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Early human occupations at the Westernmost tip of Eurasia: the lithic industries from Menez-Dregan I (Plouhinec, Finistère, France)

Premières occupations humaines à la pointe occidentale de l'Eurasie : les industries lithiques de Menez-Dregan I (Plouhinec, Finistère, France)

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Abstract

The stratigraphical complex preserved at the site of Menez-Dregan I (Brittany, France) displays an alternating sequence of 17 occupation levels and of 4 marine deposits, between ca. 450 and 150,000 years (stratigraphical units 9a and 3b). The lithic industry retrieved at the site is extremely abundant, with more than 153,000 artefacts over 3 cm in length, as well as millions of knapping debris, and corresponds to a regional facies of the Acheulean, with heavy-duty tools essentially represented by choppers, as well as a few handaxes and cleavers. This paper presents a first synthesis of the data produced for almost 30 years on the site of Menez-Dregan I. The typological study of the entire lithic collection is now complete, and allows us to assess the different human occupations that occurred at this site during the Lower Palaeolithic.

Résumé

Le complexe stratigraphique conservé à Menez-Dregan I (Bretagne, France) présente une alternance de 17 niveaux d'occupation et de 4 dépôts marins, entre environ 450 et 300 000 ans (US 9a et 3b). L'industrie lithique retrouvée sur le site est extrêmement riche (plus de 153 000 artefacts supérieurs à 3 cm de longueur, ainsi que des millions de débris de taille), et correspond à un faciès régional de l'Acheuléen, dont le macro-outillage est essentiellement représenté par des choppers, ainsi que par quelques bifaces et hachereaux. Cet article présente une première synthèse des données produites depuis presque 30 ans sur le site de Menez-Dregan I. L'étude typologique de l'ensemble de la collection lithique est à présent achevée, et permet de faire le point sur les différentes occupations humaines qui se sont succédé sur ce site au cours du Paléolithique inférieur.

1. Introduction

The site of Menez-Dregan I is located on the coast of the city of Plouhinec, in Finistère, north-western France (fig.1). It is more specifically located on the Souc'h tip, in a corridor of marine erosion opening at 7m above the current average sea level, the roof of which has gradually collapsed, thus allowing the preservation of the deposit. Therefore, at each marine transgression, the collapsed roof blocks would have decreased the erosive action of the Atlantic Ocean. The deposit is currently located in the cliff, just above the sea level (fig.2). Palaeoenvironmental data indicate that during the prehistoric occupation of most of the archaeological levels, the sea level was much lower, with a shoreline probably 5 to 10km further than the current one (Lefort et al., 2007, 2016). Thereby, during these phases of occupation, the deposit stood at the top of a high plateau and opened onto a vast landscape, providing a strategic shelter for hominins giving them an ideal position above the plain (Monnier et al., 2016a, 2016b).

The deposit of Menez-Dregan I was discovered in 1985 by B. Hallégouët, a geographer from the University of Brest, who studied fossil beach deposits in the area. It was by clearing cliff sections at the Souc'h tip that he discovered the site, which led him to alert J.-L. Monnier, specialist of the Palaeolithic of the Brittany region (UMR 6566 CReAAH). There followed two years of exploratory surveys in 1988 and 1989 on Menez-Dregan I and Menez-Dregan II, which is located a little further west of the first site. These first two surveys confirmed the importance of the site of Menez-Dregan I, as well as the abundance of the lithic artefacts. In 1991 the excavation of Menez-Dregan I started, continuing for two years, under the frame of a "planned rescue excavation". These two excavation seasons unambiguously confirmed the potential of the preserved archaeological remains (Hallégouët et al., 1992), and led to a multidisciplinary program of the UMR 6566 CReAAH (Monnier et al., 1996a, 1996b; Ravon (dir.), 2018) which permitted excavations on the site every summer since 1991 without interruption, except in 1996, when the post-excavation operations and analyses were prioritised.

This paper presents a first synthesis of the data produced from almost 30 years of excavations at Menez-Dregan I. The preliminary typological study of the entire lithic collection is now complete, and allows us to present a first overall summary of the assemblages, and to start to assess the different human occupations that occurred on this site during the Lower Palaeolithic, in the frame of the variability and diversity of the Western European Acheulean.

2. Materials and methods

2.1. The stratigraphical succession of the human occupations

The stratigraphy preserved at Menez-Dregan I displays an alternating sequence of marine and littoral formations (pebble layers and dune sands) interbedded in slope deposits (colluvium), with palaeosols and levels of human occupation dated between Marine Isotopic Stage (MIS) 13 and 8 (Laurent et al., 1996; Yokoyama et al., 1996; Monnier et al., 1994, 2001, 2016a; Mercier et al., 2004; Ravon et al., 2016a, 2016b; Ravon, 2017a). Apart from

stratigraphic units (SU) 1, 2, 3 and 10-11, all the levels attest to a human presence on the site. The layers are described from the oldest to the most recent as follows (fig.3).

Layer 10-11 is the first geological layer infilling the gully of marine erosion. This Pleistocene pebble layer does not present any trace of human activity, and was likely deposited during a high sea level, prior to MIS 12 (layer 9), filling several fissures and marine pools dug into the surrounding metamorphic gneiss of the cave (Hercynian orthogneiss type).

Above this archaeologically sterile pebble bed, the first human occupation is layer 9, still undergoing excavation, and whose complex stratigraphical succession is still unclear (Ravon (dir.), 2018). However, two different and clearly separated human occupations were identified in SU 9 and 9a. Layer 9 is actually composed of four levels (9, 9a, 9b and 9c; Ravon, 2017a), interbedded into an accumulation of pedogenetised colluvium deposits, in which the hearth of SU 9a was dated by ESR to 465 +/- 65 ka (Monnier et al., 1994, 2001), placing it amongst the oldest fireplaces in Europe, probably at the end of MIS 12 or beginning of MIS 11. The sea level estimated at this time of occupation is between ca. -60 and -40m, based on global climatic models (Shackelton, 1987; Waelbroeck et al., 2002; Lisiecki and Raymo, 2005; Laforge, 2012; Ravon, 2017b), geoarchaeological correlations (Laforge, in: Ravon and Laforge (dir.), 2017) and palaeoenvironmental analysis, which evidenced the presence of a mesophilic forest in SU 9a, and of a boreal forest in SU 9 (D. Aoustin et al., in prep.). Although these are very rare in Brittany because of the natural acidity of soils, 25 bone remains were collected during the excavation in the 1990s and analysed (P. Auguste, in: Monnier et al., 1996b, p. 77). Poorly preserved and dissolved into the sediments, only eight long bone fragments of large herbivores could be identified, and attest to the presence of a Bovid, an Equid and a Rhinocerotid in this layer. During the 2017 and 2018 field seasons, several additional bone remains associated with the lithic industry were discovered (fig.4), and are currently being analysed (Ravon (dir.), 2018; Ravon, 2017a, 2017b).

The second human occupation occurs in layer 8b, on a Pleistocene fossil beach. Amongst the levels of layer 8 (8d, 8c, 8b inf. and sup., 8a), only layer 8b and 8c seem to attest to one (or more) human occupations. Indeed, SU 8b (inf. and sup.) concentrates almost all the artefacts for these levels. No clear hearths were identified during the excavation, despite the presence of heated soil and of abundant charcoal. The new ESR dating carried out in 2016 on samples taken in 2012 in SU 8a tend to place this occupation between ca. 403 +/- 30 ka and 398 +/- 88 ka, during MIS 11 (Voinchet et al., in: Gaillard and Ravon (dir.), 2016). SU 8c, discovered during the 2017 field season, shows similarities with layer 9, and seems to reflect a first phase of human occupation in this level.

The third archaeological layer of the site is layer 7. Many traces of combustion and hearths are associated with it. Like layer 9, the archaeological levels that compose layer 7 are interstratified within colluvium deposits. In absence of dating, SU 7 has been geochronologically attributed to the beginning of MIS 10, with a sea level probably between -30 and -40m (Ravon et al., 2016b; Ravon, 2017a; Ravon (dir.), 2018).

Layer 6' corresponds to a human occupation on a pebble layer of variable thickness (layer 6). This ancient pebble bed is pedogenetised and humiferous, and thus retains the traces of a palaeosol, similar to the current coastal soil in place above the cliff. The pebble bed from layer 6 attests to a high sea level corresponding to a climatic optimum. With regard to the

stratigraphy of the region, layer 6 is attributed to an interglacial phase, with a sea level close to the current one, during the isotopic sub-stage 9c, ca. 330 ka ago (Ravon, 2017a). A circular hearth was discovered at its top in 2009 (Monnier et al. (dir.), 2009).

Layer 5 consists of many archaeological units, all interbedded into a thick layered pedocomplex: 5a, 5a', 5b, 5b', 5c, 5c', 5d, 5d', and finally 5e. This is the most important layer of the site, and the one that delivered the highest number of artefacts (91,789 pieces). Three hearths are also attested within the archaeological levels: in SU 5c a circular hearth consisting of eight slabs of granite laid flat, discovered in 1993, included in its centre a fragment of molar from an Elephantid (P. Auguste, in: Monnier et al., 1996b, p. 77); at the bottom of SU 5e / top of SU 6' a fireplace was discovered in 1988, formed of six large quartz pebbles arranged in a circular arc near a collapsed block; and in SU 5d another hearth was identified in 2005. Three ESR datings were carried out in SU 5e on the heated sediments of the hearth, and gave an age of 396 +/- 45 ka, 369 +/- 47 ka, and 377 +/- 52 ka (Monnier et al., 1994, 2001; Yokoyama et al., 1996). A thermoluminescence dating on heated sediment in the same SU 5e gave an age of 145 +/- 75 ka (Mercier et al., 2004); additional TL dating on burnt flints in SU 5a, 5b', 5c and 5d gave results ranging from 167 +/- 16 ka to 230 +/- 23 ka (Mercier et al., 2004), in complete disagreement with the ESR dating and in stratigraphic inversion on the site, probably resulting from a methodological bias due to the natural environmental conditions, and affecting the TL dating (Mercier et al., 2004; Monnier et al., 2001; Yokoyama et al., 1996). The thick sedimentary complex of layer 5 includes at its base a lenticular dune level, very partially preserved (SU 5e-d). This sand may have been deposited during the second climatic optimum of MIS 9a, around 310-320 ka (Laforge, 2012; Laforge and Monnier, 2011), when the sea level was ca. -30 m. In the current state of research, the different human occupations of layer 5 are therefore correlated with MIS 9a (Ravon (dir.), 2018).

Layer 4 is the last human occupation of the site. It consists of three levels: 4a, 4b, and 4c, which attest to two successive human occupations, the first in 4c, the second in 4ab (Ravon, 2017a and b). This last human occupation on the site (SU 4ab) marks the beginning of the transition with the Middle Palaeolithic in the region (Ravon and Monnier, 2013; Ravon et al., 2016a; Ravon, 2017a and b). No hearth was found in these layers, despite the presence of burnt or thermally fractured artefacts and of abundant charcoal. Thermoluminescence dating was realized on heated flints in SU 4c, giving an age of 223 +/- 23 ka (Mercier et al., 2004). However, in the current state of research, layer 4 tends to be chronostratigraphically placed in MIS 8, according to the stratigraphical succession, sedimentological analyses and available dating of the overlying and underlying levels (Monnier et al., 2001; Laforge and Monnier, 2011; Ravon and Laforge, 2016; Ravon and Laforge (dir.), 2017).

On top of layer 4, an archaeologically sterile dune sand (SU 3b) was deposited, dated by ESR to 141 +/- 16 ka (Monnier et al., 2001), and ca. 170 ka according to ESR dating done in 2016 (Voinchet et al., in: Gaillard and Ravon (dir.), 2016), thus placing this sequence in MIS 6. However, its chronostratigraphical attribution would tend to place it in MIS 7 (Laforge and Monnier, 2011; Laforge, 2012).

The sequence is finally sealed by a head deposit (SU 2b), collapsed blocks from the roof cave (SU 2a), another head deposit (SU 1), and the current top soil (SU 0).

When the deposit was discovered, it was coated by a vegetation bank, obliquely eroding the upper archaeological levels (fig. 5). The excavated upper layers are thus only partially preserved, which explains for example the absence of hearths in some of the levels where there are burnt artefacts or charcoal.

2.2. The annex sites

In the immediate vicinity of the deposit lie the sites of Menez-Dregan II, III and IV (fig.6). These small annex sites numbered from east to west from the main deposit (Menez-Dregan I) attest to the important human settlement in the early Palaeolithic in the Souc'h tip area, and were all surveyed and studied between 1988 and 1993 (Monnier et al., 1996b). Amongst these annex deposits, the site of Menez-Dregan II, which was surveyed in 1989, delivered an abundant industry, which needs to be reassessed in order to make new comparisons and interpretations in light of the information available thanks to the recent studies concerning the lithic industry of Menez-Dregan I. The deposits of MDI, MDII, MDIII and MDIV are all sheltered in gullies of marine erosion and all preserve remnants of Pleistocene fossil beaches from which the different human groups who settled in the area would have chosen their raw materials. The fieldwork carried out between 1988 and 1993 revealed both shelters and open-air sites, certainly reflecting the territory of acquisition and activities related to the main site of Menez-Dregan I (Ravon, 2017a and b).

2.3. The recording systems

The excavation of the deposit of Menez-Dregan I is divided into two sectors: the gully of marine erosion itself, and the "upper bench" situated on the north part of the shelter, at the bottom of the cliff. The first years of excavations focused mainly on the south part of the gully, in order to study the stratigraphical succession of the deposit whilst creating a reference section (section E-F, fig.7). The recording of the artefacts from the first excavation seasons was based on a grid system per square meter over the entire surface of the deposit (fig.7). Three other recording systems were in use between 1998 and 2018: four different systems were therefore used successively on the site during the past thirty years, and have recently been subject to a procedure of homogenization of the spatial data, in order to be exploitable at a site-wide level, and to produce distribution maps in the future. This process was achieved in 2018: for this reason, the spatial distribution of the material and of the areas of activities will not be presented in this paper.

From a methodological point of view, and in order to cope with the large amount of material available on the site (153,560 lithic pieces and millions of knapping debris), only the artefacts whose dimensions exceed 3 cm in length are plotted in three dimensions; smaller elements are simply collected per square meter within bags indicating their provenance. Therefore, these small elements do not figure in our study for the moment, due to the recording methodology used.

2.4. The lithic assemblage

All the lithic artefacts from the site have been sorted and inventoried between 2009 and 2017, under the simplified methodology developed specifically in order to face the large

quantity of artefacts (Ravon, 2017a), the lithic assemblages of the 17 levels of human occupation consisting of 153,560 pieces so far (Table 1). Only two pieces come from SU 3a (pedogenetised dune sand), and are likely reworked from the underlying layer 4. Each plotted artefact was attributed to a SU according to the observations made on site during fieldwork, in concordance with the stratigraphical succession of the different layers and the evolution of the excavation year after year. The artefacts from all the archaeological layers have mint fresh surface condition, being neither rolled nor weathered.

Due to the amount of artefacts available for study, the complete typo-technological analysis of all the material is still in progress. Nevertheless, layers 4 (the most recent of the site) and 9 (the oldest) benefited from this approach.

Two different methodologies were thus applied to the studied material: a typo-technological study, and a typological and lithological inventory.

- Typo-technological study: Whenever possible, each piece was observed in detail, describing its nature (flake, core, fragment, etc.), raw material, surface condition, and general shape (oval, sub-rectangular, etc.). The measurements in millimetres and the weights in grams were also indicated. Each edge and each face have been described according to a detailed, adapted and classical typological grid. This is the case for layer 4, and partially for layer 9, since it is still undergoing excavation.

- Inventory: Artefacts in this category have not benefited from any measurements or full examination so far. Only their type and raw material have been recorded, allowing nevertheless exhaustive counts of the lithic artefacts, as well as a first overall presentation of the assemblages.

In order to highlight the debitage methods in each archaeological level, a small and random sample of the cores from SU 9 to 5a benefited from a detailed study (533 / 16,132 cores).

This methodology was chosen in order to overcome the lack of information about the cores when simply counted by level and by lithological category. However, the question of the debitage methods and strategies is currently open as studies and technological analyses are still in progress.

Some artefacts at Menez-Dregan I are considered as Acheulean *sensu lato* on the basis of their typology and underlying technology: they correspond to handaxes and cleavers.

Handaxes, also called bifacial pieces, are tools showing a bilateral symmetry, with rather elongated shape, convergent edges, a bifacially shaped edge exceeding 50% of the perimeter, and a *façonnage* covering more than 50% of the surface of the blank. These bifacial pieces are considered as belonging to the Acheulean technical tradition for they are worked on both faces, but they do not always result from typical bifacial *façonnage*. On the contrary, cleavers (large cutting tools made on flakes, with a transversal edge kept unmodified while the lateral edges are shaped either unifacially or bifacially) are very characteristic of this technical tradition (Ravon et al., 2016b).

The millions of fragments resulting from knapping and/or shaping have not been studied as part of our research work for two reasons. The first is the large amount of material available, the second is that before studying these pieces, it is necessary to wash them, and this is still ongoing in the process of post-excavation work. However, all the debris from layer 9 were observed, in order to obtain an inventory of the raw materials used on the oldest archaeological levels of the site of Menez-Dregan I.

3. Results

3.1. Composition of the lithic assemblages

Figure 8 synthesizes the data obtained from the lithic artefacts coming from the 17 stratigraphically distinct occupation levels. The millions of pieces of debris have yet to be quantified per layer, but the global inventory of the lithic assemblages already shows that all the elements of the *chaînes opératoires* of *débitage* (cores, flakes, flake fragments, knapping debris) and *façonnage* (macro-tools and their shaping flakes) are present in all 17 levels, demonstrating *in situ* knapping and tool manufacture.

In most of the cases, short knapping sequences are applied, producing flakes with wide striking platforms seldom faceted, prominent bulbs, and open angled ventral faces. Sometimes flakes are produced by percussion on an anvil, or on previous flakes, and the Levallois method is never used. The small tool kit mainly includes denticulates and notches with a few scrapers. The heavy-duty tools mostly comprise various types of choppers (fig.9), shaped on large cobbles selected for their rather flat, often elongated shape and for their homogenous nature (sandstone or microgranite).

Macro-tools are largely dominated by choppers, whereas chopping-tools are rare (fig.10). Handaxes (n= 54; fig.11) and cleavers (n= 12; fig.12) are very poorly represented in the assemblages, and represent less than 0.1% of the lithic collection. They are globally poorly standardized, if at all, and are completely absent from SU 9, 9a and 8c (end of MIS 12), and from SU 5d, 5c, 5b and 5a (MIS 9a). Handaxes are mostly shaped from sandstone and microgranite marine cobbles, by a few large removals. Compared with the choppers, the configuration of these large cutting tools suggests that they are less specialised, not only in the manner of being handled but probably also in the manner of being used: several active parts often appear on a same blank (Ravon et al., 2016b). In contrast, the choppers usually offer one active part only, associated with a wide cortical proximal area. The raw materials used at Menez-Dregan I to make the handaxes and cleavers are the same as the ones used for the cobble-tools: sandstone, microgranite, quartz and quartzite, from cobbles or boulders available on the local beaches. Their blanks are large flakes, split cobbles, broken cobbles, or indeterminate.

3.2. Raw materials

The lithic industries from Menez-Dregan show a high petrographic diversity, due to the complex geology of the Armorican Massif (Ballèvre et al., 2013). However, they can be sorted into six main types: flint coming from a submerged cretaceous outcrop located 40 km far from the site in the Audierne bay, quartz, sandstone, microgranite and quartzite of various types, and glossy sandstone (Ravon et al., 2016a). Apart from the glossy sandstone which outcrops 20 km from the site inland, all of these raw materials are available immediately locally as marine pebbles of various sizes and shapes, and can easily be found in the current or Pleistocene beaches in or surrounding the site. From this stage of collection, the selection of raw materials is clearly evident (fig. 13). Globally, the use of raw materials is the same throughout the sequence: the *débitage* and small retouched tools are made from flint or quartz pebbles, or sometimes from glossy sandstone. The *façonnage* is

mainly realized on sandstone, microgranite or quartzite cobbles. This link between raw materials and tool types persists over time: the apparent homogeneity of the lithic industries of Menez-Dregan I indicates a strong environmental constraint, where flint is only available in the form of small size marine pebbles, leading the hominins to select other raw materials on the fossil beaches surrounding the site for the manufacture of their heavy-duty tools. Interestingly, the glossy sandstone is almost totally absent in the oldest levels (SU 9, 9a and 8c), suggesting a different territory of activities, palaeogeography, or access to raw materials for these occupations (Ravon, 2017a and b; Lefort et al., 2016).

Although the use of most of the different raw materials appears constant throughout the sequence, the use of quartz decreases over time. The exception to this is in SU 4ab, which shows the lowest use of flint of the site, instead favouring sandstone, attesting to the importance of the macro-tools in this level (Ravon, 2017a and b; Ravon et al., 2016a).

3.3. The different hominin occupations

The long stratigraphical sequence and the abundant lithic assemblages at Menez-Dregan I is a rare opportunity to make intra-site comparisons. We present here the main characteristics of each of the 17 levels of human occupation, in order to place the site of Menez-Dregan I in the broader context of the first hominin occupation in Western Europe.

3.3.1. Layer 9: MIS 12

Still undergoing excavation, layer 9 includes 1584 artefacts (2018 fieldwork included). SU 9a contains the highest amount of artefacts in this layer (79.7%), followed by SU 9 (20.3%).

SU 9a is characterized by a *débitage* mainly on flint and quartz (half of the cores), a high proportion of retouched small tools (6.2%), and by very scarce choppers (0.8%). The 9a human occupation is also the first evidence of the use of fire in the region.

SU 9 is characterized by a *débitage* only on flint followed by quartz: flint cores are mostly exploited by short knapping sequences on two surfaces, and more than half of the quartz cores were knapped on an anvil. The shaping (and probable use) of the choppers took place on site, but they were taken off-site afterwards. There are numerous shaping flakes and flake fragments on sandstone, but no choppers of this raw material. The retouched small tools are much more frequent than in SU 9a (14.6%) and almost exclusively made on flint.

Thus, for these two occupations attributed to the end of MIS 12, two different domestic uses of the cave seem to emerge. SU 9, without any hearth, displays a high proportion of small tools, but the choppers were probably used off-site after being manufactured *in situ* (or taken off-site after *in situ* manufacture and use). Small tools are less frequent in SU 9a, some choppers are present, together with a fire place. Handaxes and cleavers are totally absent from both levels. It is very likely that SU 9 attests to a very brief activity on-site, and SU 9a of a more continuous or longer occupation of the cave.

3.3.2. Layer 8: MIS 11

Layer 8 includes 5509 artefacts, and is composed of SU 8b (n= 5274) and of SU 8c. SU 8b, the main human occupation, is characterized by a fairly high *débitage* of all materials (12.1% of cores) except sandstone, and primarily flint. SU 8b shows a strong production of flakes (44.7%) detached by hard percussion, and sometimes by soft hammer stones, attested by the use of sandstone for percussive activities. The macro-tools (4.9% of the assemblage) were probably shaped and used on the site; handaxes and cleavers are present in a significant quantity (1.9% of the heavy-duty tools), and represent the first occurrence of the Acheulean within the region (Ravon, 2017a and b). The flint and sandstone handaxes were removed from the deposit after their shaping and/or use on-site, and scrapers are numerous. 0.8% of the artefacts show signs of heating. The presence of several small traces of hearths attests to a high activity on the site, if not several occupations of rather short duration. SU 8c, discovered during the 2017 field season, is yet to be assessed, but shows strong similarities with layer 9, and could therefore represent a first phase of occupation in this layer. The material coming from SU 8c could also just be reworked from the underlying SU 9a: geoarchaeological analyses are still in progress in order to clarify the conditions of deposition of this level.

3.3.3. SU 7: MIS 10

SU 7 is composed of 16,383 pieces, and is characterized by a flake production slightly more frequent than in SU 8b (48.4%), sometimes detached by a soft hammer stone. Pebble-tools (4.2%) were produced and used on the site, and Acheulean tools are also part of the assemblage (2.2% of the heavy-duty tools). As for SU 8b, the flint handaxes were removed from the deposit after being manufactured on-site, and scrapers are even more numerous (the highest rate of the site). SU 7 shows strong similarities with SU 8, especially in the composition of its lithic assemblage (Table 1), presenting a division of activities between the deposit itself and the exterior, although this is less marked than in SU 8. It appears that the flake and tool production as well as use took place on-site, according to the composition of the assemblage. SU 7 appears to consist of several small occupation levels of rather short duration that could not be distinguished during the excavation. It seems that human groups repeatedly came to settle on the site and left again. Could this fact attest to short movements of populations, related to the climatic oscillations of the beginning of MIS 10?

3.3.4. SU 6': MIS 9c

SU 6' corresponds to a human occupation with a hearth on top of a raised beach, in a rather temperate phase, and probably of a significantly long duration. This is the second richest archaeological level of the site, after layer 5, with 20,516 artefacts. SU 6' is characterized primarily by *débitage* made from all the raw materials (12.4% of cores), but mainly flint, with a strong implementation of bipolar flaking on an anvil. Soft stone percussion is less used than in the underlying levels (SU 8b and 7). Like the previous layers, the macro-tools have been shaped and used on site (3.6%). Ten handaxes made from sandstone, microgranite and quartzite cobbles are present within the lithic assemblage. Several flint biface thinning flakes were found, but the flint handaxes themselves are absent, which shows the mobility of

the different groups that frequented the deposit, and the organization of the different areas of activity on and around the site. SU 6' also presents all the criteria for a real dwelling place.

3.3.5. Layer 5: MIS 9a

Above SU 6' begins the sequence of layer 5. Layer 5 and its many sub-levels alone make up for more than 60% of the lithic collection from the site, with 91,789 artefacts. Levels 5d' (n= 39,219), 5a' (n= 14,652), 5b' (n= 12,927), and 5c' (n= 11,612) contained most of the artefacts. The different human occupations are presented according to their stratigraphic succession, from the oldest level to the most recent (from SU 5e to 5a).

SU 5e (2052 artefacts) corresponds to a human occupation of rather short duration on a dune level, with a fireplace. SU 5e is characterized by very high *débitage* activity (17% of cores), selectively on flint, quartz, glossy sandstone, and quartzite. Moreover, the quartzite cores were probably removed from the site after knapping, since they are entirely lacking in the assemblage. Small tools (0.8%) and to a lesser extent macro-tools (2.3%) are rare, but likely shaped and used directly on site. A single handaxe is present in SU 5e, which represents less than 0.1% of the assemblage. Despite the presence of a hearth, the occupation of this level reflects the image of a rather short-term use of the site, with activities mainly dedicated to flint and quartz knapping.

SU 5d' is the most important human occupation of the site, of a fairly long and continuous duration, but without any hearths, although 0.5% of the assemblage shows signs of heating. It comprises a large number of cores (14.2%), with a *débitage* of all materials, but preferentially flint, using hard hammer and bipolar flaking on an anvil. Macro-tools are not very frequent (1.7% of assemblage), and were probably shaped and used on-site, including Acheulean tools (1.9% of the heavy-duty tools). Small retouched tools are even less frequent than macro-tools, and constitute only 0.8% of the artefacts for this level. SU 5d' presents the characteristics of a rather intensive production site: the main activity seems to be the production and use of unretouched flakes, but it is likely that the location of use of the tools was off-site, hence their low representation within the assemblage, and the absence of a hearth despite the presence of burnt elements.

SU 5d (3829 artefacts) corresponds to a human occupation with a hearth, and is characterized by a *débitage* solely consisting of flint, quartz and quartzite, with an occasional implementation of bipolar flaking on an anvil. If the macro-tools were once again manufactured and used on site, they are as rare as the small retouched tools (0.8% of the assemblage each). Handaxes and cleavers are completely absent from this level, including their thinning flakes, which could indicate the presence of a group with skills or technical traditions different from the previous ones (Ravon, 2017a). The deposit was likely used as a production site, with a fairly short-term occupation. However, a hearth was found in SU 5d during the excavation, which suggests that despite the very small amount of retouched tools, the dwelling place was on site, unless it reflects an area of specialized activities related to the presence of the fireplace, which brings the occupation of SU 5d closer to that of SU 5e. The main difference between these two occupations seems to be the Acheulean element present in 5e (a sandstone handaxe) and not in 5d.

SU 5c' has no hearth, although 0.7% of lithic pieces are burnt, and seems to reflect a rather long-term occupation. The main activity on the site is the production of flakes (57.3%) of all raw materials, but mainly flint, quartz and glossy sandstone. Macro-tools (0.5%) and small retouched tools (1.3%) are almost absent, but produced and used on site, as for the previous layers. Two choppers are included in the assemblage, and were shaped and discarded on site after use. This level seems to attest to a production site; it is possible that most of the activities took place off-site, where the hearth was likely to be, just as SU 5d'.

SU 5c (1883 artefacts) provided the most structured hearth, at the center of which a fragment of molar of an Elephantid had been found (Monnier et al., 2016a and b). The occupation of level 5c seems to have been of rather short duration, with a very strong production of flakes (54.4%), detached only with hard percussion. Small retouched tools are not very frequent (2%), but are mostly composed of flint scrapers. The macro-tools are almost absent (1.2%), but were shaped on site, only on sandstone and microgranite, and then probably taken outside the deposit. Handaxes and cleavers are completely lacking. The structured hearth suggests that activities related to its presence occurred on the site, while the activities related to the retouched tools, such as butchery, may have taken place outside. Once again, a certain distribution of the areas of activity seems to be emerging.

SU 5b' displays 0.5% of artefacts with traces of heating, but no hearth was noticed during the excavation. This level of occupation seems to be of rather long duration, and is characterized by a high production of flakes (57.1%), with recurrent use of bipolar flaking on an anvil and soft hammer stones. Macro-tools (1.4%) have likely been shaped and/or used on-site and taken away afterwards, and small retouched tools are scarce (1.3%). Flint and quartzite handaxes were shaped *in situ* and then taken outside, while those made from different raw materials were probably used and then discarded on-site. SU 5b' presents the characteristics of a site of production, more than consumption, according to the very small amount of retouched or shaped tools, and by the absence of a hearth. The main place of use of the retouched and manufactured tools must certainly have been outside the site, whereas the unretouched flakes seem to have been used and discarded on-site.

SU 5b (1767 artefacts) has no hearth either, but 0.5% of the lithic artefacts were burnt as well. It is characterized by an important production of flakes (57%), preferentially on flint, and a fairly marked implementation of bipolar flaking on anvil. The macro-tools (0.6% of the assemblage) seem to have been manufactured *in situ*, and then used and/or taken away. Handaxes and cleavers are absent. Small retouched tools are nearly absent (1.4%), and made only of flint. The occupation of this level reflects the use of the cave as a site of production, of rather short duration. The place of use of the tools was likely outside the site, which allows us to compare this occupation to those of SU 5d and 5c, which present the same overall organization of space as well as the same overall management of materials.

SU 5a' has no hearth either, although 0.8% of the assemblage consists of burnt elements. It seems to indicate an occupation of rather long duration. Once again, the production of unretouched flakes is preponderant (61.7%), and the bipolar flaking on an anvil is well marked. The macro-tools seem to have been manufactured on the site and then discarded and/or used somewhere else, and the small retouched tools are almost absent (1.3%). A flint handaxe is included in the assemblage, the only one in the entire collection of Menez-Dregan I, and was likely introduced from another location by the hominins occupying this layer. SU 5a' shows similarities to SU 5d', 5c' and 5b', both in terms of duration of

occupation, of intensity of production, of composition of the series or of management of raw materials.

SU 5a (3545 artefacts) is characterized by a high production of flakes (52.4%) and by a sporadic implementation of bipolar flaking on an anvil. No hearth was found in SU 5a, but 1.1% of the artefacts show traces of heating. Here again, small retouched tools are scarce (0.8%), and the macro-tools have been shaped and probably used on site and/or discarded off-site. Handaxes and cleavers are absent, just like in SU 5b, 5c and 5d (shorter-term occupations).

3.3.6. Layer 4: MIS 8e

Above layer 5 begins the sequence of layer 4. Layer 4 corresponds to the last human occupation of the site. According to the current state of research, layer 4 could be placed in MIS 8e, so in a slightly colder phase. Layer 4 consists of two very distinct human occupations: one for 4b (which includes level 4a material; 6448 artefacts in total), and one for 4c (11,001 artefacts).

SU 4c is characterized by a *débitage* that uses all the raw materials of the site, but preferentially flint, and by the discard of the glossy sandstone cores off-site afterwards. Flake production remains predominant (37.88%), although less important than in previous levels. The rare macro-tools (1.1%) seem to have been initially shaped off-site, and then finalized on the site, where the tools were also probably used. A single handaxe is present, and small retouched tools are more frequent than before (5.2%). SU 4c indicates a site of production and activities of fairly long duration, with again a share of activities between the deposit itself and the outside.

SU 4ab is the last human occupation of the site, and marks the transition between Lower and Middle Palaeolithic. It is characterized by a rather low *débitage* of all the raw materials (5% of cores), but preferentially of flint, and by a recurrent implementation of the bipolar flaking on an anvil. This level shows the first appearance of discoid cores for the region, as well as the highest frequency of macro-tools of the site (10.4%), with a high proportion of small retouched tools (8.3%). Twelve handaxes and three cleavers are also present (0.2% of the macro-tools). SU 4b likely attests to a production and activity site, but of shorter duration than SU 4c. The pavement structure identified in SU 4b (Ravon and Monnier, 2013; Ravon et al., 2016a) is an additional indication in the sense of a real dwelling place, where most activities could occur.

4. Discussion: intra-site comparisons

All the levels of human occupation present a partition of activities between the site itself and the exterior, in different ways. While some characteristics of the lithic industries of the site of Menez-Dregan I remain constant throughout the sequence, the 17 archaeological levels reflect a somewhat different domestic use of the cave. Some SU contain clearly identified hearths (9a, 7, 6', 5e, 5d, 5c), while most layers do not present any, despite the constant

presence of abundant charcoal and burnt artefacts, thus attesting to the fire use on site or just nearby (8c, 8b, 5e, 5d', 5c', 5b, 5b', 5a, 5a', 4c, 4ab). The presence/absence of fauna is presumably preservational, due to the naturally acidic soils in Brittany.

The human occupations of SU 9 and 9a display a high production of small retouched tools (14.6% for SU 9 and 6.2% for SU 9a), but this tendency decreases throughout the sequence, clearly moving toward increasing importance of flake production. The small tools become almost absent, until SU 4ab, which marks the transition with Middle Palaeolithic in the Brittany region, and shows on the contrary the highest proportion of retouched or shaped tools of the site (Ravon and Monnier, 2013; Ravon et al., 2016a).

The same raw materials, locally available in the form of pebbles, or exogenous and taken directly from the outcrop in the case of glossy sandstone, are used in all levels. Glossy sandstone is totally lacking only in SU 9, 9a and 8c. Although the use of different rocks seems constant over time, quartz is globally less and less used, and level 4ab shows the lowest use of flint of the site, in favour of sandstone, relating to the importance of macro-tools in this layer (fig.14). Finally, all the *débitage* seems to have been done on-site, as indicated by the composition of the different series.

Despite some similar and constant features in the lithic assemblages throughout time, such as the link between raw materials and tool types, evidence of the use of fire, and the significant flake production, some differences can be highlighted between the levels. The quantity of small retouched tools, for example, varies a lot in the sequence (although in the different SU of layer 5, it only fluctuates between 0.8% and 2% of the total assemblage of each level). A clear difference exists also between the composition of these small tools in the sequence (fig. 15), thus likely attesting to different activities on-site.

The repeated uses of the site of Menez-Dregan I during MIS 9 seem slightly different despite taking place under broadly the same global environmental conditions, with the same raw materials identically implemented overall. These numerous archaeological levels testify of the recurring visit of hominins at the site, sometimes likely by groups with different technical traditions or skills (presence or absence of handaxes and cleavers) and a significantly different use of the deposit by each group. Some of these occupations use the site over a fairly long or continuous period, with a possible division of activities between the deposit itself and its exterior, more or less well marked (SU 6', 5d', 5c', 5b', 5a'). Others suggest use of the site almost exclusively as a relatively short-term production site (SU 5e, 5d, 5c, 5b, 5a), where most activities were taking place somewhere else. However, some characteristics are more or less constant during the different phases of occupation of the deposit. It seems clear that the activities are divided between the actual site and its exterior, confirmed by the very small amount of specialized retouched tools at the deposit, or the carrying of some of the macro-tools off-site after shaping and probable use. These varied occupations could be a reflection of the climatic oscillations of MIS 9, for example with hominins leaving during the coldest phases, and likely coming back under milder conditions, but never in the climatic optimum, since the sea infilled the cave (SU 6 raised beach).

The site has been used both in relatively cool phases, as it is the case for layers 9, 7, 4 and probably 5c, where the pollen analyses suggest the presence of a boreal forest (Aoustin et al., in prep), and in more temperate periods (layers 8b, 6' and 5). Even if we should be cautious for now in the absence of data on fauna, the various anthracological and

palynological analyses provide details about the climatic conditions during the occupations of the deposit. Palaeobotanic analyses carried out by N. Marcoux and D. Aoustin (UMR 6566 CReAAH; Marcoux et al., in prep.) tend to highlight numerous climatic changes recorded in the sequence of Menez-Dregan I, either interglacial/glacial cycles or more likely small interstadials or climatic oscillations, as it seems to be the case for layer 5. The distance to the shoreline is then rather variable, exposing a landscape ranging from a coastal plain with the distance between the shoreline and the site probably around 1 km, to a forested plain or even steppe, depending on the distance to the coastline (probably up to 5-10 km; see on this point Monnier et al., 2016b, Lefort et al., 2007, 2016). Thus, the site of Menez-Dregan I was positioned at the top of a rocky promontory, sheltered in a marine cave, and had a strategic vantage point on the plain below. From this location, protected from prevailing winds, Palaeolithic groups could spot the herds of large herbivores that were likely to stop at the many water points nearby.

Depending on the period, the deposit could function as a dwelling place (production and use of lithic supports, presence of hearths) or more as a place of production of tools, their use being done off-site. Thus, the places of activity seem to vary somewhat, reflecting a slightly different organization of place according to the occupations, activities, and different climatic contexts. It could reflect the territory of acquisition and activities of the different groups that have settled in Menez-Dregan I, II, III and IV, with a probable partition of activities between the different neighbouring locations, related to the occupation of the main site of MDI. The absence of faunal remains in most of the levels is presumably preservational, but could also indicate that the initial butchery activities took place directly in the plain below, now submerged. Unfortunately, the lack of preservation of organic material due to the naturally acidic soils in Brittany does not allow any further investigations on that point, but an attempt to use-wear analyses on some of the lithic artefacts in the future could perhaps bring new information.

The apparent homogeneity of the lithic industries from the different levels implies a strong environmental constraint, in which the same raw materials are always used to make the same types of tools throughout the various visits of hominin groups to the cave of Menez-Dregan I, for nearly 250,000 years. Moreover, apart from layer 9 and SU 5d, 5c, 5b and 5a, all the archaeological levels contain a few *sensu lato* Acheulean elements (e.g. bifacial pieces and cleavers). These pieces coexist with pebble-tools, demonstrating their contemporaneity on the site, but are completely lacking in some levels. Should this indicate a stronger technical constraint, slight variations in site use during shorter-term occupations, or the presence of groups with different technical traditions?

5. Conclusion: towards the highlighting of different groups on-site?

The relative proximity of the Atlantic shoreline must have played a crucial role in the hominin dispersal towards the Western European fringe. Indeed, even during the cold phases, the maritime climatic conditions must have been always slightly milder, permitting the semi-continuous presence of different hominin groups, and favouring settlements in the area, as seen for instance in Menez-Dregan I and Saint-Colomban (Carnac, Morbihan; Monnier and Le Cloirec, 1979, 1985; fig.16). The near-costal location would have therefore procured

constant resources (e.g. pebble layers as a source of raw materials) and shelters, such as rock shelters or marine caves. Thus, the coastal fringe would have been an important and convenient passage for groups either coming from the South towards the North, or conversely from the North towards the South during colder phases, with Menez-Dregan perhaps marking the north-western boundary of habitable Europe during cold climates (Dennell et al., 2010). Therefore, the levels in Menez-Dregan I that contain or do not contain any Acheulean elements could in fact reflect the presence of different groups in the region between MIS 12 and 8, because if the *débitage* methods, the *chaînes opératoires*, and the raw materials remain the same, even during different climatic contexts, it seems plausible that the activities on or around the site remain the same as well. Therefore, the difference we make here between these groups is only typological, since it concerns only the presence or absence of handaxes and cleavers. If the presence of this type of artefacts makes it possible to highlight an Acheulean background, its absence could likely indicate groups with different technical skills, but adapted in the same way to the raw materials available locally (pebbles).

Considering the long occupation of the site of Menez-Dregan I, the presence of levels with bifacial technology and of some others without, the type of deposit (cave) or its proximity with the shoreline, and the raw material used (pebbles available locally), Menez-Dregan I is not really an exception in the Lower Palaeolithic context of Europe. The sites of Terra Amata (de Lumley (dir.), 2015) and Caune de l'Arago (Barsky and de Lumley, 2010; Barsky, 2013), the Italian sites of La Polledrara (Anzidei et al., 2004) and Castel di Guido (Radmilj and Boschian, 1996), the Spanish sites at Atapuerca (Ollé et al., 2016) and the British sites of Barnham (Ashton et al., 1994), Clacton-on-Sea (Bridgland, 1994), Swanscombe (Conway et al., 1996), and High Lodge (Ashton et al., 1992) are particularly interesting in this perspective, scattered into two different geographical domains, e.g. North and South Western Europe (fig.16), and occupied also between MIS 12 and 9. They all present contemporary levels to those of Menez-Dregan I. These different sites make it possible to highlight several facts, through a broad comparison (Ravon, 2017a and b). The first is that regardless of the context, the duration of occupation of the site, its type, or the raw materials available, handaxes or cleavers can be either present or absent. The second is that this variability in the assemblages can be explained according to the authors by differences of raw materials, their availability or their management (Moncel et al., 2015, 2016a and b; Aureli et al., 2016; Sharon, 2008; Villa, 1981, 1983), by different site functions (Lhomme et Connet, 2001; Nicoud, 2013), environments, or finally by different technical traditions (Grifoni et Tozzi, 2006; Ashton et al., 2016). Similarly, if the palaeogeographical and geological context as well as the type of deposit can explain a certain variability in the composition of the assemblages, it does not explain the technical traditions, and in particular the presence or absence of handaxes or cleavers. If the type of activities can then explain this variability, repeated visits to a same site in a relatively similar context, as is the case in Menez-Dregan I for MIS 9a, may likely indicate a regular visit of hominin groups with different technical traditions, as has been recently demonstrated for example in Barnham, where bifacial industries are succeeded by non-bifacial industries (Ashton et al., 2016). Even if a lot of work is still left to undertake in order to try to identify territory sizes, natural variations in lithic assemblages through time, or culturally transmitted traditions in the Western European region, we conclude that the site of Menez-Dregan I thus fits perfectly into this mosaic of technical or cultural traditions of the Western European Lower Palaeolithic.

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MIS	12			11	10	9c	9a										8e			7	Total	%
Artefact type / SU	9	9a	8c	8b	7	6'	5e	5d'	5d	5c'	5c	5b'	5b	5a'	5a	5	4c	4ab	4	3a		
Unretouched flakes	60	398	101	2358	7934	10773	1155	23448	2408	6654	1025	7382	1011	9041	1856	132	3594	1748	165	1	81244	53%
Flake fragments	131	493	71	1532	5047	5139	451	8876	977	3623	541	3514	526	4023	1182	85	4753	1186	97		42247	28%
Cores	34	117	37	637	1590	2556	349	5587	368	1076	253	1628	194	1215	402	51	424	324	37	1	16880	11%
Miscellaneous	36	148	2	49	244	179		19	1	14	1	8		11			1513	1857	4		4086	3%
Small retouched tools	47	78	14	297	573	823	17	329	32	148	38	167	24	191	30	4	576	533	9		3930	3%
Macro-tools	7	14	5	262	695	729	47	656	34	61	22	188	10	101	52	9	122	677	35		3725	2%
Hammerstones	6	15	5	134	285	307	32	280	9	34	3	37	2	64	23	19	18	108			1381	1%
Handaxes				4	10	10	1	12				3		1			1	12			54	0%
Cleavers				1	5			1		2								3			12	0%
Total	321	1263	235	5274	16383	20516	2052	39208	3829	11612	1883	12927	1767	14647	3545	300	11001	6448	347	2	153560	100%
%	0%	1%	0%	3%	11%	13%	1%	26%	2%	8%	1%	8%	1%	10%	2%	0%	7%	4%	0%	0%	100%	

Table 1: Composition of the lithic assemblage and chronostratigraphical attribution (MIS) of Menez-Dregan I. In this table, SU 4 and 5 actually consist of a mix of reworked different archaeological levels, and do not correspond to a human occupation level. Small chips and debris do not figure in this table.

Tabl. 1 : Composition de l'assemblage lithique et attribution chronostratigraphique de Menez-Dregan I. Dans ce tableau, les US 4 et 5 représentent des niveaux remaniés ou dont l'attribution géoarchéologique est incertaine. Les esquilles ne figurent pas dans les décomptes.