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An open-air site from the recent Middle Palaeolithic in the Paris Basin (France): Les Bossats at Ormesson (Seine-et-Marne)

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ABSTRACT

The recent discovery (2009) and excavation of the open-air site of Ormesson (Seine-et-Marne – France) was initially intended to document a Gravettian occupation floor dated around 29,000 cal. BP and related to a preferential bison hunt. Whilst checking the thickness of the loess in which the Gravettian level was found, several other prehistoric settlements were discovered (Chatelperronian, Middle Solutrean) including two units attributed to the Middle Palaeolithic. One, level 4, seems to be particularly well-preserved. It occurs between 1 and 3 m below the main Upper Palaeolithic occupation. The lithic industry from level 4 belongs to a single kind of reduction sequence: the Discoid method. The freshness of the material and the presence of bone fragments attributed in part to horse support a general good state of preservation of this occupation. The Mousterian remains seem to cover at least 500 m^2, as currently estimated. Even more exceptional is the close spatial relationship between the discoid industry, the bone pieces, remains of fireplaces and especially the numerous fragments and nodules of red colouring materials. These were brought to the site where they were utilised by the Mousterians. The used surfaces show indisputable scraping traces and facets. These recent discoveries will certainly contribute to the debate on the cognitive capacities of nearly the last representatives of the Middle Palaeolithic, and the complex stratigraphy will allow comparisons between the different periods.

1. Introduction

In the Paris Basin in the northern part of France, open-air sites from the Middle Palaeolithic are numerous and have yielded abundant archaeological material consisting mainly of flint tools and knapping by-products. Few caves or rock-shelters are known from the area with an exception of those from the Vallée de la Cure, where the famous sites of Arcy-sur-Cure have yielded Late Mousterian levels, particularly at the Grotte de l'Hyène (Girard, 1978), the Grotte du Renne (Leroi-Gourhan et al., 1964) and the Grotte du Bison (Lhomme et al., 2005) (Fig. 1). In the north-western plains of Europe, most of the known Middle Palaeolithic sites are open air settlements (see for instance Antoine et al., 2003). These sites are thought to offer a different view of the Middle Palaeolithic in terms of chronological record, taphonomic processes and prehistoric behaviour when compared to the cave and rock-shelter sites documented in neighbouring karst regions such as those in Belgium (Di Modica, 2010), or to the foot-cliff settlements such as those in Brittany (Cliquet et al., 1990). For instance, many cave and rock-shelter sites offer evidence of multi-stratified occupations from the last part of Middle Palaeolithic and the MP/UP transition, that is to say the middle part of the last glacial event (MIS 4 and 3). In contrast, a large majority of the Middle Palaeolithic sites from the NW plains of Europe yielded older evidence of occupation, dated to the period between the Saalian glaciation (MIS 8 to 6) and the beginning of the last glaciation (MIS 5d to MIS 5a, Antoine et al., 2003). Although rock-shelters and caves offer favourable preservational conditions for the faunal remains, karst sedimentary processes induce a complex setting of stratigraphic sequences with palimpsest of settlements and a high level of post-depositional disturbance (Bordes, 1975; Brochier, 1999; Villa, 2004). In addition, the excavated surfaces are often small, which limits the

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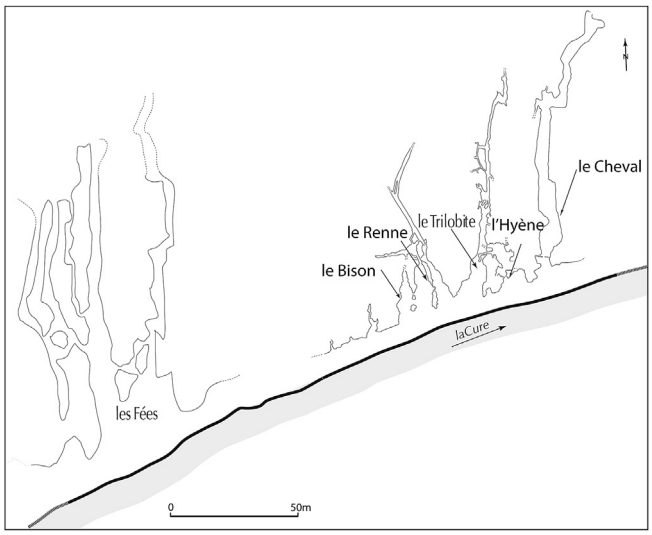

Fig. 1. Map of the caves of Arcy-sur-Cure (Yonne, France), (after Schmider, 2002; DAO: D. Molez).

possibilities to understand spatial organisation of the activities at a fine scale. Several open air sites in loessic or fluvial contexts may offer fine records of the activities, as long as the original spatial distribution of the artefacts is preserved well enough and allows the reconstruction of economic and even social behaviour as well as settlement patterns. However, fully open air sites scarcely provide evidence of dwelling structures, whereas they can often be observed at rock-shelter, cave or foot-cliff sites. Moreover, other evidence of activities, faunal remains in particular, is often more badly preserved at open air sites. As a consequence of these disparities in the archaeological record, a refined reconstruction of site-structure and habitat organisation of the last Neanderthals that lived in Northern Europe before the MP/UP transition can hardly be expected. A direct comparison with the current observations from the Upper Palaeolithic sites in the same region, in particular the most ones recent dated to the Late Glacial (for instance, the Magdalenian sites of Pincevent, Etiolles, and Gönnersdorf) may give the impression that there was a significant behavioural or even cognitive gap between the two periods. Such interpretations will stay controversial as long as prehistorians do not work with the comparable archaeological materials. Thus, unlike the archaeological assemblages from rock-shelter sites, especially favourable for the study of the hunted animal species, the hunting strategies and the subsequent treatment of the game, material from open-air sites rarely includes well preserved faunal remains. It is even more unusual to find combustion structures at these open-air sites, as opposed to the more recent Upper Palaeolithic sites where they usually constitute the heart of activity areas.

The fortuitous discovery of the Middle Palaeolithic level in Ormesson in 2009 (Bodu et al., 2011) (Fig. 2) presented a rare opportunity to study a very large settlement floor in detail. Completely buried and protected under tens of centimetres or meters of loess, this level meets the requirements of a palaeoethnological study. At Ormesson, the succession of prehistoric occupations allows us to identify changes in hunting practices as well as in technological and economic strategies over a period of nearly 30,000 years through the prism of two different groups of humans that occupied the same location. In 2012, an important fieldwork project led to an understanding of the geomorphological position and the sedimentological composition of the site and allowed identification of three additional occupation levels. We have identified five different archaeological levels at Les Bossats (Middle Solutrean, Gravettian, Chatelperronian, Final Middle Palaeolithic and undetermined Middle Palaeolithic) (Fig. 3). This pattern of successive settlements in the stratigraphic sequence of a single site is exceptional for the Paris Basin and, more generally, for northern France. A second set of artefacts attributed to the undetermined Middle Palaeolithic was found in a mediocre state of preservation within the fluvioglacial or slop deposits at the base of the sedimentary sequence (level 5). The twenty flints located in this partially destroyed level were found in pits far apart from each other, suggesting that this occupation was large. We observed at least two levels of Middle Palaeolithic settlement, including level 4 that is perfectly preserved. This level is the focus of the present article.

2. Location and setting of the site

"Les Bossats" in Ormesson, Seine-et-Marne, France, is located 70 km south of Paris (Fig. 2). The prehistoric site is oriented south, backing onto debris from the massif of sandstone, in a cirque overlooking a valley (Fig. 4). The geologically homogeneous substratum consists typically of sorted sand, completely decalcified after deposition during the Stampian stage. The quartz grains are easily mobilized through wind and water flow. According to some authors (Thiry et al., 2010), the water flow at different temperatures is the origin of silicification which led into the formation of the Fontainebleau sandstone relatively recently (Weichselian or Saalian glaciation). The sandstone blocks lost their original horizontal positions due to the erosion processes invoked by the climatic changes during the Quaternary. They mark the landscape of the site Les Bossats.

When cold calcitic water percolations meet warmer groundwater, calcite impregnates sands and forms sandstones with calcareous matrix. Blocks of this sandstone, measuring several decimetres in dimension, are found in primary position in the Fontainebleau sands or reworked in talus scree or fluvioglacial deposits (level 5). This kind of block is also found in soils related to different prehistoric occupations.

The site location is highly strategic for prehistoric humans because of the protection against winds made possible by the sandstone blocks. Furthermore, flint was available all along the Loing River, some 4 km east of the site, where the Campanian horizon provides raw nodules and elongated flint and possibly nearer where Mousterian groups collected less good quality flint (Geological map, 1/50000, 1970 and 1971). The camp was established at the edge of a valley which was used as a passageway for humans and animals. From a taphonomic point of view, two thalwegs limit the area in the east and west, and had a protective role by draining the runoff (Fig. 5).

Fig. 3 shows the sedimentary set of layers observed in different pits. They give a satisfactory view of the site's sedimentary and archaeological sequence. In pit 3, the Mousterian and the Chatelperronian were found in the sandy levels with different hues, more orange downwards and more yellowish upwards, but similar in composition. These quartz sands show numerous ferromanganic oxide stains, deriving from ancient pedogenesis. There is no calcite addition in either of the levels. Nonetheless, sediments covering these sands are calcitic loams. Les Bossats has a sandy sequence in which the proportion of loam varies, showing a range from loamy sands to sandy loams. The abrupt change between the two variants could be interpreted as a limit of erosion. In the lower part of the loessic sequence, the loamy sands show different zones varying slightly in colour and limited by layers with fine gravels, deposited by the runoff. The upper part of the loess is more homogeneous. It consists of sandy loam significantly disturbed by bioturbation, indicated by calcified voids (root seeds, loess dolls). At the top of the

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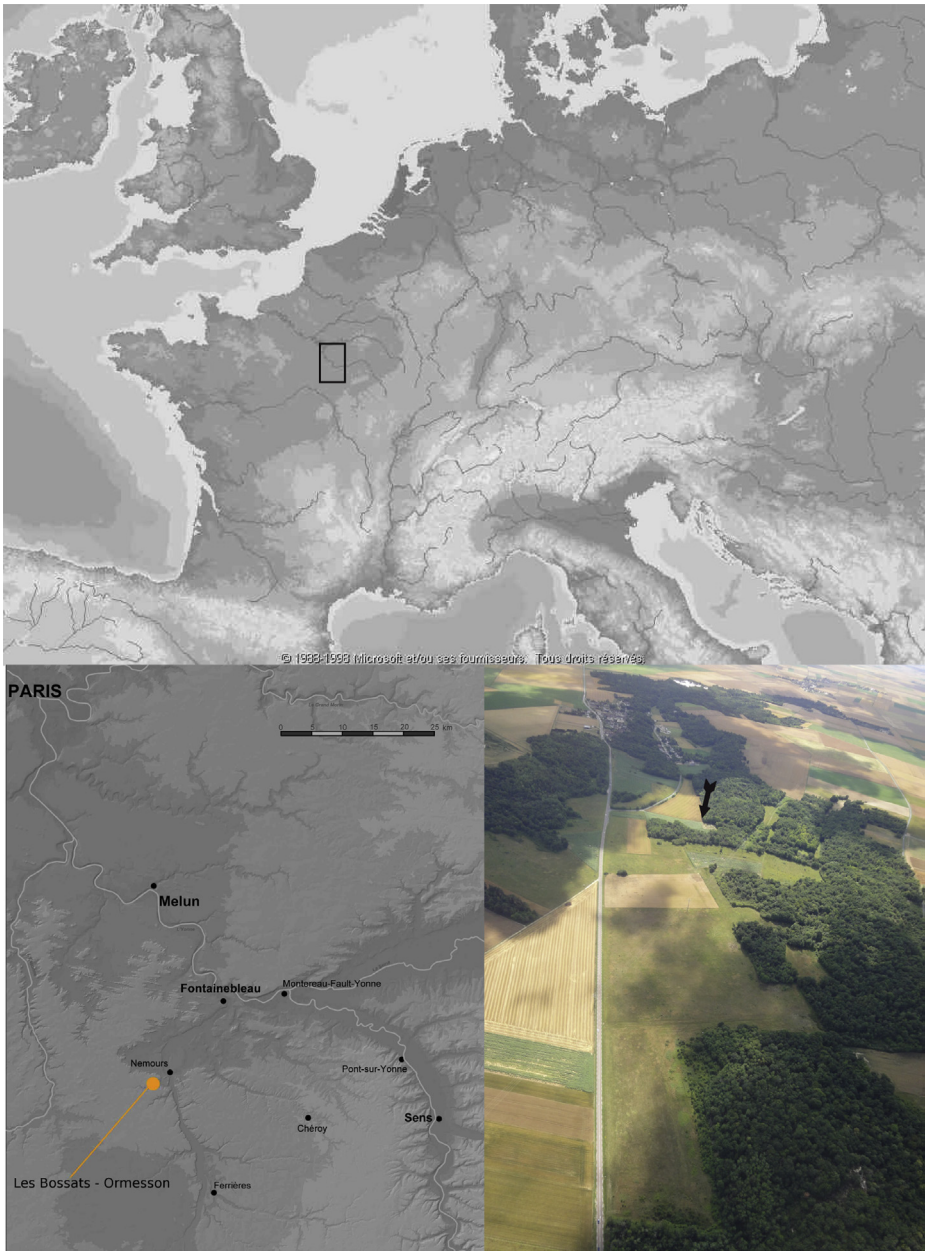

Fig. 2. Localisation of the site of Les Bossats at Ormesson (Seine-et-Marne, France), (DAO: D. Molez, Photos. E. Fortier).

sequence, the Gravettian is situated within a level showing intense subsequent calcification, which has impregnated most of the archaeological material.

The Mousterian layer (level 4) reveals flaked flints, worked colouring materials, bones and diverse stones. The archaeological material is found under a succession of sandy and loamy sediments below a 0.5–3 m thick deposit as currently estimated (Fig. 3). The sand in the layer where this industry was discovered originates from the eroded sandstone located nearby and was deposited by wind and gravity.

The preservation of the fine matrix and biological features reflects in-place pedological evolution and thus a stable soil. Typically, it indicates that the soil was not reworked after its formation. The Mousterian level appears well-preserved because:

- This is an acidic environment, in which the bones were preserved through subsequent carbonatization,
- Furthermore, the remains present similar surface conditions. The freshness of the archaeological remains observed is the same from one piece to another. The edges are sharp and the flake ridges are still fresh. The flint collection seems to have suffered from few alterations, including, however, a well-developed patina. We sometimes observe some small chips, shiny and matte spots (Guéret, 2010). In addition, the surfaces of the worked pieces of ferruginous material are fresh and show well-preserved traces of use including facets, striations and micro-striations and even shiny areas. The edges of the fragments are sharp without smoothing. Ferruginous rocks are very sensitive to mechanical and water erosion, which, if present in these layers, would have significantly modified the surfaces by smoothing. This is in contrast to what we observed. Thus we can assume that the surfaces did not suffer from either vertical or horizontal water or sand displacement,
- Archaeological remains were found in horizontal position,

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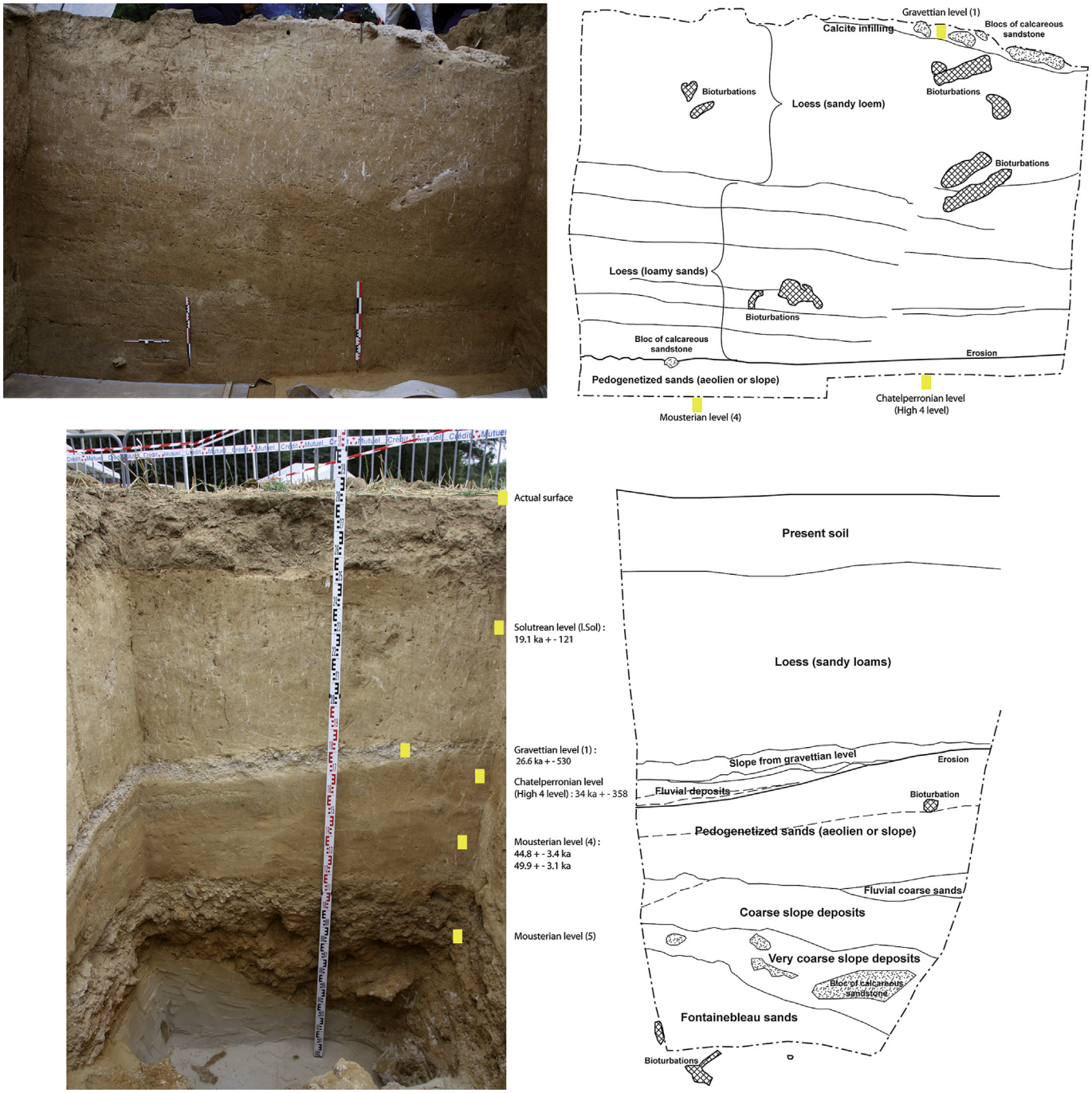

Fig. 3. Stratigraphic and archaeological sections of surveys 3 and 33 in the Bossats (Seine-et-Marne, France), (Cl. & DAO: H.-G. Naton).

- Small pieces are common and their spatial distribution does not exceed three centimetres. Different sizes of artefacts (flints, colouring materials, other stones and bones) are present. Chips are abundant as are flakes and cores. As an example, 520 chips of flint, less than 1 cm in size, were found during the sieving of sediments from a single half a square meter. Most of these seem to derive from spontaneous removals from hard hammer percussion, suggesting in situ knapping. They were mixed with numerous burnt bones fragments and colouring material chips,
- Burnt remains (flint, bones and ash impregnated in the sediment) were often concentrated into small zones. In one case, a small hole is completely filled with archaeological material,
- Some flint flakes have been refitted to cores in the course of the washing of the material,
- Finally, a sandy deposit, approximately 15 cm in thickness, separates the Chatelperronian and the Mousterian levels. Both are thin and marked by uniform horizontal deposits of artefacts. Very limited dispersion of the archaeological remains was observed.

Thus it appears that the Mousterian level was fossilized in situ and contains a high concentration of various undisturbed remains.

Prior to the discovery in 2009, auger holes and 40 test pits between 1 and 5 square meters were done (Fig. 6). Ten pits revealed a

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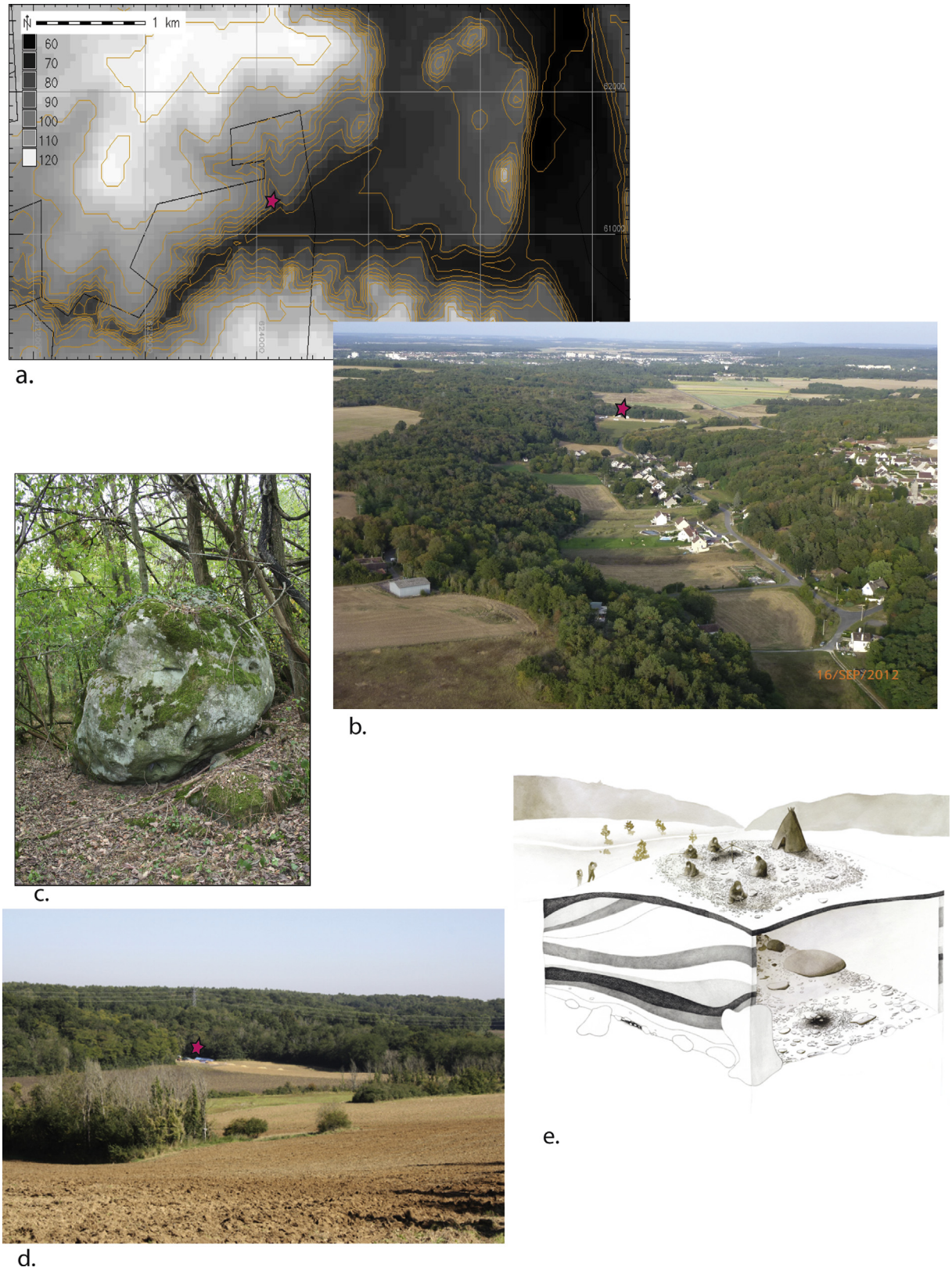

Fig. 4. Different views, map and drawing of Les Bossats (Seine-et-Marne, France), (DAO: P. Bodu; photos: P. Bodu and R. Tisna; drawings: M. Jamon); a: localisation of the site in the Ormesson valley (star); aerial view of the site (star); c: sandstone block around the site; d: view of the site toward the north (star); e: reconstruction of the site stratigraphic between Gravettian and Middle Palaeolithic.

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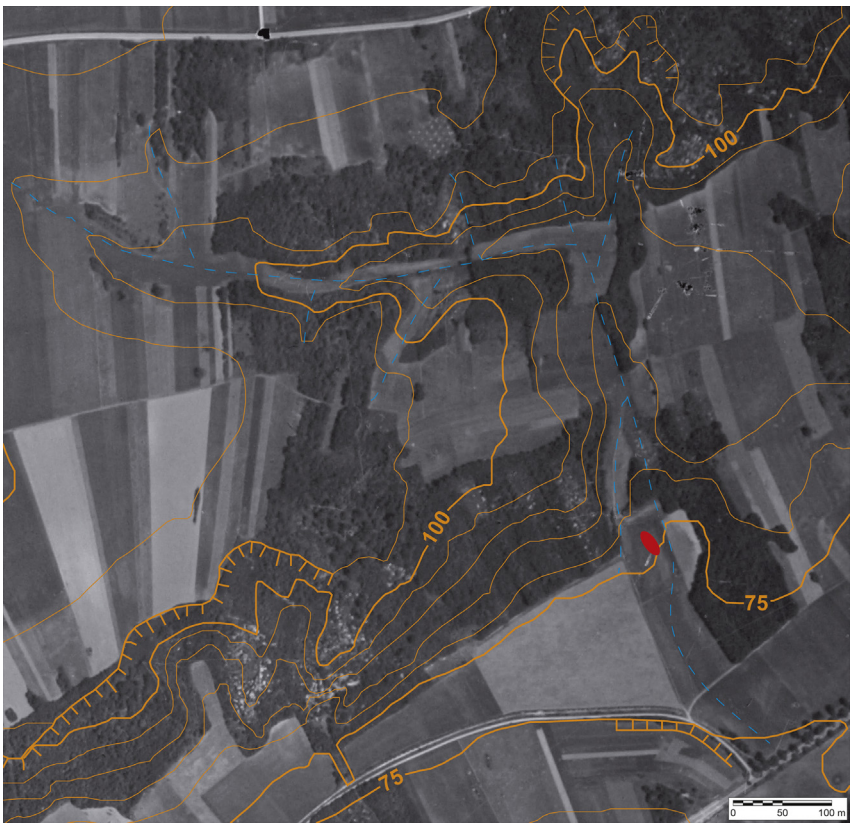

Fig. 5. Topography of actual landform and the talwegs near the Bossats (Seine-et-Marne, France) on the background of an aerial photograph from 1949 (Cl. IGN, DAO: H.-G. Naton).

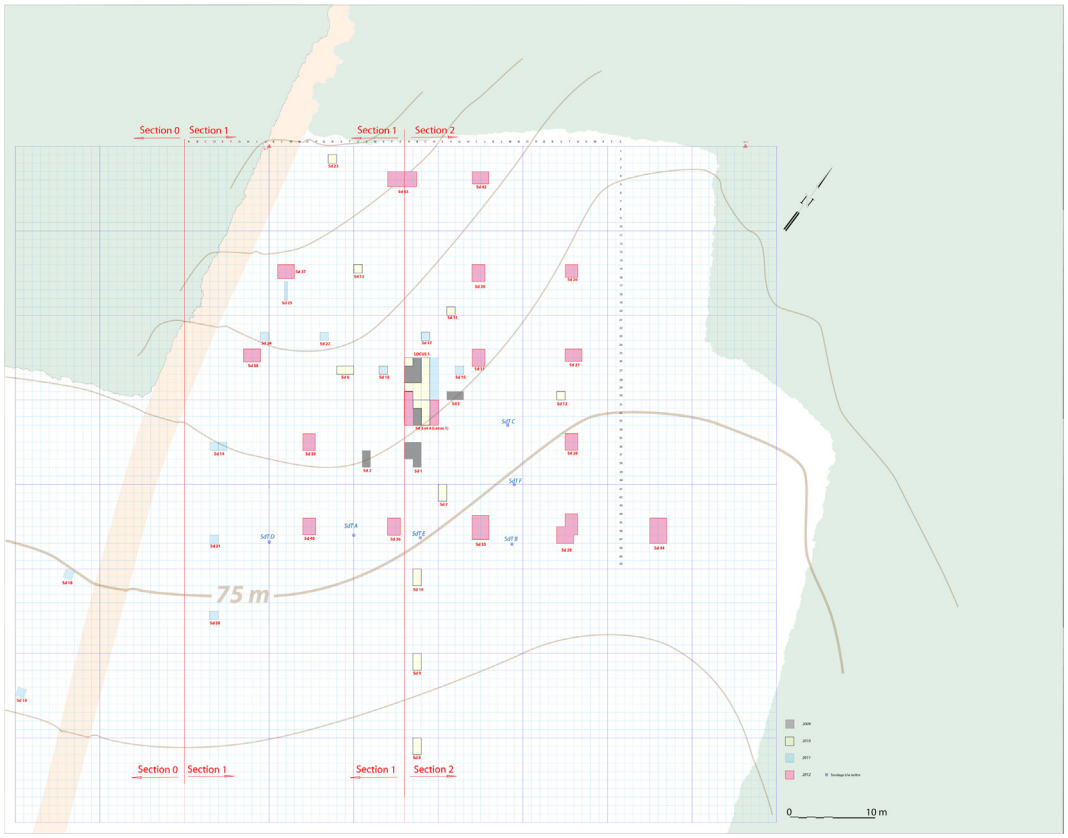

Fig. 6. Map of the pits dug between 2009 and 2012 (DAO: J. Suire, D. Molez).

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Mousterian level (level 4), particularly in pit 3 (square meters B32 and B33), enabling evaluation of the surface covered by the camp, now estimated as at least 500 square meters with a low dip (Fig. 7). The surface could reach 2000 square meters if the material found 60 m east of pit 3 actually correspond to the same thin and dense Mousterian level, which would be the result of a single settlement level. At any rate, this surface is exceptional though not unique for this period. For the moment, the higher concentrations of archaeological remains are found in pit 3, within the square meters B32 and B33. In the other pits, the archaeological material is less numerous, but it is interesting that in pits less than ten meters away (pit 3 and pit 7), identical colouring materials were found, worked in the same way by Mousterian groups (Fig. 7). In the peripheral pits, there is a gradual decrease in the amount of material, suggesting the existence of real spatial organisation and thus of activities, between a core area represented by pit 3 and less occupied areas at which some lithic artefacts and rare bones were found, as observed in pits 10, 27 and 36.

3. Chronocultural context

The lithic industry belongs to the Middle Palaeolithic. The only kind of flaking method that has been currently recognized in level 4 is Discoid (Boëda, 1993; Mourre, 2003; Thiébaut, 2005). Cores with a discoidal shape are far from uncommon at Middle Palaeolithic sites and appear in various periods. However, following the recent advances in this field of study (Mourre, 2003; Peresani, 2003; Jaubert et al., 2011) a distinction should be made between these occurrences. On the one hand, there are ubiquitous occurrences of discoidal cores which can be obtained by various reduction processes, favoured by contextual factors such as raw material quality and availability. In these cases, discoidal cores can be an epiphenomenon of other technological systems, such as the Levallois method. On the other hand, the Discoid flaking method which is based on specific technical gestures and goals, produces cores with various shapes from discoidal to prismatic (Boëda, 1993; Jaubert, 1993; Locht, 2003) and occurs as the main, if not the only, method displayed in an industry, even in contexts where raw material was abundant and of good quality.

At Ormesson, thermoluminescence dates obtained on two heated flints are consistent with production of the Mousterian level between −44.8 ± 3.4 ka and −49.9 ± 3.1 ka, a final period of the Middle Palaeolithic within MIS 3. This dating is also quite consistent with that of most Mousterian industries with denticulate and discoid features known in southwest France (Caspar et al., 2005; Thiébaut, 2005; Jaubert et al., 2011).

Cultural layers dominated by the Discoid flaking method have been frequently reported from southwestern France and northern Spain, where they have been found mainly in caves and rockshelters (such as Les Fieux, Combe Grenal, La Quina, Saint-Césaire, Roc de Combe, Abri Romani) but also at a few open air sites such as the bison-kill site of Mauran (Farizy et al., 1994). They are mainly dated to MIS 3, and display mainly denticulate and notch types. On the basis of the growing evidence of a temporally limited but technologically distinctive phenomenon occurring within the classic Mousterian sequences in this region, several authors have postulated the existence of a Discoid-denticulate techno-complex (Thiébaut, 2005; Jaubert et al., 2011), dated broadly between 38 ka

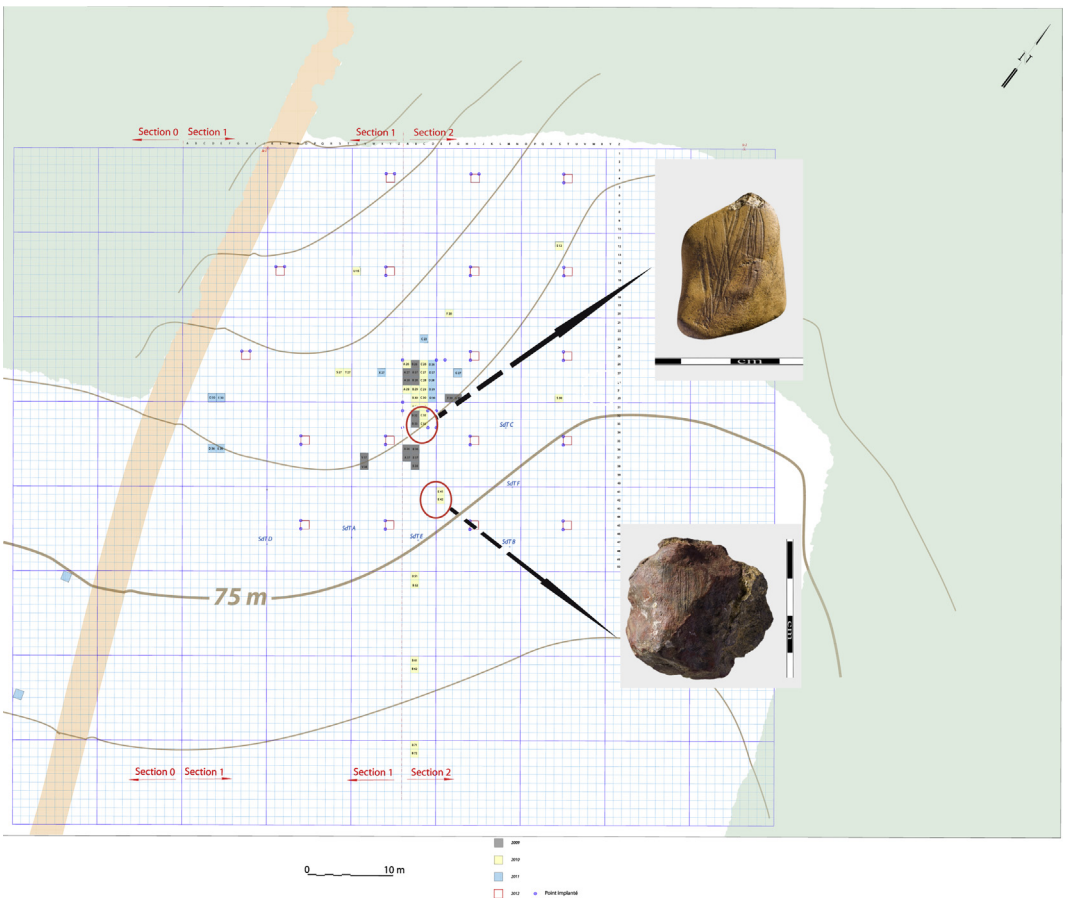

Fig. 7. Localisation of the pits having delivered some colouring materials in the level 4 (DAO: J. Suire, P. Bodu; photos: S. Oboukhoff).

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and 50 ka. Further to the north, there are fewer industries that would both illustrate a similar technological specialisation (i.e., the Discoid knapping method) and be reliably dated to this chronological period. The most noteworthy is certainly the Discoid horizon isolated within three different cave sequences at Arcy-sur-Cure (Hyènes, Bison and Rennes caves (Fig. 1, Lhomme et al., 2005)) and the two levels at the open-air sites of Beauvais dated as late as 55.6 ± 4 ka BP (Locht, 2003). While this older site and other sites in France (e.g. Baume de Gigny), Belgium (e.g. Sclayn) or Great Britain (e.g. Oldbury) may question the definition of the Discoid-denticulate techno-complex with respect to both geographical extension and age, dates from Les Bossats offer additional evidence that speaks for an association with most of the Discoid industries from southwestern France.

4. A preliminary spatial analysis of the Middle Palaeolithic level from the pit 3

In pit 3, in two square meters, we discovered a continuous spread of artefacts, primarily flint, sandstone blocks, colouring materials and, to a lesser extent, bones (Fig. 8). Despite the small size of the pit and of the concentration, some facts support the hypothesis of spatial organisation in this level. In one corner of the square meter in question, a combustion area emerged, containing rubefied sediment, burnt fragments of flint and sandstone and charred bone chips. At present, only a small area (less than 40 cm^2) has been excavated, but the importance of past combustion can be seen by the density of charcoal in a brown and black area and the large number of burnt artefacts found here (Fig. 9). Careful sieving of the sediment also yielded a few wood charcoal fragments, preliminarily identified as *Juniperus* sp., *Gymnosperms* and *Pinus nigra/sylvestris* (Isabelle Théry-Parisot, identification). In square B33, two small depressions (12 cm in diameter and 8 cm in depth) were filled with flint and bones, as well as with colouring materials and traces of charcoal. There, the material was very concentrated, concretionary and also showed divergent dips, giving the impression that the depressions were filled in after being dug. Their function is as yet unknown.

Pit 3 also yielded four large stone blocks (length about 30 cm, about 10 kg) whose relationship with the settlement floor is clear, because a few flint pieces and bones were found underneath when the blocks were removed. (The two other large sandstone blocks were not removed during the last campaign.) The blocks, probably collected from the calcitic debris surrounding the open-air site, could not have been naturally deposited here (Fig. 10), but were rather brought and deposited by the Mousterians for a reason still unknown. No wear related to the use of one or more of their surfaces has been observed so far, but better observation of the different faces of the blocks is required. The observation window is quite short now, but these blocks were used to delimit space, used as "site furniture" (seat, anvil, etc…). More information will be collected when the excavated area is enlarged. Currently, the lithic material is the most abundant at all of the different pits, and particularly so in pit 3.

5. A lithic industry of Discoid type

Among the pits that yielded evidence of Middle Palaeolithic occupation, the material coming from pit 3, excavated in only two square meters, constituted by far the most important contribution to the corpus (Fig. 9). Not less than 721 artefacts referable to flint knapping were recorded. In addition, many chips were recovered by sieving and referred indicate in situ production. For example, square B33 alone yielded 482 lithic artefacts with a size greater than 1 cm.

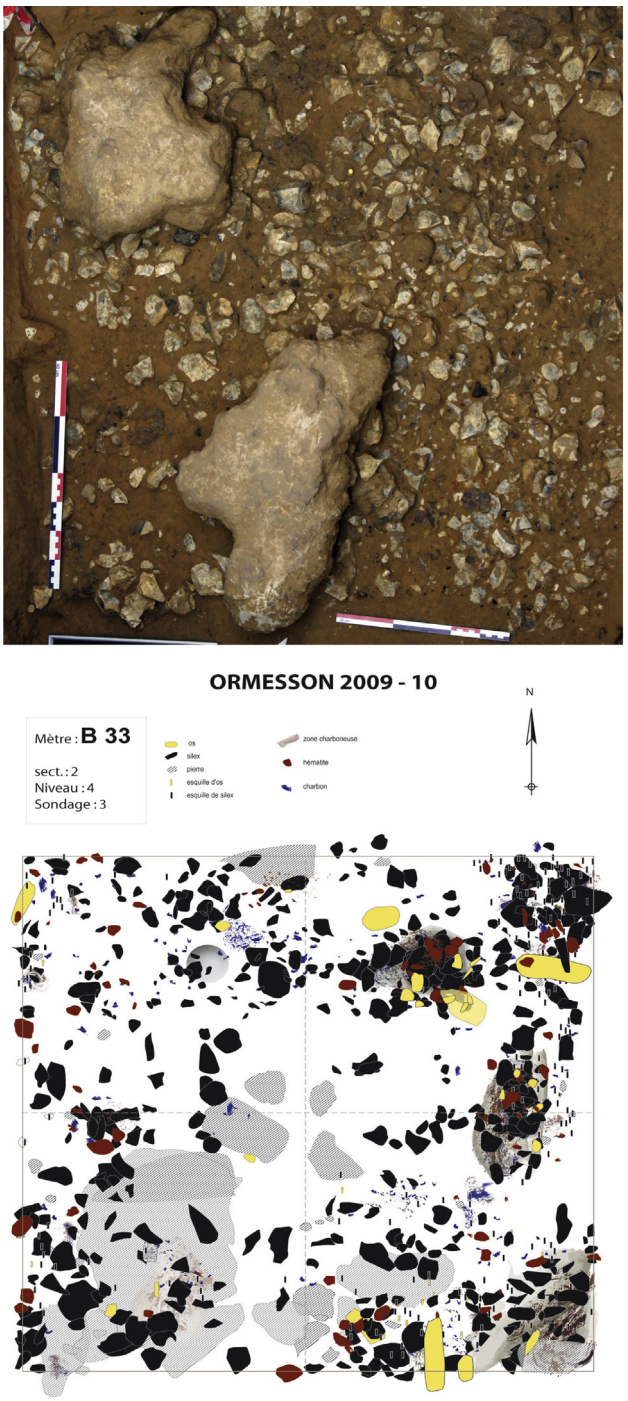

Fig. 8. Photo (a) and map (b) of the pit 3 (Photos: P. Bodu; DAO: D. Molez).

The predominant raw material is a secondary flint with a white patina, sometimes with crystalline areas (Fig. 11). Its light-beige-coloured cortex, washed or rolled, is associated with earlier natural fracturing areas, indicating procurement in secondary context (Campanian?). This flint was collected in deposits different from those used by the Gravettians and the Solutreans.

These aspects of level 4 were immediately observable during the excavation, and the realisation of some refits shows the coherency of the assemblage, even if this homogeneity needs to be confirmed by future expansion of the excavated areas. The material comes from the *chaine opératoire* for flake production (Fig. 12). The technique

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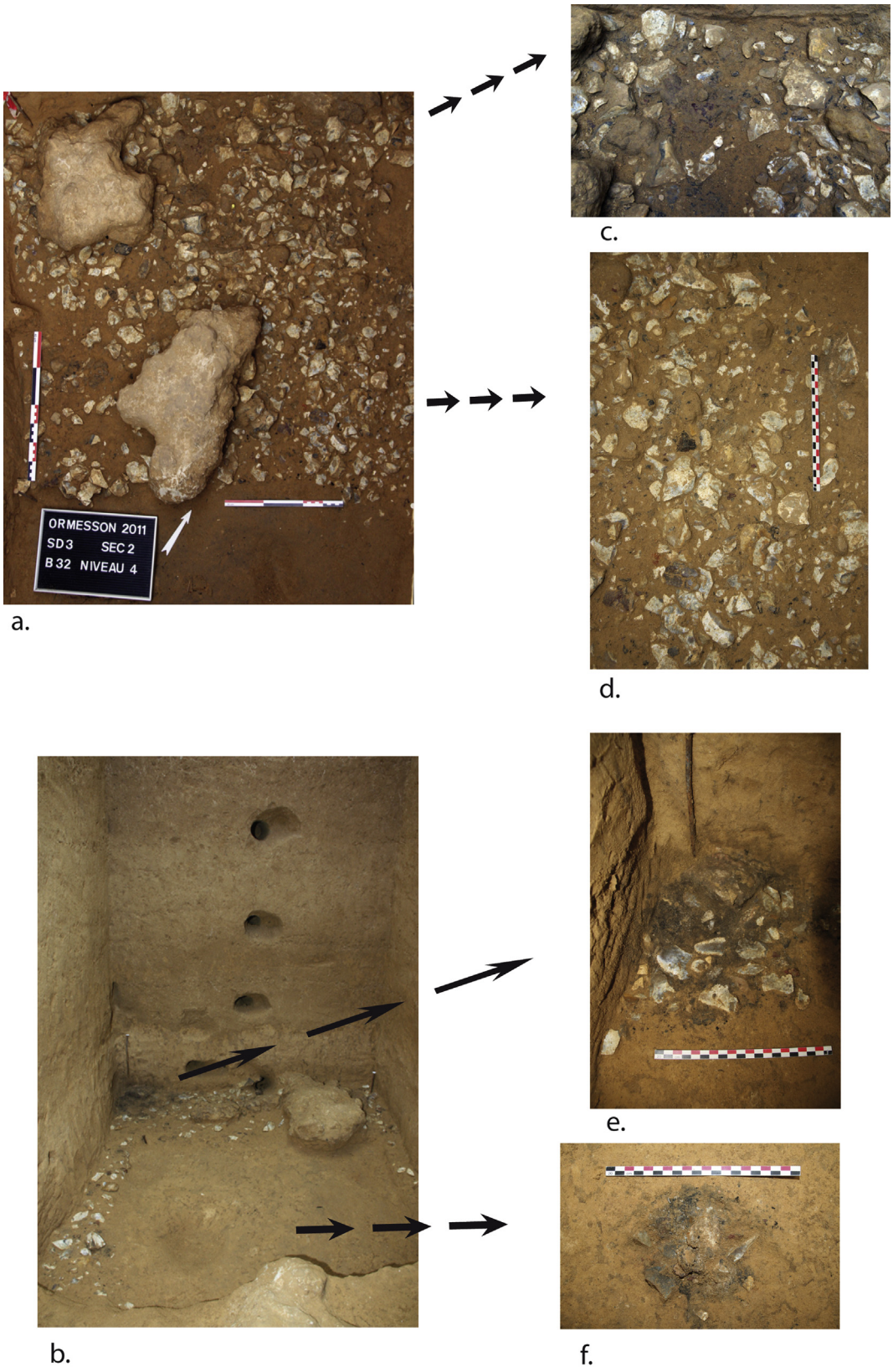

Fig. 9. Different photos of the level 4 floor: a: view of the square B32; b: partial view of the square B33; c: detail of a fireplace; d: detail of a flint heap; e: detail of a fireplace; f: bowl filled with archaeological artefacts (photos and DAO: P. Bodu).

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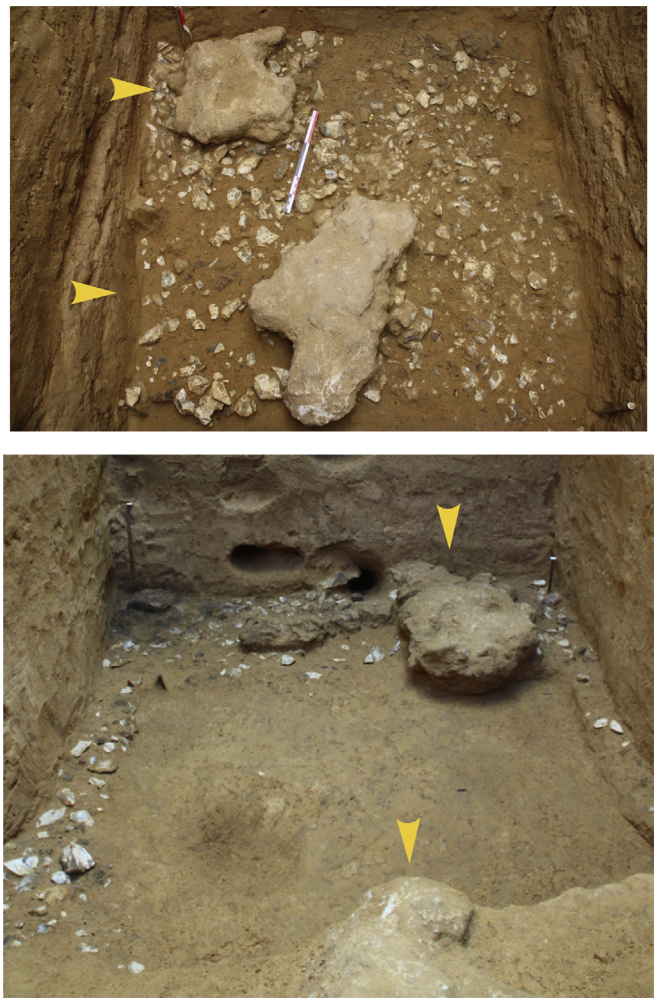

Fig. 10. Photos of the concretion blocks lead on the level 4 surface (Photo and DAO: P. Bodu).

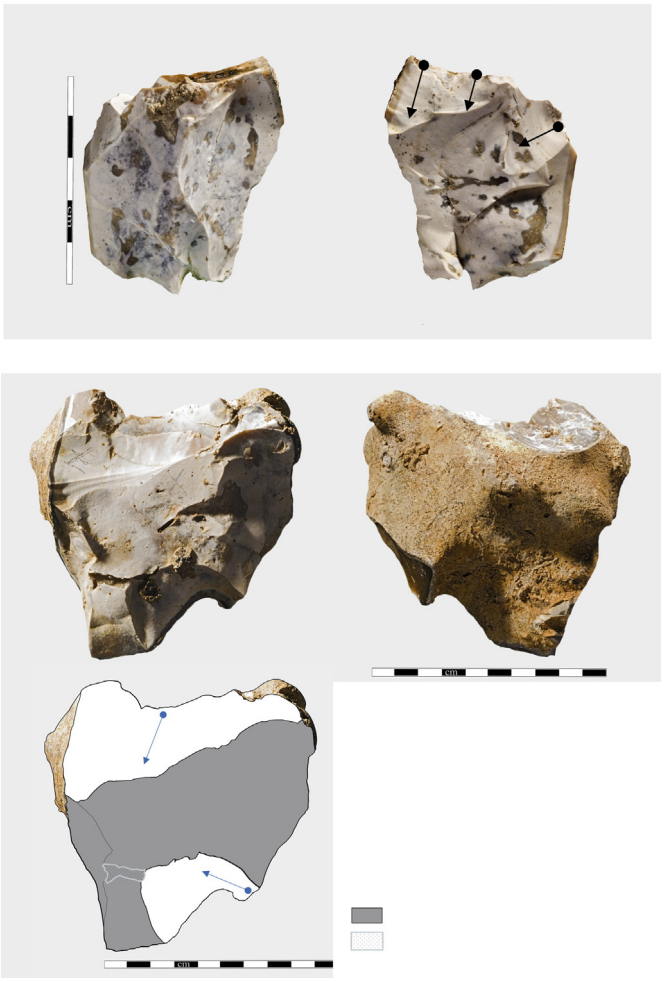

Fig. 11. Examples of siliceous raw material used in the level 4 (Photos S. Oboukhoff; DAO: M. Leroyer).

used is direct percussion with a hard stone hammer, which creates thick butts with a semi-circular bulb spreading towards the surface of rupture. Some circular cracks, made by failed strikes, are often visible on the butts and inside the platforms. Those knapping rarely used a phase of preparation of the striking edges.

At present, the refits are too scarce to completely describe the knapping reduction sequences. The reconstruction of these sequences is currently based on direct reading of the artefacts, especially cores (Fig. 13). These are grouped in two main categories: cores on blocks and cores on flakes. The analysis of the cores on blocks supports use of a Discoid system "taken in a broad sense" (Locht, 2003; Peresani, 2003; Delagnes et al., 2007). This is shown by cores whose exploitation is very close to Discoid method as defined by Boëda (1993). This relationship is particularly evident in the application of four of the six technical criteria mentioned by the author:

- organisation of the knapping around a core with an asymmetrical biconvex structure;
- production of intersecting plane removals, according to a centripetal or chordal orientation of the flakes;
- no distinctive sequences to maintain convexities;
- lack of permanent technical hierarchy between the core surfaces. As already observed at Beauvais, a flexibility in the organisation of the knapping surface seems to be related with the variability of cobbles shapes. Among the products associated with such reduction, there is the morpho-technical sequence specific to discoid reduction: points, pseudo-Levallois and typo-Levallois; flakes with a limited back and flakes with broken profiles. Very few retouched tools were associated. They mainly consist of discrete backed knives. Fig. 14 provides an example of this kind of discrete tool. This is a small flake of *plein débitage*, elongated and thin, on the proximal end of which an oblique back was developed, with very discreet abrupt retouch. This kind of flake may constitute an atypical product of Discoid method and might have been produced in a unipolar knapping sequence.

The rest of the debitage from pit 3 reveals non-characteristic elements, including cortical flakes, fragments of flakes and some elongated or lamellar flakes, which appear to constitute an epiphenomenon of the main production. Given the large proportion of these artefacts in the assemblage, it is not very surprising that most of the flakes discovered in the other pits belong to this category. However, in pit 7, the second richest in lithics after pit 3, two flakes with broken profiles and a small pseudo-Levallois point (Fig. 15) were discovered among 15 flint elements. Their presence supports the hypothesis of a technically homogeneous level, already suggested by the raw material and the surface conditions identical from a pit to another. No additional retouched tool has been found in the other pits, including

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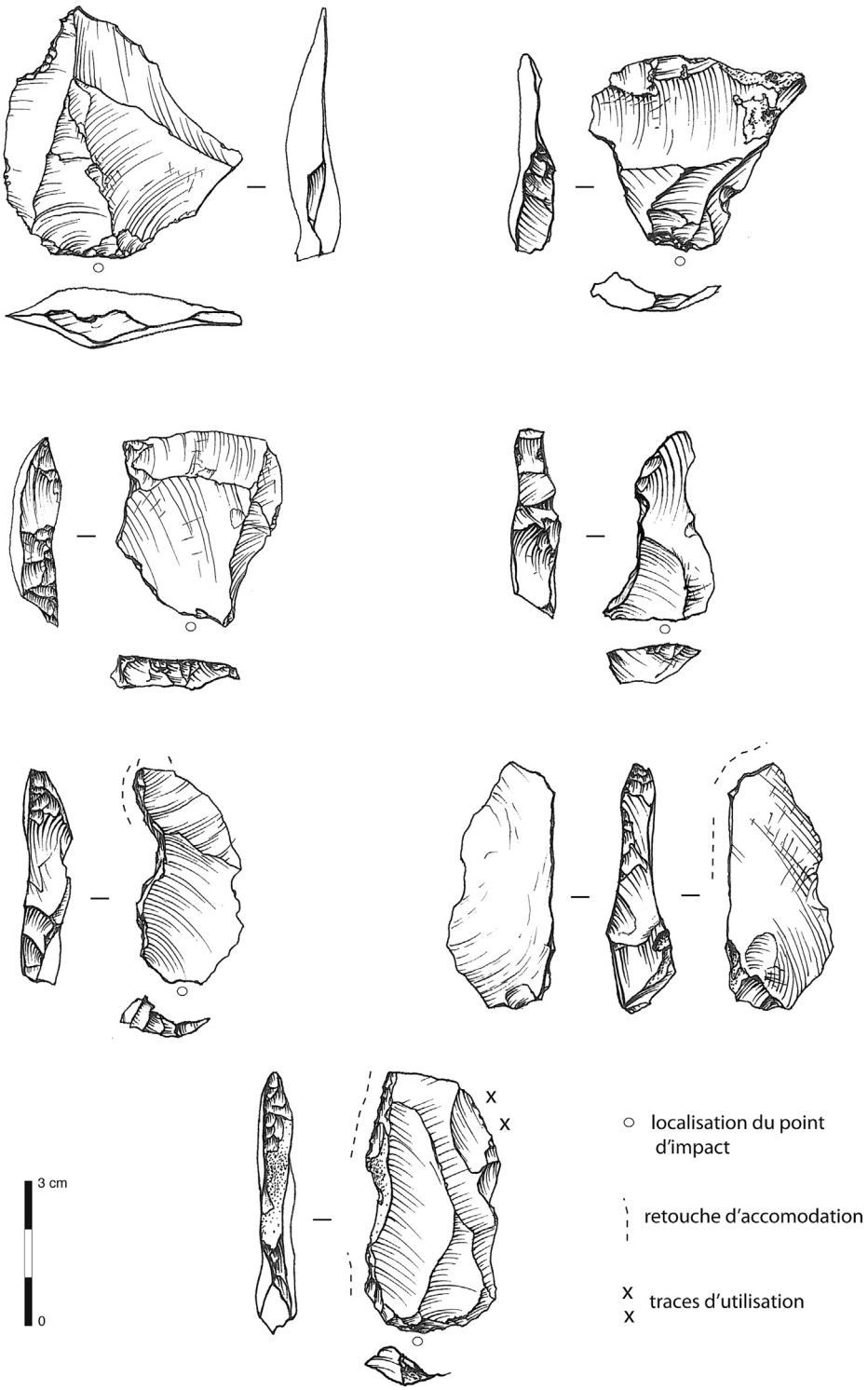

Fig. 12. Different flakes of the level 4 (DAO: M. Leroyer).

the most recent. At present, flint exploitation in this level seems to be oriented to the systematic production of small raw flakes, with thin sharp edges directly available, especially for cutting activities.

The dominant intention is also illustrated by a *chaîne opératoire* of secondary reduction on flakes. This is demonstrated by rare cores on flakes and by some Kombewa flakes (Tixier and Turq, 1999) (Fig. 16). Such productions are frequent in assemblages dominated by the Discoid method (Bourguignon and Turq, 2003; Locht, 2003; Bourguignon et al., 2004). As in these assemblages, the reduction of flakes as cores does not seem to reflect a desire to save flint. Such behaviour would contrast sharply with the low degree of exhaustion of the cores on blocks and the presence in this level of a large barely used flint block. It could indicate a spontaneous but recurrent behaviour to create and use small thin flakes from the immediately available matrix.

A final point should be mentioned. Most of the cores on blocks show evidence of knapping prior to onsite reduction, incompatible

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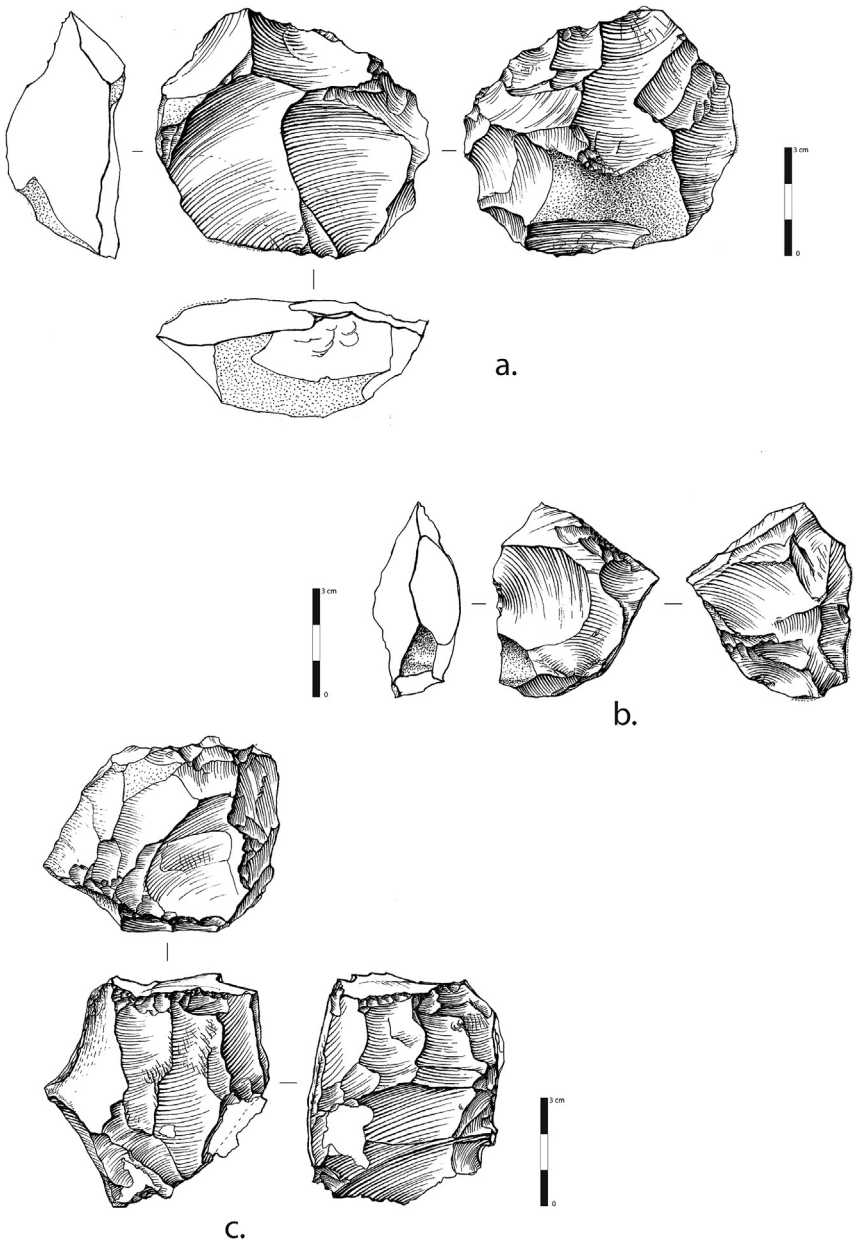

Fig. 13. Different cores of the level 4 (DAO: M. Leroyer).

with the removal of flake: this is manifested by the combination of "fingernail" impacts (circular and isolated cracks) in the middle of the artefacts. Rather than the desire to break the cores, these traces indicate their reuse as a hammer. Although this practice is not evidence of a particular technique (Claud et al., 2010), the way the discoid cores were reduced led to frequently massive volumes, which *a priori* lends itself to this kind of reuse (see e.g. Antoine et al., 2006).

6. Limited faunal remains

Fauna is the least represented in level 4, due partly to preservation phenomena as indicated by the multitude of small burnt bone fragments directly associated with the concentration layer. These seem to be better preserved than the unburnt bone. The spatial distribution may play a role in the presence or absence of fauna in different zones of the site. Until the last campaign during which a horse tooth was discovered in B32, no species determinations were possible. Some rare bison bones and a piece of mammoth molar discovered during the first field excavation are now considered to belong to a more recent level (Chatelperronian), located less than 15 cm below level 4, a level which was not identified at first as such.

The small excavated area limits interpretation of the fauna hunted by the Mousterians of Ormesson. However, the presence of identifiable bone fragments in place in pit 3 shows that this analysis can be developed when level 4 is excavated over a larger area. During the 2012 field excavation, it was nevertheless possible to add a species to the fauna of the Mousterian level. In pit 36, located a dozen of meters south of pit 3, two upper teeth of a hyena have been identified, a molar and a premolar closely associated with some lithic material from Discoid technology. The presence of this species in a Mousterian archaeological open-air context is quite exceptional in the Paris Basin.

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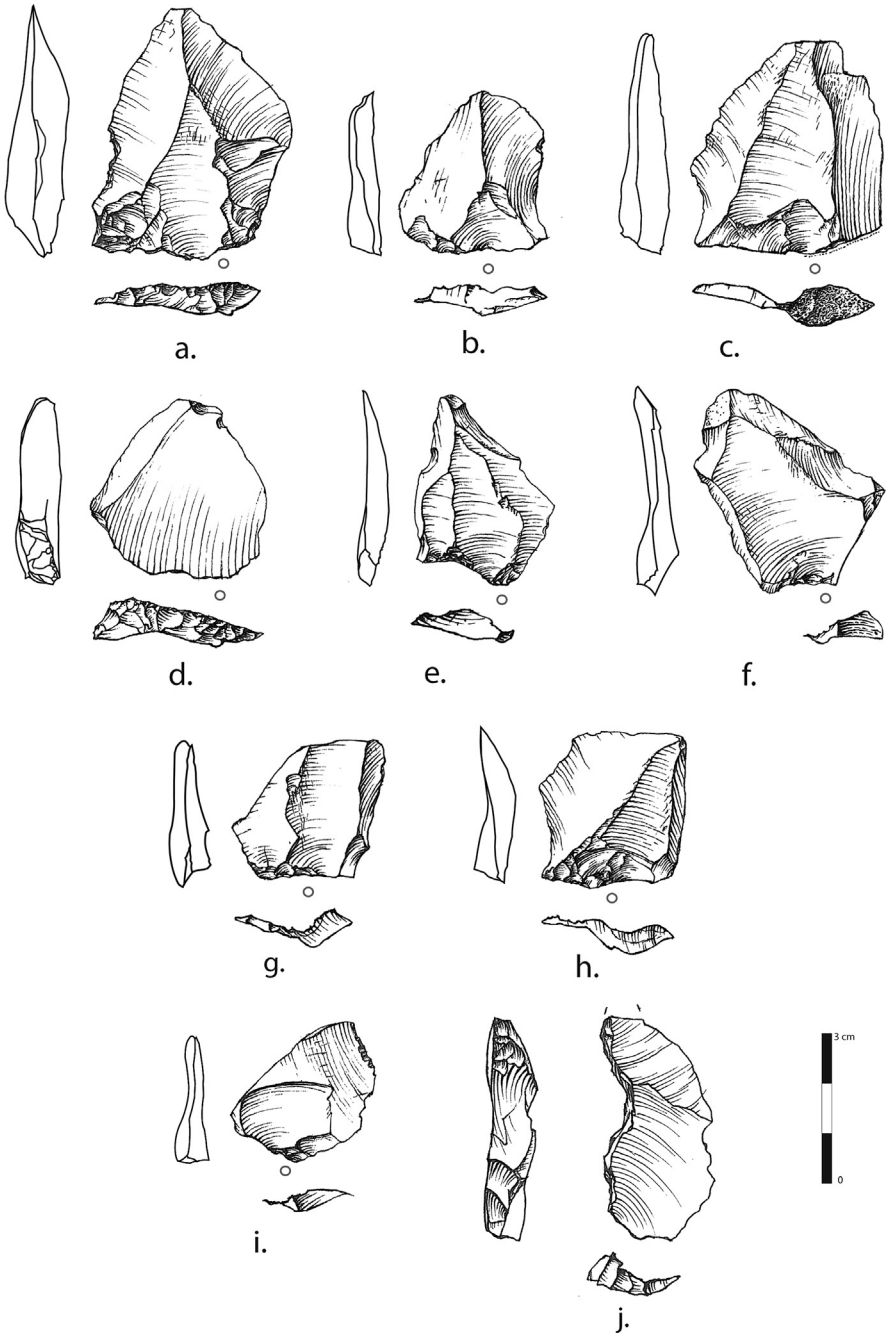

Fig. 14. Pseudo-Levallois points as tools of the level 4 (DAO: M. Leroyer).

7. Colouring materials

More than bones and flint, the presence of colouring materials is particularly unprecedented at Ormesson. At the end of the first field excavation, pit 3 yielded 77 yellow and/or red fragments, most of small size (<3 cm), to which can be added five other fragments discovered in the same level in pit 7 (Fig. 17). This is a quite exceptional discovery for the final Middle Palaeolithic context of the Paris Basin and in the Mousterian world in general, firstly because of their abundance in association with the bone remains and the knapped or unknapped lithics, but also because the findings from pits 3 and 7 demonstrate the intensity and variability of the processes implemented to extract the colouring powder.

The discovery of colouring materials is sparsely documented among Middle Palaeolithic artefacts. However, abundant remains were recently discovered in the Middle Stone Age of South Africa (Watts, 2002; Barham, 2002;; Van Peer et al., 2003; Marean et al., 2008; Henshilwood et al., 2002;, 2011; Wadley et al., 2009), red colouring materials were recovered in the Levantine Mousterian in Israel at the sepulchral caves of Qafzeh (Hovers et al., 2003; Bar-Yosef Mayer et al., 2009) and Skhul (D'Errico et al., 2010; Salomon et al., 2012), haematite traces were found at the site of Maastricht-Belvédère (The Netherlands, Roebroeks et al., 2012). For a decade, these materials, increasingly numerous and well-documented, fee the debate, showing the apparent use perhaps as early as 250–200 ka at Kapthurin Formation in Kenya (Tryon and McBrearty, 2002), in Twin

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Fig. 15. Lithic material coming from the level 4 (pit 7) (Photo. S. Oboukhoff).

Rivers (Barham, 2002), in the Lower Sangoian at Sai Island in Sudan (Van Peer et al., 2003), at Maastricht-Belvédère in the Netherlands (Roebroeks et al., 2012). These materials, mostly red, extracted from their geological rock and then used, actively contribute to the intense debates on the "origins" of symbolic practices, thought to be indicative of "cultural and behavioural modernity" (review in Salomon, 2009).

The discoveries in the Mousterian of Ormesson are not completely isolated in Europe. Colouring materials are generally black, more rarely red and yellow, recovered in different Mousterian facies from the Périgord, specifically in the final phases, but also at the Grotte du Renne at Arcy-sur-Cure (Yonne – France; Couraud, 1991; Salomon, 2009) and at Spy in Belgium. These sites have provided quantities of colouring materials with wear facets, striations due to block scraping, but also artefacts, including slabs, scrapers and possible grindstones, covered to varying degrees by colouring residues, reflecting their use in activities of reduction into powder of the colouring rocks (De Sonneville-Bordes, 1969; Capitan and Peyrony, 1912; Bordes, 1952; Soressi and D'Errico, 2007; Demars, 1992). In sum, the increased number of colouring remains and artefacts involved in their treatment or use shows that an organisation existed for the exploitation of minerals with respect to as yet undefined properties and uses not yet well understood or even described. Nevertheless, provided that we can advance in the knowledge of a subject still in its infancy, the use of colouring materials is now a confirmed element in Mousterian culture in Western Europe. The remains are in different categories: mostly chips a few mm thick, fragmented and revealing edge cracks; nodules or fragments of nodules formed by sequences of layers a few mm thick and, among these, nodules faceted by different actions (Fig. 17).

The chemical determination (scanning electron microscopy, X-ray fluorescence and X-ray diffraction) and observation scales at the metallurgical microscope indicate that these colouring materials have a morphology, an organisation and a composition characteristic of ferruginous concretions, that is, accumulations of iron-rich material around a core or on the ground, by successive deposition of layers of haematite (red) and goethite (yellow to brown) (Fig. 18). Iron oxides are naturally found in kaolinite clay and rare quartz grains with regular granularity.

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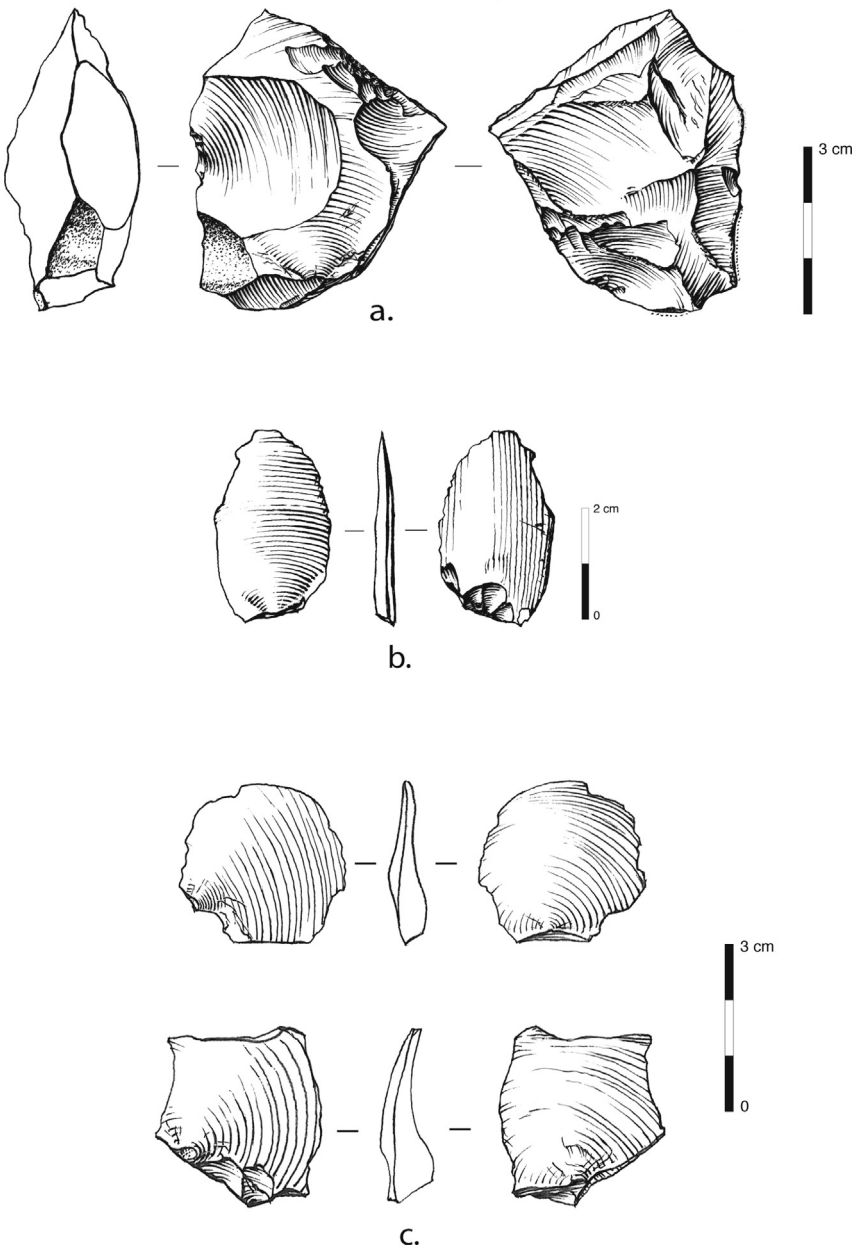

Fig. 16. Core on flake and Kombewa flakes of the level 4 (DAO: M. Leroyer).

The concretionary and stratified appearance of the haematite–goethite nodules does not show any evidence of fluvial or colluvial transport. The surface irregularities (cracks, blisters) are intact. Consequently, the colouring materials were collected at the primary outcrop and brought to the site.

In the area around the site, two geological formations may provide ferruginous materials with concretionary structure, according to the geological maps from the BRGM 1:50,000 (Fontainebleau n° 294 and Château-Landon n° 329, (Geological Maps 1:50,000, 1970, 1971). The nearest one is the surrounding Stampian horizon (g2a), situated at the bottom of the Vallée d'Ormesson less than 1 km from the site. It provides such concretions which are suggested by the name given to some places ("Crottes de Fer", for instance). Locally, sandstone blocks are covered with iron oxides crusts found in primary position and generally not blunted. The second one is the Sparnacian stage (e3–4) dated to the beginning of the Palaeogene. Its outcrop area, exclusively represented on the right side of the Loing, on the opposite side from the Mousterian occupation, may have reached Nemours 40 to 50,000 years ago. The ferruginous materials used by the Mousterians of Ormesson may have been extracted from both these formations. The supply in raw ferruginous concretions was determined by crossing petrographical characteristics and geochemical fingerprints measured by proton Induced X-Ray analyses (Mathis et al., in press). It was demonstrated that the raw ferruginous material was selected within the Sparnacian formation. Procurement required crossing the river because the raw materials were removed from primary context.

Six artefacts from pit 3 and pit 7 show six different kind of use-wear (Figs. 17 and 19):

- Parallel and sub-parallel deep striations in groups with the same orientation. This repeated action of scraping the surface of the red object is indicative of the desire to obtain powder.

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Fig. 17. Colouring materials of the level 4 (Photo and DAO: H. Salomon).

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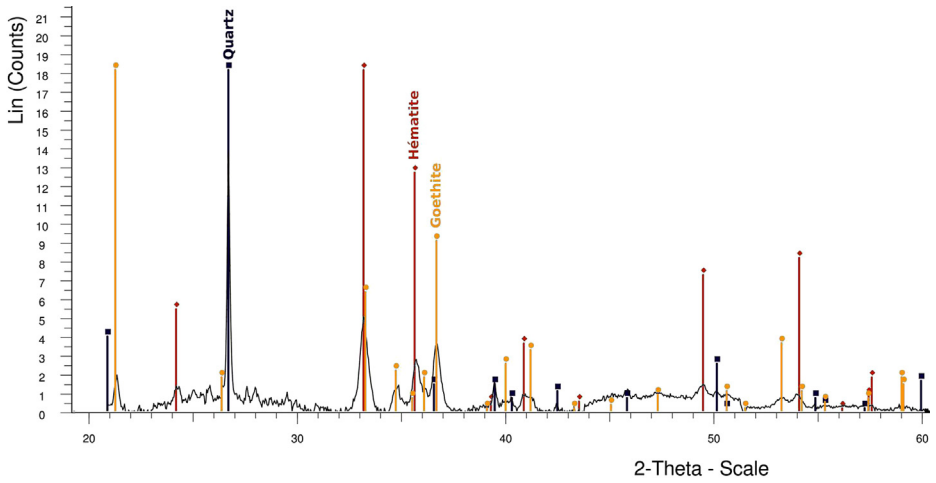

Fig. 18. Analysis of the mineral composition in micro-diffraction of the X-ray (C2RMF) of the artefact OR09-B33-107 (scraped artefact) (DAO: H. Salomon).

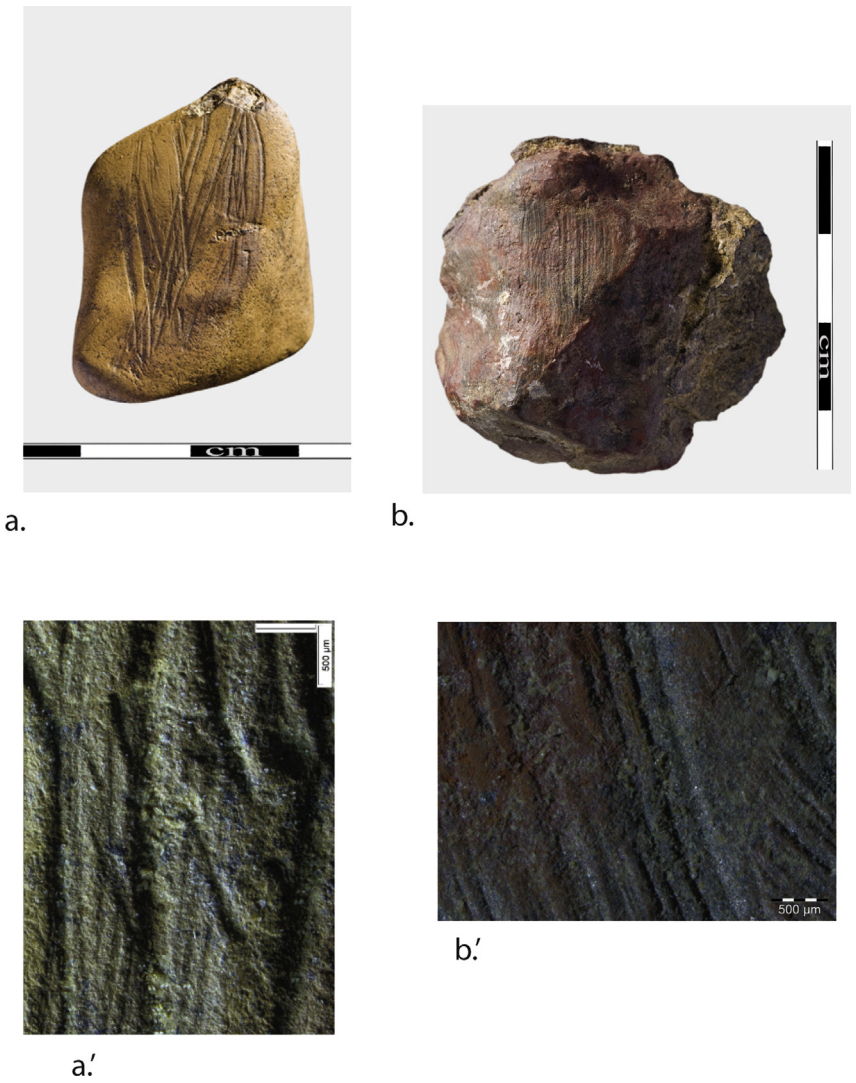

Fig. 19. Colouring materials working blocks (a, b) and details of the working stigmata on the same blocks (a′, b′) (Photo: S. Oboukhoff and H. Salomon; DAO: P. Bodu).

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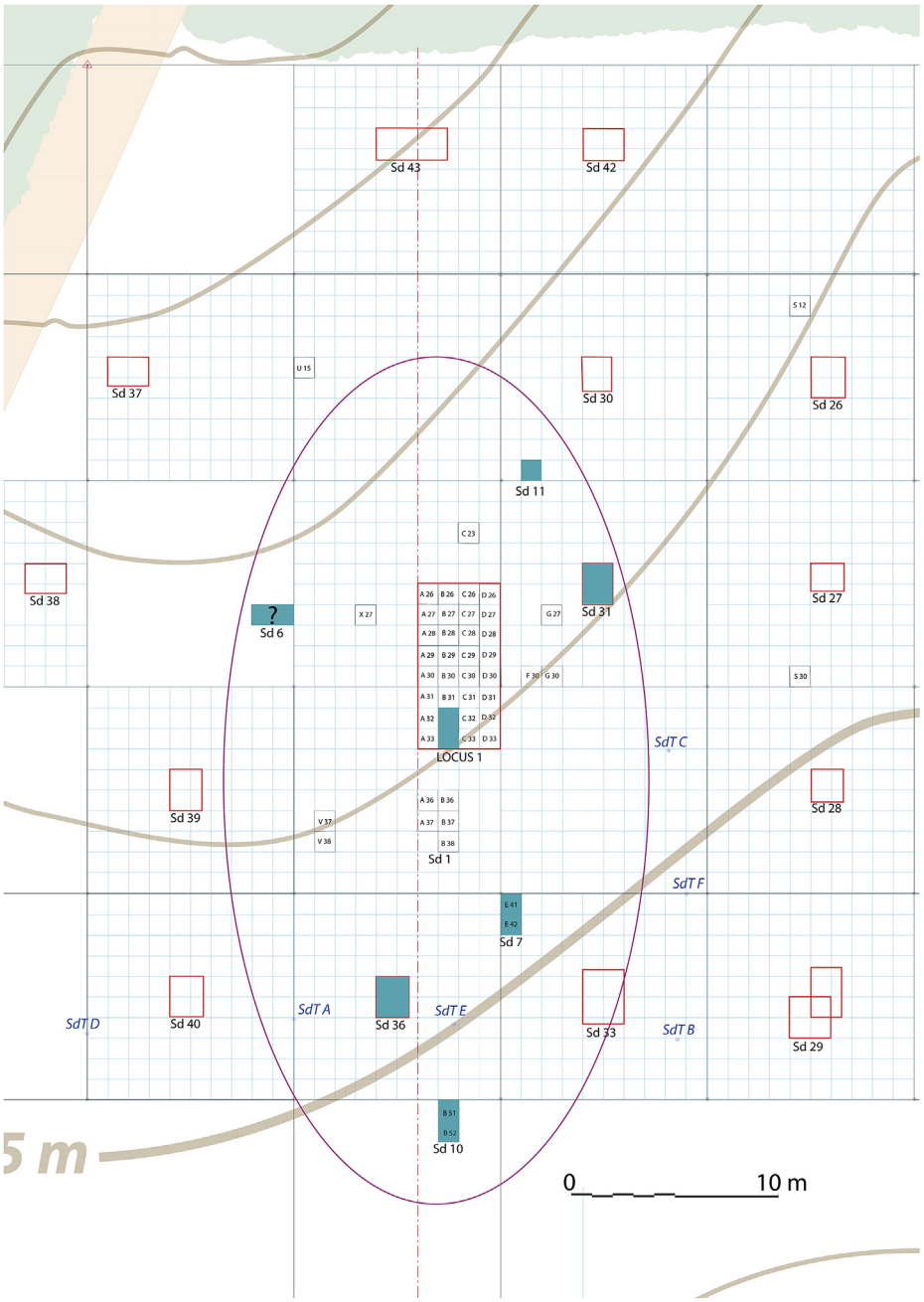

Fig. 20. Map of the presume extension of the Middle Palaeolithic level 4 (DAO: J. Suire, D. Molez).

- Thin, short, sub-parallel or striations associated with disordered facet or very small juxtaposed plano-convex facets, 0.7×0.7 per cm^2.
- Planar to plano-convex facets covering almost all the colouring material with smoothed and thin striations.
- The impact of pounding leads to detachment of flakes.
- Very fine and disoriented striations on the remains of red chips adhering to a yellow-coloured layer of a nodule.
- Long and deep isolated or sub-parallel striations in groups of two to four lines, disordered and sub-parallel, intersecting.

The other 72 fragments are mostly too small to observe any treatment, but at least one crack could be anthropogenic. Distributed within two different pits about 8 m distant (pits 3 and 7) and probably forming a large layer, colouring materials seem to have undergone substantial use in this Middle Palaeolithic level. The current studies show that a red powder was preferentially extracted by scraping, abrasion or scratching from grinding red layers together. Different kinds of striations were identified, indicating that different kinds of tools, materials or gestures were used to extract this haematite-rich powder.

8. A large Mousterian site

The extension of this level was estimated through pits of one to several square meters and by coring, suggesting a minimum extent of 450 m^2, but this surface is probably even larger (Fig. 20). Indeed,

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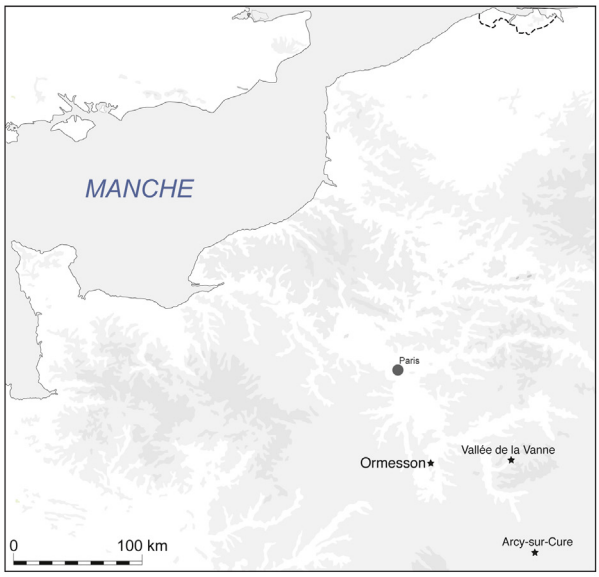

Fig. 21. Localisation of the Middle Palaeolithic sites in the Vanne valley, of Arcy-sur-Cure and Ormesson (DAO: P. Bodu).

in the plot directly adjacent to Les Bossats, La Maladrerie, a lithic assemblage (core, flakes) that appears to be Middle Palaeolithic was exposed by ploughing, indicating the limited thickness of the level (35–50 cm maximum). These few artefacts were found about 60–70 m west of the pits containing the Middle Palaeolithic material, which could indicate, if these artefacts belong to the same level, that the level covers a minimum area of 2000 m^2. This surface is not incongruous for the Middle Palaeolithic, because some delimited sites have similar surface areas, for example not far from Ormesson, in Northern Burgundy, in the Vallée de la Vanne (Deloze et al., 1994; Locht et al., 1994; Depaepe, 2007), but if Ormesson covers a complete and unperturbed site, as the first pits seem to show, this is totally exceptional.

Furthermore, at Ormesson, the altitudes between the most distant pits show that the inclination of the sandy level is very shallow (only 60 cm difference in height over a distance of 40 m on the N–S axis). This archaeological level could be a large-scale undisturbed site across a horizontal surface (relatively low slope overall) with good preservation of different artefact classes. For the moment, the Mousterian layer presents a peel-like aspect and nothing indicates that it is the result of multiple occupations. The presence of colouring material blocks similar in two pits within eight meters would further support a single occupation floor, at least in this part of the site.

9. Initial comparisons, projects and conclusion

Middle Palaeolithic sites are common in the Paris Basin and more generally in northern France. However, sites more or less contemporaneous with Ormesson, which offers the possibility to analyse spatial organization at a large scale with regards to different kinds of activities including flint working, colouring material processing and fauna, are exceptional. In Northern Burgundy, in the Vallée de la Vanne, near Sens and about 30 km south-east of Ormesson, excavations by the AFAN (*Association pour les Fouilles Archéologiques Nationales*) in the 1990s have discovered Middle

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Palaeolithic occupations (Levallois or small biface industries, rare blade industries), which are represented by large concentration of lithic artefacts, within which some activity areas could be identified (flint clusters) and associations of specific objects (tools), but with no faunal preservation (Fig. 21). Without numerical dates, the sites have been attributed to the Typical Mousterian or MTA (*Moustérien de Tradition Acheuléenne*) based on technological or typological criteria, but do not really allow comparisons with Ormesson. Furthermore, they would appear to be slightly older (Deloze et al., 1994; Locht et al., 1994; Depaepe, 2007).

If an analogy was to be found, both in terms of methodological potentialities and chrono-cultural context, the site of Beauvais, also excavated at the beginning of the 1990s by Jean-Luc Locht, would probably offer the best one (Locht et al., 1995; Locht, 2003). This site was attributed to the Lower Pleniglacial, Weichselien, MIS 4, by TL dating on heated flint (55.6 ± 4 ka BP). The knapping method is exclusively Discoid, the objective was the production of flakes with a back opposed to a raw sharp edge, obtained by chordal percussion, and probably used in cutting activities (Locht and Swinnen, 1994). The site, located at the foot of a Palaeogene hill was considered by J.L. Locht as a site used preferentially for reindeer processing after hunts. At Beauvais, bones were used as fuel in fireplaces which seem to have polarized activities. These provide rare evidence of combustion structures in the recent Middle Palaeolithic in northern France. In this sense and because the site is chronologically close to Ormesson, the site of Beauvais provides one of the most pertinent comparisons. Before the discovery of Ormesson, the site of Beauvais was relatively isolated as a recent Middle Palaeolithic open air site with exclusively Discoid reduction. It is now possible to develop interpretations using both sites.

So while the central question of research on the recent Middle Palaeolithic of northern France remains the identification of distinct “cultural” groups, for example by highlighting different lithic production patterns (Levallois, discoid, laminar reduction in association with one of these components, small bifaces industry), recent research addresses the concept of territory (Goval, 2012) or tests the effects of climatic changes on settlement patterns. While making a significant effort to elaborate a highly detailed chronostratigraphic framework based on archaeological and geological analyses, it is now possible to discuss concepts related to group movements, the organisation of large scale areas (regions), or on a smaller scale (sites). Such considerations were the focus of much research several years ago in southwest France (Jaubert and Delagnes, 2007). It is true that the territorial approach in southwest France is often facilitated by the diversity of the available siliceous raw material used by the Mousterians, while in northern France, flint commonly occurs in secondary geological position. These flint types are also less well-described and distinguished, probably due to the lack of specialists but, also because of the relative lack of variability in lithic raw materials across this region.

The contribution of Ormesson to the issue of territoriality in the Paris Basin remains uncertain, as study of this site has concentrated first on the reconstruction of the behaviour of the last Mousterians occupying the site. The results presented here are preliminary, given the small area excavated thus far. It is clear that refits, little tested so far due to the small size of the excavated area, will very soon provide information on the location of activity areas and the general organisation of space. These results will be assessed against the combustion structures, on which we just have begun to focus. An extensive field project of the Middle Palaeolithic level should start in four or five years, after we have dealt with the most recent level. It should be possible to present the first results of the extensive spatial analysis.

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