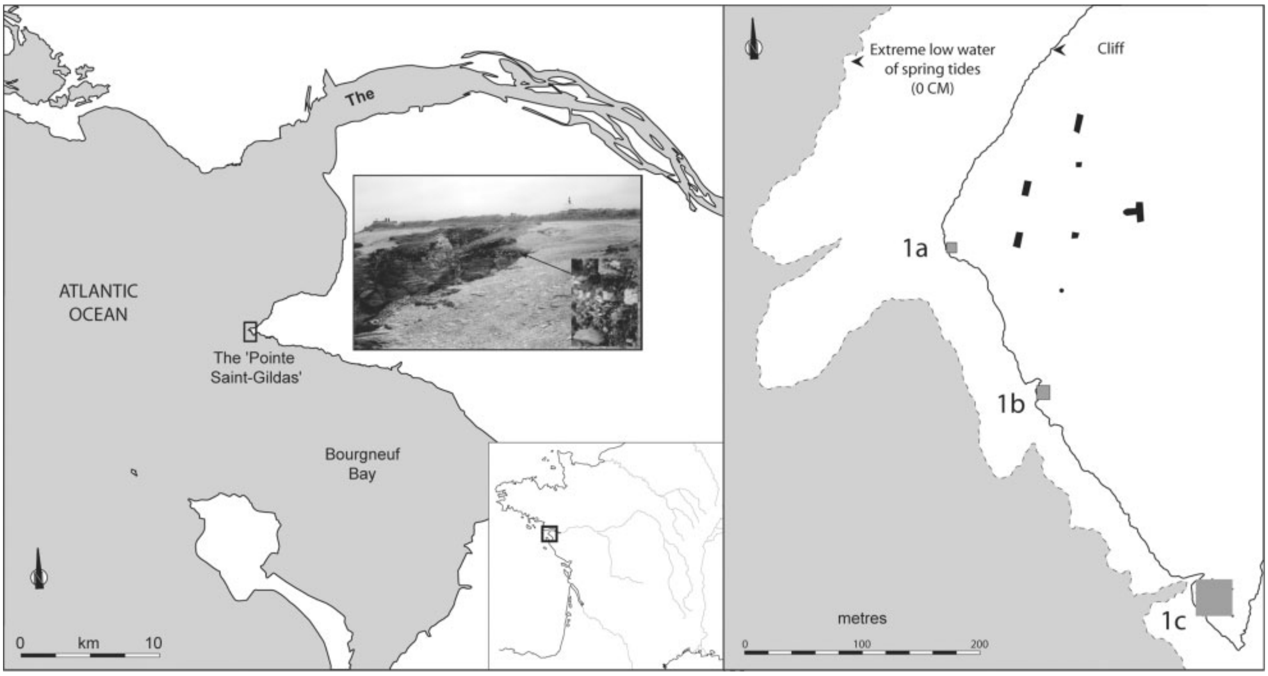

Figure 1 Location of the Pointe Saint-Gildas (Préfailles, Loire-Atlantique) and the three studied Mesolithic sites: Saint-Gildas 1a, Saint-Gildas 1b and Saint-Gildas 1c (CAD: F. Bertin and G. Marchand)

Saint-Gildas 1c (Tessier 1984). The third station, Saint-Gildas 1a, contains only lithic industry material and ceramic shards. The first field campaign at this site was undertaken in 1994 to check the stratigraphic relations between these two types of associated remains (Marchand 1998; 1999). The threat of natural retreat of these micaschist cliffs by collapse has led to two other excavations on station 1b, which were carried out by C. Dupont and G. Marchand in 2003 and 2004.

According to the description of G. Bellancourt, the shelly deposit of Saint-Gildas 1b was 2·50 m long, with a width of no more than 0·80 m and a thickness of 0·25 m above ground (Bellancourt 1980, 17). Picking of lithics was carried out over a distance of 40 m in the space between two faults, over an estimated area of 500 m^2. If we include the zones still covered by vegetation, the total area of the site does not exceed 1000 m^2, so we are dealing here with a small habitat. Three borings carried out in 2004 behind the shelly zone showed that the Mesolithic level was strongly altered by erosion, before the deposition of the dunes, at a distance of 10 m from the cliff. In 2003, a cliff collapse exposed a lens of *Scrobicularia plana*, (otherwise known as the 'peppery furrow shell') lying in place within the Mesolithic level, thus providing material for radiometric dating.

The Saint-Gildas 1c station has not been the object of archaeological surveys, unlike the two other stations. It is also the most degraded locus, containing the richest surface material, yielding more than 2000 lithic items and a small shell deposit which now has disappeared (Tessier 1984).

The three Mesolithic sites are established at points where access is facilitated at the foot of cliffs: stations 1b and 1c border the two main faults on the south-western part of the point, while the cliffs drop down to join the beach near locus 1a. These sites represent interface zones between the foreshore and the plateau, ideal for exploiting the marine environment. We should also note that fresh water is flowing out almost continuously in these faults, which allows an easy access to this fundamental resource.

Radiometric dating and the 'the reservoir effect' problem

At Saint-Gildas 1b, ^{14}C dating of the shells collected by Mr Tessier yields an age of 7520 $\pm$ 140 years BP (Gif-3531), without correction of the $^{13}C/^{12}C$ ratio (Tessier 1984; Table 1). Further radiocarbon dating was carried out in 2003 on *Scrobicularia* shells collected from the shell deposit. The measured age is 7670 $\pm$ 40 years BP; the conventional age is 8000 $\pm$ 40 years BP; the calibration using two-sigma errors lies between 6590 and 6420 BC (Beta-194786; $^{13}C/^{12}C$ Ratio = $-5{\cdot}0$‰; Table 1). This last operation was performed using the Oxcal marine curve, without subtraction of the reservoir effect, which remains unknown in this zone. Note that the variations of the oceanic reservoir effect in this species are not known in this area. To compare this date with that obtained at Gif-sur-Yvette (7520 ± 140 years BP), it is necessary to re-examine the oldest dates in the light of new knowledge. Indeed, at the time when the first counts were carried out, the value of the $^{13}C/^{12}C$ ratio, which defines the isotopic fractionation, was not taken into account. Using the $^{13}C/^{12}C$ ratio of −5‰ proposed by the *Beta Analytic Inc*. laboratory, it is necessary to add 330 years to the measured date. Therefore, the date initially obtained from Saint-Gildas 1b becomes 7850 ± 140 years BP after isotopic correction. When calibrated with the marine curve, the age can be placed in the bracket 6700–6000 BC. This latter result falls within the range of error of the more recently obtained date, the width of the confidence interval explaining the low precision. Thus, it is entirely possible that the two dating results represent the same age.

Dating work had been carried out on the Saint-Gildas shell pocket (station 1c). If we apply a similar isotopic fractionation correction to the date obtained, the measured date (6790 ± 90 years BP) gives a conventional age of 7120 ± 90 years BP; calibration then places it between 5830 and 5480 BC. This corresponds to a definitely more recent period, immediately prior to the ages obtained from the large shellmiddens in South Brittany. These results have to be considered cautiously because of the estuarine biotopes of *Scrobicularia*.

The new dating results obtained from Saint-Gildas 1b, and the reconsideration of previously obtained ages, tend to give the Gildasian an older age compared with observations carried out in the 1980s. Thus, station 1b would be occupied in the first half or towards the middle of the 7th millennium BC, while station 1c would be placed in the first part of the 6th millennium. In a previous section, we discussed the difficulties of using radiocarbon dating in a marine context, especially when we do not know the value of the variation of the reservoir effect. In this context, it is advisable to remain prudent when establishing comparisons. These dates indicate a broad chronological range, extending from 6700 to 6000 BC on station 1b and from 5800 to 5500 BC on station 1c. This last interval is coeval with the dates obtained for certain burials on Téviec and Hoëdic (Schulting and Richards 2001). In both cases, however, the comparisons are complicated by the inaccuracies of the method used for dating materials from marine environments.

Lithic production of the occupants of Pointe Saint-Gildas

The lithic assemblages of the sites of the Pointe Saint-Gildas are determined essentially from flint pebbles up to 15 cm in size collected on beaches below the sites. The knapped pieces from Saint-Gildas display a white patina which clearly distinguishes them from other industries on the coast of Loire-Atlantique. The production of flint tools is probably one of the motivations for the settlement of prehistoric communities on the Pointe Saint-Gildas (Marchand 1999; Dupont *et al*. 2007). Flint pebbles are still notably abundant on the foreshore, and the strong currents off the headland are likely to ensure a regular supply. It is difficult to understand in what form the Montbert quartzite arrived at the Pointe Saint-Gildas. Since it is known in geological outcrop about 60 km to the east, at a locality south-east of Nantes, this material could indicate sporadic contacts or may have been transported by the river and then collected at the foot of the sites. Activity evidently included the manufacture of hunting weapons, which implies dislocation of damaged arrowheads (innumerable broken arrowheads) and the repair of throwing weapons, with breakage in the course of manufacture. In addition, pebbles of quartzite and quartz are extremely numerous. These weighty objects are more easily abandoned on the spot during displacements. They are used for flint percussion activities or are intended to be retouched as denticulated tools. The 'crusher' function seems absent, but this corpus is incomplete compared to the original. Contrary to flint, these pebbles do not represent a rare resource in this department, since the Loire deposited so many pebbles of different type on its old terraces. Humans did not come here especially to collect and export

Table 1 **Radiocarbon dates obtained on shells of *Scrobicularia plana* from Saint-Gildas 1b and 1c (Oxcal 3·10; Bronk Ramsey 1995 and 2001). The conventional ages suggested for the results obtained at Gif-sur-Yvette (France) are purely indicative, since they were calculated from the $^{13}C/^{12}C$ ratio for the date determined by Beta Analytic**

Locus	Laboratory code	Calculated age (BP)	$^{13}C/^{12}C$	Conventional age (BP)	Calibrated date(2 sigma – cal BC)
Saint-Gildas 1b	Gif-3531	7520 ± 140	–	7850 ± 140	6650–6000
Saint-Gildas 1b	Beta-194786	7670 ± 40	−5·0%	8000 ± 40	6590–6420
Saint-Gildas 1c	Gif-4847	6790 ± 90	–	7120 ± 90	5830– 5480

these pebbles, but their concentration nevertheless implies a particular operating mode on the locus of Saint-Gildas 1b. The dimensions of the site plead in favour of occupations by small groups, but we should consider the importance of erosive factors that have degraded the spatial information. To refine our understanding of this site within its network of exploitation of the environment, we need to address the question of food remains.

Mode of subsistence

The malacological data observed at locus 1b correspond to three sources of information (Table 2). These results show a relative homogeneity of the shells composing this deposit whatever the source of studied information. The large-sized shells that are likely to have been consumed include the limpet *Patella* sp., the oyster *Ostrea edulis*, the mussel *Mytilus edulis*, the clam *Ruditapes decussatus* and the cockle *Cerastoderma glaucum*. Although these species are in the minority, they are common to the three sources of information. The lower species diversity observed during the field campaign in 2003 can be explained by the increased degradation of the deposit. The small dimensions of the deposit also reflect this degradation, as well as the surface quality of the shells. The larger-sized species seem to have been isolated from the batch studied by Mr Tessier, and were donated to the Dobrée museum at the expense of delicate-shelled species such as the bivalve *Scrobicularia plana*. Indeed, this seems to confirm the quantitative information from the 2003 collection, which shows a much higher percentage of *Scrobicularia* than that observed in the Dobrée museum collection (Table 3). However, the heterogeneity of the shell deposit could be partly responsible for these differences, in view of the species composition that can be observed on the photograph published by G. Bellancourt (1980, 8). In addition, the higher proportion of *Scrobicularia* observed in 2003 can be explained by the use of sieving and the method for calculating the MNI (Minimum Number of Individuals), which is based on only part of the shell, the chrondrophore.

Table 3 Quantitative estimate of malacofauna present in US D.4 of Saint-Gildas 1b (MNI = Minimum Number of Individuals; NR = Number of Remains

Latin	Weight (g)	MNI	NR
Patella sp.	4·5	4	134
Ostrea edulis (Linnaeus)	1·2	1	12
Mytilus edulis (Linnaeus)	6	2	219
Littorina littorea (Linnaeus)	1	1	11
Ruditapes (Tapes) decussatus (Linnaeus)	1	1	8
Scrobicularia plana (da Costa)	181	208	8326
Cerastoderma glaucum (Linnaeus)	3·2	1	21
Indeterminate	1·7	1	67
Total	197·9	218	8731

Nothing remains of the shells observed at station 1c. The only useable data are the calculations of Mr Tessier (Table 4). The same distortions that apply in the case of Saint-Gildas 1b could lead to an under-representation of *Scrobicularia plana.* In spite of these distortions, the malacofaunal assemblage of Saint-Gildas 1c approaches that of Saint-Gildas 1b. Indeed, *S. plana* largely predominates, accounting for 69% of the total MNI of shells, followed in order of abundance by the limpet.

We were only able to apply a biometric approach to the batch of *Scrobicularia* from the field survey carried out in 2003 at Saint-Gildas 1b. Since they live in a mudflat-type habitat, we considered it important to check whether the presence of this species on the Pointe Saint-Gildas was really indicative of the food of Mesolithic times and not the transport of mud onto the site. The length distribution of *Scrobicularia* was determined after reconstructing the lengths of the

Table 2 Comparison of the malacofaunal assemblage of Saint-Gildas 1b according to different sources of information

Taxon	Common name	Saint-Gildas 1b (Tessier 1984)	Saint-Gildas 1b Dobrée Museum	Saint-Gildas 1b 2003
Patella sp.	Limpet	+	+	+
Osilinus lineatus (da Costa)	Thick top shell	+	+	−
Gibbula umbilicalis (da Costa)	Purple topshell	−	+	−
Littorina obtusata (Linnaeus)	Yellow periwinkle	+	−	−
Nucella lapillus (Linnaeus)	Dog-whelk	+	+	−
Ostrea edulis Linnaeus	Flat oyster	+	+	+
Mytilus edulis Linnaeus	Common mussel	+	+	+
Littorina littorea (Linnaeus)	Periwinkle	+	+	+
Pholas dactylus Linnaeus	Angel wing	+	+	−
Ruditapes (Tapes) decussatus (Linnaeus)	Carpet shell	+	+	+
Scrobicularia plana (da Costa)	Peppery furrow shell	+	+	+
Cerastoderma glaucum (Linnaeus)	Lagoon cockle	+	+	+
Species diversity		11	11	7

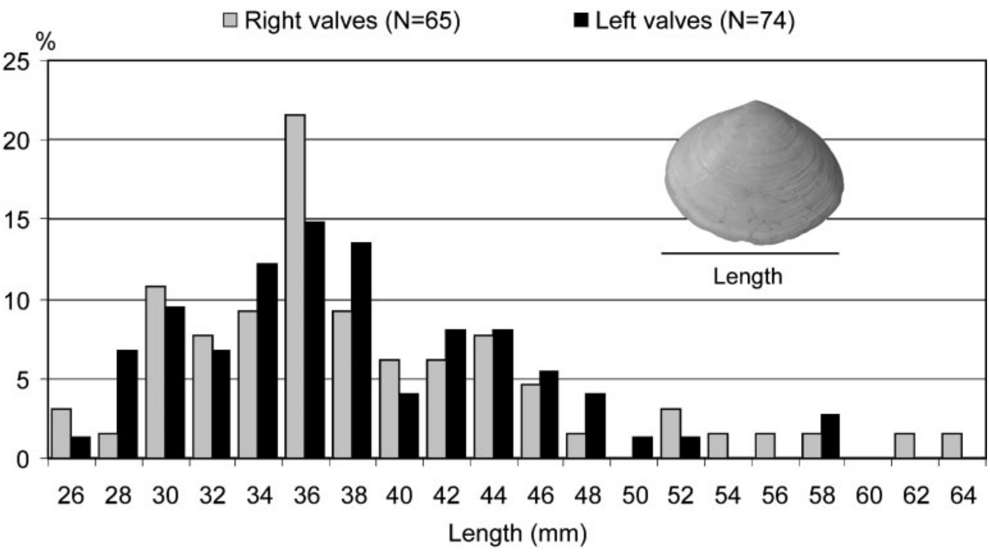

Figure 2 Histogram showing distribution of right and left valves of *Scrobicularia plana* (peppery furrow shell) found at Saint-Gildas 1b

valves from the length of the internal ligament (Gruet 1998; Dupont 2006). The average length of scrobicularid valves obtained in this way is 40 mm (Fig. 2). The larger individuals were selected at the expense of the small individuals. A comparison between the length distributions of the right and left valves shows that there is no statistically significant difference ($\chi^2 = 3{\cdot}38$; ddl = 4; P = 0·5; Schwartz 1980). To apply the Chi-square statistics, the percentages of length values have been gathered all 10 mm. This point confirms that the scrobicularids were collected with joined valves, showing they were undoubtedly alive, to be consumed as food by the Mesolithic groups. The anthropic origin of this deposit is corroborated by burned shells.

For the 2003 collection at Saint-Gildas 1b, the scrobicularids are dominant, with more than 95% of the total MNI of shells (Table 3) as against 69% at Saint-Gildas 1c (Table 4). The next most abundant species represented is the limpet, with more than 1% at Saint-Gildas 1b (Table 3) and 23% at 1c (Table 4). The collection of shellfish carried out by the Mesolithic groups seems to be concentrated on a reduced number of species. The collection of scrobicularids suggests the exploitation of a mudflat, perhaps with bare hands. By contrast, the limpets were collected on the rocks. Although two distinct zones of the foreshore were exploited, they were not necessarily far apart: one environment is sheltered, and the other more open on the sea. The periwinkle *Littorina littorea* tolerates a more sheltered mode of exposure than the limpet, and could have been collected on a silted-up rocky zone. The cockle species *Cerastoderma glaucum* could also be collected in silted-up zones. Along with the scrobicularids, these species indicate the presence of a sheltered zone near the sites of Saint-Gildas.

The limpet is accessible from the upper foreshore during neap tides, while scrobicularids can be collected from the middle foreshore. These food resources could be accessible daily on foot. The shellfish consumed by the Mesolithic groups come from a sheltered mudflat biotope that is incompatible with the mainly rocky foreshore currently facing the

Table 4 Quantitative estimate of malacofauna present in Saint-Gildas 1c

Latin	Appellations of Tessier (1984)	MNI
Patella sp.	patella	40
Ocenebra erinaceus (Linnaeus) (sting winkle)	ocinebra	1
Littorina littorea	littorina sexatilis	10
Pholas dactylus	pholas	(2 valves) 1
Scrobicularia plana	scrobicularia piperata	(235 valves) 118
Cerastoderma glaucum	cardium edule	(3 valves) 2
Total		172

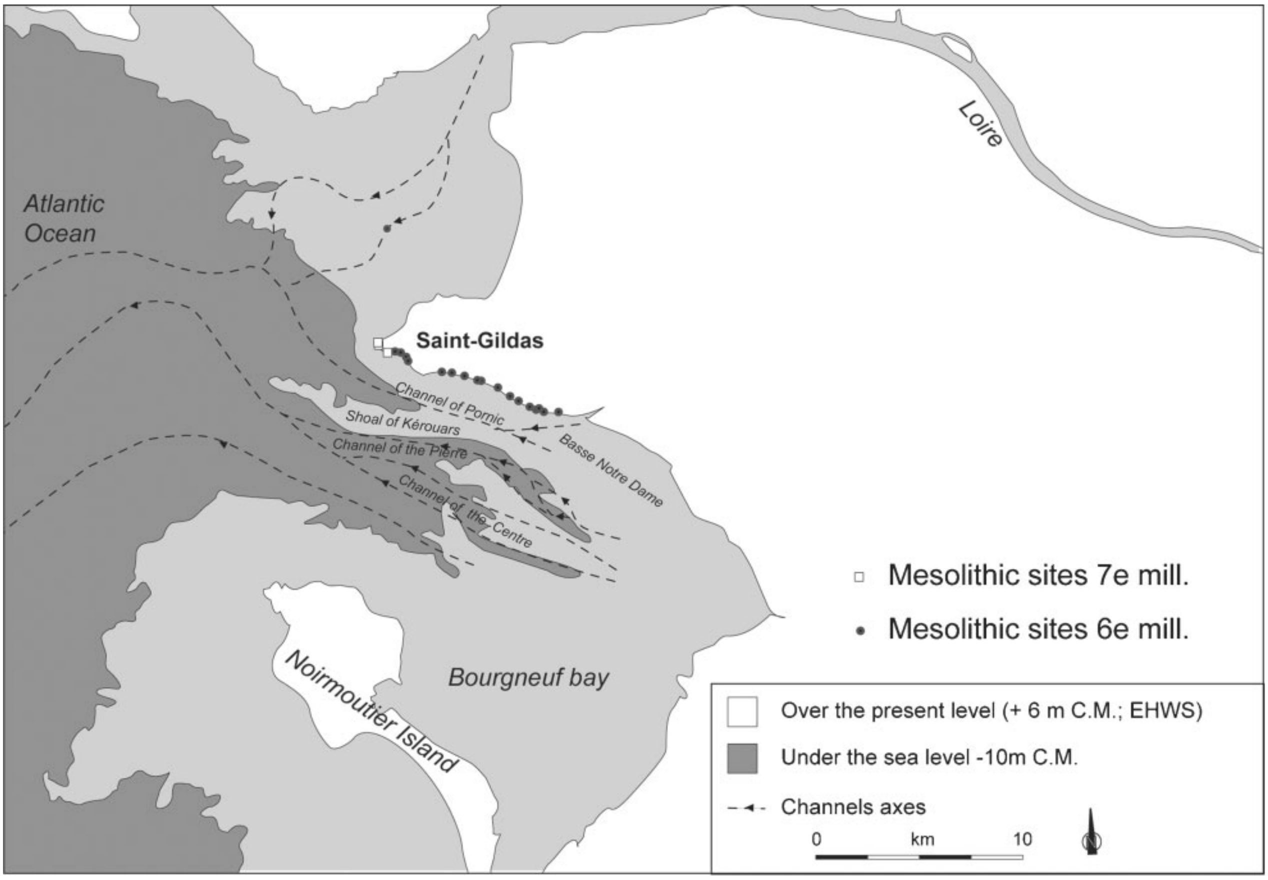

Figure 3 **Position of sea level at around −10 m CD from the Loire estuary to the island of Noirmoutier in the south, with location of Gildasian and Retzian sites (Dupont 2006, according to SHOM 1952 and Klingebiel and Larsonneur 1980) (CAD: F. Bertin and G. Marchand)**

sites of Saint-Gildas. Rather than making a prior assumption about cultural choice, it is appropriate to seek the causes of this discrepancy in environmental changes related to the Holocene transgression. We can account for this discrepancy by analysing bathymetric charts, sedimentary cores and the archaeological data on sea-level variations (Dupont 2006), while remaining aware of the many obstacles in the reconstruction of paleoenvironments: tectonic movements, marine erosion, local variations in sedimentation rate, etc.

Reconstruction of the environment

After a period of rapid sea-level rise, the rate of increase slowed down during the 7th millennium BC (Pirazzoli 1991). According to different authors, the level of the open sea varied between 13 m and 7 m below chart datum (CD) for this area at the beginning of the 7th millennium BC (Ters 1973; Morzadec-Kerfourn 1974; Pinot 1968). We should bear in mind that the zero datum of French sea charts (CD) is the extreme low water level of the tide. The trace of the −10 m CD isobath has been established from the sea chart (SHOM 1952; Klingebiel and Larsonneur 1980). This isobath highlights the presence of a paleovalley near Saint-Gildas, as well as a channel in the natural prolongation of the present-day ria of Pornic (Fig. 3). Multiple studies on the filling of the Bourgneuf bay show that the simple contour at −10 m CD is insufficient to reconstruct the approximate coastline during the Mesolithic (Gouleau 1968; 1971; Delanoe *et al.* 1971; 1974). Indeed, observations of the seabed of the Bourgneuf bay based on sea charts show a thickness of approximately 3·6 m of mud at the level of the channel of Pornic (Gouleau 1968; 1971). The thalweg of this channel was detected at −25m CD opposite Sainte-Marie and below −35 m CD to the north of the Kérouars bank (Delanoe *et al.* 1971). The Pornic paleovalley was thus broader and extended farther towards the land that the contour obtained by reconstructing the −10 m isobath. The Kérouars bank, composed of hard rocks such as gneiss and granite, then probably formed a continuous feature connected to the rocks of Basse Nôtre Dame (Delanoe *et al.* 1974). It represented a trace parallel to the southern flank of the estuary, leading to the channel of Pornic, while its northern bank skirted the current coastline. Lastly, according to Delanoe *et al.* (1971) 'only the channels of Pornic and Pierre can be connected up with the present-day river system'. The presence of gravels in certain cores shows that the action of the sea, and hence erosion, could be very powerful during certain phases of the filling of the channel of Pornic (Gouleau 1971). Part of the sediments deposited during the Mesolithic could be eroded and can no longer be observed in the channel of Pornic. However, the muddy environment, and thus the functioning of the channel of Pornic as an estuary, is entirely in agreement with the surveys of D. Gouleau (1971).

The sites of Saint-Gildas were thus separated by approximately 1 km from the marine influence associated with this old estuary represented by the channel of Pornic. This is compatible with the presence of peppery furrow shells in the Mesolithic shell deposits. In addition, the geological map shows that the rocky outcrop of Saint-Gildas currently continues in a north-westerly direction to a depth greater than −10 m. Therefore, this headland was accessible during the Mesolithic and could correspond to a site for the collection of species typical of a rocky shore, such as the limpet and thick top shell (*Osilinus lineatus*).

The place of the shell deposits of Saint-Gildas in the context of the Late Mesolithic of France

The known data on the mode of subsistence of the Late Mesolithic populations are rare and scattered. There is no geographical continuity between the Mesolithic shell deposits of Brittany (Beg-er-Vil, Beg-an-Dorchenn, Téviec and Hoëdic) and those of Saint-Gildas (Dupont 2005). The syntheses carried out on the mode of subsistence of the human groups of Beg-er-Vil, Beg-an-Dorchenn, Téviec and Hoëdic show that these coastal populations exploited all the diversity of the local resources with a strong dependence on the marine environment (Péquart *et al.* 1937; Péquart and Péquart 1954; Kayser 1985; 1992; Schulting *et al.* 2004; Dupont and Gruet 2005; Dupont 2006). Even assuming the Mesolithic populations of Saint-Gildas also exploited the coastal fringe, we detected no other food resource apart from shellfish at this site. This is one of the most important differences between the shell deposits of Saint-Gildas and Brittany. Taphonomic factors could partly explain the absence of bones in the deposits of Saint-Gildas. On the one hand, the shells extracted from these deposits exhibit a very marked degradation of their surface quality. In addition, previous studies have shown that the bones are highly altered even in zones located at the periphery of the shell deposits (Dupont 2006). Unfortunately, the 2003 sampling campaign at Saint-Gildas 1b showed the small extent of this shell deposit and, in view of this evidence alone, does rule out the dissolution of food remains other than malacofaunal. However, the earlier observations of this deposit indicate the presence of more voluminous remains, without actually evoking the presence of animal bones. Thus, it is extremely likely that, from the start, food waste at Saint-Gildas was composed exclusively of shells.

No structures associated with a habitat or hearths were observed in the shell deposits of Saint-Gildas. These data also contrast with the Brittany sites where paved surfaces are sometimes present, containing well arranged combustion structures and burials covered with pebble mounds (Péquart *et al.* 1937; Péquart and Péquart 1954; Kayser 1985; 1990; 1992). These various structures related to daily activities imply a more prolonged occupation of the Brittany sites compared with Saint-Gildas. The low volumes of shells on the Saint-Gildas sites would also corroborate this hypothesis, as would the composition of the lithic artefacts (Marchand 2005). The shell deposits in Brittany reflect a greater diversity of activities than the more specialized 'light littoral stations' of Saint-Gildas (Marchand 2000).

The characteristics of lithic industry in the north-west of France contribute to our thinking on the economic organization of this area during the Mesolithic (Gouletquer *et al.* 1996; Marchand 2000; 2005). Satellite sites could be complementary to habitats used for prolonged residence. If we apply this model to the sites with shells, the shell deposits in Brittany display the characteristics of a base camp, while those of Saint-Gildas are more the reflection of specific expeditions (Fig. 4; Dupont *et al.* 2007). Indeed, the narrow selection of species consumed leads us to doubt the stability of a human population whose food supply would depend on a single species. The paleoenvironmental reconstruction shows that these stations were situated at the intersection of the estuary of the Loire and the mouth of the currently drowned river of Pornic. These estuarine ecosystems represent a stage in the migration of various animal species. Thus, the human groups could exploit one of these resources, which would be more abundant at certain times of the year, and consume shellfish while at their stopping place.

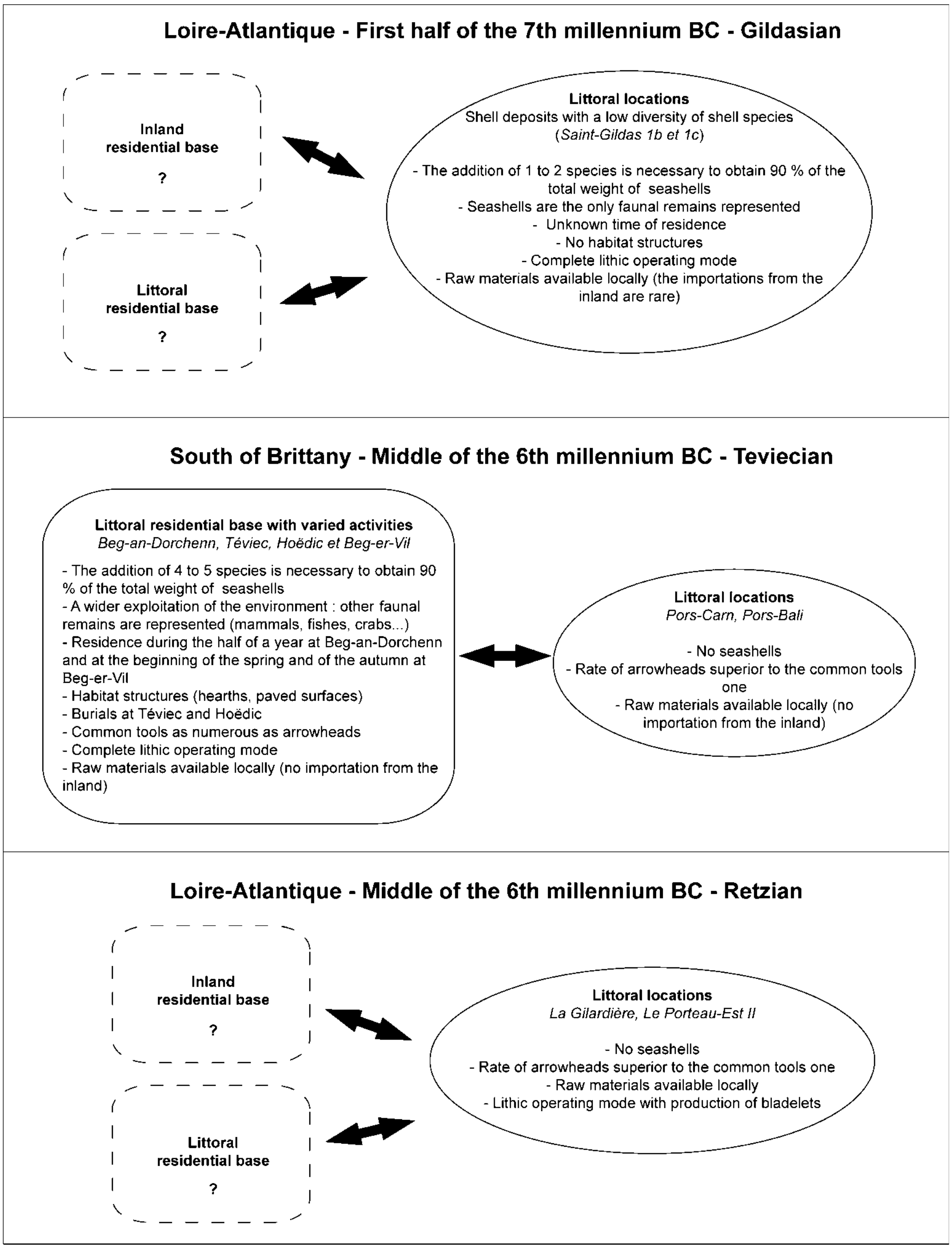

Figure 4 Models of economic organisation of the coastal zone during the Mesolithic (Teviecian, Retzian, Gildasian). The main economic features are indicated (nomenclature after Binford 1980; data in Gouletquer *et al.* 1996; Marchand 1998; 1999; 2005; Dupont 2006; Dupont *et al.* 2007) (CAD: C. Dupont and G. Marchand)

Similar models distinguishing base camps from satellite stations have been proposed for the Late Mesolithic of Denmark (Hodder 1993; Andersen 1995) as well as the Late Mesolithic and Early Neolithic of Portugal (Soares 1996; Tavares da Silva 1996). Assuming that sites with large and low specific diversity would have functioned simultaneously, semi-permanent habitats associated with diversified predation activities could be contrasted with small stations like Saint-Gildas with less diversified activities.

Mesolithic populations of the Gildasian and Retzian: from differential erosion of the coast to a different management of the coastal resources

The prospection work of Mr Tessier in the northern part of the Bourgneuf bay has revealed many Mesolithic sites along 10 km of coastline. However, we need to find an explanation for the bimodal distribution of ages for these sites: the beginning of industries with trapeze-shaped artefacts (known as the Gildasian) is recorded on the Pointe Saint-Gildas, while stations on the rest of the Pays-de-Retz coast are associated with Retzian industries and the end of this cycle (Fig. 4). The methods used to exploit the archaeological data are identical and cannot explain these differences. Another explanation could be provided by a simultaneous change in the food economy and the environment of the Mesolithic groups between the 7th and 6th millennia BC. Indeed, while the exploitation of mudflats is an important factor in the settlement of groups during the 7th millennium, we can assume that the habitats were most suitable for this type of exploitation far in front of the present-day cliffs, perhaps on mud or sand banks. The sea-level rise in the ria of Pornic would have led to the disappearance of these stations by erosion of the loose sediments. The low anthropic pressure during the 7th millennium between Saint-Gildas and Pornic could be also explained by a more difficult access to the foreshore. Indeed, the cliffs are steeper near Pornic than opposite the Pointe Saint-Gildas. In the second half of the 6th millennium, the Retzian groups continued to be interested by the sea margins, but apparently no more in the intensive exploitation of mudflats. In fact, no Retzian shell-middens are known on the Atlantic seaboard. We cannot exclude the possible erosion of shell deposits in relation to the Holocene transgression. A less intensive exploitation of the shellfish could also have led to the accumulation of less voluminous food waste. Being sensitive to taphonomic factors, these shell deposits perhaps dissolved and hence are absent from the archaeological record. The human groups bringing in the Retzian industry thus either completely gave up the exploitation of shellfish, or restricted the contribution of these molluscs to their diet. The Mesolithic communities then returned to the coast for other types of activities that were nonetheless also related to the marine environment.

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