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Human Mobility Patterns and Environmental Cycles during the Mesolithic of Western France: Interdisciplinary Studies into the Shell Midden Site of Beg-Er-Vil

Modèles de mobilité humaine et cycles environnementaux au cours du Mésolithique dans l'ouest de la France : Études interdisciplinaires croisées sur le site coquillier de Beg-Er-Vil

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Abstract

The human movements currently observed on a global scale are diverse. While some seem to be well established and based on seasonal migrations, such as the appeal of the sun or of more moderate temperatures, climatic upheavals such as the aridification of certain areas of the globe or political conflicts demonstrate that mobility is governed by an interweaving of movements that are both individual and collective, cyclical and occasional. Once these variations start to haunt us, the task of examining the temporal patterns of occupation of a prehistoric settlement becomes a complex one. This is the challenge we have chosen to undertake at an archaeological site imbued with the scent of iodine, the Mesolithic shell midden of Beg-er-Vil in South Brittany (Quiberon, Morbihan). One of the site's defining characteristics is its intimate link with the marine environment, whether in terms of its coastal setting or of the resources that its occupants harvested and consumed. It is also one of the rare Mesolithic coastal habitats where the remains of a diverse fauna (marine and terrestrial mammals and birds, fish, molluscs and crustaceans) are preserved alongside a homogeneous lithic industry. This last point is crucial for this period, as there are many Mesolithic sites with mixed industries that reflect successive passages that we cannot distinguish. Beg-er-Vil, with its forty-centimetre-thick shell layer, is an exception. Although Beg-er-Vil is now attacked from the sea, it was further from the coast when it was first occupied. Although palaeoenvironmental reconstruction models are subject to error, we thought it appropriate to recall the rate at which islands were broken off in western France and the changes in the coastline of the Bay of Quiberon as a result of rising sea levels. Distances are closely linked to the temporality that interests us here, including the movement associated with the accessibility of exploited mineral resources, animals and plants. Once this geographical framework is established, each type of artefact and ecofact that makes up the shell pile is examined. It bears witness to the diverse utilization of the Atlantic Ocean were supplemented by the Beg-er-Vil fisher-hunter-gatherers, who used land-based resources ranging from large game to nuts, as well as wood for heating, cooking and, no doubt, to build shelters. The shell midden is essential to the illustration of the multiplicity of activities encountered. It is an aggregate of waste where shells mingle with charcoal, bones, flint fragments, etc. In this

article, each of these artefacts is examined from the perspective of its geographical and temporal accessibility, in an attempt to identify the routes and patterns adopted by the occupants of Beg-er-Vil as they fished, gathered and collected these resources. On a more global scale, the shell deposit at Beg-er-Vil is by no means a snapshot in time. The publication of the new radiocarbon dates in this article offers a new perspective on the settlement pattern of one of the rare sites dating back to the end of the coastal Mesolithic on what is now the French Atlantic coast. Using Chronomodel, it was possible to distinguish 4 periods of occupation between 6400 and 5920 cal. BCE were identified. In order to understand the organization of the remains within the shell mound and the pattern of the occupation of Beg-er-Vil (continuity, succession), the sedimentary archives were studied. They provide us with a renewed understanding of the rate of formation and occupation of one of the rare sites dating from the very end of the coastal Mesolithic period along what is now the French Atlantic shoreline. Beg-er-Vil represents a tiny link in the diversity of coastal settlements in the Second Mesolithic period. The proposed interdisciplinary approach allows us to analyse the settlement pattern of the last fisher-hunter-gatherers on a variety of levels.

Résumé

Les mobilités humaines observées actuellement à l'échelle mondiale sont variées. Si certaines semblent bien rodées et calées sur des migrations saisonnières, comme l'attrait pour le soleil, voire pour des températures plus modérées, les bouleversements climatiques comme l'aridification de certaines zones du globe ou les conflits politiques montrent que les mobilités sont régies par une imbrication de déplacements à la fois individuels et collectifs, cycliques et exceptionnels. Certains événements observés à l'échelle de nos vies humaines comme la mort massive de nos aînés liée à une canicule nous rendent humbles devant l'objectif fixé. Dès lors que l'on garde à l'esprit ces exemples, la complexité à aborder le rythme d'occupation d'un habitat préhistorique est posée. C'est le challenge que nous nous sommes fixé à partir d'un site archéologique, largement imprégné des effluves iodés qu'est l'amas coquillier mésolithique de Beg-er-Vil (Quiberon, Morbihan). Une de ses spécificités est son lien intime avec les environnements marins, que ce soit du point de vue de son implantation en contexte côtier, des matières premières ou des ressources alimentaires que ses occupants ont exploitées. Il est également un des rares habitats côtiers du Mésolithique où les restes de faunes variés (mammifères et oiseaux marins et terrestres, poissons, mollusques, crustacés) sont conservés au côté d'une industrie lithique homogène. Ce dernier point est crucial pour cette période car nombreux sont les sites du Mésolithique aux industries mélangées reflétant des passages successifs qu'il ne nous est pas possible de différencier. Avec ces quarante centimètres de couche coquillière Beg-er-Vil fait figure d'exception. D'autres sites auraient pu être de bons candidats, comme les amas coquilliers de Téviec ou d'Hoedic aussi localisés dans le Morbihan. Malheureusement, l'ancienneté de leurs fouilles, à un moment où la couche de coquille n'était considérée que comme du sédiment a gommé nombre d'informations spatiales, stratigraphiques mais aussi la diversité des vestiges archéologiques. La prise en compte dès la fouille de Beg-er-Vil de son caractère exceptionnel nous a amenés à multiplier les observations de terrain qui n'ont eu que de cesse d'évoluer au fur et à mesure du développement même des disciplines de l'archéologie sur le temps court des fouilles qui a été de 6 ans et le temps long de la post-fouille qui à l'instar de Téviec et Hoedic à encore de nombreuses années devant elle. Beg-er-Vil ne se résume pas à son amas coquillier. Nos investigations à proximité de ces zones d'accumulation de déchets et de vie ont mis au jour l'existence de huttes témoignant de l'extension d'un site archéologique dont nous ne pouvons observer que des bribes. Cette

vision partielle du site est importante, car elle est aussi visible dans les paysages actuels dans lesquels s'est implanté cet habitat préhistorique.

En effet, si Beg-er-Vil subit actuellement les assauts de la mer, il était sans doute légèrement en retrait du trait de côte lors de son fonctionnement. Si les modèles de reconstitution des paléoenvironnements sont accompagnés de marge d'erreur, il nous a semblé opportun de rappeler le rythme du morcellement des îles à l'échelle de l'ouest de la France et les modifications du trait de la baie de Quiberon induits par la remontée du niveau de la mer. En effet, ces modifications changent les distances d'un site à l'autre, mais aussi celle de Beg-er-Vil aux lieux de pêche, de collecte, de cueillette et de chasse. Ces distances sont un lien étroit avec la temporalité qui nous intéresse ici dont celle des déplacements liés à l'accessibilité des ressources minérales, animales et végétales exploitées.

Une fois ce cadre géographique posé, l'ensemble des artefacts composant l'amas coquillier est disséqué. Il témoigne à la fois des exploitations multiples de l'océan Atlantique par les pêcheurs-chasseurs-cueilleurs de Beg-er-Vil mais aussi de celles de milieux plus boisés avec des ressources d'affinité terrestre qui vont du gros gibier aux fruits à coque en passant par le ramassage du bois pour se chauffer, cuire sa nourriture mais aussi sans doute pour s'abriter. L'amas coquillier est central dans la description de la multiplicité de ces activités. Il est un agrégat de déchets où coquilles se mêlent aux charbons, ossements, éclats de silex...

Chacun de ces artefacts est interrogé du point de vue de son accessibilité géographique et temporelle pour tenter d'y déceler les parcours et les rythmes des occupants de Beg-er-Vil nécessaires à la pêche, la cueillette et la collecte voire le ramassage de ces ressources. A cette accessibilité théorique des ressources animales basée sur l'actualisme, d'autres instantanés sont recherchés comme par exemple la saison de collecte de certains coquillages abordée via la sclérochronologie. Pour le silex la question de la temporalité peut être approfondie en prenant en compte la diversité des outils taillés et confrontée aux modèles existants. Parmi les artefacts majeurs de la temporalité, les charbons sont centraux. Ils ont fait preuve d'une sélection méticuleuse pour mieux comprendre l'évolution du site au cours du temps. Les datations radiocarbone sont ainsi confrontées à la lecture stratigraphique de terrain. Elles aident à mieux comprendre la succession de l'utilisation de certaines structures comme les foyers ou fosses par exemple. Certaines de ces datations sont inédites, elles ont été multipliées pour tenter de déceler des phases d'occupation sur un site qui peut frapper par l'homogénéité de son industrie lithique.

Enfin, pour tenter d'approcher le rythme d'occupation de Beg-er-Vil (continuité, succession d'occupation) les archives sédimentaires sont interrogées. Elles permettent de nous donner une vision renouvelée du rythme de formation et d'occupation d'un des rares sites de la toute fin du Mésolithique côtier le long de notre actuel littoral atlantique français.

Beg-er-Vil représente un maillon infime de ce que pouvait être la diversité des occupations du littoral du second Mésolithique. L'approche interdisciplinaire proposée permet d'aborder le rythme d'occupation des derniers pêcheurs-chasseurs-cueilleurs à des échelles variées.

Keywords: Mesolithic, Mobility, Shell midden, Fisher-Hunter-Gatherers, Atlantic coast

Mots-clés : Mésolithique, Mobilité, Amas coquillier, Chasseurs-cueilleurs-pêcheurs, Côte atlantique

Preamble

This article was written by six hands. Grégor was its instigator. Work began on the first version he proposed in March 2023 in Ireland, while we were being hosted by Graeme

Warren and Martin Moucheron as part of the Out of shell PHC Ulysses programme. Our text is based on our joint contributions to the “13th International Conference on Hunting and Gathering Societies (CHAGS 13) ‘Living Well Together’”, which took place from June 27th to July 1st 2022, in Dublin, Ireland. At this occasion, one of us presented our research titled “*The mobility of Mesolithic communities on the coast: between disturbing stereotypes and diffuse traces*” (Onfray M, Marchand G., Dupont C.). This paper was part of a session called *Bridging the gap between theory, methods, ethics, and the validation of knowledge: an interdisciplinary dialogue on coastal hunter-gatherer societies* (co-organised by R. Connolly, I. Mc Iven, M. Moucheron, and M. Onfray). This synthesis was intended to promote several articles that we had written in French, as well as a number of ongoing research projects (ANR GEOPRAS GEOarchaeology and PRehistory of Atlantic Societies ANR-21-CE27-0024-01, planned excavations at Beg-er-Vil / funded by the Service Régional de l'Archéologie, Ministère de la Culture et de la Communication, Ville de Quiberon, Département du Morbihan, CNRS, CReAAH, IRN Réseau international de chercheur PrehCOAST "Coast-inland dynamics in prehistoric hunter-gatherer societies"). The aim was both to communicate our results to the international community (Marchand et al. 2023-a and -b), and to incorporate the very latest data on a subject that was so close to Grégor's heart—the occupation patterns of maritime hunter-gatherer populations. In April, just a few weeks before he left us, he asked us to amend, reorganise, and even deconstruct this paper, which we have tried to do, to the best of our ability.

1. Uncovering mobility through archaeological remains

The movements of modern human populations highlight the complexity of the issue of mobility. It may be recurrent or exceptional, voluntary or involuntary, driven by a local or global phenomenon, individual or collective (Shilpimita and Mishra, 2018; Pitoski et al., 2024). On the other hand, current observations show that causal links are rarely direct. For instance, the report issued by the International Panel on Natural Resources and Human Mobility (United Nations Environment Programme, 2023) stresses the need to adopt "an integrated approach that accounts for multiple causal links and interaction networks". This research demonstrates "that the relationship between natural resources and migrations requires us to consider the interactions between human beings and the environment as a complex adaptive system" (United Nations Environment Programme, 2023). Of the many factors that can influence the close relationship between human populations and natural resources, some of the ones that may have had an impact in the past include environmental variables (coastline variations, climate change) and those of societal, economic, or demographic origin (Averbouth et al. ed., 2021; Averbouth et al. ed., 2023).

Regarding the world's hunter-gatherers, both past and present, collective mobility is often seen as occurring cyclically and along closed pathways—described here as circular (Binford, 1980, 1990, 2001; Kelly, 2007). It encompasses the individual and collective movements that were central to the way the first human communities operated, linking them to dispersed resources whose availability depended on the seasonal or tidal cycles. As with contemporary examples (United Nations Environment Programme, 2023), the impetus for these journeys goes well beyond adaptive processes and a supposed economic rationality that is disconnected from other contingencies. The regular displacement of homes also responds to family, social, or religious demands, as well as to an ethos that values this mobility, whether it be that of hunter-gatherers (Kelly, 1992) or that of today's nomadic communities in France (Bergeon, 2014). From the outset, we differentiate this type of mobility from linear spatial movements, either voluntary or imposed and non-periodic in time, which are most often described as migrations and tied to the exploration of new continental (Kelly and Todd, 1988) or island territories (Warren, 2017; Tune, 2020). In a maritime or fluvial context, navigation transforms the structure of mobility networks, allowing all or part of the group to be projected further afield, providing access to insular areas with distinctive ecological conditions (Marchand, 2013) and enabling the transport of voluminous resources that can be processed far from where they were acquired (Ames, 2002). For the archaeologist, these cyclical collective movements necessarily result in the reduced visibility of remains, since these nomads almost never bring heavy equipment with them, nor do they abandon certain valuable possessions as they travel. Four parameters are suggested to define this type of mobility: 1/ the points of contact in space (habitats / archaeological sites), 2/ the territorial extension of these movements (defined broadly by transfers, i.e., in this case, the spatial dispersion of styles, techniques, and raw materials), 3/ the quantity of materials or information transferred between network points, and 4/ the temporal patterns of these movements (Marchand, 2014). The latter is the focus of this article on the last hunter-gatherers of western France, as this topic seems to have received

little consideration in recent research. Prehistoric archaeology knows how to draw up an inventory of some of the resources exploited (provided they have been partially preserved); on the other hand, a finer understanding of the management of environmental cycles is more rarely addressed (Carter, 2009; Mannino and Thomas, 2009; Dupont et al., 2009 and 2010). This is due, in part, to the variables inherently affecting the reading of each archaeological site, in the field and post-excavation, including the degree of conservation, the spatial extent of the excavations, methodological advances used for recording information, the questions asked by the archaeologists at the time of the excavation, etc. (Dupont, 2016).

Among the thirty or so known Mesolithic sites on the French Atlantic coast (Marchand, 2014), few display several artefacts and ecofacts in association, preventing us from addressing the notion of their temporality. While most of them contain lithic materials, only a small number have partially preserved occupation layers and give us access to the sphere of the exploited animal and plant resources. In this respect, shell middens have proved to be ideal playgrounds, provided that archaeologists have considered the mass of waste as artefacts and not as sediment fit only for the preservation of bones (Dupont and Marchand, 2021).

At the Beg-er-Vil coastal site in Quiberon (Morbihan, France), the question of temporality has been incorporated right from the start of the excavation (2012–2018) depending on the methods of analysis, which have continued to evolve as the field campaigns have progressed (Marchand et al., 2016; 2018), as well as during the post-excavation phase. Analyses, some of them exploratory, such as environmental DNA, were applied to a diverse range of archaeological remains. Among these investigations, micro-stratigraphic analysis *via* the micromorphology of archaeological soils and sediments, or sclerochronology on mollusc shells (growth increment analysis) have provided new temporal markers. These data are here compared with more traditional archaeological methods (stratigraphy, lithic typology and technology, radiocarbon dating, seasonal access to animal and plant resources based on the theory of actualism) in order to discuss both the duration of use and frequency of visit of this coastal habitat and its territory during the Mesolithic period.

2. A shifting coastal geography at different observational scales

The study of temporal patterns cannot be approached on the scale of a coastal site's territory without taking into account fluctuations of the coastline.

2.1. Gradual formation of the coastline

The story of the earliest continental and island occupations was written in parallel to the Holocene marine transgression, which constantly reshaped the landscape. There are a number of reasons why it is difficult to estimate when today's islands were separated from the mainland:

- The tidal range has changed in accordance with the configuration of the coastline and seabed, ranging from 5 m in the south to 12 m to the north of the current French Atlantic coastline.
- Sea variation curves are sometimes established on the basis of very few reference points.
- Some of the radiocarbon dates that were used to generate these curves have not been corrected for the marine reservoir effect, which can vary depending on the types of samples dated, while others lack a credible sedimentary context.
- The removal of periglacial aeolian deposits and other colluvial sediments, as well as dune deposits and pebble beds, have impeded the rise of the sea to a degree that is difficult to measure.

Drawing from currently available sea level curves (Morzadec-Kerfourn, 1974; Pirazzoli, 1991; Lambeck, 1997; Lambeck et al., 2014; Stephan and Goslin, 2014; Garcia-Artola et al., 2018), as well as regional bathymetric records (Pinot, 1974; Menier, 2004; Menier et al., 2009, 2010; Sorrel et al., 2010), a five-phase insularisation process can be presented (Table 1).

Phase	Dates (cal. BCE)	Island
1	10 th and 9 th millennia	Ouessant, Guernesey
2	8500 - 7500	Sept-Îles, Sein
3	7500 - 6500	Palaeo-island of Houat-Hoedic, Groix, Belle-Île-en-Mer, Jersey, palaeo-island of Glénan, palaeo-island of Molène
4	6500 - 6000	Yeu
5	After 6000	Ré, Oléron, Noirmoutier

Table 1. Phases of separation of today's islands from the continental landmass. We define as palaeo-island the ancient unified form of a present-day archipelago.

Island fragmentation further extends this insularisation process. It has been particularly well investigated for the Molène archipelago (Finistère, France) between 5000 cal. BCE and today (Stéphan et al., 2019, 2020), or for the islands of Houat and Hoedic (Morbihan) that separated between 6000 and 4000 cal. BCE (Buttin, 2009). The rise in sea level on the present-day landmass has contributed to a significant retreat of the coastline in the larger bays (Quiberon, La Forêt-Fouesnant) and a slightly smaller retreat in front of the present-day cliffs. Following the period that is of interest to us here, the Mesolithic, islands continued to separate from the mainland. In this way, the Mesolithic settlement of Téviec (Saint-Pierre-Quiberon, Morbihan), which was continental at the time of its use during the first half of the 6th millennium BCE, is now a 300-metre-long island located 1.8 km away from the mainland (Péquart et al., 1937). Human settlements near estuaries and bays are currently the blind spot of our research in western France, a fact which can no doubt be explained by the significant sedimentation that may have covered any dwellings located in low-lying areas. Nonetheless, this initial overview of insularisation is a reminder that the same movements that are often seen from the coast to the interior and vice versa may also have taken place for Beg-er-Vil from the coast to the islands.

2.2. A network of Mesolithic settlements along the coast

Research into Late Mesolithic settlements (end of 7th and 6th millennia cal. BCE.) carried out in Brittany over the last few decades have revealed the nodes of some of the economic and social networks operating along these coasts. M. and S.-J. Péquart's excavations carried

out between 1928 and 1934 on the present-day islet of Tévéc and on the island of Hoedic were pivotal for their discovery of burials in shell middens (Péquart et al., 1937; Péquart and Péquart, 1954). Despite the quality of their work in the field, stratigraphic uncertainties still hamper our understanding of the possible sequence of funerary and domestic activities, while the archaeological evidence that was unearthed was only partially preserved. During the 1980s, the data collected by O. Kayser on the shell midden levels at Beg-an-Dorchenn (Plomeur, Finistère) and Beg-er-Vil helped to refine our knowledge of technical traditions (Kayser, 1992; Marchand, 1999) and palaeoenvironments (Tresset, 2000, 2005; Gruet, 2002; Schulting et al, 2004; Dupont, 2006, 2016; Dupont et al., 2010; Marchand, 2014). These large settlements with shell middens and heavy structures (slab hearths, for example) belong to a coastal system that also includes small sites with no observed structures nor preserved faunal remains, signalled at the top of today's cliffs by thousands of lithic pieces scattered over the eroded surface (Marchand, 1994; 2014; 2020a). However, we must remain prudent about this differentiation between sites, which may in part reflect their degree of degradation. This is illustrated by the progressive thinning of the rare shell middens found in western France over a lifetime (Dupont, 2006). Furthermore, the faunal remains from the 1980s excavations at Beg-er-Vil appear to be better preserved than those from the 2010s excavations. The Pointe Saint-Gildas sites (Préfaïlles, Loire-Atlantique) also support this trend. Locus 1b, described as a small mound in 1980, had been reduced to a lens by the early 2000s (Dupont et al., 2007).

These shell middens and small sites are found on islands during the Late Mesolithic, such as Hoedic, Belle-Île-en-Mer, and Groix (Marchand, 2013). Organic remains are known only from the Port-Neuf shell mound on the island of Hoedic (Péquart and Péquart, 1954). New surveys conducted there between 2018 and 2021 by P. Arias and G. Marchand aimed to analyse the shell mass and its components more closely and to track down the possibility of additional, yet unexplored, tombs. Animal bones are rare and severely degraded, although we can observe the remains of large Holocene mammals (deer, roe deer, wild boar, fox, and even aurochs; Tresset, 2000), alongside numerous mollusc shells and crab fragments. This prompts questions about the underlying motives behind these island settlements, the means of navigation, and the way in which these sites fit into mobility pathways (ANR project GEOPRAS ANR-21-CE27-0024). The confined nature of these islands certainly made hunting terrestrial mammals of little benefit (Marchand, 2013, 2020a) or perhaps even secondary to these island populations' diets. The seasonal hunting of migratory birds and marine mammals must evidently be considered instead (Tresset, 2005; Dupont et al. 2009). Furthermore, these islands have very limited resources of workable stone, even in the form of foreshore flint pebbles, which therefore could not have been an incentive for travel, and above all would have been a constraint for long-term human settlement.

This distribution of littoral sites forms the backbone of the coastal mobility system. Its autonomy can be illustrated using a number of indicators. Isotopic analyses (carbon and nitrogen) have also demonstrated the strong dependence of these populations on marine foods, in more equal proportions with continental protein inputs at Tévéc (between 38 and 60% depending on the individual), and clearly dominant at Hoedic (from 57 to 78%; Schulting and Richards, 2001; Simões et al., 2024). Furthermore, the local stones mined at the heart of the Armorican peninsula (phtanite, ultramylonite, micro-quartzite, Eocene sandstone) never reached the coastal settlements, indicating a lack of pendulum movement between land and sea (Marchand, 2020b). Understanding the nomadic practices that

animated this network requires a quality of information that is still rare on the regional scale.

Drawing on the excavations carried out at the Mesolithic shell midden of Beg-er-Vil (Marchand et al., 2016, 2018; Dupont and Marchand, 2021), we aim to review the chronological data available to us in order to understand the collective mobility patterns of these coastal hunter-gatherers.

2.3. The unique case of the Beg-er-Vil site

The Beg-er-Vil prehistoric settlement, located on the southern end of the Quiberon peninsula (Figure 1), rests at the bottom of a small inlet on the western side of a rocky promontory, only 5 m above sea level. It consists of a single archaeological level 20 to 40 cm thick, lying on a Pleistocene fossil beach altered at the top, and buried under a dune. The original configuration of the site is difficult to perceive, due to the dune cover, the partial nature of the deposit, and the recent urban alterations, but there appears to be a slight slope of the granite surface towards the west and the ocean, at the top of which the human settlement was established. The site was discovered during surveys of the cliffs and initial excavations occurred between 1985 and 1988, covering around twenty square metres of the Mesolithic shell mound, of which 50 cm remained at the time (Kayser and Bernier, 1988). In response to the obvious deterioration of the loose marine cliff bordering the site to the west, a full-scale excavation of the site was initiated in 2012 before its ineluctable disappearance (Figure 2, excavation by G. Marchand and C. Dupont; Marchand et al., 2016; 2018). This field operation was severely affected not only by the existence of an asphalt car park above the archaeological layers, but also by the extensive dune cover and urban alterations. The project called for a detailed excavation of a remarkably well-preserved archaeological layer, as well as a series of test pits, recordings, and surveys in the surrounding area in order to integrate the site into its initial environment.

All the archaeological work took place between 2012 and 2018. The operations covered a rectangle measuring 27 m by 13 m, stripped each year mechanically, with 180 m² excavated by hand. For this last stage, all the sediments were sieved at 4 and 2 mm with seawater, then rinsed with fresh water, and spatialised by quarter of square metre, with their altitude recorded. Noteworthy finds such as large bones, rare molluscs species larger than 2 cm, as well as lithic remains of reasonable size (larger than 1 cm) or tools spotted during the excavation were recorded in three dimensions. Stony fills were regularly documented, often using a combination of manual and photogrammetric methods.

When the site was in use during the Mesolithic period, the sea level was around 10 m below today's level (Pirazzoli, 1991). At the time, the Beg-er-Vil habitat was located less than a kilometre from the coastline, but it is now being subjected to marine erosion forces (Dupont, 2006; Marchand et al., 2016). With regard to the environment, the reconstruction proposed by the isobaths and maps of the seabed's sediments points to the existence of a wave-cut platform facing the site, with the potential presence of a sandbank less than a kilometre from the occupation area, in the section facing the ocean, and of a large sheltered bay undergoing silting at the level of what is now Quiberon Bay (Dupont, 2006). The settlement consists of a shell layer deposited on the slope leading towards the ocean and a sandy peripheral zone (Figure 2), which correspond to spatially differentiated activities. The former is both a discard and an activity area; its preserved thickness at the time of the 2012 excavation was between 20 and 0.40 cm. The five pits excavated there, measuring approximately 1 metre in diameter, are interpreted as hearths due to their high degree of

rubification (Marchand, 2017). A large hearth was also established in a natural basin 1.50 m in diameter, partially bordered by slabs laid out flat. In the midst of the shell deposit, a dense level of burnt granite blocks associated with oyster shells represents an important stratigraphic event, which has not yet been clearly interpreted. It covers the entire site and likely resulted from multiple clearings and restoration measures of the combustion structures. This layer seals off the upper part of the structures, although it is not always easy to separate them stratigraphically.

The site's periphery was equally devoted to activities, but also to dwelling spaces, which are recorded in a 30 to 40 cm silty-sandy layer laid on the rock surface or on the fractured fossil beach. Unfortunately, bones were not preserved outside the shell midden area. Post holes 15 to 0.20 cm apart mark the presence of two circular structures, each about 3.5 m in diameter and with large central pit-hearths lined with inclined granite slabs, ranging from 1.5 to 2 m in length (Figure 3; Marchand et al., 2018; Marchand et al., this volume). A number of functional interpretations have been considered for these two structures with large pit-hearths (wigwam, sweat lodge, drying and smoking facility, windscreen, etc.). The dwellings are marked by activities involving combustion. These are manifested by the presence of six different types of hearths (circular areas of burnt stones, basins lined with obliquely inclined slabs, hearths surrounded by slabs, small hearth framed by vertical slabs, fire pits without slabs, stone rings around a hearth inside a natural basin), probably used for a variety of activities, including cooking, domestic, craft, worship... The site plan shows a high degree of coherence, with very few overlaps between structures (Figures 4 and 5), which suggests few repeat occupations: This is already an initial temporal indicator. The arrangement of wedging stones used to hold stakes is more unclear for the northern structure (Structure V, Figure 4), which could be a sign of its age compared to the southern structure (Structure L, Figure 4). Other parameters give us access to finer temporal details, which allow us to better qualify mobility practices and the management of environmental cycles.

3. The gears of time, with every cog an artefact

3.1. An extended timeline based on radiocarbon dates

Several difficulties arose during the establishment of the chronology of the Late Mesolithic in Brittany, particularly within shell middens, where specific problems were encountered, such as the poor definition of the maritime reservoir effect's value or the occurrence of laboratory errors (Marchand and Schulting, 2019). At Beg-er-Vil, twenty dates were selected from short-lived samples. They were obtained from animal bones (roe deer) or charred twigs (Table 2, Figure 6). The synthesis presented here excludes dates obtained from shells and a human tooth due to variations linked to the maritime reservoir effect, although the roe deer may have grazed on some seaweed on the neighbouring foreshores. The dates thus retained span four centuries, between 7550 and 7125 uncalibrated years BP, i.e., between 6400 and 6030 cal. BCE (Figure 7). Furthermore, the terminus ante quem is the installation of the dune, dated by OSL within the 6400–5200 cal. BCE interval (Guérin et al.,

2021). These radiocarbon dates are distributed on either side of a small plateau in the calibration curve (Marchand and Schulting, 2019), at the time of the 8.2 ka BP / 6200 cal. BCE event (Alley and Ágústsdóttir, 2005). Two plateaus impact the calibration curve (INTCAL20), one around 7420 BP (i.e., 6380–6260 cal. BCE), the other around 7300 BP (6220–6080 cal. BCE); they widen the time intervals and obscure comparisons (Reimer et al., 2020).

The two oldest dates (BEV₁₃ and BEV₂₀) fall beyond these plateaus and point to an initial phase of occupation between 6400 and 6390 cal. BCE. The earliest one of these comes from structure G (BEV₁₃), a pit that was less than 5 cm deep when it was excavated. This feature had clearly been eroded and is therefore a residual one. The initial backfill (US 113) of pit-hearth L belongs to the same chronological period.

A second phase corresponds to charcoal collected under the angled slabs of structure L (BEV₂₃, BEV₂₄, and BEV₂₅) and to the backfill of hearth O situated away from the dwellings (BEV₂₂). However, the dates obtained are spread out, due to a plateau that marks the 6380–6230 cal. BCE interval.

The third set of dates is the most important one and suffers from the same propagation effect linked to a slightly more recent plateau. These dates occur between 6330 and 6070 cal. BCE, with a maximum probability between 6200 and 6100 cal. BCE (in descending order BEV₁₀, BEV₄, BEV₁₁, BEV₅, BEV₁₄, BEV₃, BEV₉, BEV₁₂, and BEV₂₁). They concern pit-hearths (V, AA, 85-1), a stone-bordered hearth (D), as well as the upper part of the fill of pit L (US 107). They also include charcoal samples not collected within structures below the level of burnt stones. The BEV₁₁ date obtained from a burnt twig poses problem since it comes from the stone level (US 5.3) but it is slightly older than an underlying date (BEV₇). Still, insofar as this stony level is the product of multiple cleanings of pit-hearths, it is easy to imagine that an older twig might have been displaced.

A set of five dates (BEV₂₇, BEV₆, BEV₇, BEV₈, and BEV₂₆) constitutes a fourth phase. After calibration, it is easier to make use of, as it escapes the plateaus of the curve. We can see in particular that the large hearth, AB, to the north of the central boulder, is the most recent of the structures dated at Beg-er-Vil, notwithstanding the discrepancy mentioned above between the two isotope readings (BEV₂₆ and 27), which nevertheless originate from the same stratigraphic unit. The sole date available for a stratigraphic unit above the bed of burnt stones is BEV₆, giving the interval 6220–5920 cal. BCE for the top of the shell midden, just below the dune.

The dates obtained from archaeological structures within the single level at Beg-er-Vil suggest a fairly significant chronological depth, spanning four centuries. This is not simply the result of the margins of errors inherent to this technique. Structure L, a vast hearth at the centre of a dwelling unit, yielded several dates spread over three centuries, bearing witness to a long period of use that we had not suspected, with probable clearing and restoration events.

Inventory no.	Stratigraphic Unit	Structure	Reference	BP	Error	Dated material	Accuracy	Inferior marker (68,2%)	Superior marker (68,2%)	Phase
BEV26	US 150	Structure AB	Lyon-18725	7125	35	Charcoal	Oak, evergreen	6029	5927	4

			(SacA-63402)				type - sapwood or duramen			
BEV8	Layer 3B – Sublevel 6	Shell midden	OxA-25916	7193	36	Animal bone	<i>Roe deer</i>	6071	6021	3
BEV7	Layer 3B - Sublevel 6	Shell midden	Beta-253153	7210	50	Fruit	<i>Pear</i>	6211	6010	
BEV6	Layer 3A – Sublevel 2	Shell midden	Beta-274301	7220	50	Fruit	<i>Pear</i>	6214	6017	
BEV27	US 150	Structure AB	Lyon-18726 (SacA-63403)	7235	35	Charcoal	<i>Deciduous oak - sapwood</i>	6214	6027	
BEV10	US 42	Structure E	Beta - 421804	7280	30	Charcoal	<i>Twig (Maleae)</i>	6218	6077	
BEV4	Layer 3B - Sublevel 6	Shell midden	Beta-253154	7300	50	Charcoal	<i>Twig (Maleae)</i>	6222	6086	
BEV11	US 5.3	Shell midden	Beta - 421805	7320	30	Charcoal	<i>Twig (Maleae)</i>	6227	6091	
BEV5	Layer 3B - Sublevel 9	Shell midden	OxA-25915	7332	35	Animal bone	<i>Roe deer (3rd phalanx)</i>	6232	6090	
BEV14	US 107	Structure L	Lyon-14906 (SacA-52518)	7335	30	Charcoal	Not available	6233	6091	
BEV3	Layer 3B – Sublevel 8-9	Structure 85-1	Beta-259108	7340	40	Charcoal	<i>Twig (Maleae)</i>	6236	6089	
BEV9	US 32	Structure D	Beta - 421803	7350	30	Charcoal	<i>Twig (Maleae)</i>	6240	6090	
BEV12	US 125	Structure V	Lyon-149814 (SacA-52742)	7355	35	Charcoal	Not available	6245	6089	
BEV21	US 132	Structure AA	Lyon-18720 (SacA-63397)	7360	40	Charcoal	<i>Amygdaleae, blackthorn type</i>	6334	6089	
BEV23	US 126	Structure L	Lyon-18722 (SacA-63399)	7415	35	Charcoal	<i>Amygdaleae, blackthorn type</i>	6368	6235	2
BEV25	US 126	Structure L	Lyon-18724 (SacA-63401)	7425	35	Charcoal	<i>Amygdaleae and Maloideae</i>	6371	6240	
BEV24	US 126	Structure L	Lyon-18723 (SacA-63400)	7440	35	Charcoal	<i>Maloideae</i>	6376	6246	
BEV22	US 131	Structure O	Lyon-18721 (SacA-63398)	7445	35	Charcoal	<i>Deciduous oak - sapwood</i>	6378	6250	
BEV20	US 113	Structure L	Lyon-18719 (SacA-63396)	7540	35	Charcoal	<i>Oak, evergreen type - sapwood</i>	6441	6390	1
BEV13	US 50	Structure G	Lyon-14905 (SacA-52517)	7550	30	Charcoal	Not available	6441	6398	

Tableau 2. Dates ¹⁴C obtenues à Beg-er-Vil sur des échantillons à vie courte (calibration à l'aide du logiciel OxCal 4.4, à partir de la courbe IntCal 20, intervalle de confiance à 68.2%, Bronk Ramsey, 2021; Reimer et al. 2020).
 Table 2. Radiocarbon dates obtained from Beg-er-Vil on short-lived samples (calibration using OxCal 4.4 software, based on the IntCal 20 curve, with a 68.2% confidence interval, Bronk Ramsey, 2021; Reimer et al. 2020).

3.2. A timeline set to the tide

As with the skeletons from the coastal site of Tévéc (Simões et al., 2024), the composition of the Beg-er-Vil shell midden reveals food resources that drew largely from the sea, with an added diversity factor thanks to the presence of mammals, birds, fish, crustaceans, and marine molluscs (Dupont and Marchand, 2021). Of these resources, many depend on the tide, either because they are accessible at low tide or because they may have washed up on the coast.

At Beg-er-Vil, the shellfish and crabs were evidently caught over the course of several days and undoubtedly at different tides. The first indicator of this is their abundance. For instance, over than 600 crabs have been recorded to date in an area of around fifty square metres (Dupont et al., 2023). Additionally, at Beg-er-Vil, as at other Mesolithic deposits in north-western France, the diversity of molluscs and crabs consumed has been observed not only in terms of the species present, but also in terms of the substrates and foreshore levels from which they originate (Dupont, 2006; Dupont et Gruet 2022, Dupont et al. 2023). All of the species large enough to be consumed were harvested by the hunter-gatherers of Beg-er-Vil. While some of them were accessible daily such as limpets and top shells, or nearly daily, such as oysters, mussels, carpet-shells, cockles, peppery furrow shells, dog whelks, edible crabs, and warty crabs, others, such as murex snails, and velvet and furrowed crabs, required higher tidal coefficients (greater than 90). The latter were probably only accessible for a few days each month (no more than 5 days out of 8 months of the year), without it being possible to assign a harvesting season to them. At Beg-er-Vil, these foreshore species contrast with the absence of shellfish accessible only during very high coefficients, for which wading in the water is necessary, such as abalones, scallops, great scallops, and cockles such as *Acanthocardia* sp. or *Laecardium crassum*. While these species were also consumed, the most accessible ones (visibility in relation to the substrate of rock species, higher foreshore levels) have been more heavily exploited. Within a 5 km radius, the distance often used to describe the daily range of hunter-gatherers, all the species found at Beg-er-Vil were theoretically accessible (Marchand and Dupont, 2018). Alongside the time spent travelling, these marine products also provide information regarding the consumption timeframe. This period is limited once molluscs and crabs have been harvested or fished. It could be a few days long by keeping these marine products in a cold, damp, iodised environment, such as in seaweed bundles. Yet, to date, no evidence has been found that these products were preserved to delay consumption.

The diversity of this low tide seafood also indicates that the foreshore was frequented at different tidal coefficients and in different parts of the coastline, providing access to a variety of seabed substrates. Species such as carpet-shells, cockles and peppery furrow shells require the sand or mud to be scraped away. For these to be caught effectively, they need to be spotted or reported, forcing regular visits to the fishing spots, which are governed by the rhythm of the tides.

Some other resources are dependent on tidal strandings. Such resources can however be gathered daily without their collection being dependent on the tidal cycle. This is the case, for example, of the pierced cowries (*Trivia* sp.) found in the shell midden, which were probably lost by the site's occupants, or of the flint pebbles used as raw material for the Beg-er-Vil lithic industry. Regrettably, these resources do not provide us with any temporal information about when the community was present at the site, in terms of the seasonal calendar, apart from the fact that it was necessary to have the time to walk around the foreshore near the site. Other strandings are more exceptional. They may be storm-related

or linked to the ethology of certain animals that move closer to the coast on a seasonal basis. This could explain the presence of grey seal at Beg-er-Vil. Since the remains are scarce this suggests that this animal was not hunted intensively. Although this hypothesis cannot be verified given the current state of evidence, the occurrence of spider crab allows us to establish that some food sources were seasonally accessed. Indeed, this species moves closer to the coasts as the waters warm up in late spring. It can then either be picked up washed up on the beach, or fished by wading into the water or by free-diving. However, as research currently stands, all the molluscs caught seem to have been harvested at low tide, with no consumption of species that can only be reached by walking in the water.

3.3. A seasonal timeline for animals and plants

Extracting information on the timescales associated with the plants and animals found at Beg-er-Vil is a painstaking task. Although the question of temporality is often discussed in relation to biofact accumulations on the scale of Atlantic Europe, it has to be said that the scientific demonstrations supporting this or that model of occupation are rare, or even absent from publications (Dupont, 2016). Thus, since the first excavations at Beg-er-Vil, data concerning the presence of these hunter-gatherer-fishers have been accumulating (Dupont, 2006; Dupont et al. 2009, Dupont and Marchand, 2021). This information evolves in parallel with the lapse of time required to analyse different animal and plant remains, including the ongoing sorting of the material, and the work of the disciplines involved in the archaeological process. We must not lose sight of the fact that the area containing well-preserved organic remains may represent a very small part of the original deposit, owing to coastal erosion and the gradual disappearance of organic remains, including the dissolution of shells. The homogeneity of the waste pile remains to be tested, both spatially and stratigraphically. Thus, in the current state of investigations, it is difficult to generalise about specific pieces of information that sometimes appear to us occasionally. By compiling the data obtained from the bioarchaeological record at Beg-er-Vil, we are able to understand several timescales. Some actions lasting a few seconds only are visible at the centre of the pile, including the punctual discarding of a handful of shells from a single species, such as dogwhelks (Marchand et al., 2018).

The preferred accessibility timetable for animal and plant species (Dupont et al., 2009) has been updated to include new discoveries such as hazelnuts (collected in autumn and consumed over the course of a year) and spider crabs (Figure 8). As mentioned above, the ethology of certain animals suggests that they were more likely to be caught at certain times of the year. For instance, based on the animals' current ethology woodcock and Mallard ducks were more abundant in winter (Dupont et al., 2009). Several bird species travel closer to the coastline during the nesting season, from mid-spring to the beginning of summer, such as the great auk and the razor-billed auk (Dupont et al., 2009). Beyond this period, they are offshore and not easily accessible to human populations. Their eggs may also have been valued, although to date none have been found at Beg-er-Vil. Similarly, some fish come close to the coast during the hottest part of the year and can be caught more easily. This is the case of the school shark and gilthead sea bream (Dupont et al., 2009; Figure 8).

Although carpet-shells can be harvested all year round, a study of the growth of specimens from Beg-er-Vil has shown that they were collected at two periods, in early spring and early

autumn. Similarly, based on the seasonal stranding of spider crabs, it seems that Mesolithic people were present at Beg-er-Vil at least in late spring.

When it comes to fruit, while hazelnuts can be kept for more than a year, pears are eaten shortly after ripening, in autumn. The combination of these data shows that, theoretically, these Mesolithic maritime populations had access to food all year round. Unfortunately, given the hundreds of possible years of occupation, this idea does not allow us to know whether this potential year-long presence was continuous or if it is simply the result, misleading to the archaeologist, of a series of stays.

3.4. A short timeline according to lithic industries?

Dating by typological analogy allows us to assign the lithic assemblage to the Late Mesolithic (7th - 5th millennium), which is characterised in continental Western Europe by the use of trapezes and triangles, notched blades, and indirect percussion debitage (Marchand and Perrin, 2017). The types of trapezes and triangles found in France were transformed over this 1,500 years-long phase, as was the case during the Teviecian of Brittany (Kayser, 1992). At Beg-er-Vil, symmetrical trapezes with abrupt retouch, which functioned as transverse arrows, were almost the only tool form unearthed, numbering 450, in contrast to what was found at the shell deposit sites of Téviec and Hoedic (Calvo Gomez et al., 2021; Calvo Gomez, 2023). This type of typological homogeneity of the arrowheads is observed for small find-sites in valley bottoms in the north and east of France (Séara, 2000; Ducroq, 2001). They are most often evidence of brief hunting camps considered to be short occupations. However, we are dealing here with a settlement with heavier structures; with an assemblage of almost 40,000 lithic artefacts collected over an area of 180 m²; clearly, this notion of a short timeframe needs to be put into perspective.

The process of producing lithic tools corresponds to another type of temporality, recorded in particular by the successive removal of blanks from cores: each of these removal operations carries with it a temporal sequence, often lasting a few minutes. However, the transfer of cores from site to site can extend the timeframe over several months, or years. At Beg-er-Vil, refittings proved impossible given the sheer volume of finds, the high degree of patina that seemed to homogenise all the materials (around 80% of the artefacts), and the large number of burnt pieces (25% of the recorded finds; 31% of the sieved ones). As things stand, it is impossible to judge whether these objects were carried away from dwelling spaces, either when people changed their place of residence or, in the case of arrowheads, when they went hunting. The lithic technology is therefore less eloquent here than at "poorer" sites.

3.5. A drawn-out timeline according to sedimentary records

The determination of the processes involved in the formation of shell middens using sedimentary records has been the subject of recent studies, albeit still limited in number. The initial results testify to their importance in helping to define the duration and rates of mobility of maritime hunter-gatherers (Villagran, 2014; Aldeias and Bicho, 2016; Duarte et al., 2019; Villagran, 2019, Villagran et al., 2021). The shell deposit at Beg-er-Vil displays an observed stratigraphic sequence of 20–40 cm, consisting of three dark brown to black, silty-sandy layers with varying proportions of gravel and fragments of numerous shells (Figure 9). Only one level of oyster shells is clearly distinguishable. A geoarchaeological study of the

sedimentary records based on a micromorphological analysis of soils and archaeological sediments and a micro-stratigraphic analysis has aimed to determine the nature, and temporal and spatial relationships, of deposits of natural or anthropogenic origin (Cammass and Wattez, 2009; Marchand et al., 2018). It draws on a two-pronged approach, functional and temporal (Gé et al., 1993; Cammass et al., 1996; Villagran et al., 2011; Villagran 2014; Onfray, 2017; 2019). The latter is designed to clarify: 1/ the accretion rates of archaeological remains (nature and thickness of accumulations); 2/ the natural pedo-sedimentary markers (biological activity and sedimentation) and the breaks present in the layering processes of the stratigraphy, which, through the gradient of the resumption of natural activity, bear witness to episodes of settlement abandonment.

Among the stratigraphic sequences at the heart of the shell midden sampled between 2013 and 2018, the synthesis of the results obtained provides some preliminary discussion points regarding the duration(s) of occupation of the Beg-er-Vil camp (Figure 9 and 10 A and B). The first signs of a Mesolithic occupation appear below the shell level. The upper part of the fossil beach corresponds to a cumulic soil made up of a succession of short-distance lateral deposits (fine colluvium) approximately 1 cm thick. They are formed from elements resulting from the dismantling of the fossil beach (pebbly gravel) and a cambisol with luvic behaviour. These inputs were patterned by the formation of textural crusts in response to surface runoff during rainfall events. Indicators of biological activity suggest that the landscape environment was open, with a low, discontinuous vegetation cover. Over time, rare fragments of shells and fish bones were deposited on the surface. Their orientation and placement in this short-distance colluvial layer preclude any possibility of infiltration of these elements from the shell level. Rather, their presence should be seen as an indirect sign of a Mesolithic camp located no more than a few dozen metres away. This may have come from an initial occupation, for example in connection with structure G attributed to "phase 1 of the radiocarbon dates", or from the same occupation, which either witnessed a shift of the habitat area over time, or an extension of this area.

An accumulation of domestic waste materials that can be classified into two categories was responsible for the shell midden: thin materials, between 5–12 mm, and thicker ones, averaging 20 mm. Shells, fish bones, mammal bone fragments, burnt or unburnt, as well as charcoal pieces and a few ashy deposits were found in a brown to dark brown loam sedimentary mass containing organic microparticles indicative of the brunified aspect of the soil (Figure 10 C). This type of input is more likely to have resulted from the maintenance of combustion structures and occupation floors (cleaning, sweeping) located inside huts and in their immediate periphery (Villagran et al., 2011). This type of facies has rarely been identified, to our knowledge, within shell midden sequences dominated by consumption waste and characterised by an accumulation of shells with few sedimentary intrusions between them (Duarte et al., 2019). At Beg-er-Vil, this type of facies has only been described exceptionally elsewhere (Figure 10 D).

Throughout the entire depth of the preserved shell level, the microstratigraphic analysis of the sequences reveals a succession of more than twenty dumping episodes. This number may seem low, suggesting a brief occupation. However, it is important to bear in mind that the studies performed only focused on the periphery of the shell mound (min. 125 m²) and these discards should not be regarded as continuous micro-layers over the entire mound area, but rather as discontinuous and localised lenses testifying to as many episodes of

discard, which would suggest either a long occupation period spanning several months, or several phases of occupation lasting a few weeks.

The upper part of the waste heap functions as a real activity surface which recorded the frequentation of the space by trampling. Beyond being a discard area, the shell midden, through the presence of pits and combustion structures, also evolved as a circulation and activity space. Variations in the degree of trampling can be distinguished within the stratigraphic sequences, indicating fluctuations in circulation zones over time (Figure 10 E). These activity surfaces also recorded the meteorological conditions of their contemporary environment. We find active surfaces that operated in rather dry conditions, but others that evolved in rather wet conditions, with the presence of textural crusts linked to runoff testifying to alternating wetting and drying periods of the soils (Figure 10 F), which is difficult to relate to specific seasonal meteorological changes.

Although the observed stratigraphy of this pile is poorly developed, it does not reflect a "short term occupation" lasting just a few days, but rather a "long term occupation" lasting several months, or a succession of occupations lasting several weeks. Microstratigraphic analysis did not reveal any natural deposits (e.g., aeolian sands or fine colluvial deposits) for any of the sequences studied, which would have sealed off two episodes of occupation and indicated periods of non-occupation of the site, as was the case at other shell midden sites (Duarte et al., 2017; Villagran et al., 2011).

Likewise, while the accumulation of organic matter in the refuse heap encouraged the development of biological activity (Figure 10 G), natural processes never became dominant in comparison with anthropogenic processes, suggesting that any periods of abandonment that may have occurred were only temporary and too brief to be recorded at the scale of the soil. Thus, the interpretation of the sedimentary records reveals a long period of residency, but it does not rule out successive short-term moves (a few weeks). It demonstrates that this shell midden, which grew in size and depth as periods of occupation accumulated, became a feature of the soil and of the landscape, providing a real anchor point for Mesolithic communities.

4. Conclusions and perspectives: Short timelines, long timelines, cyclical timelines

The alleged increased sedentism of Mesolithic communities as Neolithisation neared is nothing more than an old evolutionary paradigm, often asserted and not seriously pondered. Our aim was to examine the data differently to break away from this tiresome finalist perspective. The seemingly contradictory analysis of chronological indicators unearthed at Beg-er-Vil made for a much more exciting investigation.

With its ostensibly single layer sealed by a two-metre-thick dune, Beg-er-Vil is a highly legible site compared to other Atlantic Mesolithic settlements. It allows us to delve deeply into the timescales of one of the bases of collective mobility used at the end of the Mesolithic. Still, the research process is a long one, requiring us to carefully manage the information we can extract and the limits of each type of data. Each of us has brought to

the table different chronological elements—our “pieces of time”—whose appreciation is a direct function of the frames of reference of the disciplines involved. The Beg-er-Vil site therefore illustrates:

- The timeframe tied to a single type of arrowhead, which theoretically should be short but whose length is called into question by other time sensors,
- The extended timeline provided by radiocarbon dates (four centuries),
- The prolonged period of all combined harvesting seasons for plants and animals (all seasons),
- The short, cyclical duration of the tide visible through marine invertebrates (between 4 and 6 hours),
- The timeline of tides with coefficients greater than 90 (on average 5 days 8 months of the year),
- The prolonged timeframe of the sedimentary records of the shellfish heap (indicating the community occupied this space once or several times, but always with limited periods of absence),
- The fleeting time spent discarding a handful of shells, knapping flint, cleaning a floor, building a hut, a hearth or a pit... (a few seconds to a few hours).

As with Jean Tinguely's “Fatamorgana”, created in 1985, archaeologists are trying to reconstruct a mechanism, while remaining well aware that we are missing wheels and that not all timeframes are uniform. Much like the elements that make up the “Fatamorgana”, each of these gears, objects, or wheels driven by a belt of different diameter, notch spacing, and speed may correspond to a cycle, some producing cyclical movements, others pendular ones, whose pace may be altered by natural or anthropic events. In this way, we may look at populations over several generations, or a single human generation, a year, or the cycle of the seasons, the cycle of the tides, or even the rhythm of the tides over the course of a day. The challenge is to fit all these cogs together without losing any information, while resisting the temptation to extrapolate excessively. While it can be shown at two different points in the midden that carpet shells were collected and probably eaten in early spring and early autumn, it cannot be deduced from this that the site was occupied only during these two seasons, as this analysis remains to be carried out over the entire excavated area of the midden. The initial results of micromorphological analyses have revealed intercalations of natural deposits between the occupation layers found outside of the shell midden, indicating periods when certain parts of the site were not occupied (Marchand, Onfray et al., this volume). By combining the sedimentary readings of the shell mound, of the occupation layers at different locations within the camp, and of the combustion structures, it will be possible to propose more detailed occupation scenarios. At present, radiocarbon age determinations do not allow us to describe accretion phases inside the shell layer. Events seem to follow one another with no way for us of stretching the timeline. It would therefore be advisable to obtain new radiocarbon dates and compare them with a Bayesian model in order to better assess the development of the midden. The diversity of environments (forest, cliff, foreshore, etc.), of substrates (rock, sand, mud), of species and even individuals (size variations observed for molluscs and crustaceans) increases as we sort through this refuse heap. This midden bears witness to an osmosis between humans and the natural resources around the site (Dupont et al., 2010; Dupont and Marchand 2021). In light of current research, it remains difficult to know whether this

predation has had an impact on the resources available, both in terms of quantity and period of presence.

The diversity of resources highlighted by the time-consuming process of excavating, sorting, and studying the components of a shell midden conceals activities that took place in the vicinity of these Mesolithic people's habitat. For example, underlying the many animal, plant, and mineral resources is the time spent searching for them along the shoreline, in the forest, on a cliff, during the low tide, in the sand or mud for burrowing bivalves, or dislodging them, like crabs, from under rocks and crevices.

Similarly, the diversity of marine invertebrates present in the Beg-er-Vil shell midden brings to light another temporality: that of the long-term transmission of fishing spots, which may have been passed down over several generations (Dupont and Marchand, 2021). In fact, the diversity observed, involving both species visible on the rocks as well as those requiring digging in the ground, did not occur by chance. The quantities and sizes of the different species of molluscs and crabs identified indicate that these resources were actively targeted. This diversity could not have been achieved in the space of a few days, as the fishing zones had to be found and tested before fishing became effective. These practices are well documented in contemporary coastal traditions, although it is difficult to prove this for the Mesolithic period, since these transmissions are oral ones.

The investigation into these « pieces of cyclical time » is continuing to help us understand when Mesolithic people occupied the site of Beg-er-Vil. While in theory the occupants were able to remain year-round at this habitat site from the point of view of the accessibility of the food resources available, precise temporal markers are still needed. For a number of molluscs (European carpet shells, flat oysters, top shells, or limpets) several investigations are underway, including the compilation of collection snapshots, an analysis of the period during which firewood was collected, and new methodologies to mammal faunas such as cementochronology. The pace of change in techniques and tools also needs to be better measured, as does the time it takes for structural crusts to form on activity surfaces within soil layers. Even if we can draw closer to this temporality at the scale of a site by means of archaeological evidence, defining a precise chronological scenario remains a challenge, given that the archaeologist's field of vision remains fragmentary in view of the passage of time, which little by little erases the evidence of any anthropic presence. The same challenge needs to be tackled when it comes to Neolithic coastal sites, where concrete archaeological evidence of sedentarisation, such as snapshots of presence according to an annual calendar, are rarely explored (Dupont, 2016).

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Figures

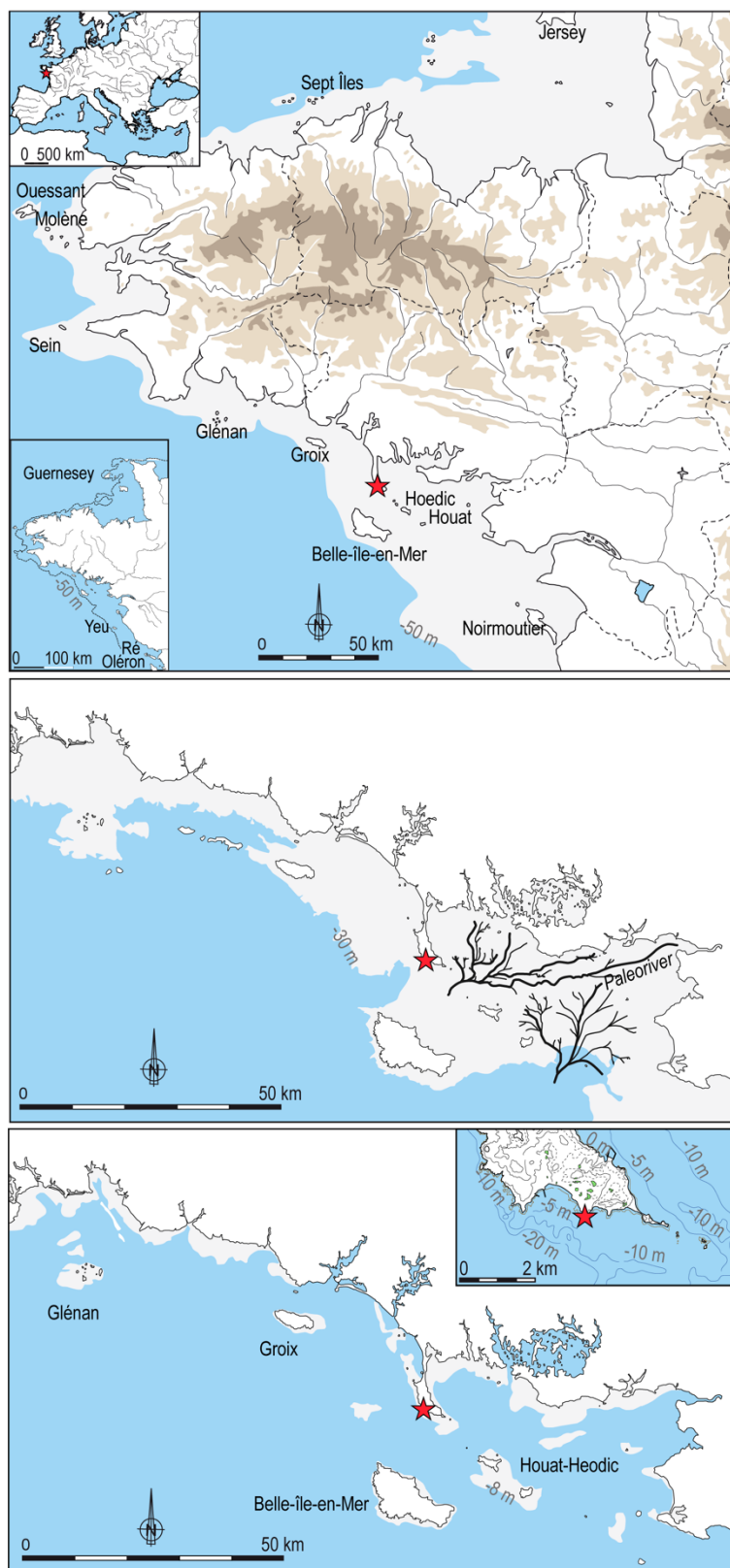


Figure 1. Location of the Berg-er-Vil site and of the islands based on bathymetric curves (CAD L. Quesnel, G. Marchand, and C. Dupont, from Menier 2004 and Marchand, 2013).



Figure 2. Northern view of the sandy area (as it was in 2017) (photograph: G. Marchand).



Figure 3. Pit-hearth (structure L) at the center of one of the habitation units (photograph: G. Marchand).

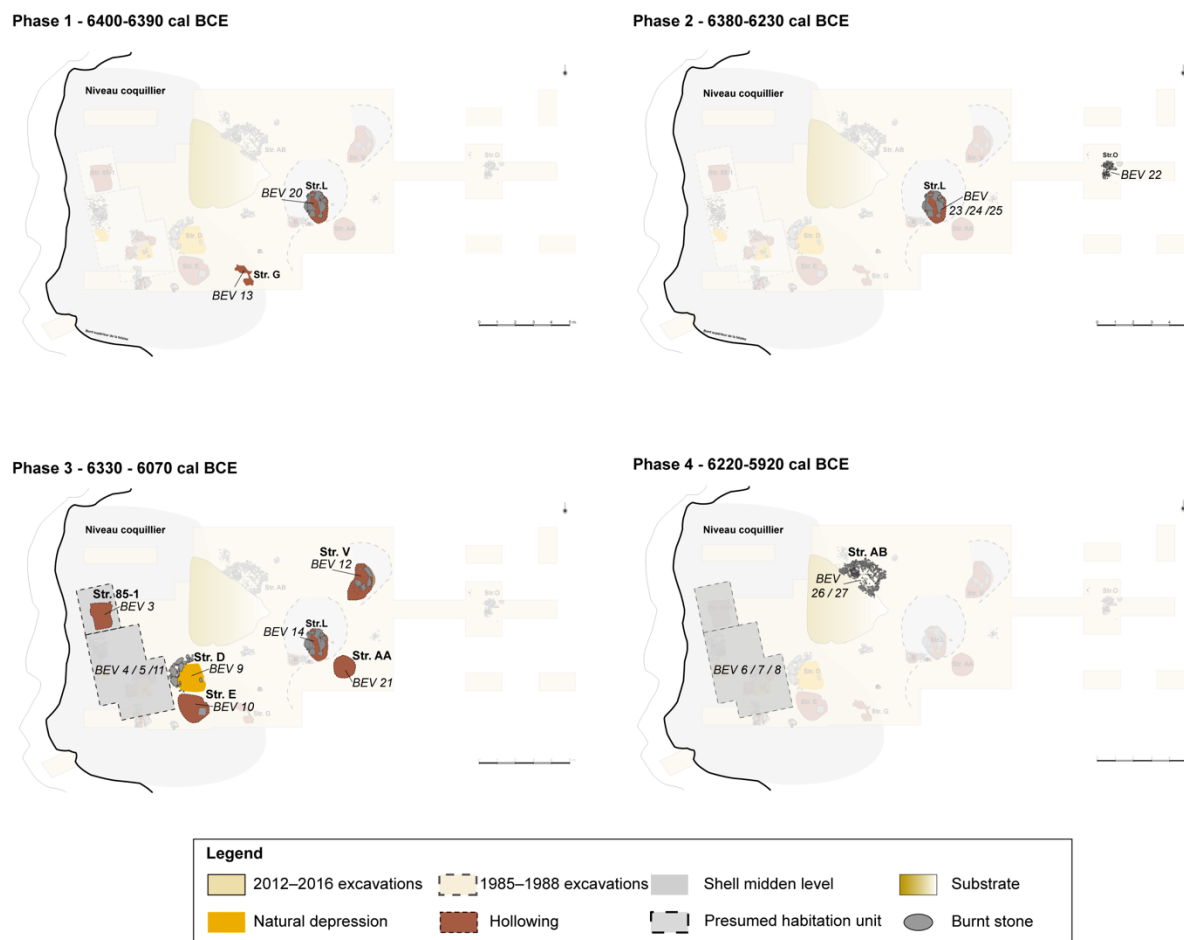


Figure 4. Global plan of the Beg-er-Vil site and detail of the structures dated based on the four proposed occupation phases.

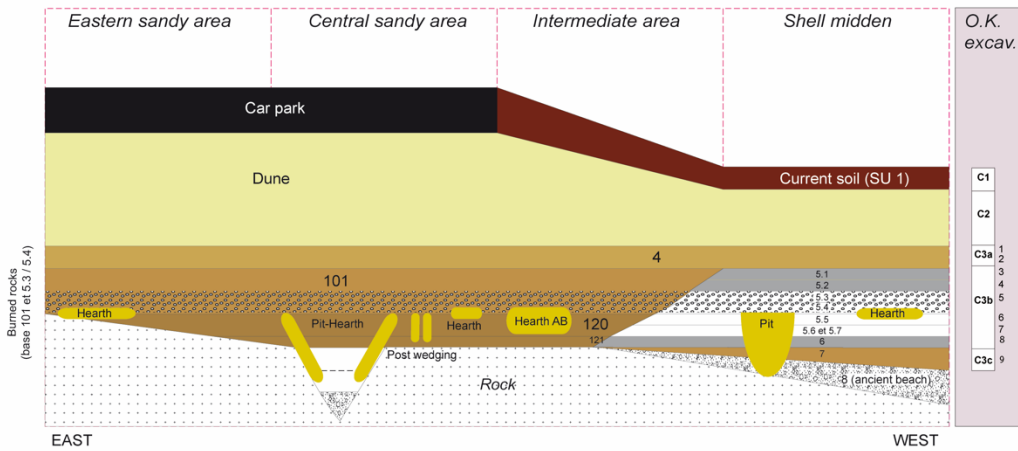


Figure 5. Schematic cross-section from east to west of the Beg-er-Vil site, showing the location of the structures (CAD: G. Marchand).

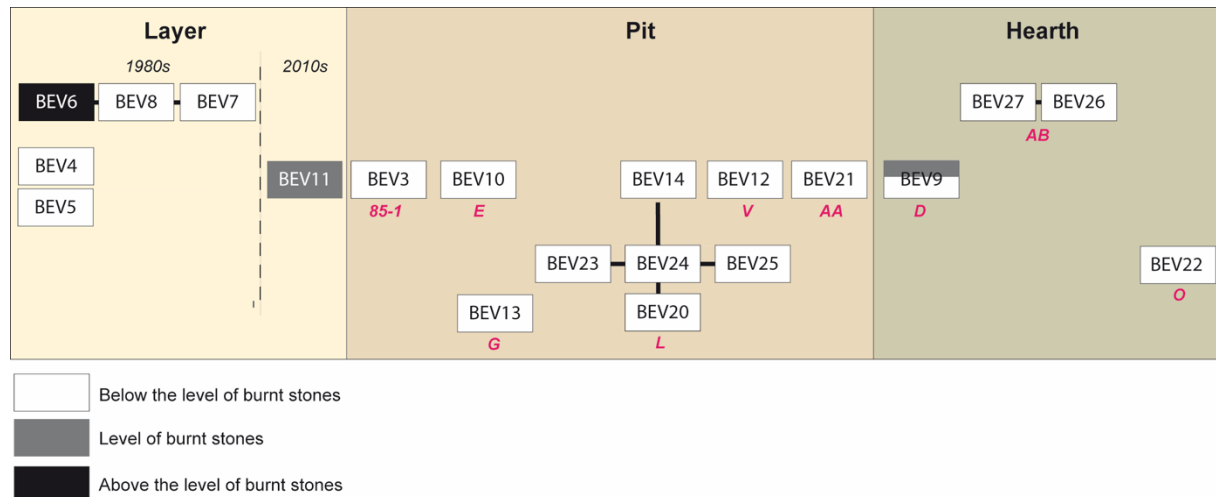


Figure 6. Stratigraphic situation of dated samples (BEV5: roe deer bones, BEV7 and BEV8: pear; all others: charcoal). The name of the structure is in red. The burnt stone level covering the site is indicated. Most of the dated samples were collected in underlying deposits (CAD: G. Marchand).

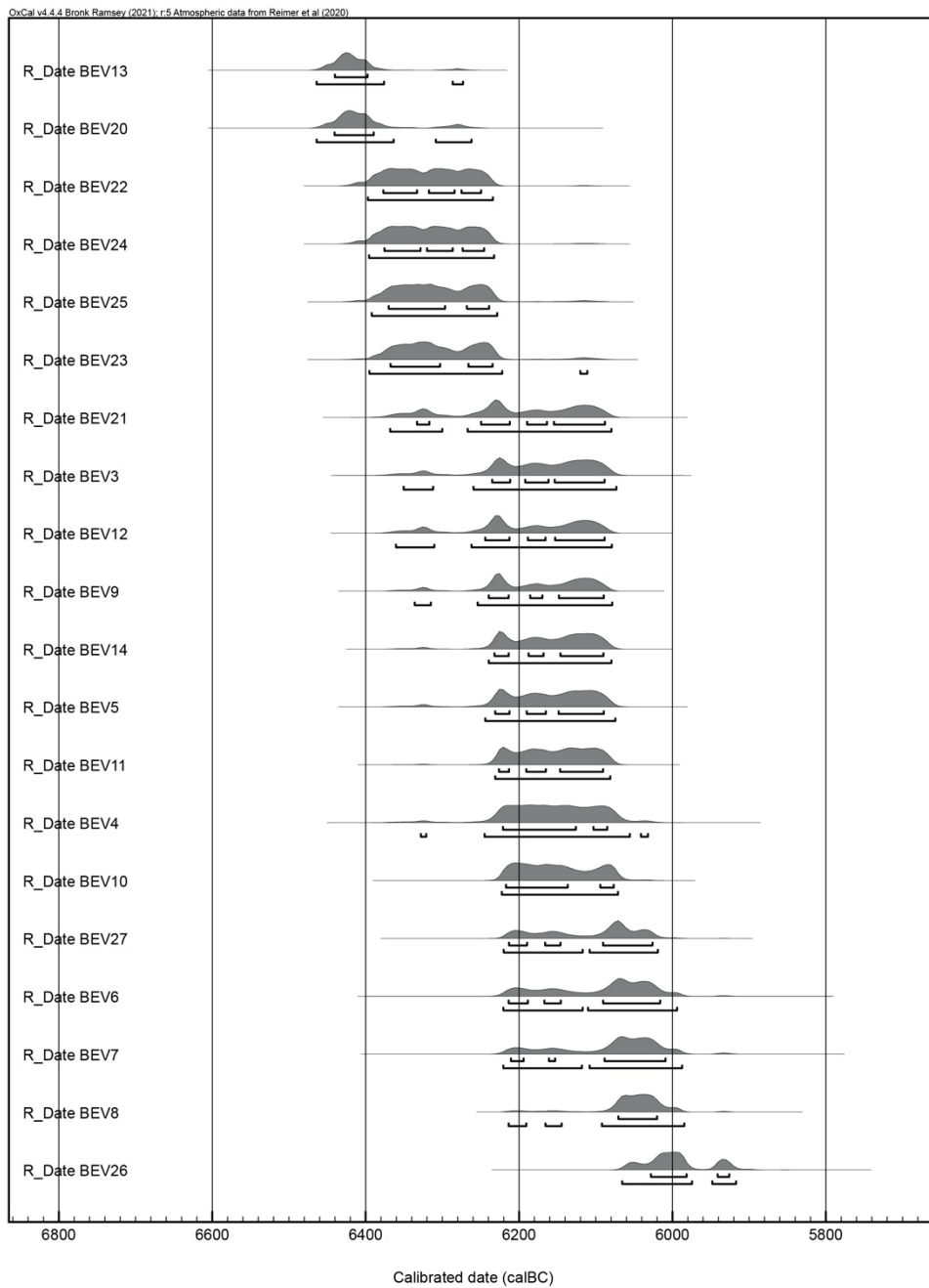


Figure 7. Dates obtained from charcoal samples and roe deer bones (INTCAL20, Reimer *et al.* 2020).

Artefacts	Species	Season of availability				Biotope of accessibility	Accessibility depending on the tide			
		Winter	Spring	Summer	Autumn		Intertidal			Subtidal
							High seashore	Middle seashore	Low seashore	
Marine and terrestrial birds	Razorbill <i>Alca torda</i>		+			Exposed coast				
	Great auk <i>Alca impennis</i>		+			Rocks, cliffs				
	Guillemot <i>Uria aalge</i>		+	+		Sheltered coast				
	Woodcock <i>Scotopax rusticola</i>	+	?	?		Coastal waters				
	Mallard <i>Anas platyrhynchos</i>	+			+	Wooded zone				
Marine molluscs	Limpet <i>Patella</i> sp.					Rocky shore				
	Thick topped shell <i>Phorcus lineatus</i>									
	Dogwhelk <i>Nucella lapillus</i>					Muddy rocky shore				
	European sting wrinkle <i>Ocenebra erinaceus</i>									
	Periwinkle <i>Littorina littorea</i>					Muddy sand				
	Mussel <i>Mytilus edulis</i>									
	Flat oyster <i>Ostrea edulis</i>					Mud				
	Carpet shell <i>Ruditapes decussatus</i>									
	Cockle <i>Cerastoderma edule</i>									
	Peppery furrow shell <i>Scrobicularia plana</i>									
Marine fishes	All fishes					Coastal waters				
	Tope <i>Galeorhinus galeus</i>			+						
Fruits	Gilthead <i>Sparus auratus</i>			+						
	Wild pear <i>Pyrus cordata</i>				+	Wooded zone				
Marine crabs	Hazelnut <i>Corylus avellana</i>				+	Wood-land edges				
	Edible crab <i>Cancer pagurus</i>					Rocky shore				
	Warty crab <i>Eriphia verrucosa</i>									
	Velvet swimming crab <i>Necora puber</i>					Rock with mud				
	Furrowed crab <i>Xantho</i> sp.									
	Green crab <i>Carcinus maenas</i>					Sand next to rocks				
Marbled rock crab <i>Pachygrapsus</i> sp.										
Marine and terrestrial mammals	Spider crab <i>Maja squinado</i>		+							
	All mammals					Coastal waters				
Wood	All wood species					Rocky shore				
						Wooded zone				
					Wood-land edges					
					Wooded zone					
					Wood-land edges					

Figure 8. Seasonal accessibility and biotopes of harvested resources at Beg-er-Vil (dark blue: period of greatest accessibility, light blue: potential accessibility; white: resources not accessible; Dupont and Marchand, 2021, CAD C. Dupont CNRS).

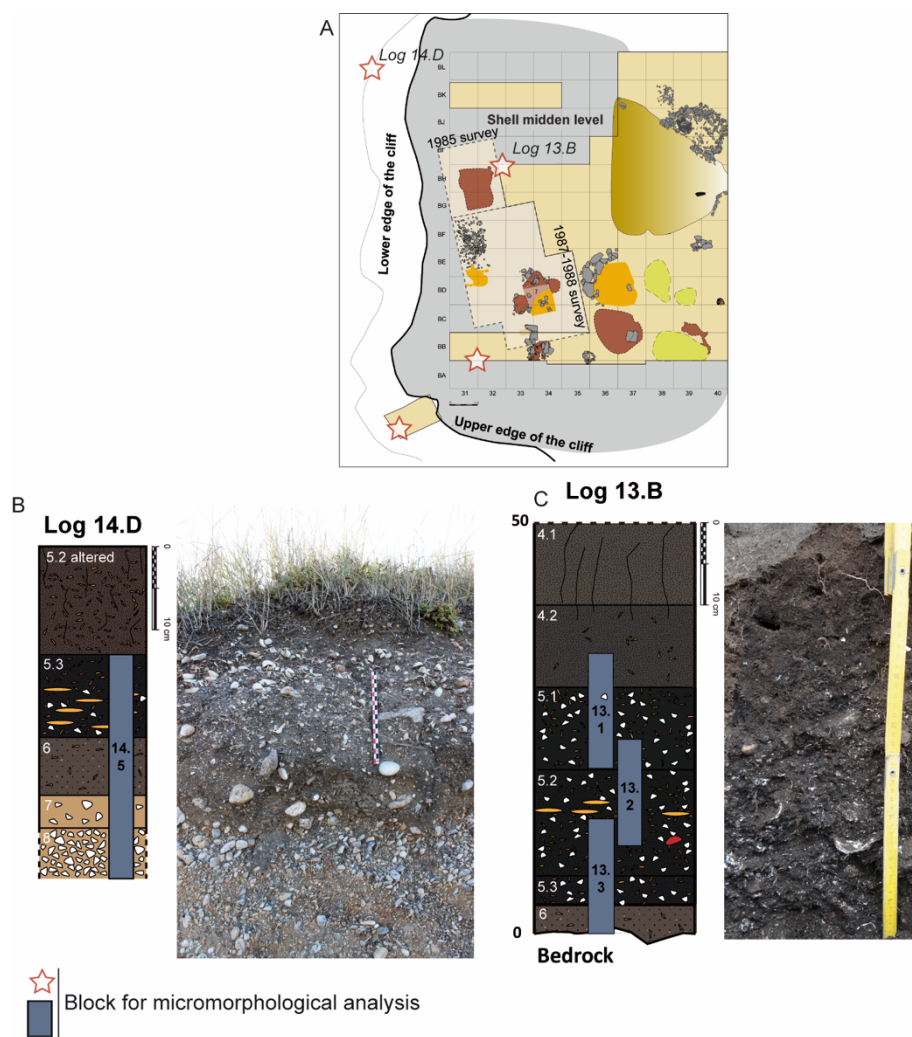


Figure 9. A: Location of the pedo-sedimentary sequences recorded and sampled in the area of the shell midden (plan modified from L. Quesnel and G. Marchand); B: Log and photograph of sequence 14.D; C: Log and photograph of sequence 13.D (Logs and photographs: M. Onfray).

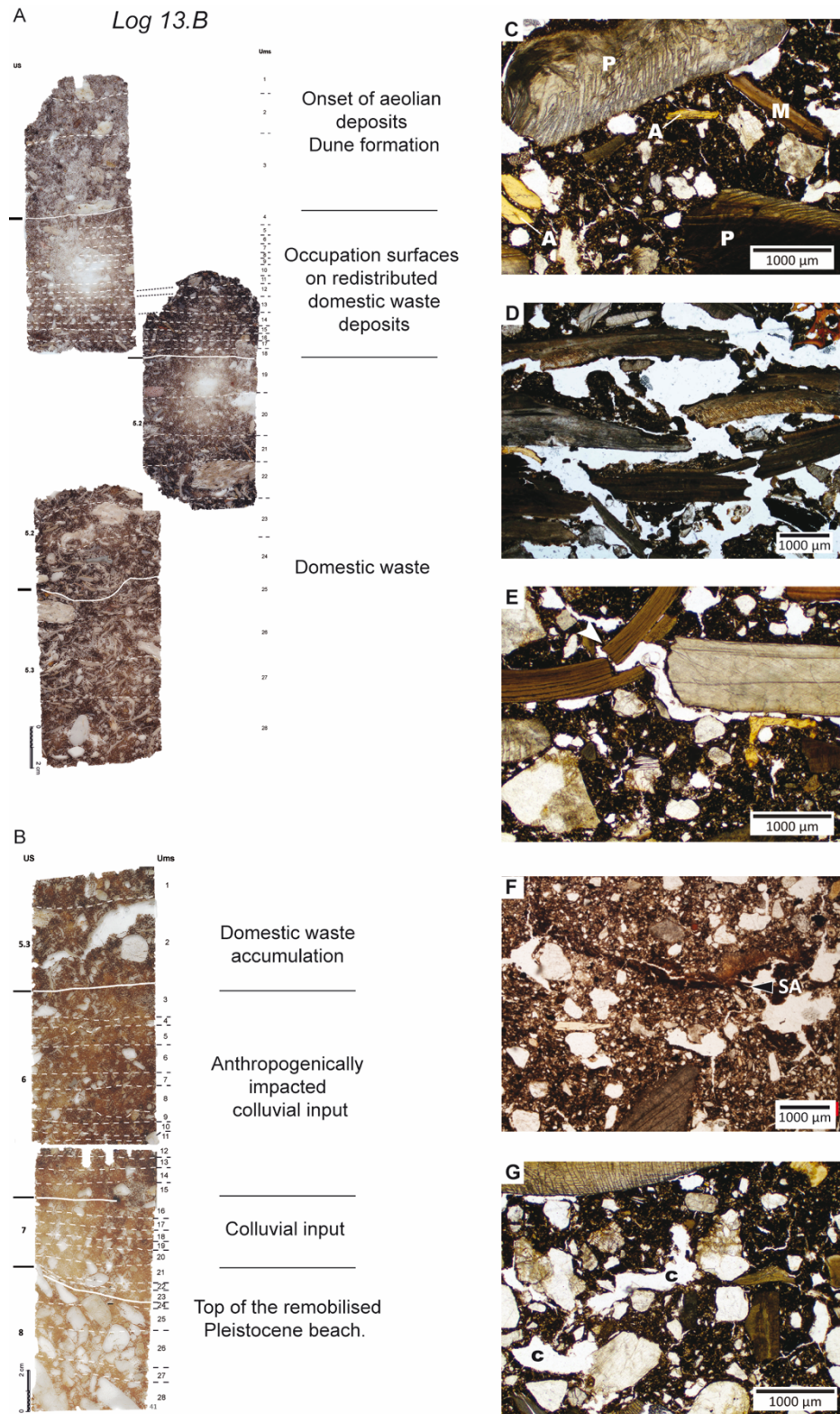


Figure 10. A: Microstratigraphy of sequence 13.D (thin section scans); B: Microstratigraphy of sequence 14.D; C: Domestic waste consisting of burnt shells (P: limpet and M: mussel) and burnt fish bones (A) embedded in a dark brown silty-clay sedimentary mass rich in organic micro-particles; D: Consumption waste: accumulation of large shells organised sub-horizontally, and rare fish bone fragments, high stacking porosity, with low amount of fine matter between these constituents; E: trampled activity surface (fractured shells); F: heavily trodden activity surface in wet setting;

clay-loam textural crust; G: evolving horizon showing alternating moistening/drying phases (development of the cavity and crevice porosity). (Thin section scans and photographs: M. Onfray).

Tables

Phase	Dates (cal. BC)	Islands
1	10 th and 9 th millennia	Ouessant, Guernesey
2	8500 - 7500	Sept-Îles, Sein
3	7500 - 6500	Palaeo-island of Houat-Hoedic, Groix, Belle-Île-en-Mer, Jersey, palaeo-island of Glénan, palaeo-island of Molène
4	6500 - 6000	Yeu
5	After 6000	Ré, Oléron, Noirmoutier

Table 1. Phases of separation of today's islands from the continental landmass. We define as palaeo-island the ancient unified form of a present-day archipelago.

Inventory no.	SU	Structure	Reference	BP	Error	Dated material	Accuracy	Inferior marker (68,2%)	Superior marker (68,2%)	Phase
BEV26	US 150	Structure AB	Lyon-18725 (SacA-63402)	7125	35	Charcoal	<i>Oak, evergreen type - sapwood or duramen</i>	6029	5927	4
BEV8	Layer 3B – Sublevel 6	Shell midden	OxA-25916	7193	36	Animal bone	<i>Roe deer</i>	6071	6021	
BEV7	Layer 3B - Sublevel 6	Shell midden	Beta-253153	7210	50	Fruit	<i>Pear</i>	6211	6010	
BEV6	Layer 3A – Sublevel 2	Shell midden	Beta-274301	7220	50	Fruit	<i>Pear</i>	6214	6017	
BEV27	US 150	Structure AB	Lyon-18726 (SacA-63403)	7235	35	Charcoal	<i>Deciduous oak - sapwood</i>	6214	6027	3
BEV10	US 42	Structure E	Beta - 421804	7280	30	Charcoal	<i>Twig (Maleae)</i>	6218	6077	
BEV4	Layer 3B - Sublevel 6	Shell midden	Beta-253154	7300	50	Charcoal	<i>Twig (Maleae)</i>	6222	6086	
BEV11	US 5.3	Shell midden	Beta-421805	7320	30	Charcoal	<i>Twig (Maleae)</i>	6227	6091	
BEV5	Layer 3B - Sublevel 9	Shell midden	OxA-25915	7332	35	Animal bone	<i>Roe deer (3rd phalanx)</i>	6232	6090	
BEV14	US 107	Structure L	Lyon-14906 (SacA-52518)	7335	30	Charcoal	Not available	6233	6091	
BEV3	Layer 3B – Sublevel 8-9	Structure 85-1	Beta-259108	7340	40	Charcoal	<i>Twig (Maleae)</i>	6236	6089	
BEV9	US 32	Structure D	Beta-421803	7350	30	Charcoal	<i>Twig (Maleae)</i>	6240	6090	
BEV12	US 125	Structure V	Lyon-149814 (SacA-52742)	7355	35	Charcoal	Not available	6245	6089	
BEV21	US 132	Structure AA	Lyon-18720 (SacA-63397)	7360	40	Charcoal	<i>Amygdaleae, blackthorn type</i>	6334	6089	
BEV23	US 126	Structure L	Lyon-18722 (SacA-63399)	7415	35	Charcoal	<i>Amygdaleae, blackthorn type</i>	6368	6235	
BEV25	US 126	Structure L	Lyon-18724 (SacA-63401)	7425	35	Charcoal	<i>Amygdaleae and Maloideae</i>	6371	6240	
BEV24	US 126	Structure L	Lyon-18723 (SacA-63400)	7440	35	Charcoal	<i>Maloideae</i>	6376	6246	
BEV22	US 131	Structure O	Lyon-18721 (SacA-63398)	7445	35	Charcoal	<i>Deciduous oak - sapwood</i>	6378	6250	
BEV20	US 113	Structure L	Lyon-18719 (SacA-63396)	7540	35	Charcoal	<i>Oak, evergreen type - sapwood</i>	6441	6390	
BEV13	US 50	Structure G	Lyon-14905 (SacA-52517)	7550	30	Charcoal	Not available	6441	6398	

Table 2. Radiocarbon dates obtained from Beg-er-Vil on short-lived samples (calibration using OxCal 4.4 software, based on the IntCal 20 curve, with a 68.2% confidence interval, Bronk Ramsey, 2021; Reimer et al. 2020).