MESOLITHIC PALETHNOGRAPHY

RESEARCH ON OPEN-AIR SITES BETWEEN LOIRE AND NECKAR

Proceedings from the international round-table meeting in Paris (November 26–27, 2010)

as part of sessions organised by the Société préhistorique française

Published under the direction of
Boris VALENTIN, Bénédicte SOUFFI, Thierry DUCROCQ,
Jean-Pierre FAGNART, Frédéric SÉARA, Christian VERJUX

‘Mesolithic Palethnography…’: part of this volume’s title represents a sort of methodological and theoretical mission statement designed to convey the idea that research concerning the last hunter-collectors is today in desperate need of this type of insight. Since the beginning of the 1990s, a spectacular crop of occasionally vast open-air sites has emerged, one of the notable contributions of preventive archaeology. Several long-term excavations have also added to this exponentially increasing body of information that has now come to include a growing number of well-preserved sites that have allowed us to address palethnographic questions. This volume represents a first step towards revitalising Mesolithic research. Here we have focused on occupations from the 8th millennium cal BC, currently the best documented periods, and limited the scope to Northern France and certain neighbouring regions. The first part contains several preludes to monographs highlighting potential future studies as well as various patterns in the structuring of space and the location of camps. These, as well as other complementary discoveries, provide material for the second part of the volume dedicated to new data concerning the functional dynamics of Mesolithic camps.

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Introduction
Towards a Mesolithic Palethnology

Boris Valentin, Bénédicte Souffi, Thierry Ducrocq,
Jean-Pierre Fagnart, Frédéric Séara and Christian Verjux

Mesolithic Palethnography…: part of this volume's title is borrowed from that of the round-table meeting whose results are contained within these pages. During this session of the Société préhistorique française (26 and 27, November 2010 at the Institut national d'histoire de l'art in Paris), palethnography was invoked as a sort of theoretical and methodological mission statement designed to highlight the fact that research concerning the final hunter-gatherers is today in desperate need of this type of insight. However, such an ambition is not new and one could be forgiven for thinking it to be an inherent aspect of prehistoric research given the countless references to palethnology through to beginning of the 20th century. Nevertheless, the epistemological underpinnings were completely different and the ambition to which we refer arose from a total revision by André Leroi-Gourhan combined with subsequent contributions from ethnoarchaeology. The vital role played by several Lateglacial sites in this revision is well known; chance discoveries combined with excellent preservation conditions and the visibility of features rendered these contexts ideal testing grounds for developing new methodologies and interpretations.

It has to be admitted that French Mesolithic studies remained a step behind this important renovation. However, in parallel with the first efforts in Magdalenian palethnography, Jean-Georges Rozoy (1978), in his impressive attempt at a holistic approach, gave palethnography a central role in his 'ethnographic method' (notably inspired by Lewis Binford and Grahame Clark). Unfortunately, our understanding of the French Mesolithic was at the time essentially based on cave and rock shelter contexts from Southern France or partially excavated and generally poorly preserved open-air sites in the north which often contained a mix of material accumulated over several thousand years, in other words, contexts that did not readily lend themselves to deciphering Mesolithic lifestyles. What has changed in the last thirty years?

Beginning in the 1990s, a spectacular crop of sometimes vast open-air sites emerged, especially in the northern half of France (some twenty new sites!), representing just one of the many topics where notable contributions from preventive archaeology have helped to renew the fundamental bases of current research. Several more long-term excavations have also contributed to this exponentially increasing body of information that has now come to include more and more well-preserved sites allowing the demands of palethnography to be addressed. Mesolithic research, dependent on the indispensable and ever more fine-grained chrono-typological seriations, has not only found a means to regenerate itself, but has happened upon a new use for these seriations. Substantial variations in the composition of the landscape during a Mesolithic period covering some 45 centuries undoubtedly brought with it changes in mobility strategies and the manner in which different sites were occupied. Given that the time intervals now at our disposal represent several centuries (at the moment certain are better understood than others), we inevitably arrive at a better, more dynamic picture of these last groups of hunters that is neither over-simplified nor reductionist in nature.

This research dynamic gradually took form over the course of several conferences (see Fagnart and Thévenin, 1997; Bintz and Thévenin, 1999) and was considerably strengthened by the last large meeting in France dedicated to Mesolithic research (Fagnart et al., dir., 2008). It is this acceleration — supported by the majority of archaeological institutions — which this volume aims to highlight and encourage. We have also ensured its rapid publication and wide diffusion thanks to both an online and its bilingual format.

At this stage, we have limited ourselves to the northern half of France and several bordering regions for coherence and given the quality and abundance of data available from these areas. The focus is especially heavy on the Paris Basin and valley floors which partially reflects a disequilibrium in terms of site detection and or preservation (factors which are still difficult to untangle and sometimes connected). This very same disequilibrium played a clear role in favour of the representation of Mesolithic occupations from the 8th millennium calBC, i.e. the Boreal chronozone. The over-representation of Middle Mesolithic sites in this volume is therefore a reflection of a certain number of archaeological biases that we hope will be addressed in the future.

The fourteen articles collected in this volume are organised into two major themes in much the same way as we had done for the round-table meeting. The first, entitled (‘Current research... ’) contains several preludes to monographs, as well as a regional synthesis (Verjux et al.). However, the majority of the contributions concern single sites, several of which have only recently been discovered (Dammartin-Marpain and ‘62 rue Henry-Farman’, Paris), while the site of Noyen is re-examined following a long and well-known program of research (Mordant et al.) and yet another site, ‘La Haute-Île’ at Neuilly-sur-Marne, still holds much to be discovered by new fieldwork (Confalionéri and Le Jeune).

In this collection of sites and spaces we can observe an emergent potential for future studies, as well as several consistencies in the structuring of space or the location of camps — provided we bear in mind well-known preservation biases. These new discoveries, complemented by others, provide material for the second part of this volume (‘Elements of palethnography...’) centred on the Boreal occupations of the Paris Basin and dedicated to the growing results concerning the role of Mesolithic camps. Spatial organisation (Bignon-Lau et al.), the use of stone implements (Griselin; Guéret), funerary practices (Bosset and Valentin) and other quintessential palethnographic themes pose new questions concerning different Mesolithic societies. This is particularly the case for the 8th millennium and especially so for those societies from its beginning (Ducrocq; Kind). How many activity units compose a single camp and what were the relationships between them? Why are there so few preserved features even on sites where taphonomic factors seem not to have played a major role? Was the management of inhabited space significantly different from patterns known for the Late Palaeolithic, and if so, why? What type of territorial organisation is represented by the apparent differences seen at ‘rue Henry-Farman’ (Paris) in the use and management of microliths associated with hunting? Does this type of organisation and, more particularly, the repeated occupation of certain locations explain the relative frequencies of burials when compared with earlier periods? In Sandy Flanders, one of the regions driving palethnographic research for the Mesolithic, these repetitive occupations are well-documented and may have been influenced by specific topographic features. This volume includes Northern Belgium for not only these reasons, but also given the analytical protocols carefully fitted to the complex taphonomy of certain Postglacial sites which have been developed in this region (Crombé et al.; Noens).

This innovative update of palethnographic methods is clearly one of the pressing challenges facing Mesolithic research today. A second essential issue is the detection of new sites and, in doing so, extending palethnography beyond the 8th millennium — as has been possible in another key region of research (Kind) — assuming of course we progressively fill the existing gaps in our understanding of the Late Mesolithic and the still poorly understood Early Mesolithic. Meanwhile, our inability to devise a genuine and continuous paleo-history from the Lateglacial onwards means that we must at least attempt some preliminary, structural comparisons with Magdalenian and Azilian palethnographies.

Of these numerous opportunities for new, more focused or, conversely, more general meetings, this volume represents but a first, still novel step in the movement towards revitalising Mesolithic research.

Acknowledgements: We would first like to thank all those who made the 2010 round-table meeting possible: the participants, the session chairs (Pierre Bodu, Erik Brinch-Petersen, Philippe Crombé, Michèle Julien, Grégor Marchand, Frédéric Séara, Nicolas Valdeyron) and the different institutions that supported this initiative (the SPF above all, as well as the DRAC Centre, the UMR 7041, INHA and the Université Paris 1). We are also grateful to the authors for respecting the constraints associated with this volume’s rapid publication and original form which is largely inspired by the editorial innovations of François Bon, Sandrine Costamagno, Vanessa Léa and Nicolas Valdeyron, to whom we express our utmost gratitude for their inspirational audacity and understanding. Thanks also go to the administration of the SPF for having accepted this format, to Gregor Marchand for encouraging us and to Laure Salanova for promoting the project and accompanying it during every stage right up until the layout and printing. For the latter, we benefited enormously from the talents of Martin Sauvage and Marie Jamon, as well as from the precious help of Cécile Tardif. We are also grateful to Marie-Claire Dawson and Brad Gravina for their careful translation of the English and French texts. This volume has seen the light of day thanks to the financial support of the DRAC Centre, the INRAP and the UMR 7041 (Ethnologie préhistorique). Finally, particular thanks go to Anne Augereau, Pierre Bodu and Armelle Clorennec.

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CURRENT RESEARCH CONCERNING MESOLITHIC OPEN-AIR SITES

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Mesolithic occupations on the edge of the Seine

Spatial organisation and function of the site of 62 rue Henry-Farman, Paris (15th arrondissement)

Bénédicte Souffi, Fabrice Marti, Christine Chaussé, Anne Bridault, Éva David, Dorothée Drucker, Renaud Gosselin, Salomé Granai, Sylvain Griselin, Charlotte Leduc, Frédérique Valentin and Marian Vanhaeren

Abstract: The Mesolithic site of 62 rue Henry-Farman in the 15th arrondissement of Paris was found to the south-west of the city on the left bank of the Seine, approximately 250 m from the present course of the river. Excavations in 2008 over a surface of 5,000 m² produced a fluviatile stratigraphic sequence containing numerous interstratified occupation levels. Excavations essentially focused on the Mesolithic occupation and exposed six spatially independent concentrations (loci) of archaeological material. Based on paleoenvironmental and techno-typological studies, together with radiometric dates, the assemblage can be attributed to the Boreal chronozone or to the Preboreal/Boreal transition and thus the middle phase of the Mesolithic (8000 – 6900 BC). The different loci correspond to successive occupations characterised by at least three typologically distinct assemblages, all of which are dominated by points with retouched bases (Beuronian). In functional terms, the different loci present evidence for various activities mainly focused on the manufacture of flint arrowheads, however the use of domestic tools in flint, sandstone and bone is also documented.

The Mesolithic site of 62 rue Henry-Farman, Paris (15th arrondissement) was found to the south-west of the city on the Seine's floodplain, some 250m from the present course of the river (fig. 1). This open-air site is on the river's left bank and found in a similar geomorphological and geological context to Rueil-Malmaison 'Les Closeaux', located several kilometres further to the west (Lang, 1997; Walczak, 1998; Lang and Sicard, 2008).

EXCAVATION METHODS

Excavations at 62 rue Henry-Farman, Paris, were carried out in the framework of a rescue project by the INRAP in 2008. The extensive investigation of the level over 5,000 m² uncovered six spatially distinct loci (loci 1 – 6). Apart from locus 6, each locus was manually excavated with the pieces systematically plotted in three dimensions and by ¼ m² for locus 1. Time restraints meant that locus 6 had to be dug with the help of a mechanical digger, all pieces were however plotted in three dimensions. In general, the limits of the concentrations were not always reached, especially for loci 4 and 5, and manual excavations were generally abandoned when the number of pieces was less than 10 per m². Beyond the limits of the manual excavations, surfaces exposed with the help of the mechanical digger permitted the recovery of more marginal pieces dispersed between the different loci. The sediment was not sieved due to its extremely clayey nature. However, tests were carried out in certain loci in order to evaluate any possible 'loss' which appeared to be fairly insignificant (between 3 and 10 artefacts per 20 litres of sediment). Almost 7,000 chips (less than 1 – 1.5 cm) were also manually collected by ¼ m² over the entirety of the site.

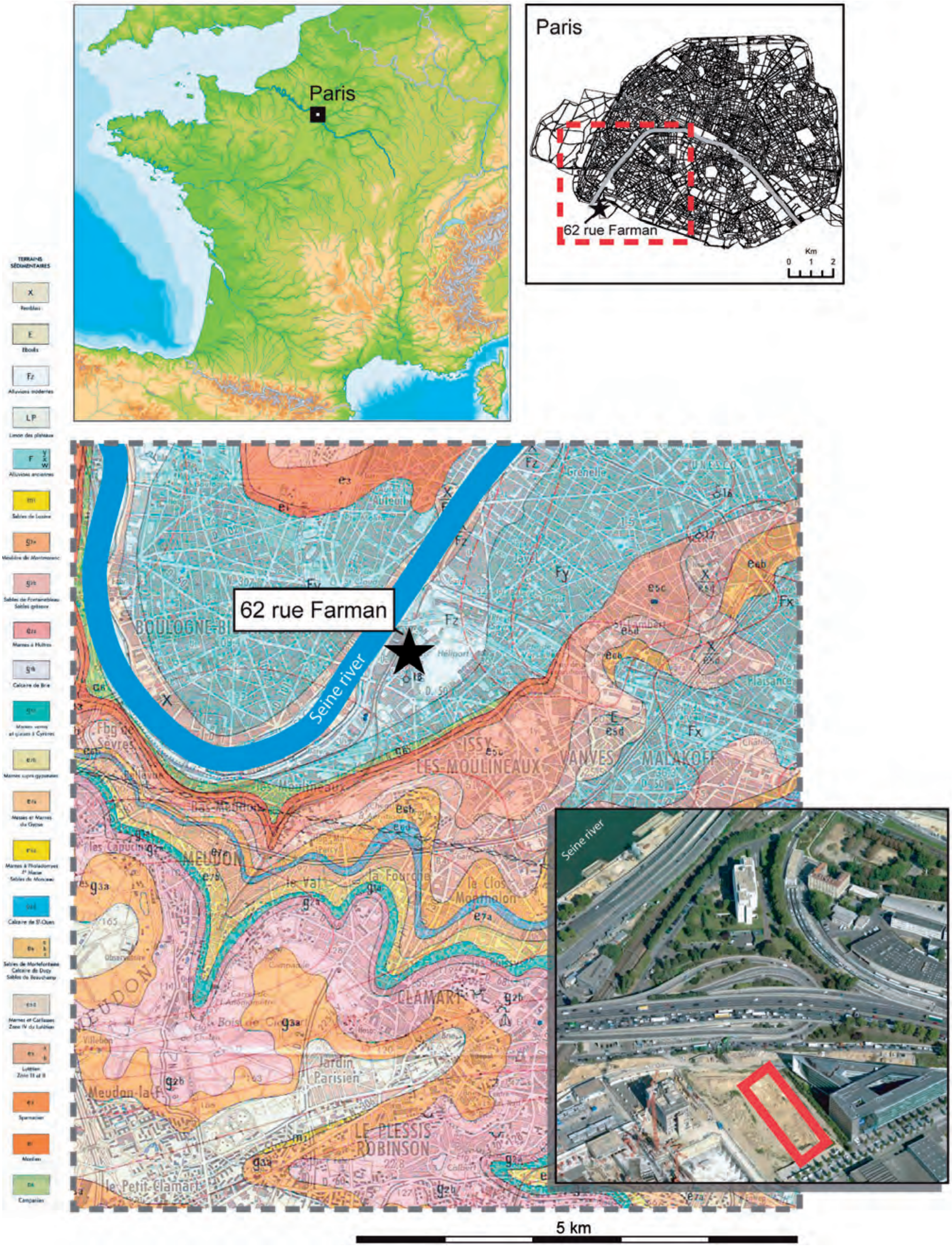


Fig. 1 – 62 rue Henry-Farman, Paris. Location of the Mesolithic site (graphic design B. Souffi after IGN 1/150000).

STRATIGRAPHY AND TAPHONOMY

The exposed fluviatile stratigraphy yielded several occupation levels including a Neolithic occupation overlying the Mesolithic level (fig. 2). All of the Mesolithic material was recovered from a single sedimentary unit containing a brown-orange clay that was siltier at its base (bed 5). The geomorphological study carried out by C. Chaussé (*in* Souffi and Marti, 2011) demonstrated that this pedological horizon developed slowly and is characteristic of a period of relative environmental stability. In taphonomic terms, alongside numerous episodes of bioturbation, a low-energy erosion event involving superficial surface wash can be seen in the upper part of the level. This colluviation could be connected to the soil's destabilisation following the Neolithic occupation that began during the Late Atlantic. Its impact on the Mesolithic remains, in terms of the movement of artefacts, seems however moderate taking into account the gentle north-west/south-west slope. The vertical redistribution of the Mesolithic remains, linked to numerous instances of animal or vegetal bioturbation, can be seen over a depth of between 20–30 cm.

The ridges and edges of the worked flint are generally fresh with certain pieces displaying a whitish patina resulting from a superficial desilicification, while others patinated when unearthed. The different origins of the worked materials (alluvial, sometimes gelifracted, flint cobbles) explains this physical variability. Faunal remains are often corroded in association with relatively significant manganese surface deposits. Furthermore, they suffered substantial post-depositional breakage perhaps connected to the volume of modern backfill at the summit of the stratigraphic sequence.

ENVIRONMENT AND DATING

Different paleoenvironmental studies — geomorphological (C. Chaussé), malacological (S. Granai) and isotopic (D. Drucker) — concerning the Mesolithic level indicate a relatively open, dry prairie type environment with some open woodlands (fig. 3). This type of landscape seems characteristic of the Boreal chronozone contemporaneous with the middle phase of the Mesolithic (9000–7800 BP or 8000–6900 cal BC) in the northern half of France (Ducrocq, 2001).

Although the 1,300 faunal remains seemed promising for numerous radiocarbon dates, preliminary isotopic analyses (D. Drucker) indicated low, poorly preserved quantities of bone collagen, thus limiting the possibility of obtaining reliable dates. Furthermore, no burnt hazelnut shells were recovered from the site that could alleviate this difficulty. The quantitative and qualitative preservation of organic material was evaluated for some twenty osseous pieces, including worked deer antler and human remains. Only three faunal samples, all from locus 4, furnished enough collagen to fulfil the reliability criteria for measuring radiocarbon, in other words, a C/N ratio between 2.9 and 3.6, as well as a carbon content of at least 30% (Deniro 1985; Ambrose 1990). Only two dates have so far been obtained, although a second sample selection is in progress (fig. 4); one on a aurochs metatarsal (9285 ± 40 BP, 8633–8421 cal BC: GrA-45018), and another on a wild boar humerus (8805 ± 40 BP, 8005–7727 cal BC: GrA-45017). These remains were recovered from the same sector and place the Mesolithic remains within bed 5 to the beginning of the Boreal chronozone or the Preboreal / Boreal transition. This attribution is in accordance with the environmental studies discussed above, as well as the techno-typological aspect of the lithic industry associated with a predominantly wild boar faunal spectrum.

ARCHAEOLOGICAL REMAINS

As features were rare, the material recovered during excavations is essentially comprised of lithic and osseous artefacts. The six excavated loci produced a little more than 25,000 pieces including chips (fig. 5). Locus 5 (108 m²) was the most dense area containing almost 6,500 pieces, not including chips, followed by loci 1 (73 m²) and 2 (76 m²) with respectively 3,965 and 3,899, not including chips. The most northern loci in the exposed area were the poorest: locus 3 (97 m²) produced 2,142 pieces (not including chips) and only 812 pieces (not including chips) were collected from locus 4 (103 m²). Bearing in mind the excavation conditions, the quantitative data from locus 6 is biased as all the material could not be entirely collected.

Artefacts

The loci are mainly composed of worked flint connected to the production of bladelets resembling the Coincy style from which microlithic arrowhead elements were manufactured (Rozoy, 1968). The microliths recovered from the different loci are characteristic of the middle phase of the Mesolithic (fig. 6) and, more precisely, the first half of the Boreal (Ducrocq, 2001; Séara et al., 2002; Séara, 2000 and 2008). Points with retouched bases are present in all loci, however isosceles triangles were only recovered from locus 3 and their association with several obliquely truncated points suggests that this locus can attributed to an older phase of the Mesolithic. Crescents and points with retouched bases dominate the material from locus 2 and are equally well-represented in loci 1 and 5 where they are associated with scalene triangles and points with retouched bases. No element attributable to the Late Mesolithic was found on the site. The production of bladelets for microliths also includes the manufacture of domestic tools, generally on waste products from the shaping-out or management of cores (flakes).

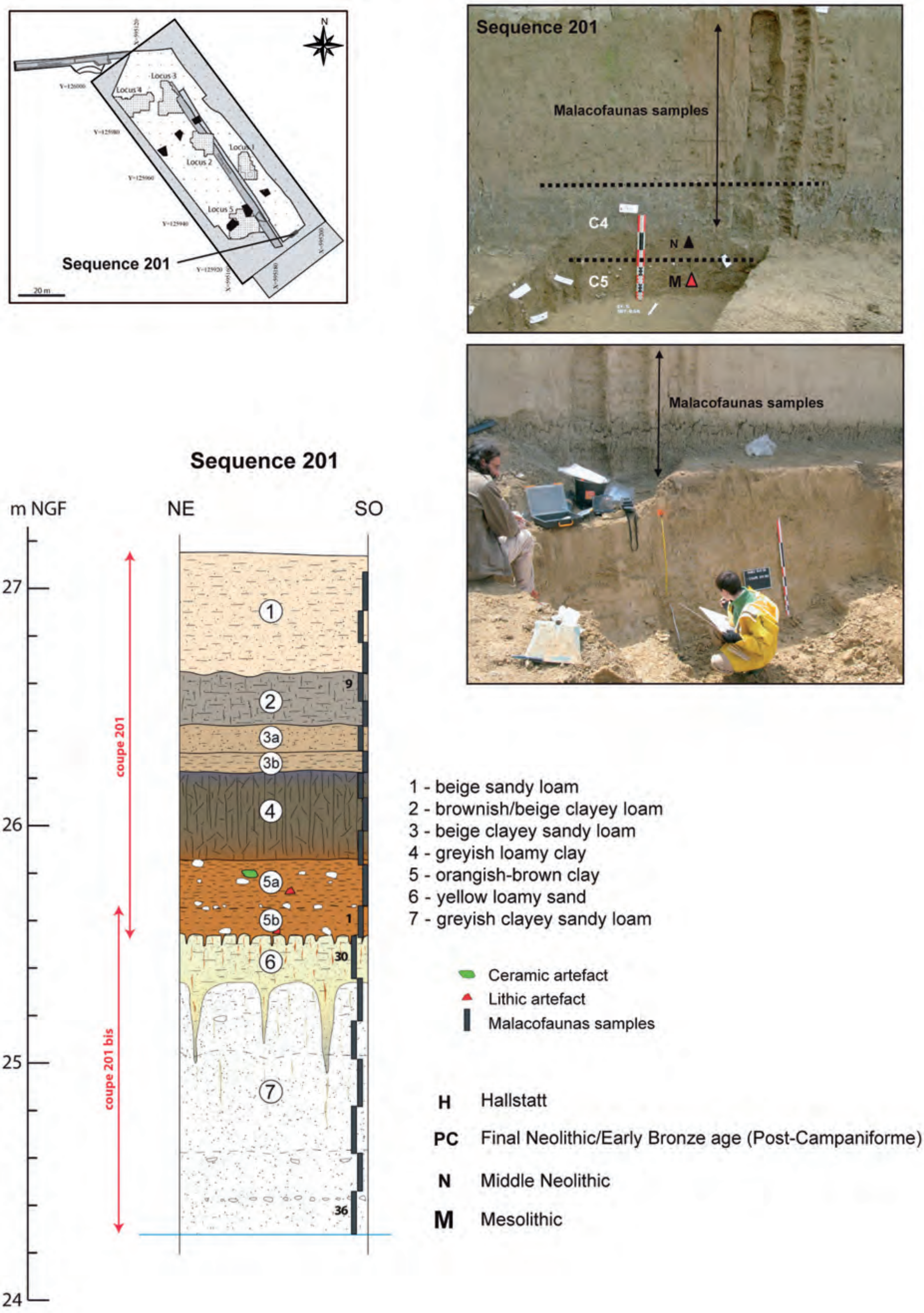


Fig. 2 – 62 rue Henry-Farman, Paris. Profile 201 (photos and graphic design B. Souffi after C. Chaussé).

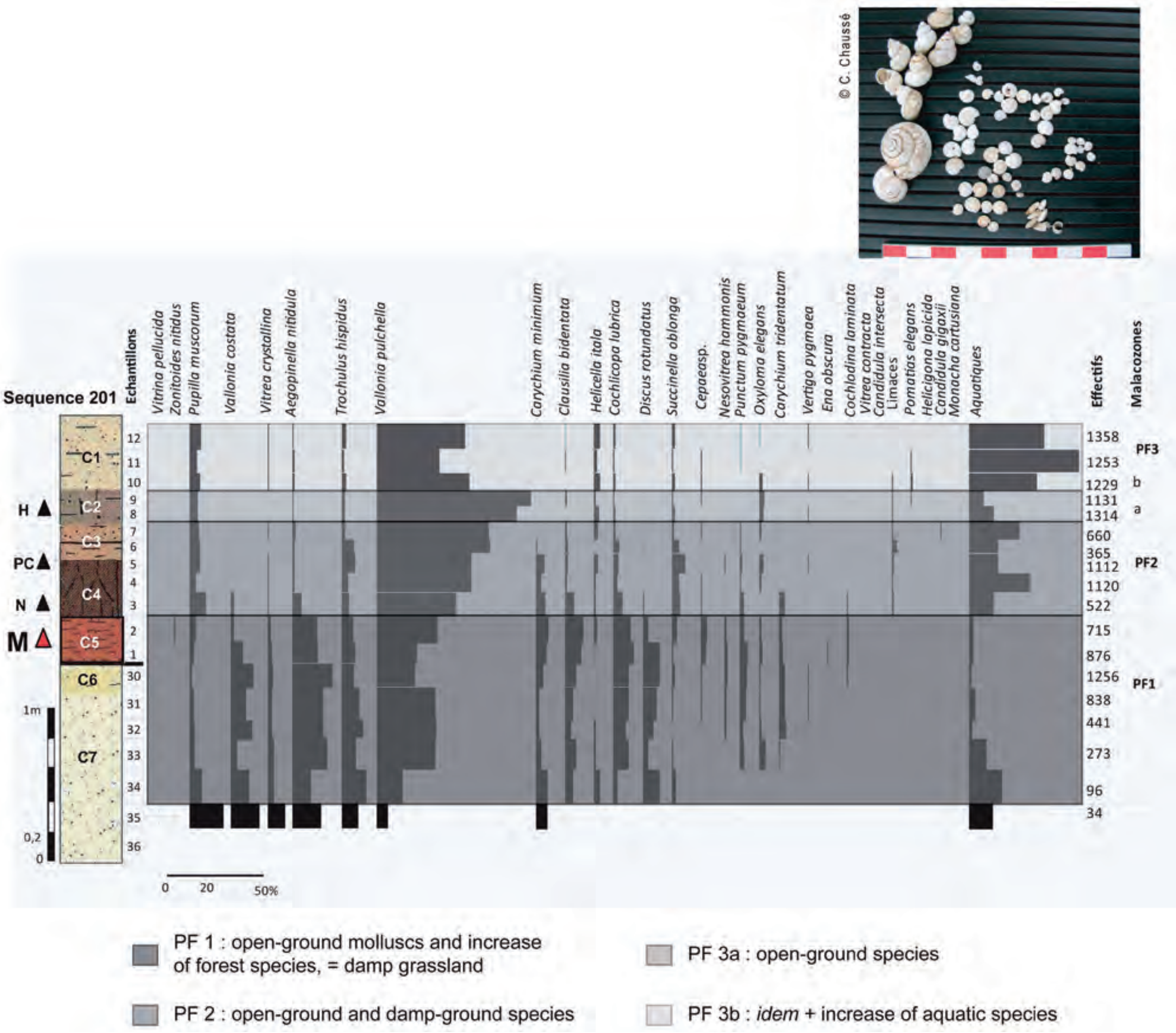
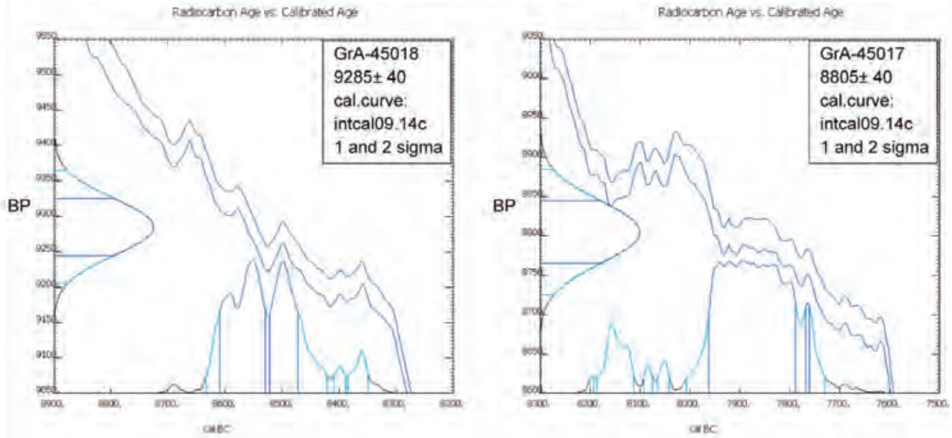


Fig. 3 – 62 rue Henry-Farman, Paris. Malacological diagram for profile 201 (graphic design B. Souffi, INRAP, after S. Granai)..

This Parisian site is also characterised by a significant collection of 193 quartzite pieces essentially comprised of finished tools discarded after use or during repair. These pieces are present in all the loci and the majority are Montmorencian prismatic tools made on quartzite (fig. 7). This quartzite seems to come from local outcrops at a maximum distance of approximately 10 – 20 km and is represented by 24 objects corresponding to 21 units of which seven are whole. These pieces are trapezoidal or triangular in cross-section and their narrow and elongated morphology systematically preserves a flat surface (Griselin et al., this volume). The broken pieces probably result from unintentional fractures produced during the repair or use of these objects. The presence of several quartzite flakes demonstrates that these objects were repaired on-site. Use-wear analysis shows that they bear traces of wear preferentially localised along the ridges on the tool's flat surface suggesting contact with a hard mineral material (study by C. Hamon). These objects have also be recovered from the sites of Rueil-Malmaison 'Les Closeaux', Hauts-de-Seine, and Neuville-sur-Oise 'Chemin Fin-d'Oise', Val d'Oise (Souffi, in prep.) and seem to be generally characteristic of the middle phase of the Mesolithic in the Île-de-France region (Griselin, 2010 and this volume). Additionally, two grooved abraders (cf. grooved sandstone) were recovered from loci 1 and 2. A functional study carried out by C. Hamon indicates that they were probably used for the sharpening and maintenance of osseous tools by abrasion. The collection of sandstone also contains 14 small polished quartzitic sandstone slabs with a substantial siliceous component. These small sub-quadrangular slabs are thin (1.5 – 3 cm), were rarely shaped and present only one flat working surface that, according to the functional study (C. Hamon), served to work hard mineral material.

Wild boar dominates the osseous remains and is accompanied to a lesser extent by deer, fox and roe deer

Lab n°	Site n°	Sample	Delta 13Ccoll (‰)	BP	Cal BC 2 sigma
GrA - 45017	Loc 4 S - 822	Wild boar humerus	-20,9	8805 ± 40	8005-7727
GrA-45018	Loc 4/Loc 2 - 895	Aurochs metatarsus	-20,8	9285 ± 40	8633-8421



One Sigma Ranges: [start:end] relative area
[cal BC 8609: cal BC 8528] 0,611435
[cal BC 8520: cal BC 8472] 0,388565
Two Sigma Ranges: [start:end] relative area
[cal BC 8633: cal BC 8421] 0,921204
[cal BC 8408: cal BC 8387] 0,024629
[cal BC 8384: cal BC 8348] 0,054167

One Sigma Ranges: [start:end] relative area
[cal BC 7960: cal BC 7786] 0,967972
[cal BC 7768: cal BC 7759] 0,032028
Two Sigma Ranges: [start:end] relative area
[cal BC 8198: cal BC 8192] 0,003626
[cal BC 8186: cal BC 8111] 0,104907
[cal BC 8092: cal BC 8073] 0,013805
[cal BC 8064: cal BC 8040] 0,018951
[cal BC 8005: cal BC 7727] 0,858711

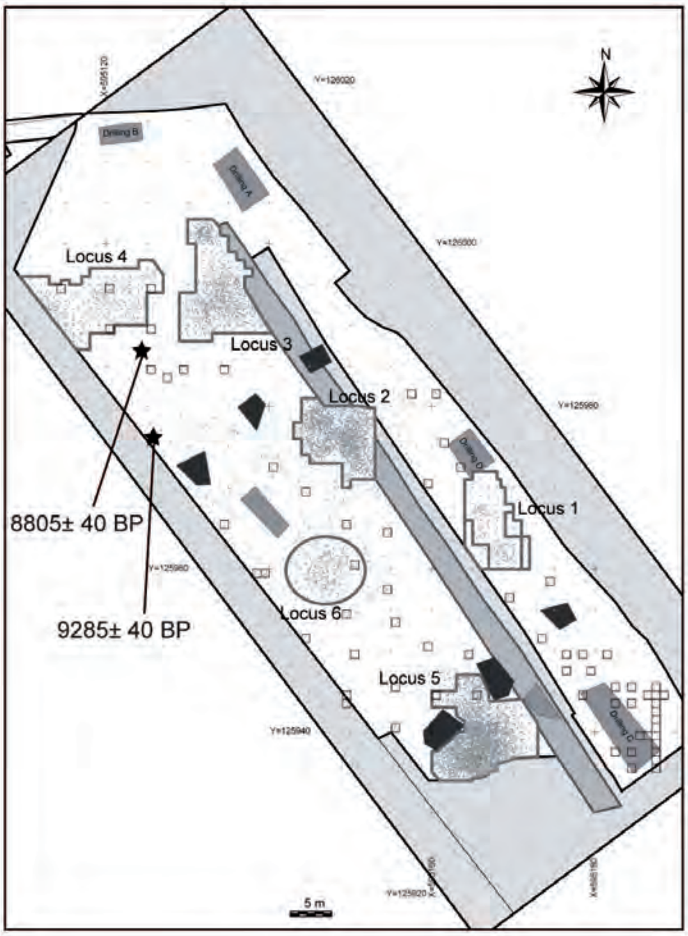


Fig. 4 – 62 rue Henry-Farman, Paris. ^{14}C Dates (calibration CALIB.REV.6.0).

	Locus 1		Locus 2		Locus 3		Locus 4		Locus 5		Locus 6		Total
Excavated surface		**60 m²**		**75 m**		**98 m²**		**101 m²**		**108 m²**		**70 m²**	**512 m²**
Faunal material	479	12,08%	294	7,55%	167	7,80%	68	8,40%	247	3,80%	33	4%	1288
Osseous industry	4	0,12%	2	0,05%	1	0,04%	1	0,10%	3	0,05%	0		11
Microliths	69	1,70%	67	1,70%	36	1,70%	7	0,90%	119	1,80%	3	0,40%	301
Microliths drafts	12	0,30%	12	0,30%	6	0,30%	1	0,10%	29	0,40%	2	0,24%	62
Microburins	57	1,40%	57	1,50%	41	1,90%	3	0,40%	39	0,60%	2	0,24%	199
Flint tools	96	2,40%	102	2,60%	58	2,70%	24	3%	137	2,10%	21	2,60%	438
Flint macroliths	0	0	8	0,20%	3	0,14%	1	0,10%	5	0,07%	2	0,24%	19
Sandstone macroliths	12	0,30%	4	0,10%	4	0,20%	7	0,90%	10	0,15%	5	0,60%	41
Sandstone flakes	6	0,15%	5	0,1	22	1	80	9,80%	20	0,30%	0	0	133
Blades	106	2,70%	194	5%	41	1,90%	26	3,20%	205	3,10%	51	6,20%	623
Bladelets	491	12,33%	640	16,44%	179	8,34%	76	9,30%	693	10,70%	118	14,24%	2197
Flakes	2285	57,63%	2117	54,30%	915	42,70%	363	44,70%	4544	69,90%	454	55%	10678
Cores	145	3,65%	153	3,90%	69	3,20%	51	6,30%	157	2,40%	62	7,65%	636
Block fragments	177	4,50%	175	4,50%	313	14,60%	56	6,90%	179	2,80%	55	6,70%	955
Flint pebbles	14	0,35%	21	0,53%	117	5,50%	23	2,80%	11	0,20%	12	1,50%	198
Other stones	7	0,18%	26	0,60%	42	2%	17	2,10%	36	0,60%	5	0,60%	133
Tertiary shell (personal ornaments)	0	0	2	0,05%	1	0,04%	1	0,10%	5	0,07%	0	0	9
Colouring agent (kaolinite)	3	0,07%	21	0,50%	0	0	4	0,50%	64	1%	0	0	92
Total without splinters	**3965**		**3899**		**2142**		**812**		**6503**		**824**		**18145**
Splinters	1573	28,40%	1416	26,70%	453	17,50%	204	20,10%	3614	35,70%	8	1%	7268
Total	**5538**		**5315**		**2595**		**1016**		**10117**		**832**		**25413**

Fig. 5 – 62 rue Henry-Farman, Paris. Artefact counts for the six loci.

(study by C. Leduc and A. Bridault *in* Souffi and Marti, 2011). Locus 2 is set apart by a larger diversity of species (aurochs, hare, pine marten, badger and tortoise). Locus 1 is characterised by the presence of a well-defined faunal discard zone containing almost 160 pieces spread across approximately 6 m². The identifiable species from this locus are essentially wild boar and deer. The faunal fragments, certain which were in anatomic connection, correspond to less meat bearing elements such as the lower posterior and anterior limbs, a portion of the vertebral column and a skull. Five loci produced elements of an industry in hard animal materials (finished tools and waste products) including three bone point fragments, two from locus 1 and the other from locus 3, two worked deer antlers from locus 5 and, finally, three worked wild boar canine teeth from loci 2, 4 and 5 (study by É. David, fig. 8). One of the deer antlers has a beveled end opposite an end with a hammered aspect. These observations suggest this piece might have functioned as a splitting 'wedge' for woodworking. Similar objects were recovered from the sites of Noyen-sur-Seine, Seine-et-Marne (David 2004) and Chaussée-Tirancourt, Somme (Ducrocq 2001). Among the three bone point fragments, the morpho-technical characteristics of the specimen from locus 3 resembles examples from different sites in the Île-de-France region such as Noyen-sur-Seine (bed 9-sup, Lower Atlantic: David, submitted) and Rueil-Malmaison 'Les Closeaux' (sector I dated to the 2nd half of the Boreal: Lang and Sicard, 2008).

Osseous artefacts from the Paris site also include two human remains discovered in locus 1 but not within a feature — a fragment of a femur and a mandible from a single adult individual. (study by F. Valentin *in* Souffi and Marti 2011).

Nine shells representing Tertiary marine fossils belonging essentially to Lutetian geological deposits (study M. Vanhaeren) were also recovered from loci 2, 3, 4 and 5 (*Fustiaria suburnea*, *Crommium* sp., *Bayania lactea*, *Vivinocerithium* sp., smooth *Antalis* sp. and *Glycymeris* sp.). Certain of these objects could represent

	Locus 1		Locus 5		Locus 2		Locus 3		Locus 4	
Obliquely truncated points	5	7.2 %	14	11.8 %	10	15 %	11	**30.5 %**	**1**	1 %
Points with retouched bases	15	**21.7 %**	21	**17.6 %**	**11**	15 %	5	13.9 %	0	0
Atypical points	0	0	0		1	1.4 %	0	0	0	0
Crescents	13	**18.8 %**	37	**31.1** %	**29**	**43.3 %**	**4**	11.1 %	1	1 %
Scalene triangles	19	**27.5** %	27	**22.7** %	**7**	12 %	2	5.6 %	0	0
Isoscele triangles	2	3 %	0	0	2	3 %	7	**18.4 %**	**2**	2 %
Backed bladelets	0	0	1	0.8 %	0	0	0	0	0	0
Trapezes	3	4.3 %	0	0	0	0	0	0	0	0
Bitroncatures	2	2.9 %	0	0	0	0	0	0	0	0
Indeterminate fragments	10	14.5 %	19	16 %	7	10.5 %	7	18.4%	3	3 %
Total	**69**		**119**		**67**		**36**		**7**	
% of all artefacts		1.7 %		1.8 %		1.7 %		1.7 %		0.7 %
Microliths drafts	13		25		12		6		1	
Microburins	57	1.4 %	39	0.6 %	57	1.5 %	41	1.9 %	3	0.3 %

Fig. 6 – 62 rue Henry-Farman, Paris. Typological counts of microliths from the six loci.

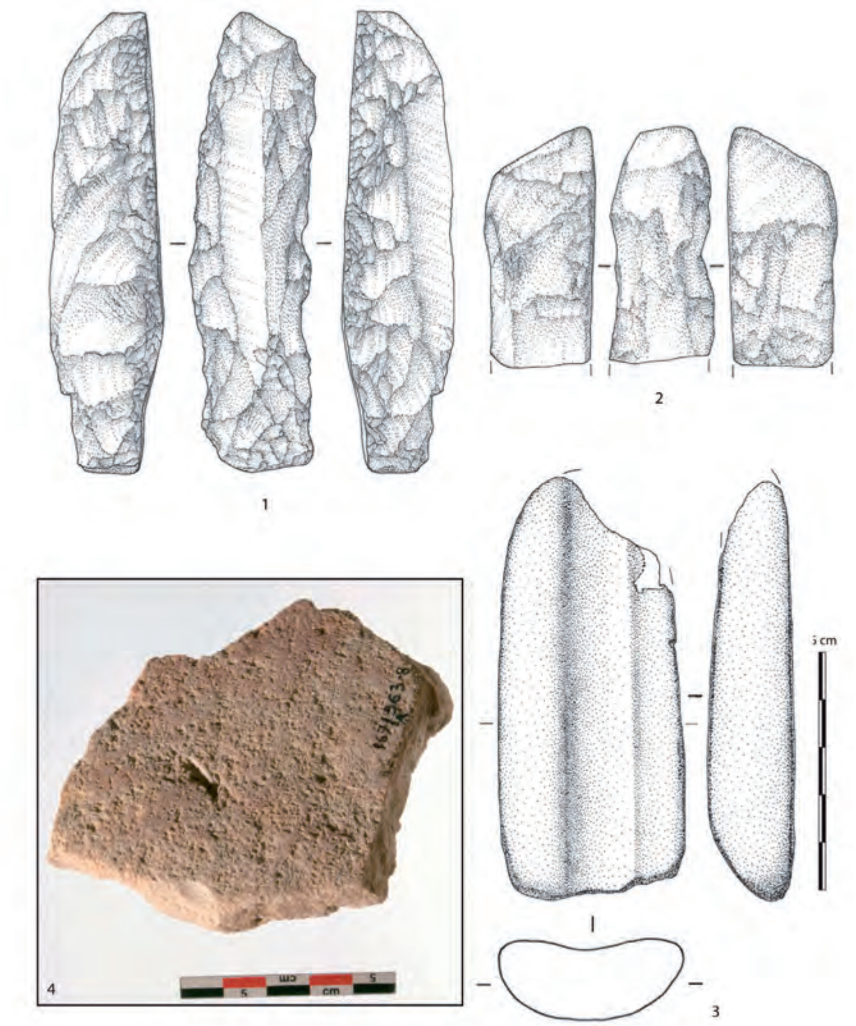


Fig. 7 – 62 rue Henry-Farman, Paris. Quartzite tools. 1–2: locus 3, Montmorencian prismatic tools; 3: locus 1, grooved abrader; 4: locus 1, small polished slab (drawings E. Boitard-Bidaut, INRAP; photo L. Petit, INRAP).

Fig. 8 – 62 rue Henry-Farman, Paris. Industry in hard animal material. 1: locus 3, bone point; 2: locus 1, bone point; 3: locus 5, beveled deer antler – splitting wedge (photos É. Davis, CNRS).

ornaments as such species are infrequent or naturally absent from floodplain deposits such as those at rue Farman.

Four loci (1, 2, 4 and 5) also produced fragments of a red mineral colorant. This material is a kaolinite clay concretion that occurs naturally in the alluvia of certain rivers in the Paris Basin (N. Le Maux *in* Souffi and Marti, 2011). However, at Paris-Farman their near systematic, well-isolated central position in the different loci seems to exclude a natural origin.

Features

Only one hearth and seven clusters of unmodified flint cobbles were noted on the site. The hearth associated with locus 3 is off-centre with respect to the main concentration of worked flint (fig. 9). This simple semi-circular surface feature is composed of numerous small-sized gravels (less than 5 cm), broken and complete flint cobbles, as well as calcareous stones or millstones, all of which were heated and lay flat over an area of approximately 4 m². The absence of charcoal and traces of rubifaction perceptible to the naked eye initially suggested the cleaning of a hearth, however the micromorphological analysis ultimately revealed *in situ* combustion (J. Wattez *in* Souffi and Marti, 2011).

Seven concentrations of un-modified, non-heated cobbles with diameters ranging between 40 and 130 cm were discovered in the periphery and within four loci (fig. 10). In four cases (loci 1, 3, St. 965 and St. 968) they were contiguous and/or superimposed clusters of occasionally tested cobbles. The morphologies and qualities of these cobbles are comparable with the knapped blocks from the local alluvia and could correspond to raw material 'reserves'.

RELATIONSHIPS BETWEEN LOCI

Certain variants can be observed between the six loci in terms of the representation of different types of remains (fig. 11). Locus 4 produced the most quartzite artefacts and is set apart from the others by a low proportion of microliths, a greater number of prismatic tools (n = 5 fragments) and the presence of quartzite flakes (n = 80). It is conceivable that this 'specialised' locus may have complemented nearby locus 3 (approximately 5 m away) that also contains a large number of prismatic tools (n = 4 fragments). The microlith assemblage from locus 3, more substantial than locus 4, is dominated by points with truncated bases and isosceles triangles (fig. 6 and 12). When compared with several recent discoveries of similar assemblages (Séara, 2000; Séara et al., 2002; Lang and Sicard, 2008; Séara, 2008), an attribution of locus 3 to the beginning of the Boreal or the Preboreal/Boreal transition appears plausible and fits with the date obtained for the south of locus 4 (GrA-45017: 8805 ± 40 BP, 8633 – 8421 cal BC). This assemblage could depict an influence of southern Beuronian A traditions as defined for the Upper Danube (Taute *in* Gob, 1984, p. 201 – 202; Séara, 2000).

On the other hand, locus 2 seemed to have functioned independently from the other loci. Given that its microlith assemblage is dominated by points with retouched bases and crescents (fig. 6 and 14), it resembles the north-western Beuronian A as defined for Northern France and placed in the Boreal chronozone (Ducrocq, 2001 and 2009; Fagnart et al., 2008).

Three refitted polished slab fragments from loci 1, 5 and 6 suggest the possible contemporaneity of the three concentrations, even if for the moment no other refits support this hypothesis. A complementary connection between the loci is however reinforced by the fact that the small polished slabs are found only in these three loci and that loci 1 and 5 have comparable microlith assemblages (fig. 6 and 13). These two loci are dominated by crescents, scalene triangles and points with retouched bases which could denote affinities with Eastern France where the first half of the Boreal sees the development of points with transverse base, scalene triangles and crescents associated with the Beuronian (see Séara, 2010; Séara and Roncin, this volume). These two loci also produced the most elements of an industry in hard animal materials (fig. 5).

INTERNAL FUNCTION OF THE LOCI: THE CASE OF LOCI 2 AND 5

Within each locus, refits, together with a spatial analysis of the artefacts, revealed a certain functional coherence, as can be seen in the examples of loci 2 and 5. The area exposed between the two loci does however demonstrate a certain diffusion of remains outside the excavated space.

Locus 2, excavated over 75 m², is composed of two concentrations (fig. 15). However, the fact that pieces were collected a the mechanical digger outside the manually excavated zone demonstrates that this locus was substantially larger. One of the two concentrations is found in the western part of the excavated zone (concentration A), while the other is situated more to the east (concentration B). The two assemblages are typologically comparable and refits suggest a complementary relationship between the two concentrations (fig. 16). Cores, not illustrated here, have a relatively diffuse distribution within each of the concentrations. The distribution of the domestic tools are particularly localised in the southern part of concentration B, while concentration A contains the majority of endscrapers (fig. 17). Use-wear analysis carried out by R. Gosselin confirms the several tools were used from each concentration for working skins, meat or hard animal materials. Locus 5 was excavated manually over 108 m². Unfortunately, the southern limits of this concentration were not reached as the locus extended beyond the exposed zone (fig. 18). The significant quantity of remains and the absence of dates make it difficult

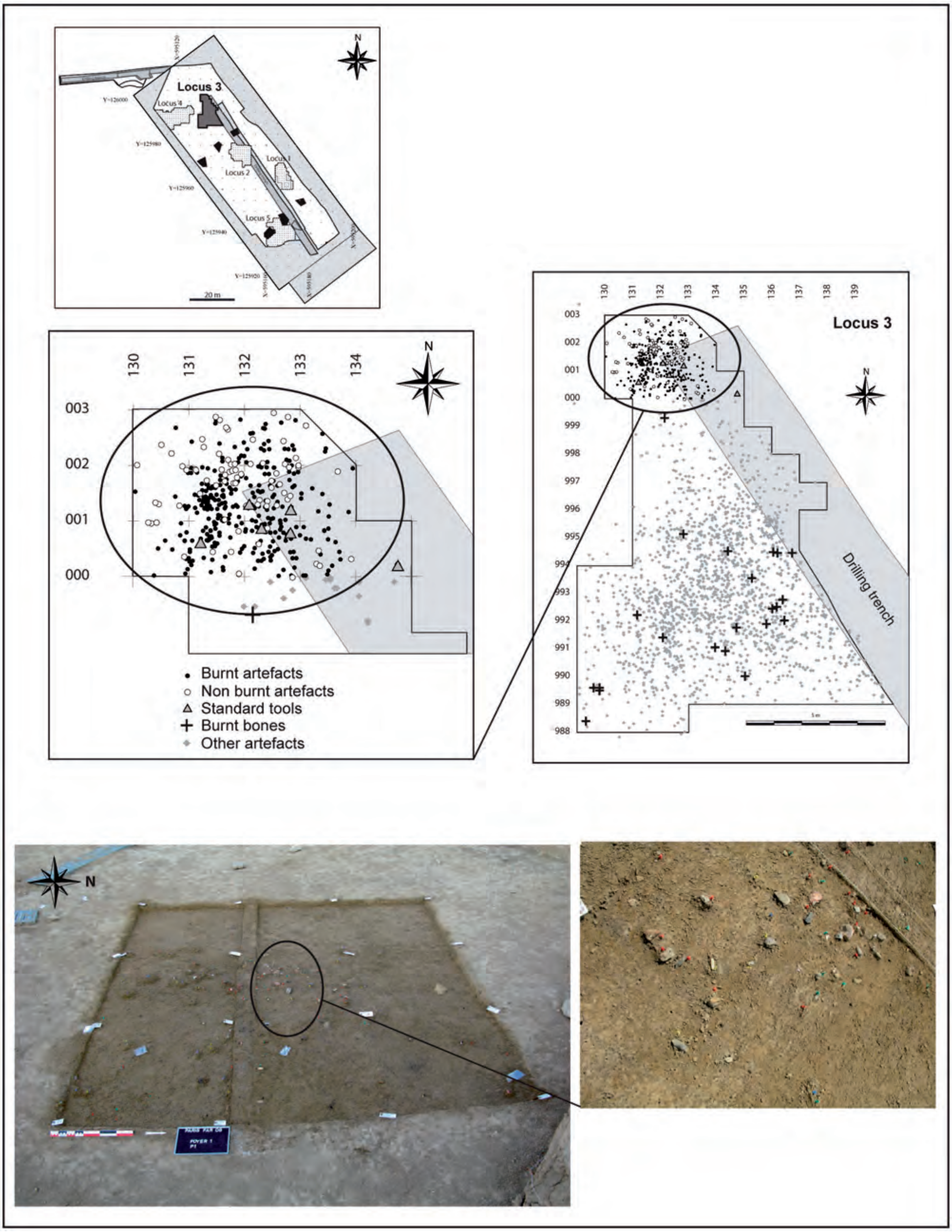


Fig. 9 – 62 rue Henry-Farman, Paris. Locus 3: hearth (photos and graphic design B. Souffi).

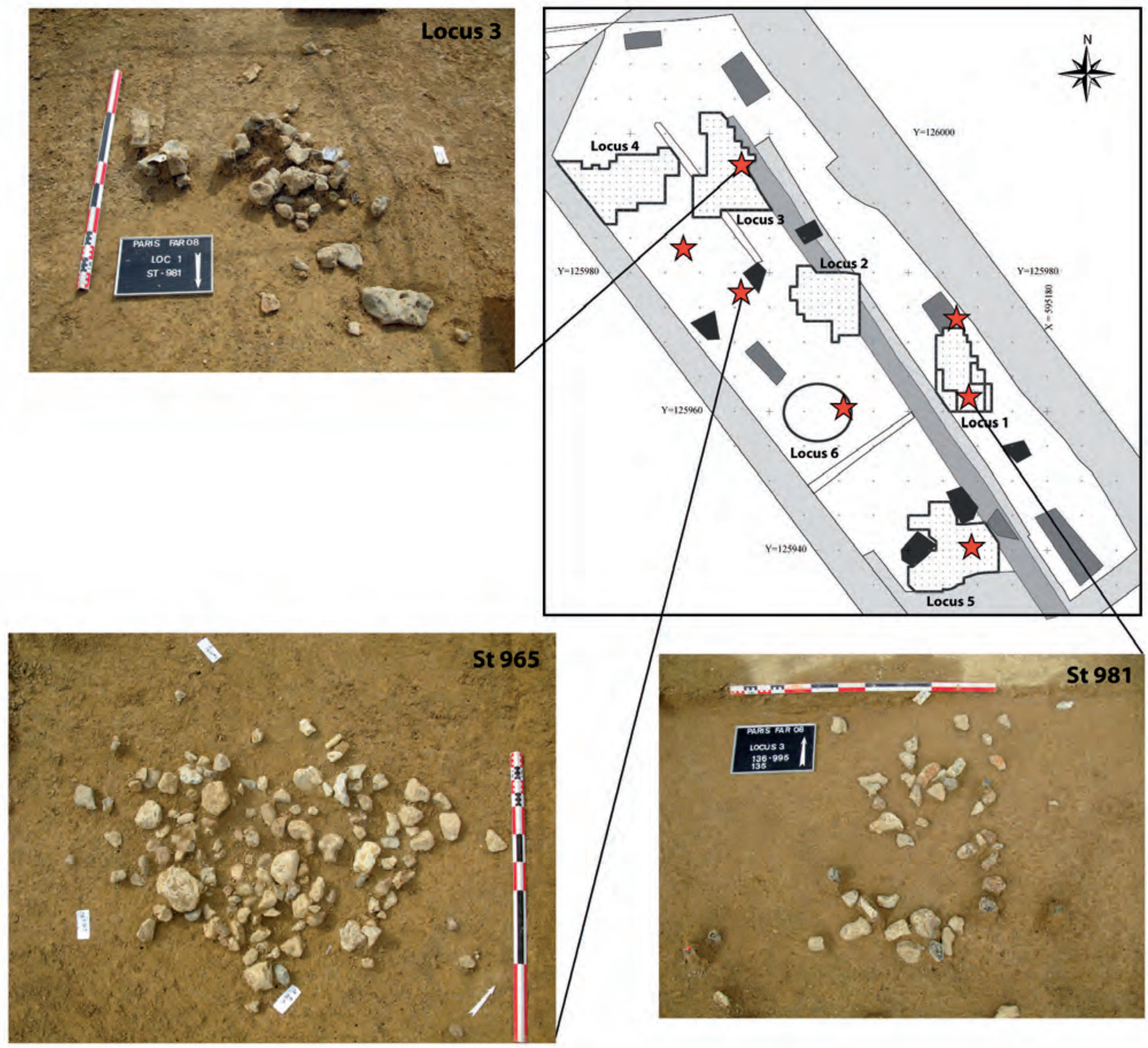


Fig. 10 – 62 rue Henry-Farman, Paris. Concentrations of un-modified flint cobbles (photos and graphic design B. Souffi).

to establish their absolute contemporaneity. However, despite an apparent uniformity in the general distribution of the material, several well-isolated elements indicate a certain spatial organisation. Chips, microburins, refitted pieces and retouched bladelets define a zone of maximal density at the centre of this locus (fig. 18). On the other hand, quartzite and millstone artefacts, as well as domestic tools, particularly scrapers and retouched blades, are off-centre in respect to this density zone and are essentially distributed along its perimeter (fig. 19)

PRELIMINARY FUNCTIONAL INTERPRETATION

Given the density of material recovered from each locus and the Minimum Number of Individuals (MNI) for each hunted species, the Mesolithic concentrations at Paris-Farman appear to represent short-term occupations. The identified activities relate to the acquisition and processing of game. In terms of acquisition, the on-site rearmament of arrows is clearly attested to by the numerous characteristic waste products. The function of the bone points from loci 1 and 3 remains unknown, although it is very likely that these objects were connected to hunting or fishing. It should be noted that for the moment no fish remains have been recovered from the site. Similarly, there exists no indirect evidence for the manufacture of arrow shafts or bows: tools with use-wear demonstrate little evidence of working vegetal materials (10% of 55 pieces bearing use-wear, study by R. Gosselin *in* Souffi and Marti, 2011). Only the presence of a beveled deer antler from locus 5, which may have served as an intermediary for splitting dry wood, suggests the working of vegetal materials. The processing of game also left very

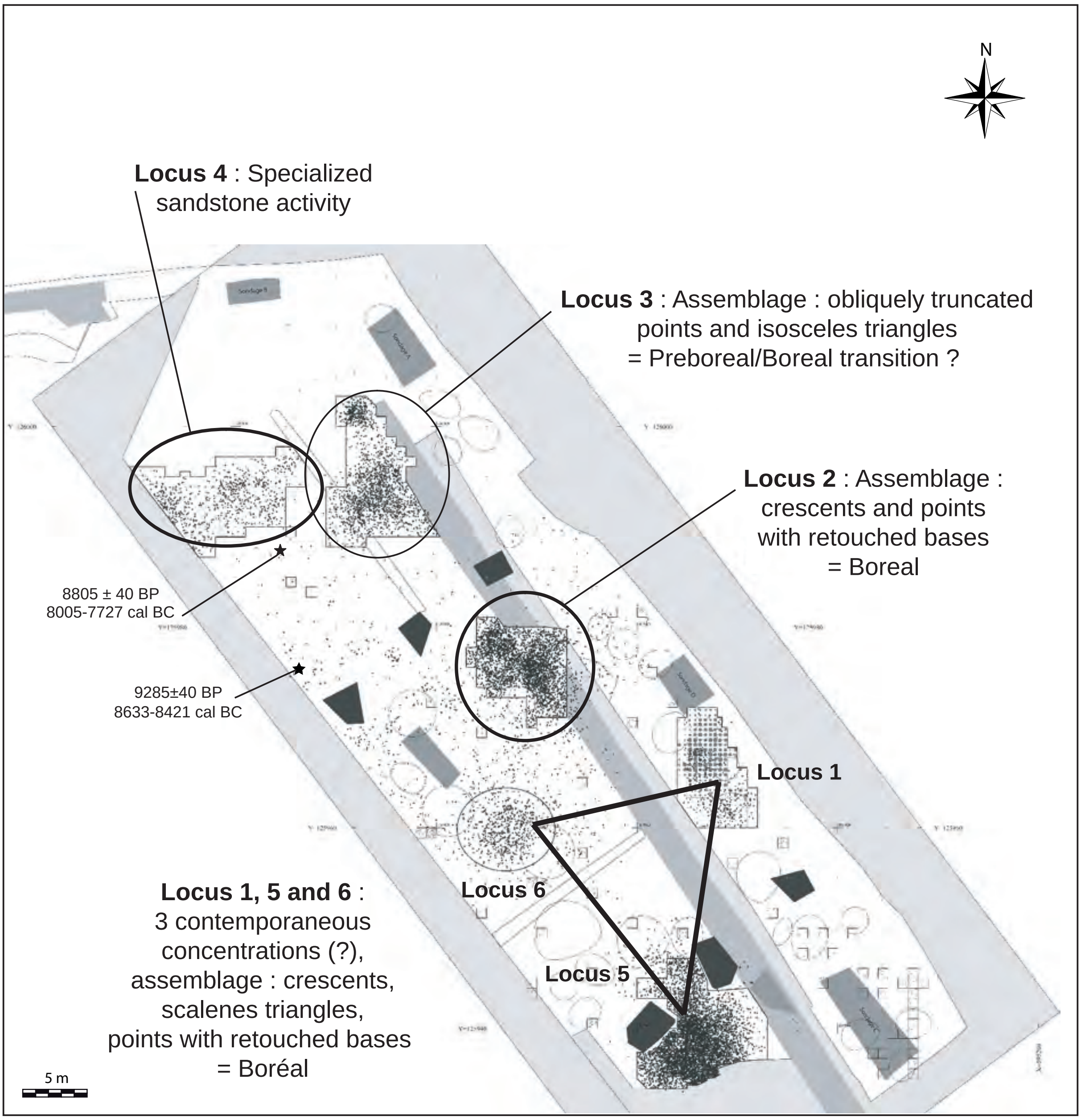


Fig. 11 – 62 rue Henry-Farman, Paris. Functional organisation of the site (graphic design B. Souffi).

few explicit traces. The poor bone surface states meant that marks referable to butchery are rare — only three specimens preserved cut-marks. At the same time, meat processing is represented on 16% percent of the domestic tools having traces of use (n = 55, study by R. Gosselin *in* Souffi and Marti, 2011). This analysis demonstrates an especially high representation of skin working particularly in loci 1, 3 and 5, sometimes in association with the use of an abrasive (37% of pieces portraying use-wear). Fragments of colorant (kaolinite) recovered from the site could also be linked to the processing of skins (see Philibert, 1993; Gosselin, 2005). However, this material could equally have been used in the hafting of tools, perhaps functioning as a degreasing agent for the production of glues (Philibert, 2002).

As suggested by use-wear analysis carried out on certain flint tools, the working of bone (19% of pieces bearing traces of wear) seems to have taken place in certain loci, but always in relatively low proportions. Furthermore, the presence of grooved quartzite in loci 1 and 2, probably connected to the abrading of bone objects, raises questions concerning the on-site manufacture of polished points such as those from loci 1 and 3 (David, 2004).

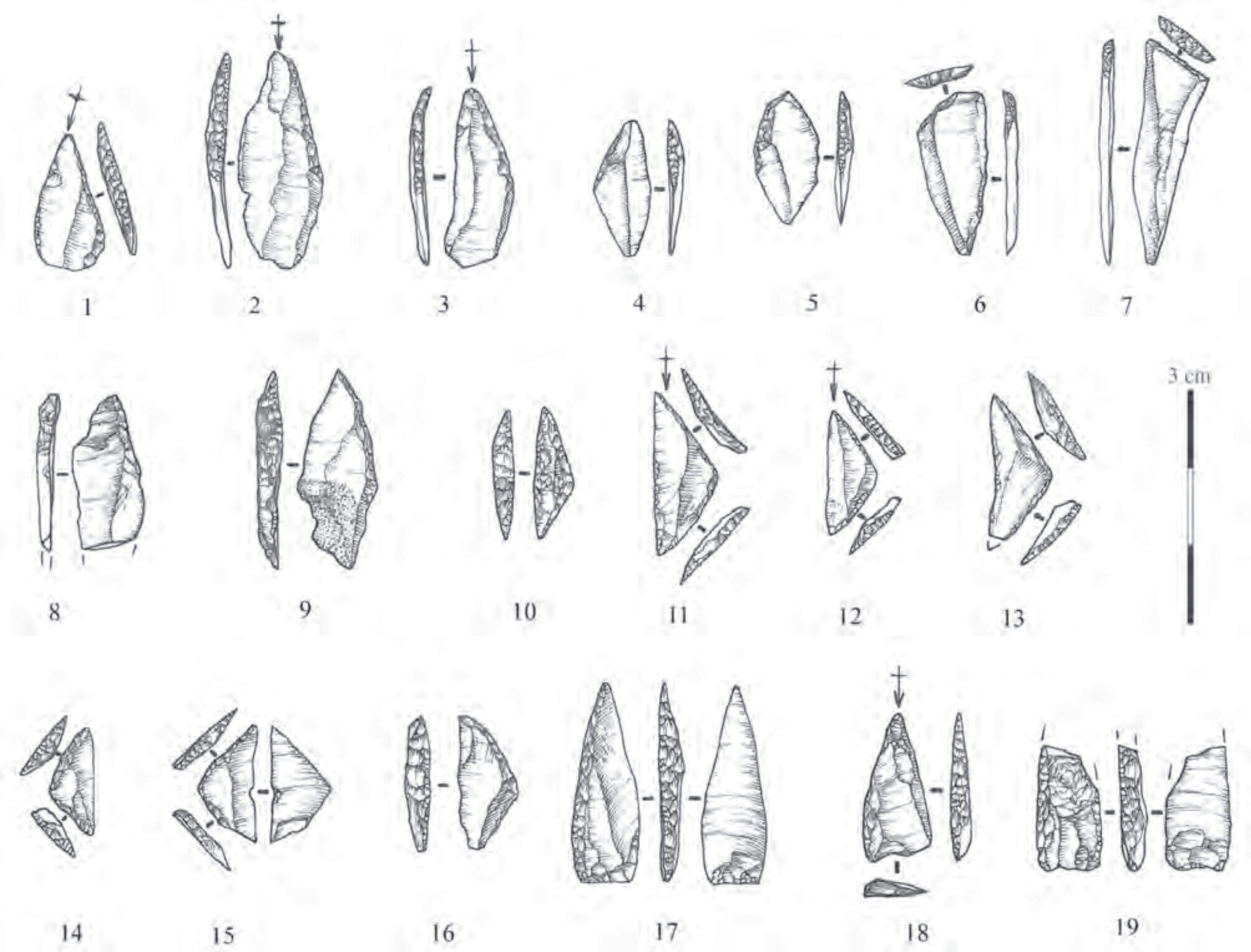


Fig. 12 – 62 rue Henry-Farman, Paris. Locus 3: microliths. 1 – 9: obliquely truncated points; 10 – 16: isosceles triangles; 17 – 19: points with retouched bases (drawings E. Boitard-Bidaut, INRAP).

CONCLUSION

Extensive excavations at 62 rue Henry-Farman resulted in the discovery of six loci. Taking into consideration different investigations carried out in the vicinity of the site (see Watrin, 1996), it was possible to evaluate the overall extension of the Mesolithic occupation. This occupation, spread over a sector of approximately two hectares, is comparable to several other open-air sites recently discovered on valley floors (Séara et al., 2002; Séara, 2010; Ducrocq et al., 2008; Coutard et al., 2010). The six loci exposed at the Paris-Farman site essentially represent ‘activity units’ such as those defined by F. Séara (2000). However, living spaces *sensu stricto* (sleeping areas, domestic hearths) were not identified on the site, although it is possible that they were not preserved (ephemeral constructions or perishable materials) or that these spaces were situated between the loci, in other words, outside the exposed and excavated zone. On the Paris-Farman site, the near total absence of hearths, rarely observed on other open-air sites, remains difficult to explain: could it be connected to the season of occupation, the lack of preservation of this type of feature or even the function of these types of units? From a cultural point of view, although the loci as a whole seem to belong to the middle phase of the Mesolithic, several aspects of different loci may be linked to diachronic influences. The excellent preservation of the archaeological level at Paris-Farman and the recording methods employed highlights the interest of the site for palethnographic studies similar to those from sites recently discovered on valley floors (see Ducrocq, 2001; Fagnart et al., 2008; Lang and Sicard, 2008; Fagnart et al., 2008; Séara et al., 2002; Séara, 2008 and 2010). The discovery of the Paris-Farman site forms part of this renewal and largely contributes to reviving Mesolithic research dynamics in the Île-de-France region (Souffi et al., in prep.) and at the larger scale of the Paris Basin.

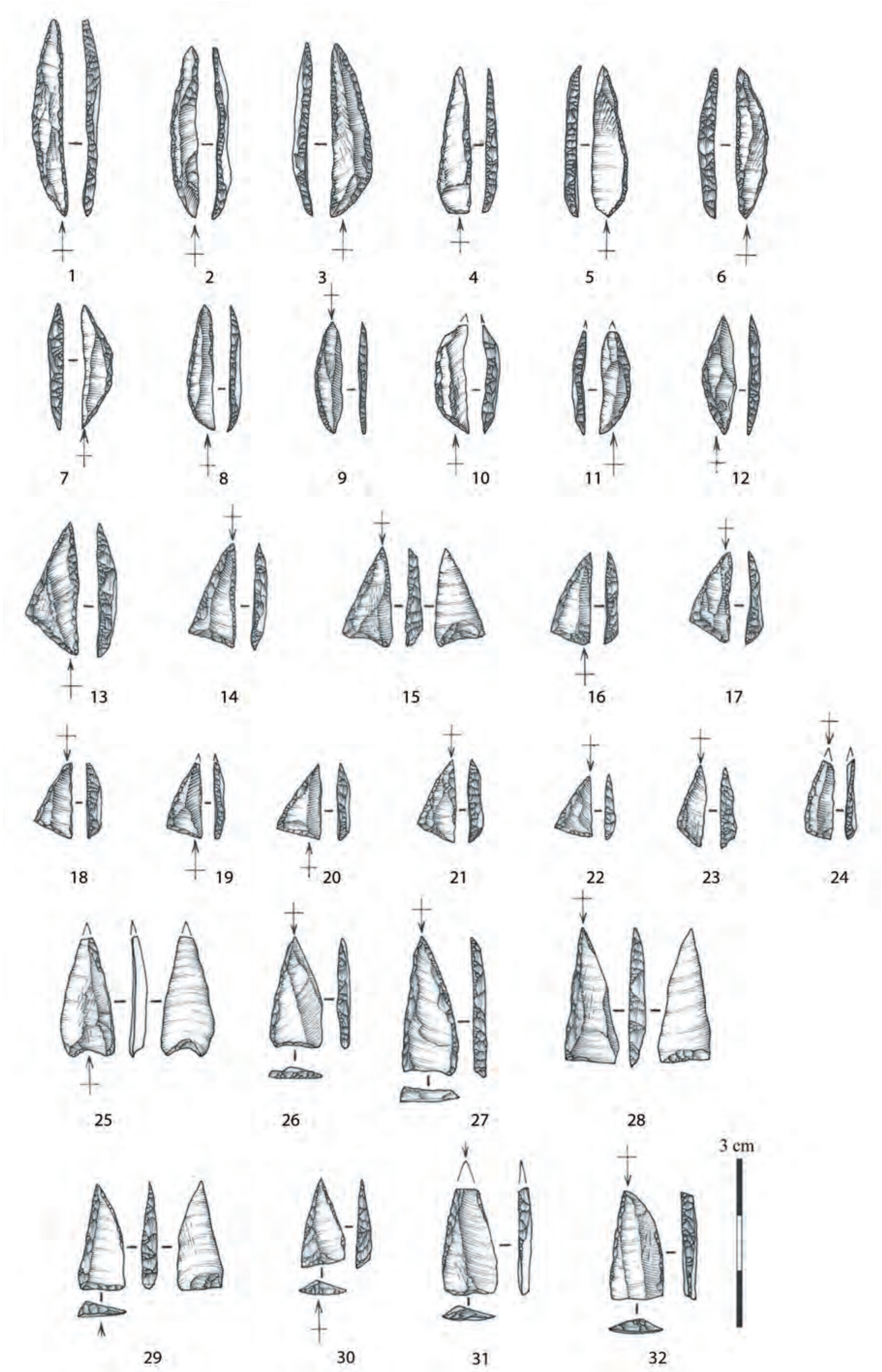


Fig. 13 – 62 rue Henry-Farman, Paris. Locus 5: microliths. 1 – 12: crescents; 13 – 24: scalene triangles; 25 – 32: points with retouched bases (drawings E. Boitard-Bidaut, INRAP).

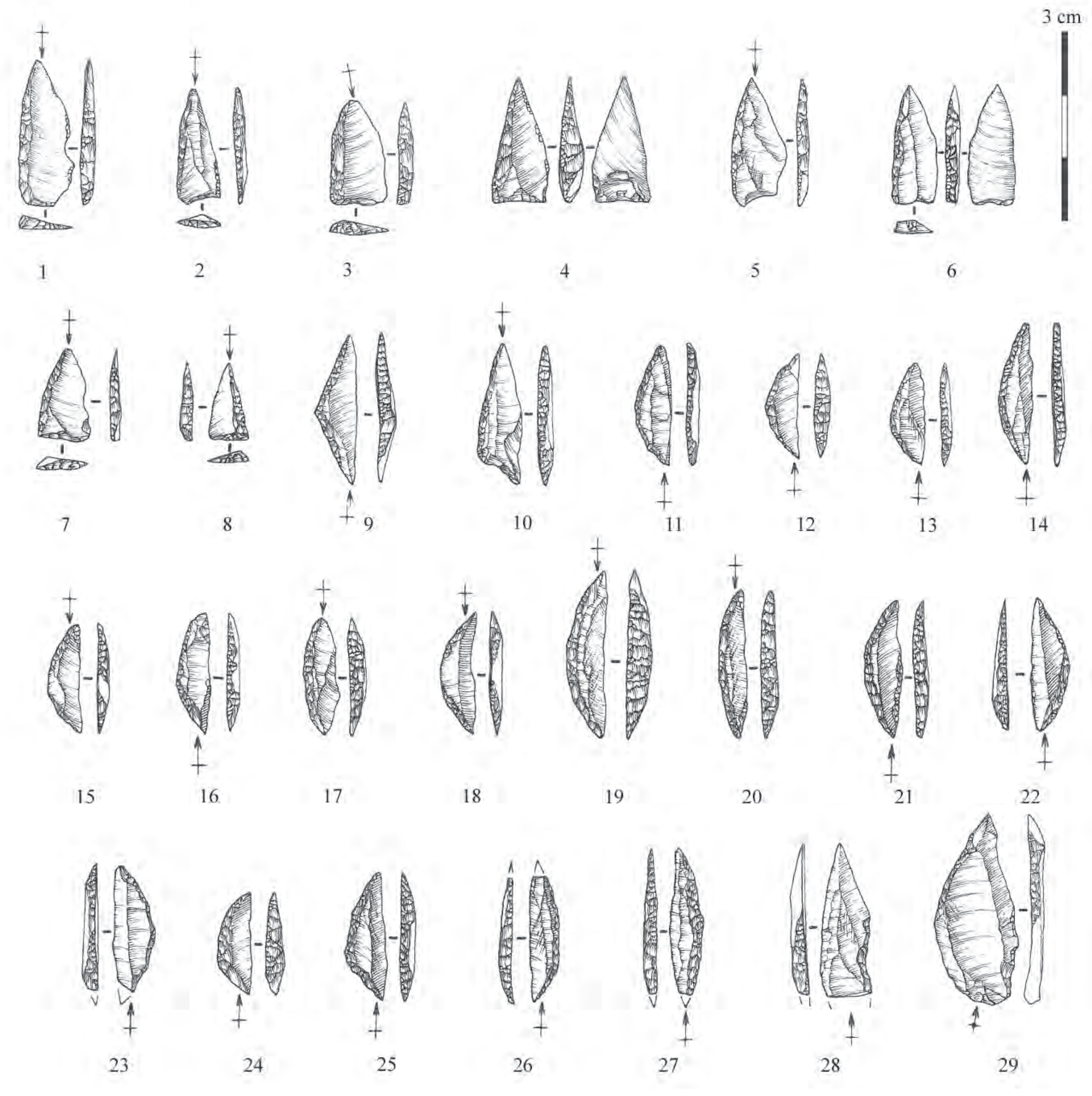


Fig. 14 – 62 rue Henry-Farman, Paris. Locus 2: microliths. 1 – 8: points with retouched bases; 9: isosceles triangle; 10: scalene triangle; 11 – 27: crescents; 28 – 29: microlith rough-outs (drawings E. Boitard-Bidaut, INRAP).

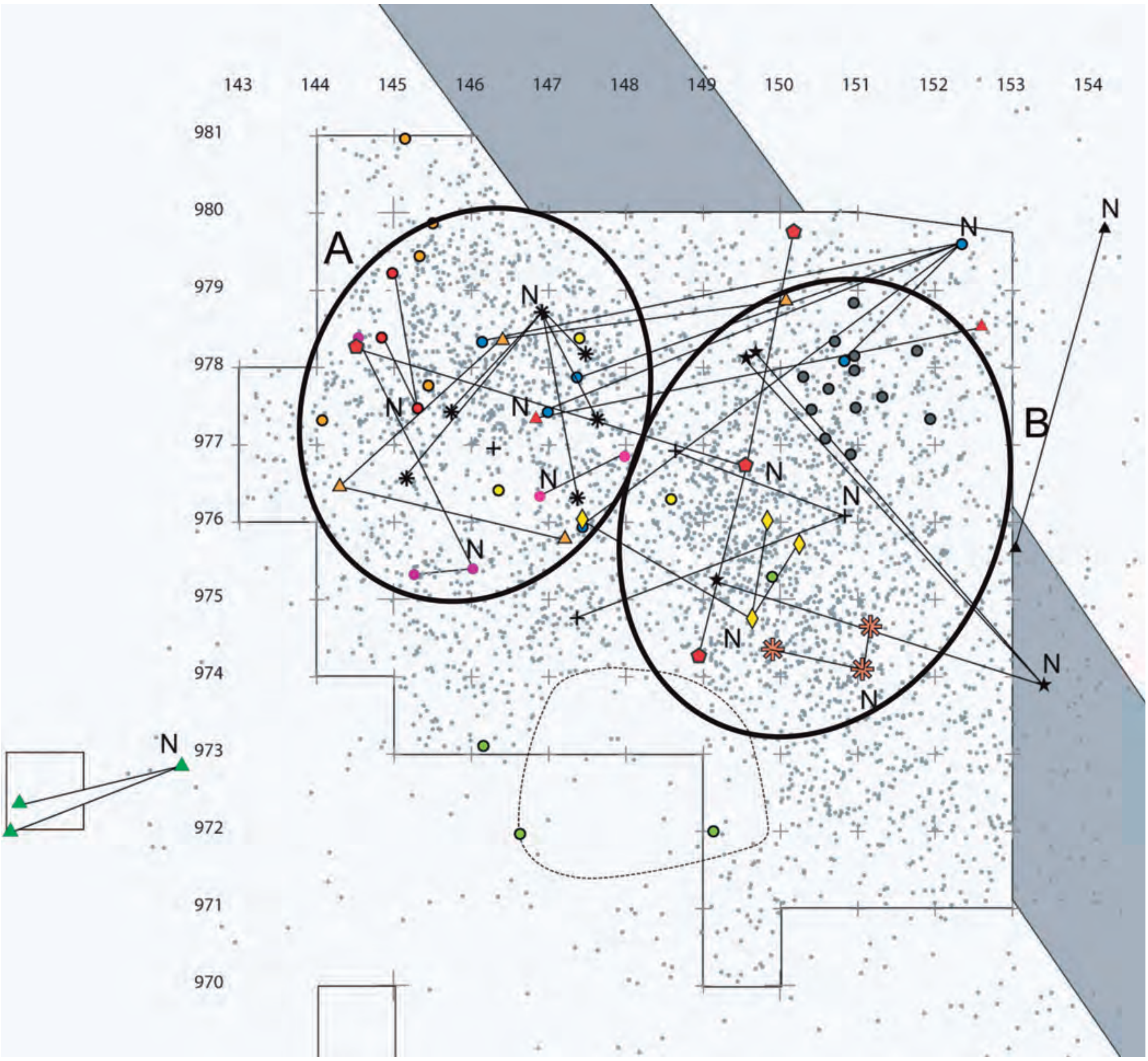


Fig. 15 – 62 rue Henry-Farman, Paris. Locus 2: distribution of refits (graphic design B. Souffi).

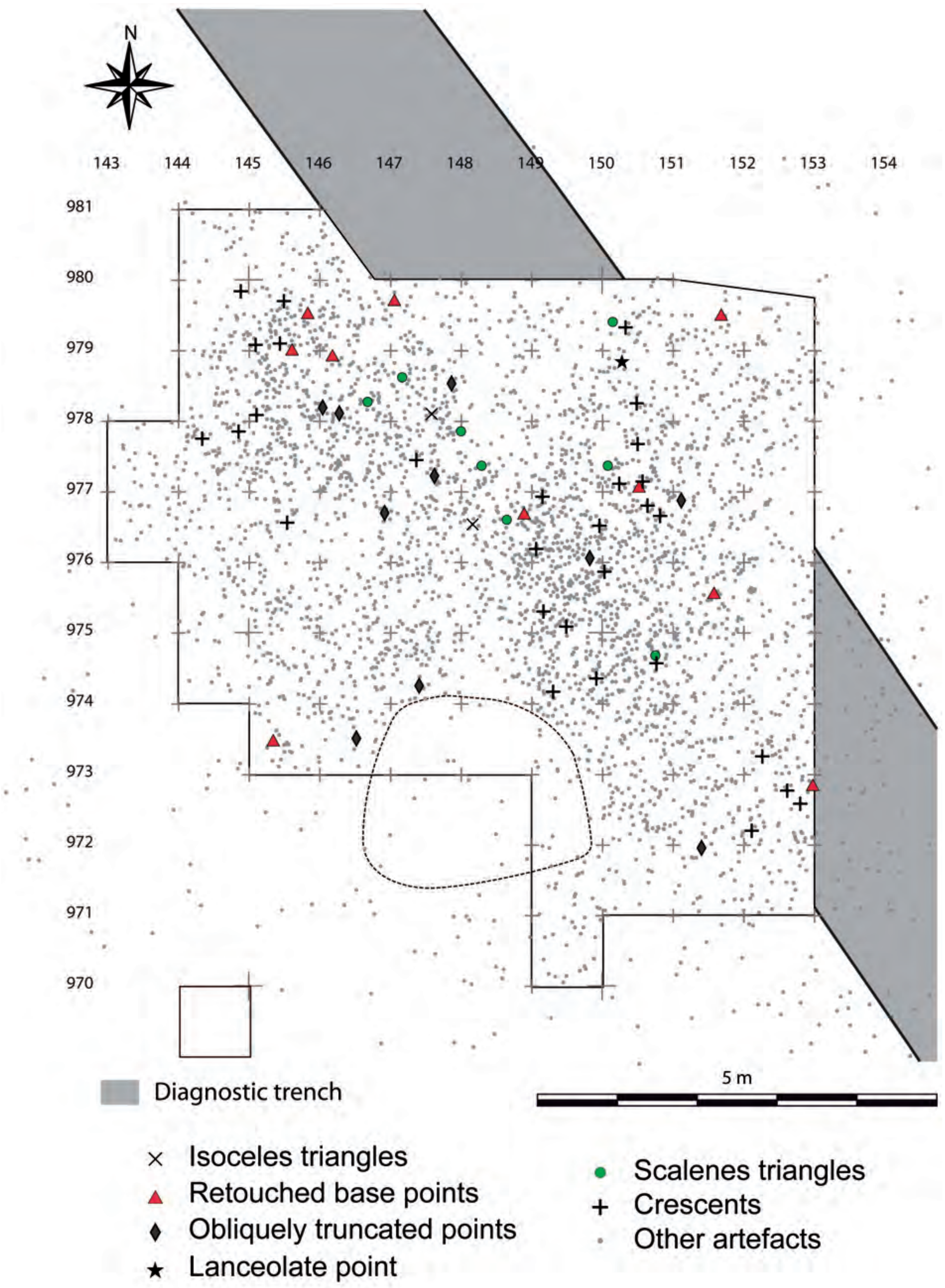


Fig. 16 – 62 rue Henry-Farman, Paris. Locus 2: distribution of microliths (graphic design B. Souffi).

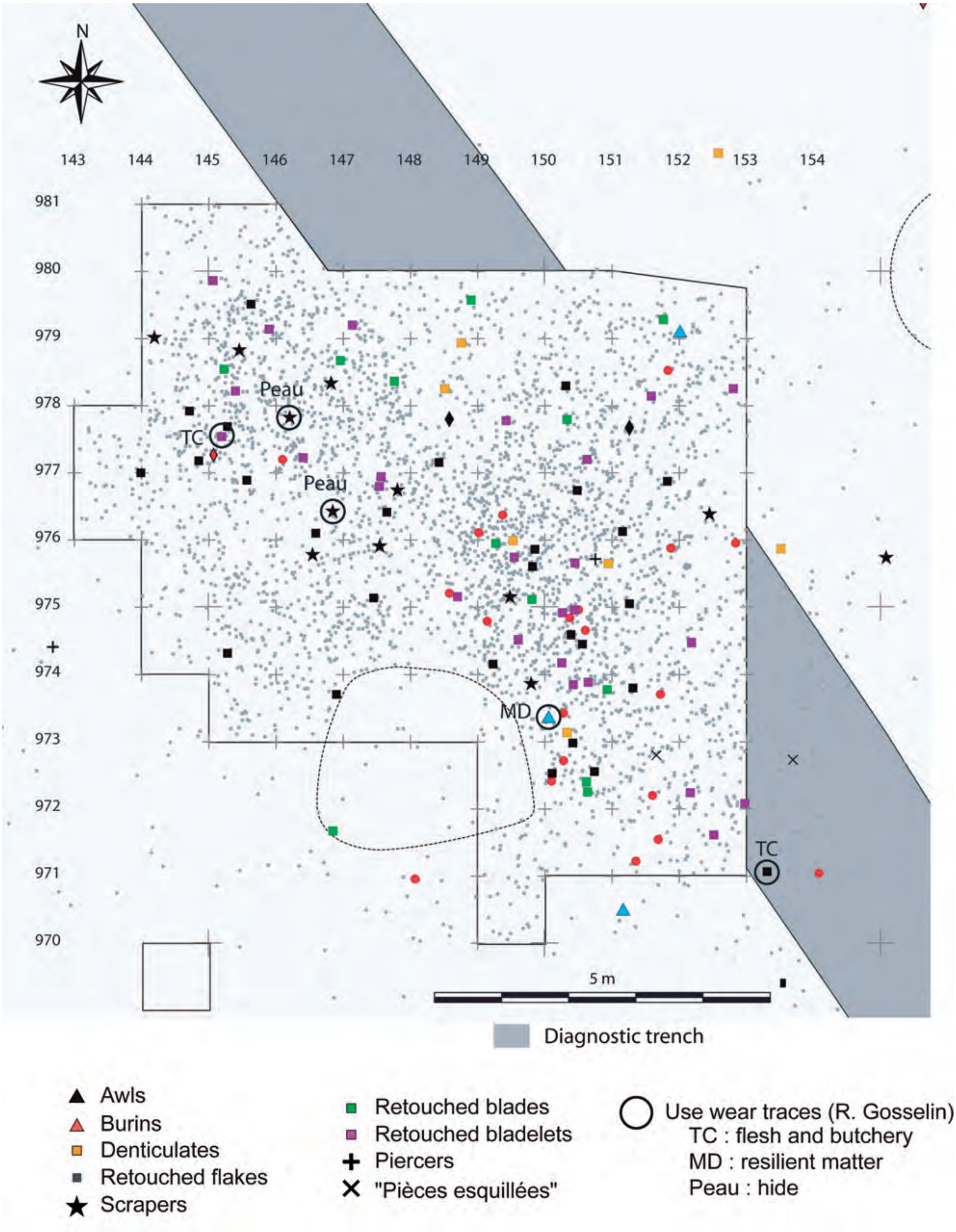


Fig. 17 – 62 rue Henry-Farman, Paris. Locus 2: distribution of domestic tools (graphic design B. Souffi).

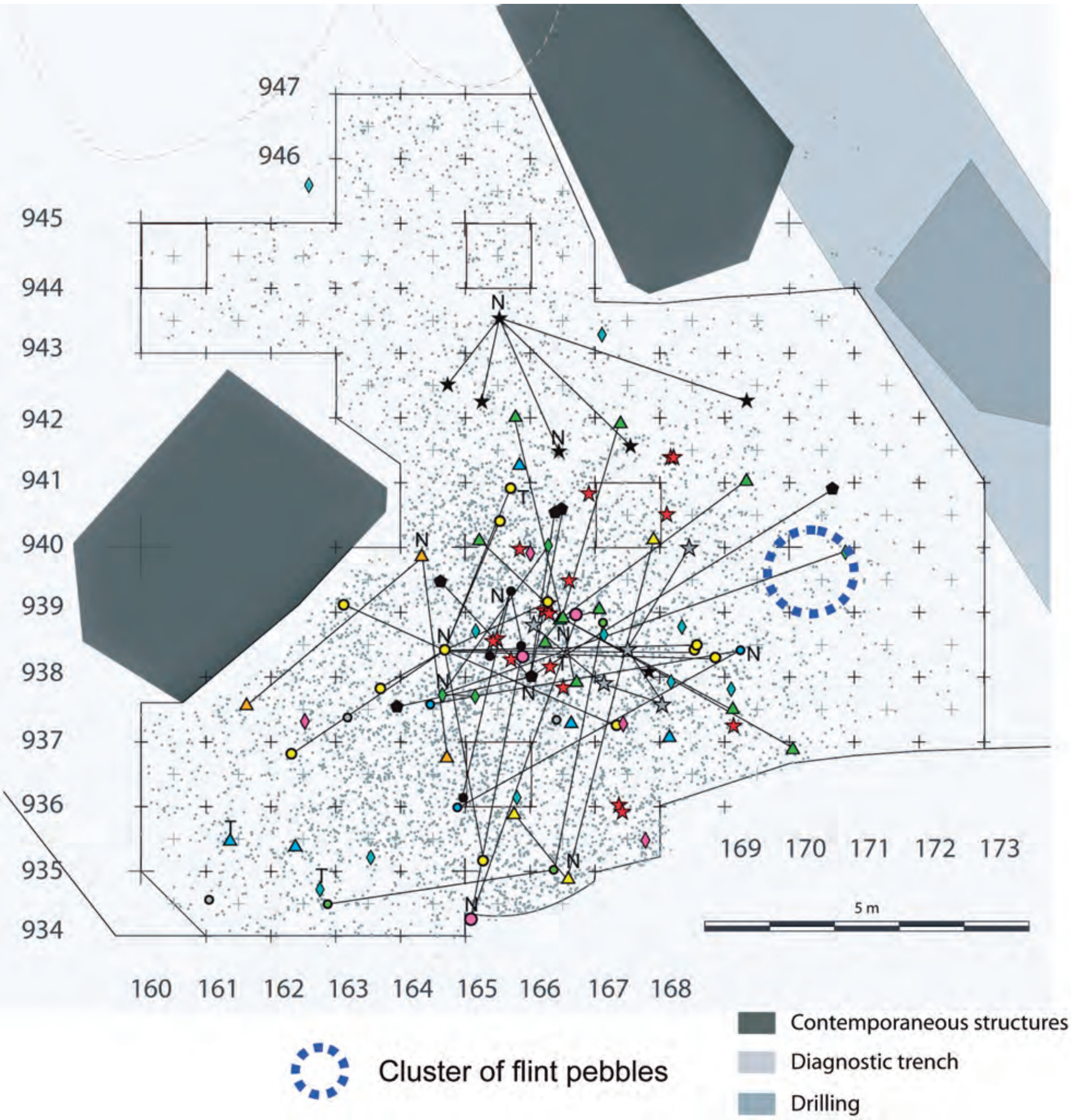


Fig. 18 – 62 rue Henry-Farman, Paris. Locus 5: distribution of refits (graphic design B. Souffi).

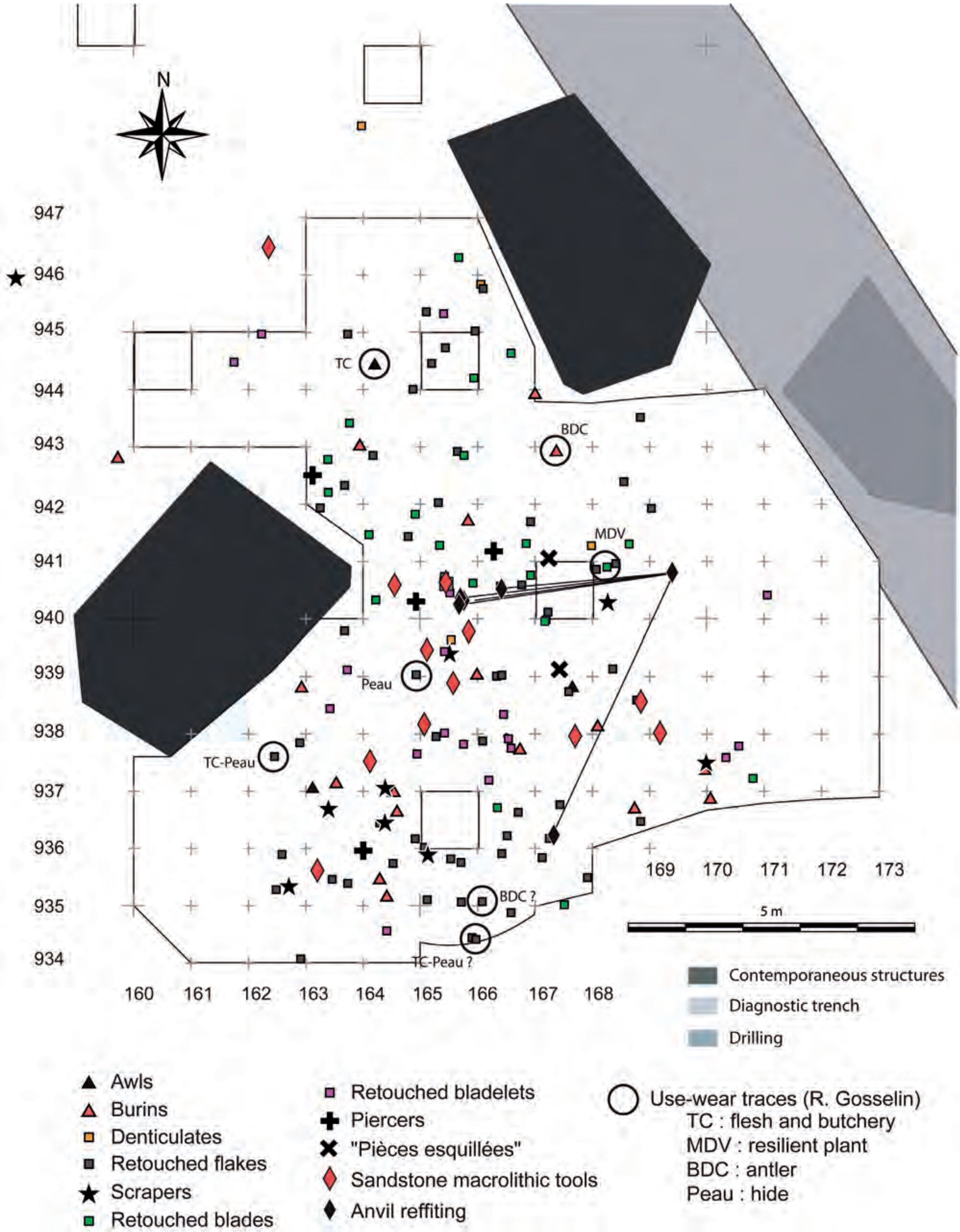


Fig. 19 – 62 rue Henry-Farman, Paris. Locus 5: distribution of domestic tools (graphic design B. Souffi)..

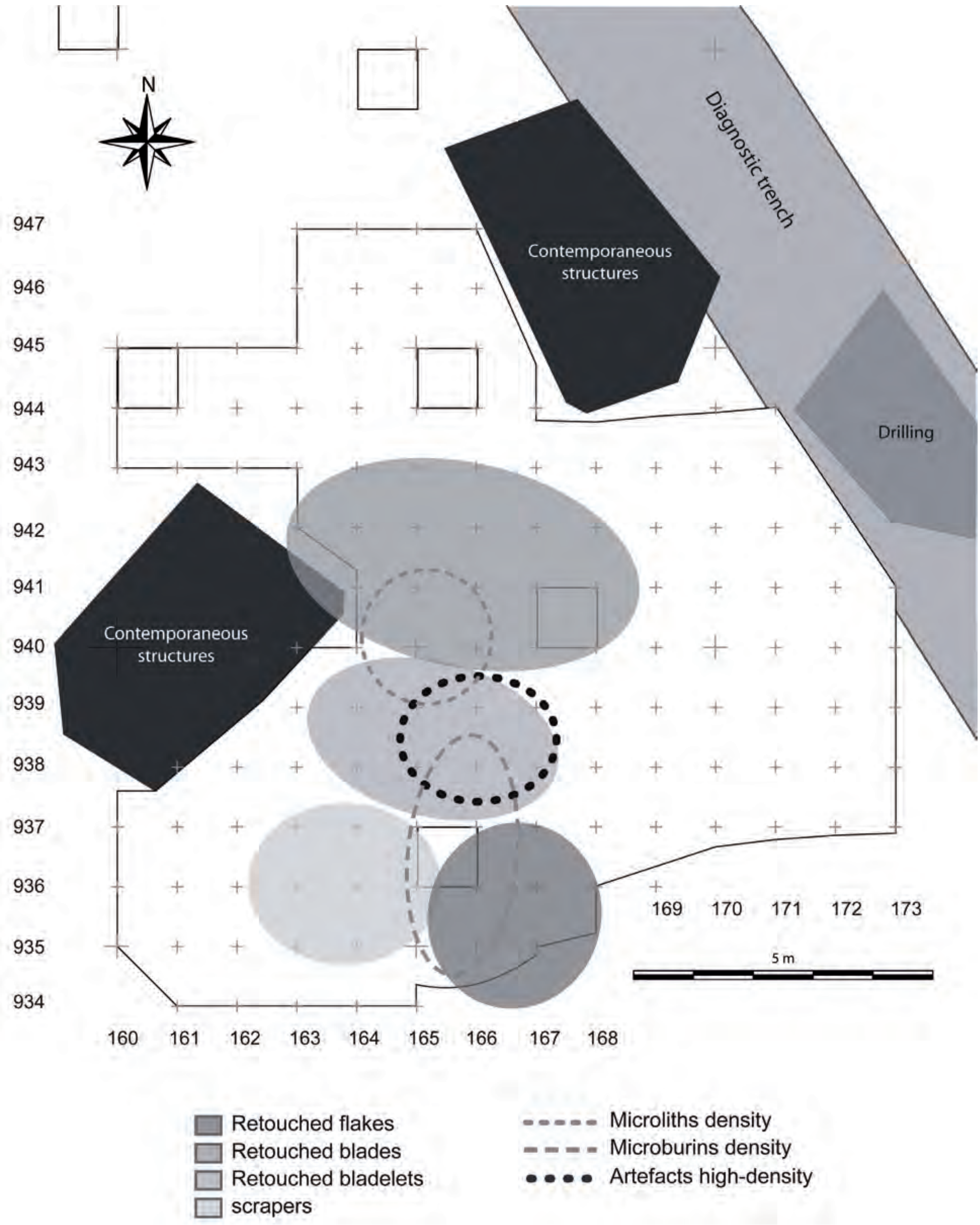


Fig. 20 – 62 rue Henry-Farman, Paris. Locus 5: overall spatial organisation (graphic design B. Souffi).

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Noyen-sur-Seine, twenty-five years on

Daniel Mordant, Boris Valentin & Jean-Denis Vigne

Abstract: This chapter summarises our current understanding of the site of Noyen-sur-Seine by highlighting several particular aspects starting from the field and leading up to perspectives which may be explored in the light of current Mesolithic research. Following a brief history of this groundbreaking research, several successive topics will be addressed: the sedimentary dynamics of the anthropic deposits, the possible origin and differential preservation of the remains (D. M.), previously published information and new perspectives concerning the faunal material (J.-D. V.), lithic industries and human remains (B. V.). This outline should by no means be confused with the presentation of a fixed research program, but rather a call for new research incorporating the many projects that remain to be elaborated or strengthened.

BRIEF HISTORY OF RESEARCH (D. M.)

The broadened scope of Mesolithic research is largely due to the increased activity of rescue archaeology. The site of Haut-des-Nachères at Noyen-sur-Seine (fig. 1), excavated over five summer seasons (each lasting two months) between 1983 and 1987, forms part of this development (Mordant, 1985, 1992a and 2006). This open-air site, comprised of five main loci totalling nearly 1,000 m², was spread across an exposed area of approximately 3 hectares. Its discovery came as a surprise as what was expected to be found, based on work carried out since 1970, was not a Mesolithic site, but the extension of a fortified Middle Neolithic occupation (fig. 1, A) in the form of peripheral refuse dumps preserved in a waterlogged context. The installation of a gravel quarry following excavations in 1981 that required significantly lowering the groundwater table by pumping water into a drainage reservoir eventually allowed the eastern zone of warped paleochannels to be investigated. These paleochannels served as a natural boundary of the Neolithic occupations. The objective had been to reach the Neolithic deposits, expected to be found approximately 2 m below the water table, as this had failed during prior attempts. Beginning in 1982, wide mechanically dug test trenches (up to −3m) were placed at the limits of the Neolithic site exposing a substantial stratigraphy above the water line. Peat deposits at the base of a channel were overlain by fine sterile grey sands, followed by light carbonated silts — the latter unfortunately yielded only occasional Neolithic remains. The interesting presence of “faunal remains and several atypical flakes” was however noted in an erosion layer related to the bank and edge of the peat deposit. The continuation of the project the following year confirmed this presence beyond all expectations with the discovery of whole deer and wild boar skulls. After a period of incertitude regarding the age of these deposits, in 1984 the ^{14}C verdict was returned — we were in the middle of the 8th millennium!

The obvious potential of the site and support from the Laboratory of Comparative Anatomy at the National Natural History Museum allowed us to mobilise, from 1984 onwards, a team of 21 young researchers, most of whom were without posts, and carry out a volunteer excavation. This work formed part of a CNRS research project (1985 – 1987) coordinated by Marie-Christine Marinval-Vigne and Daniel Mordant entitled “Archaeology

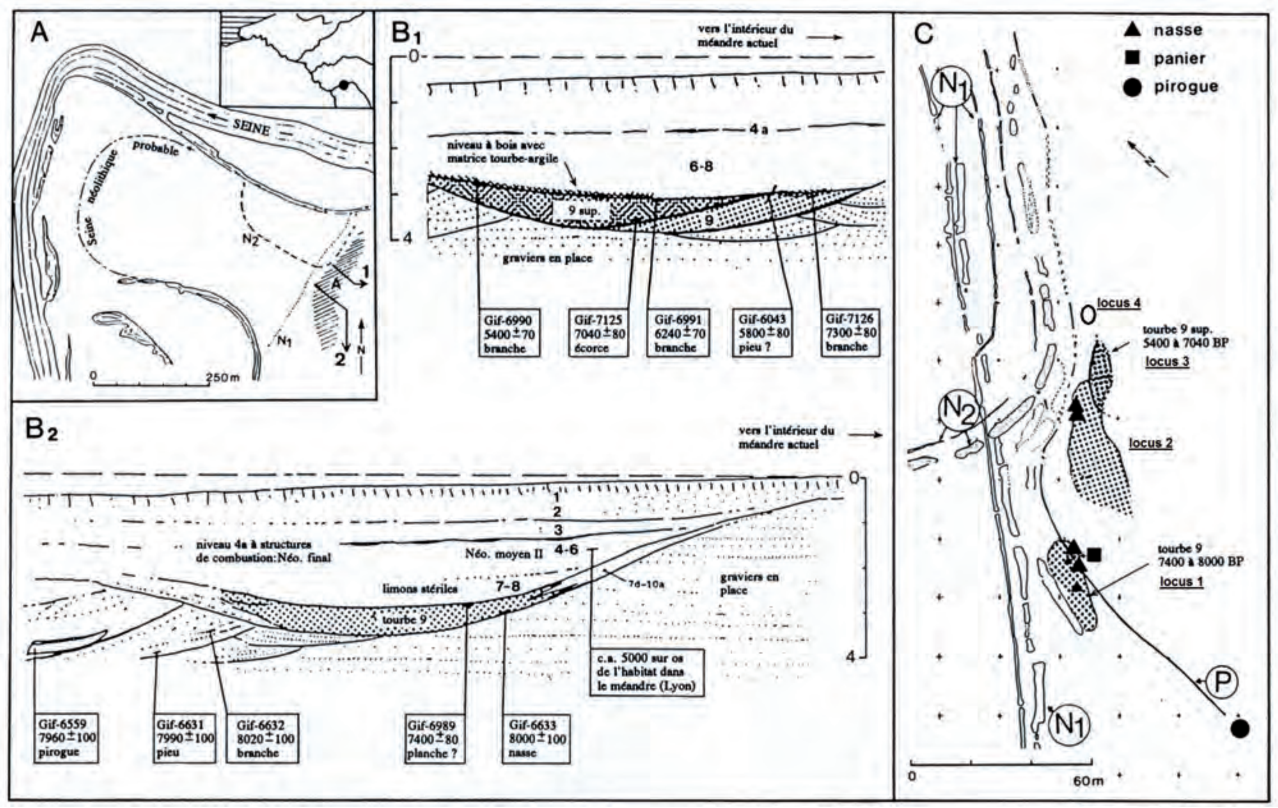

Fig. 1 – The site of Noyen-sur-Seine (Seine-et-Marne). A: Neolithic occupations; B1–B2: schematic stratigraphy of Mesolithic systems 9 and 9 sup; C: excavation loci 1 to 4 (N1–N2: Neolithic fortifications; P: Protohistoric palisade) after Mordant, 1992a.

Fig. 2 – Noyen-sur-Seine. View towards the south of the excavations in 1985: foreground, locus 3 before the excavations; background, locus 2 at the end of excavations (photo D. Mordant).

and Fluvial Environments from the Mesolithic to Protohistory based on the investigation of waterlogged deposits at Noyen-sur-Seine (Seine-et-Marne)". Various presentations at national (Mordant and Mordant, 1989; Marinval-Vigne *et al*., 1991 and 1993; Mordant, 1991) and international (Mordant and Mordant, 1992) conferences, followed by several publications and different academic work (Dauphin, 1989; Auboire, 1991) between 1987 and 1992 [(1)], highlighted the richness, excellent preservation and diversity of the excavated material. This fluviatile environment, accessible from the Preboreal onwards, is documented in an over 4 m deep stratigraphy, including nearly 1 m of peat deposits, which yielded more than 7,000 osseous remains referable to both hunting and fishing, worked objects in bone and wood (including a dugout canoe), evidence of wickerwork (fig. 3; Mordant, 1992b; Leclerc, 2004), human remains (Auboire, 1991), as well as a sparse and 'atypical' lithic industry.

NEW STUDIES (D. M.)

Initial studies, coupled with the wickerwork reconstructions carried out up until 2004 with the help of Guy Barbier's experimental basket-weaving at the Nemours Museum of Prehistory (Leclerc, 2004, p. 30 – 32), have focused on environmental questions (Leroyer, 1997; the work of V. Bernard and P. Rodriguez) and on the exploitation of more novel materials, especially vegetal remains that required careful conservation in what used to be relatively precarious conditions (Mordant, 1997). The lithic industry initially studied by A. Augereau (1989) forms the main point of reference for the Mesolithic period. Despite a program of wet sieving that resulted in the thorough recovery of fish remains (Dauphin, 1989), very few microliths were recorded. É. David studied the organic industry during her doctoral research (David, 1999).

Returning to Noyen after 25 years is not at all designed to highlight any particular oversights in this pioneering research, nor rewrite it, but rather to revisit the dynamics underlying the *taphonomy and chronology of the deposits* which must begin from exhaustively recorded field data (hand-drawn 1:10 plans with an inventory, systematic recording of levels, wet sieving of the anthropic levels). In parallel, it is necessary to re-examine the assemblages whose potential has not yet been fully explored and, in all cases, *update this new approach based on results from recent Mesolithic research*, especially those from rescue archaeology. The 'atypical' qualifier that remains attached to this site since its discovery is brought into question by this new approach. By attempting to compensate for and explain its shortcomings via different comparative studies (e.g. lithic material), as well as exploiting as best as possible its genuine assets, the site of Haut-des-Nachères at Noyen-sur-Seine could possibly be considered as any other Mesolithic site. This ought to lead to a rewarding research dynamic that will enrich our understanding of the period which witnessed the emergence of the Neolithic at the end of the 6th millennium BC.

TAPHONOMY AND CHRONOLOGY OF THE DEPOSITS (D.M.)

The Mesolithic occupations were identified in paleochannels at the western edges of a sandy-gravelly dome. Various Neolithic occupations overlaying these deposits across nearly 8 ha were also investigated: two distinct ditched embankment systems, as well as a dense, exceptionally well-preserved and structured [(2)] occupation level excavated over 10,000 m² (Mordant, 1977). The level was found on a thin bed of carbonated silt (averaging between .10 and .15 m) sealed by another more or less eroded silty bed (.20 m maximum) just below the plough-level.

The Mesolithic material was found in four 25 to 300 m² depressions with peaty bases [3] spread across several hundred square meters along the SW-NE oriented bank. Two topo-chronological systems could be discerned (fig. 4: loci 1 – 4): the oldest one to the south (*system 9*), radiocarbon dated (wood) to between 8000 and 7300 uncal. BP (7190 and 5970 cal. BC) and attributed to the Middle Mesolithic, and the most recent to the north, (*system 9 sup*) dated to between 7000 and 6200 uncal. BP (6060 and 4995 cal. BC) and assigned to the Late/ Final Mesolithic with Montbani bladelets. The more or less fragmented material, representing butchery activities or the production and use of flint tools, was recovered from gravel beds connected to the bank's erosion or from nearly 1 m thick peat deposits at the base of the channel. This material derives from human occupations whose traces have been totally erased by erosion, but were probably higher up on the sandy-gravelly dome [(4)]. Significant Mesolithic traces were not identified away from this bank despite careful investigations of the area after its exposure, nor on the dome to the west or to the east in the paleochannels.

The earliest, essentially un-preserved, occupations are without doubt slightly older than 8000 uncal. BP and correspond to the dugout pine canoe found 65 m to the south (fig. 1, C) and refuse scattered by floodwaters and dispersed within channels infilled with reworked gravels and possibly residual peat lenses. On the other hand, the terminal Boreal and Early Atlantic occupations are associated with a generally more low-energy sedimentation phase during which substantial peat deposits developed over a period on the order of 500 years, without major local erosion or a phase of raised water levels. However, the occupations, especially in the more northern loci, seemed to have suffered significant sedimentary reworking during the Atlantic period. Throughout the ensuing Neolithic period, the infilling of the eastern paleochannels involved an important carbonated mud component resulting from the considerable erosion of the catchment area.

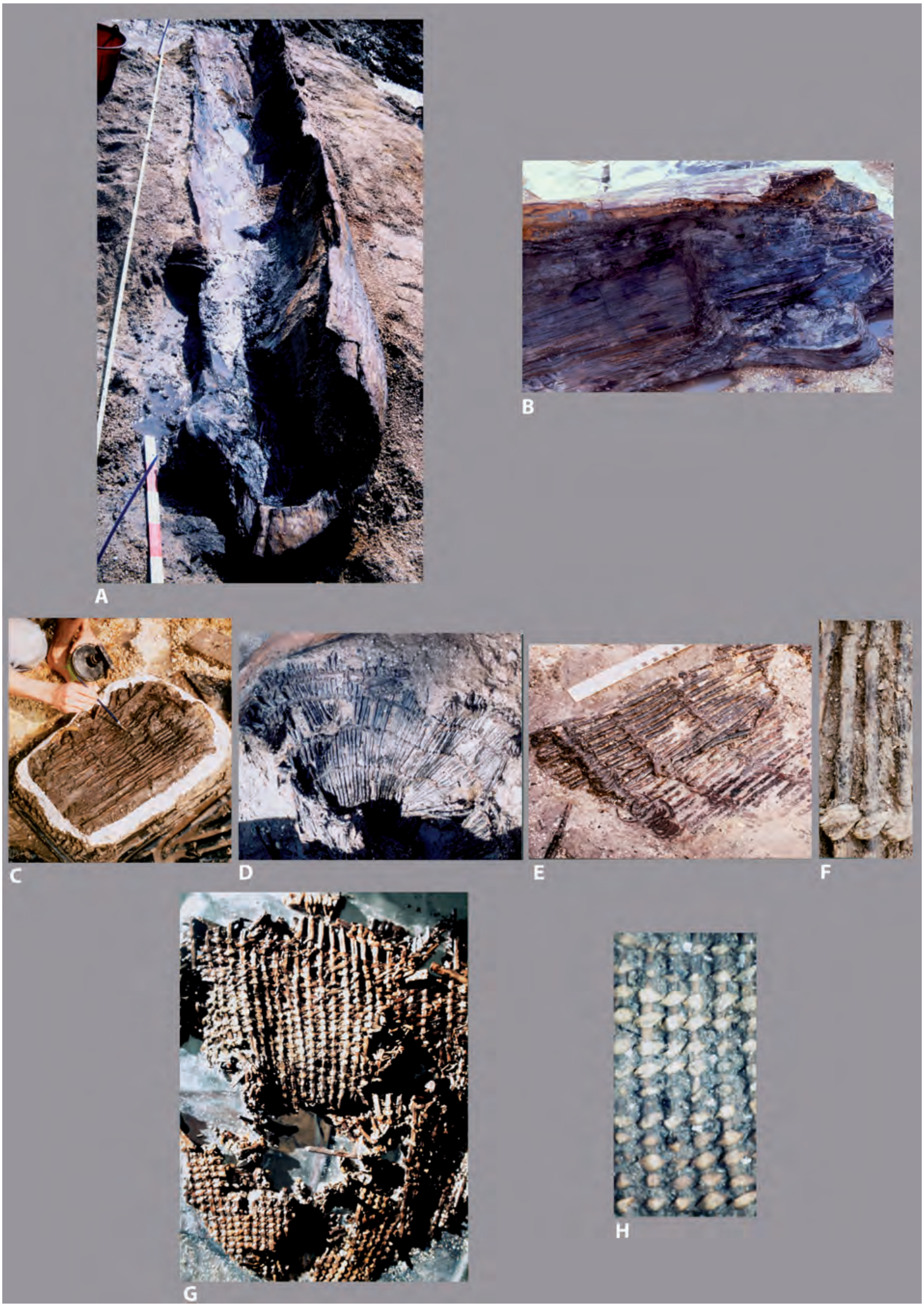

Fig. 3 – Noyen-sur-Seine. Lower channels (A, B and D) and locus 1, peat 9 (C, E to H): objects made from vegetal material. A-B: dugout canoe, *Pinus sylvestris*, L preserved = 4 m, with detail of the end with a burnt platform (container for a hearth?); C to F: wicker fish traps with funnelled openings and privet openwork, reconstructed diameters: 30 to 36 cm; maximum length: 87 cm; G and H: hemispherical woven willow container – *Salix sp.*, reconstructed diameter approximately 20 cm (A, C and H: photos D. Mordant; B: photo CNRAS).

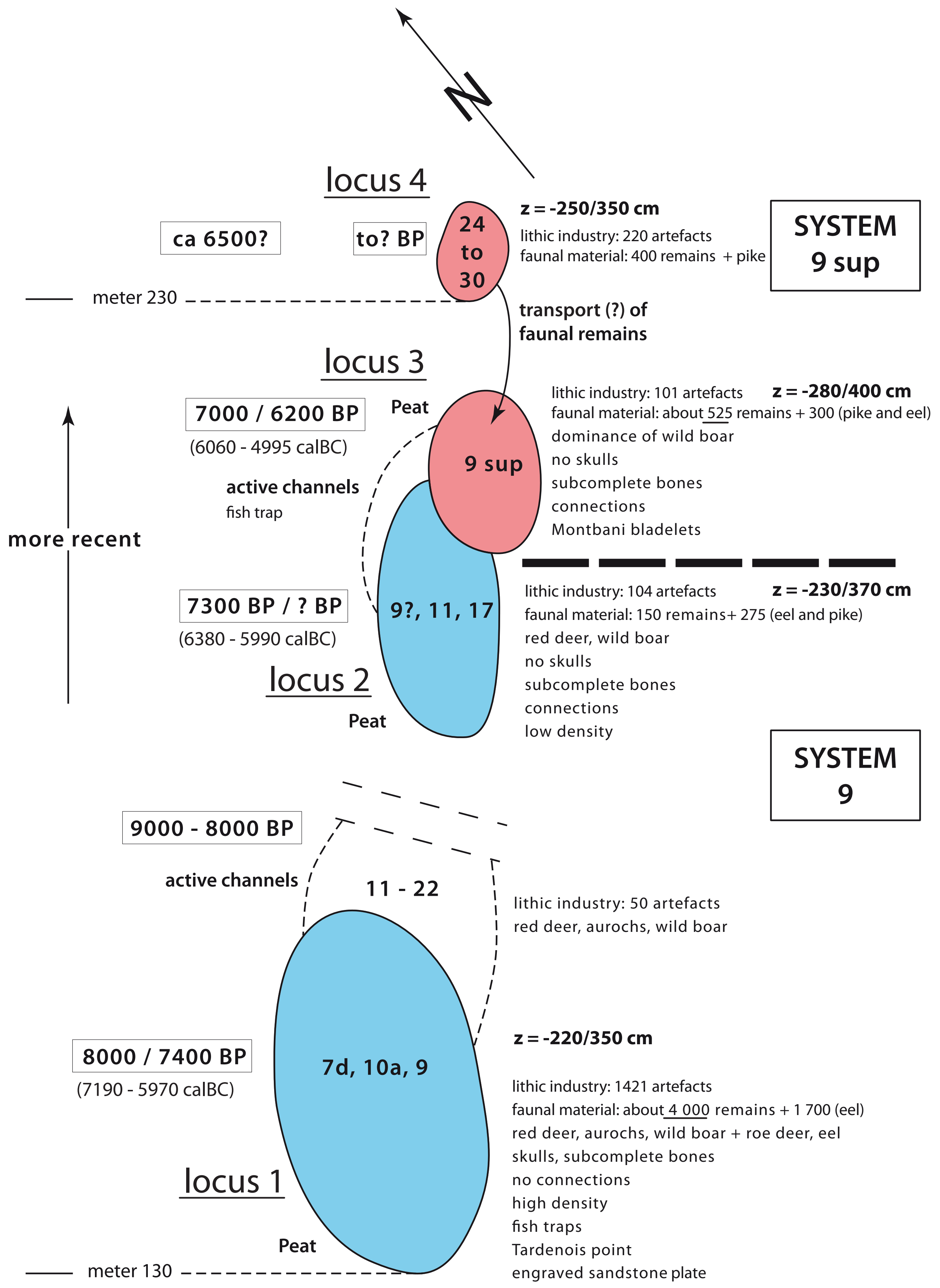

Fig. 4 – Noyen-sur-Seine. General plan of the excavated Mesolithic loci.

Fig. 5 – Noyen-sur-Seine. Locus 3, system 9 sup: discard cone of wild boar remains (photo D. Mordant).

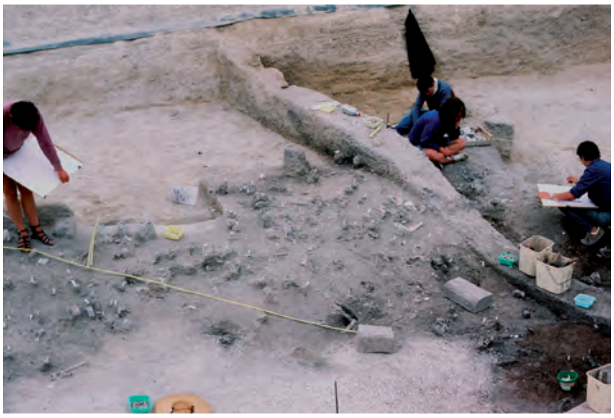

Fig. 6 – Noyen-sur-Seine. Locus 1, system 9: the bank during excavations (photo D. Mordant).

Fig. 7 – Noyen-sur-Seine. Locus 1, system 9: wild boar skull (photo D. Mordant).

Fig. 8 – Noyen-sur-Seine. Locus 4, system 9 sup.: accumulation of young wild boar remains (photo D. Mordant).

The most salient information concerning the different loci is summarized in figure 4. The nature and distribution of the remains is the product of various human activities spread over *close to two millennia* that took place on the site or, in some cases, within the fluvial environment. These far from ideal conditions for a fine-grained spatio-temporal analysis should be approached with caution. We observe: 1) refuse in a near primary position associated with the remains of wild boar in locus 3 (system 9 sup, fig. 5); 2) accumulations of fragmented bone remains and, to a lesser extent, lithic artefacts in locus 1 (system 9) probably connected to the bank's erosion (fig. 6) and could therefore result from the displacement of an occupation level located above this bank; 3) skulls of large game (wild boar, red deer, roe deer), absent elsewhere, were also noted in this locus (fig. 7); 4) an accumulation of wild boar remains, some probably in a secondary context, associated with an organic clay lens in locus 4 (fig. 8); 5) the possible human or natural transport between loci 3 and 4 (separated by 20 m) of the remains of an old stricken wild boar (based on the work of J.-D. Vigne, followed by A. Augereau and A. Bridault); 6) finally, the clear dominance of complete bones in all three loci to the north of locus 1, including locus 2 found in system 9. Furthermore, two canid skulls (Vigne and Marinval-Vigne, 1988) come from locus 1 (system 9) with a third identified amongst the remains of young wild boar in locus 4.

Wickerwork remains (fig. 2) were found solely in system 9 and include a fragment of a fish trap from the top of the peat in locus 1, together with three other fragments and a tightly woven piece (a basket?) found at its base. Two wickerwork fragments were also associated with the paleochannels at the base of locus 2. Bi-pointed shanks (straight hooks?) were also present at the top of the peat in locus 3 associated with Montbani bladelets and a Sonchamp-type microlith.

STATE OF RESEARCH AND ANTHROPOZOOLOGICAL QUESTIONS (J.-D. V.)

The rich collection of 7,200 vertebrate remains (of which 5,350 are identifiable) recovered from the peat deposits of Haut-des-Nachères at Noyen-sur-Seine constitutes an important reference collection, remarkable not only for the its state of preservation, but also for the care in which it was collected (significant volumes of wet-sieved sediment). With the exception of the gravelly levels that yielded less than 5% of the assemblage, the large fauna is characterised by a very low level of post-depositional fragmentation. Their rapid immersion and burial also protected them from damage normally inflicted by carnivores. The site has produced important anatomical assemblages of even the most fragile skeletal elements such as the skull, cervid antler tips, scapulae, ribs and vertebrae (fig. 9). Traces of even the most subtle human actions (projectile impact, scratching, disarticulation, skinning, cooking: fig. 10) are also preserved. The fauna from the peat deposits of Noyen has been the object of a detailed archeozoological study led by one of us (J.-D. V.), which resulted in a still unpublished inventory, as well as numerous more specific studies that remain only partially published.

The first publication dealt with the skulls of two large canids (*Canus lupus*: fig. 11), including morphological features resulting from life in captivity (Vigne and Marinval-Vigne, 1988), an interpretation that has been reinforced by a recent revision. These elements could provide evidence for the local domestication of wolf during the Mesolithic, significantly after the first Palaeolithic domestications gave birth to "Upper Paleolithic small domestic dogs in Southwestern Europe" (Pionnier-Capitan *et al*., 2011).

The second published study concerned 2,235 fish remains collected from the wet sieved sediments of three loci during the 1983 – 1985 field seasons (Dauphin, 1989). The combination of their very disparate spatial distribution, the overwhelming dominance of a limited number of species (notably pike, *Esox lucius*, and eel, *Anguilla anguilla*) and a high proportion of burnt pieces leaves no doubt as to the anthropic origin of this ichtyofauna. Eels dominate the deposits from loci 1 and 2 (Middle Mesolithic) forming 93% and 69%, receptively, of the faunal material, a fact consistent with the recovery of fish traps from these sectors. In locus 3, dated to the Late/Final Mesolithic, pike represents 60% of the fish remains. The fishing season was centred around the summer months, especially in loci 2 and 3 where osteological remains seem to correlate with only a small number of fishing episodes.

In the absence of a more secure chrono-stratigraphic sequence, the analytical data from the study of the large fauna has been the subject of only preliminary presentations (Marinval-Vigne *et al*., 1991 and 1993).

During the seemingly year-round Middle Mesolithic occupations, red deer *(Cervus elaphus)* was the main prey species, representing 56% of the meat-weight, followed by aurochs *(Bos primigenius)* and wild boar *(Sus scrofa)*. Roe deer *(Capreolus capreolus)* is also relatively abundant (19% of the remains). Game was principally pursued in the forest and at its edges, but also to a lesser extent from the river. Deer mortality profiles demonstrate a selective slaughter focused on adults, probably related to hunting from a hide in relatively enclosed forested environments rich in game (Vigne, 2000). The *chaîne opératoire* of deer carcass processing, largely carried out with stone hammers, could be reconstructed from use-wear analysis carried out on nearly 600 specimens together with experiments involving modern red deer (Vigne, 2005).

Patterns of Late/Final Mesolithic faunal remains depart significantly from those of the Middle Mesolithic as wild boar come to represent 70% of the prey signals (fig. 12). Seasonality data is consistent with the results obtained from fish remains in the same deposits and indicates a small number of temporally specific hunting episodes most likely situated at the end of the summer (Vigne *et al*., 2000). Hunting practices targeted females with their young (fig. 9, C). Significant differences in carcass processing *chaînes opératoires* and culinary practices from Middle Mesolithic patterns can only be partially explained by differences in sought-after products. The hunters of the 9 sup levels probably aimed to set aside quarters of meat and fat stores as suggested, respectively, by the absence of hind leg bones from young individuals in loci 24 – 26 and the unusual and systematic perforation of long bone diaphyses by pecking (fig. 9, C and fig. 10, C). These differences undoubtedly also have a cultural dimension, as can be seen in the different ways in which wild boar extremities were processed; by sawing and bending-breaking during the Middle Mesolithic (fig. 10, E) and by traditional percussion methods in the Late/Final Mesolithic. The possibility of contamination or the lack of a sufficiently refined stratigraphic interpretation notwithstanding, several domesticated bovid remains, apparently associated with the Final/Late Mesolithic deposits, could suggest contact between these groups of hunters and initial 'linear band ceramic' societies.

During the 1990s and 2000s, faunal assemblages from the Noyen peat deposits were used as an osteometric reference collection by numerous researchers (e.g. Bridault, 1993; Tresset, 1996; Albarella et al., 2009). They have also been sampled for DNA analysis in order to disentangle the origins of European domestic bovids (Edwards et al., 2004 and 2007), pigs (Larson et al., 2007) and dogs (Pionnier-Capitan et al., 2011).

Once the critical re-evaluation of field data concerning the site's stratigraphy is complete, the numerous forms of zooarchaeological data recovered from these exceptional collections ought to be the subject of an exhaustive publication in the near future.

NOYEN, A SPECIALISED SITE? NEW PERSPECTIVES (B. V.)

Since 2008, one of us (D. M.) has coordinated new work at Noyen in the framework of a collaborative research project entitled "The Final Palaeolithic and Mesolithic of the Paris Basin and its margins…" (French Ministry of Culture).

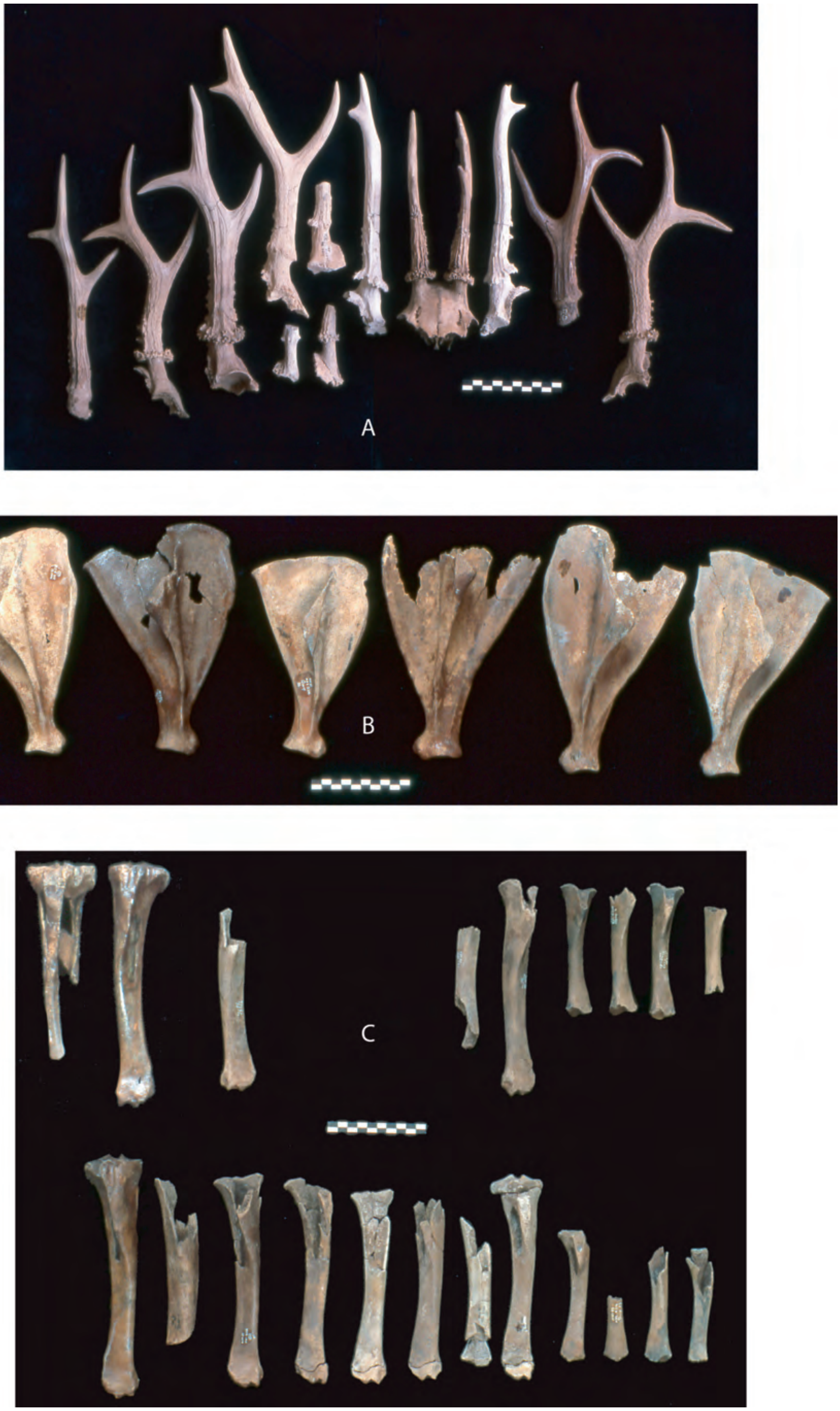

Fig. 9 – Noyen-sur-Seine. A: locus 1, levels 7d, 9 and 10a (Middle Mesolithic), roe deer antlers; B: level 9 sup (Final Mesolithic), sub-complete wild boar scapulae; C: locus 3, level 9 sup (Final Mesolithic), series of right (top line) and left tibias classed from left to right by decreasing order of age (photos and graphics J.-D. Vigne).

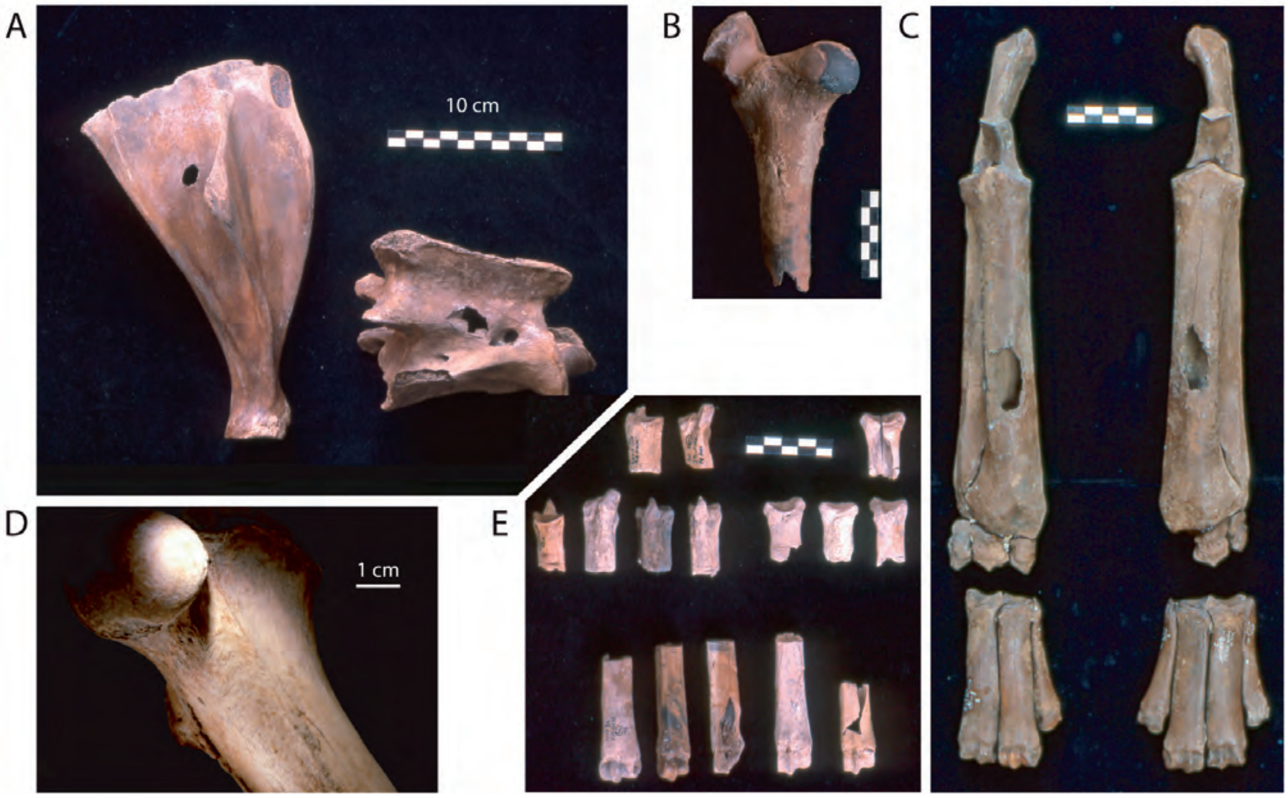

Fig. 10 – Noyen-sur-Seine. Large Mesolithic mammal bone from Noyen with traces. A: locus 1, level 9 (Middle Mesolithic), projectile impacts on the right scapula of a wild boar and on a deer axis; B: locus 3, level 9 sup. (Final Mesolithic), cooking marks on the articular condyle of a red deer left femur; C: locus 3, level 9 sup (Final Mesolithic), forearm bones and the right and left feet of the same adult wild boar, the dorsal face of a radius shaft was perforated by pecking for marrow extraction; D: locus 1, level 9 (Middle Mesolithic), traces of disarticulation/de-fleshing on the cranio-medial surface of a complete wolf femur; E: locus 1, levels 7d, 9, and 10a (Middle Mesolithic), series of proximal halves (the two top lines) and distal wild boar axial metapodials sawed at the mid-shaft during processing and for accessing marrow (photos and graphics J.-D. Vigne).

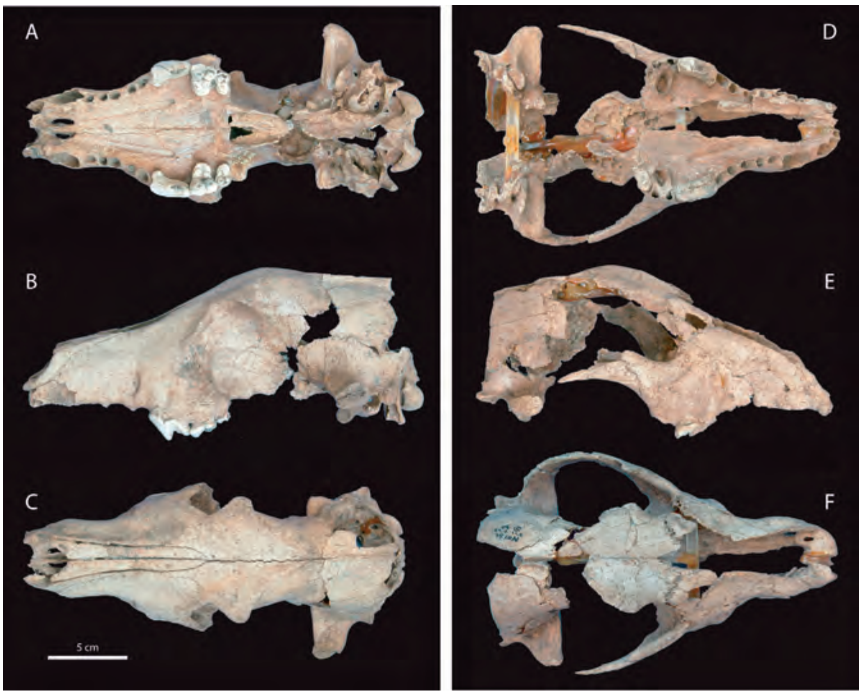

Fig. 11 – Noyen-sur-Seine. Locus 1, level 9, Middle Mesolithic (A, B, C: squares G137-119; D, E, F: squares D149-10). Ventral (A, D), lateral (B, E) and dorsal (C, F) views of the two wolf skulls *(Canis lupus)*. NB: a resin and plexiglass support had to be inserted within the cranium of the second specimen in order to consolidate it (restoration and graphics J.-D. Vigne; photos K. Debue, CNRS).

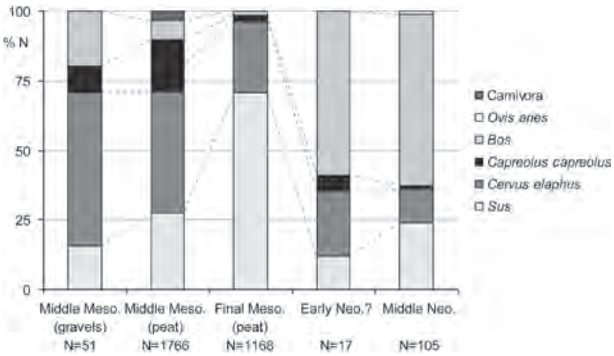

Fig. 12 – Noyen-sur-Seine. Relative frequencies (in number of identified specimens: NISP) for the main large mammal groups in the five major chrono-stratigraphic deposits from Noyen.

Objectives		N
Bladelets		30
Flakes	Thick and large	3
	Thin and small	8
Impossible to decipher (either due to an early abandon, or a lack of skill or an heat deterioration)		8
Total		**49**

Fig. 13 – Noyen-sur-Seine. Locus 1, level 9: cores classed by final principal production objective (after B. Valentin).

Following an initial study carried out by G. Auboire (1991), G. Bosset has re-examined the human remains from an archeo-thanatological perspective [5]. F. Valentin and D. Drucker have also been interested in a project studying the diets of Mesolithic populations based on the analysis of bucco-dental lesions and stable isotopes (Valentin and Drucker, 2009) in order to evaluate the contribution of aquatic resources.

We have also examined the lithic industry in order to better understand the specialised — or not — character of the human occupations at Noyen. Only several preliminary results from the terminal Boreal levels (locus 1) will be developed here.

Use-wear analysis has identified a varied functional spectrum, including significant working of vegetal materials, whose relative diversity suggests multi-functional occupations : Guéret, this volume [6].

Following on from Augereau's initial observations (Augereau, 1989), this multi-functional aspect can also be deduced from the lithic reduction sequences, particularly in respect to the cores. Level 9 of locus 1 has yielded around 50 cores where at least the final debitage objective is clear for around 40 of them, as refitting has not yet been attempted (fig. 13). Scar negatives indicate the principal intention during the last sequences to be the production of thin, short and elongated pieces having at least one rectilinear edge, in other words, bladelets *(stricto* and *lato sensu)* normally reserved for the manufacture of microliths during this period (fig. 14). In addition, debitage was geared towards the simple production of flakes. Several of these generally thick large flakes (with a maximum dimension between 40 to 50 mm) were intentionally retouched. Smaller, thinner products (20 to 30 mm) are also present and are comparable with the negatives found on cores recovered from the Mesolithic site of 62 rue Henry-Farman in Paris, particularly those from loci 3 and 4 (fig. 15).

Overall, the cores from Noyen are generally similar to those known from other Boreal open-air sites where debitage focused on the production of microlith blanks, but also flakes which are currently being analysed for use-wear. The main debitage systems detectable through cores do not directly portray any clear economic character for Noyen.

Products issuing from bladelet cores *sensu lato* are significantly under-represented. In fact, the 'fine fraction' is proportionally extremely low despite sediments from the anthropic levels being systematically sieved. Could this result from the gravitational sorting of refuse from the bank's edge? In addition to this taphonomic process, can the human selection of larger pieces, especially cores, be responsible for their over-representation in this apparently peripheral zone of the occupation? It is therefore essential that we better understand the particular function of the excavated area before we discuss the overall status of the site. This requires a phase by phase analysis of this refuse which clearly represents successive depositional

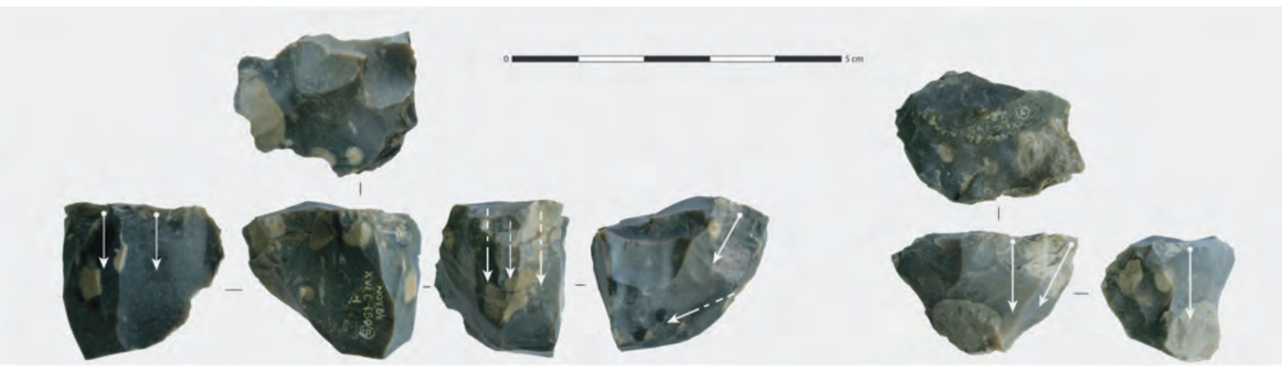

Fig. 14 – Noyen-sur-Seine. Locus 1, level 9: bladelet cores (photos S. Griselin).

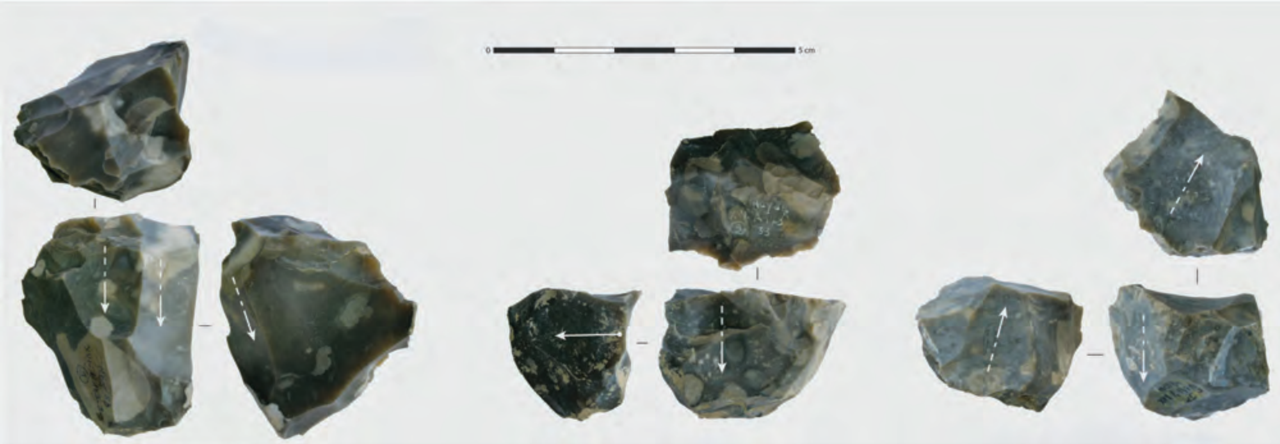

Fig. 15 – Noyen-sur-Seine. Locus 1, level 9: flake cores (photos S. Griselin).

episodes, especially new comparisons with zooarchaeological data. Are the differential distributions seen with the lithic remains identical for the faunal material?

There exists at least one other opportunity for a more large-scale inter-site comparison to explain an apparent anomaly; the fact that in level 9 only 2 microliths were recovered from the 1,500 lithics. Can this lack of microliths and the general under-representation of the fine fraction be put down to the fact that they derive from refuse at the occupation's periphery? Other factors may be at play as L. Chesnaux (this volume) and other researchers have demonstrated by experimentation — a significant number of microliths detach and remain within prey upon impact. Can the fact that so few microliths are associated with carcasses in level 9 also be due to the fact that bone points, such as those recovered from the Early Mesolithic level 9 sup, were used during this period (David, 1999)? However, no points of this kind were present in level 9 and, in any case, this would represent a novel example of hunting without microliths during this period. And why, if this were indeed the case, would bladelet production have taken place at all on the site? J.-D. Vigne's study of the material from level 9 (Vigne, 2005) suggests another possibility; that meat was boiled and when the flesh disintegrated numerous used microliths would have remained where the kill had been prepared and or consumed. Addressing this issue requires a detailed examination of microlith distributions on other sites. While it is clear that microliths are very often found in proximity to hearths, is this simply because arrows were rearmed in their vicinity or can their presence also designate cooking areas?

This line of questioning, amongst many other possibilities, underlines the usefulness of re-evaluating the studies from Noyen, particularly as increased excavations of Mesolithic occupations have failed to produce comparable zones. For this reason, Noyen remains *unequaled*, but no longer appears so *atypical*. In this respect it can be considered as a reference site, in other words, an ideal location for formulating certain hypotheses (e.g. the spatial distribution of used microliths) or for testing those developed elsewhere (e.g. the importance of working vegetal matter: Guéret, this volume).

NOTES

(1) Main researchers involved in the study of the site between 1985 and 1992: Guy Auboire, Anne Augereau, Salvator Bailon, Anne Bridault, Vincent Bernard, Marie-Agnès Courty, Éva David, Charles Dauphin, Georgette Delibrias, Vincent Krier, Georges Lambert, Chantal Leroyer, Philippe Marinval, Marie-Christine Marinval-Vigne, Claude Mordant, Daniel Mordant, Patrice Rodriguez, Jean-Denis Vigne, Philippe Vilette.

(2) Possible residual Mesolithic pieces, although small in number, have been noted amongst the Neolithic remains.

(3) Sedimentary units were initially numbered from 1 to 10 based on the reference profile from locus 1 and then up until 30 (locus 4): the peats 9 (locus 1) and 9 sup (locus 3) served as a reference for designating the two main chrono-topographic assemblages during this preliminary phase of study (system 9 and system 9 sup).

(4) Remains of a hearth were observed. Erosion also affected the Neolithic occupation level, although it was not preserved in this sector.

(5) PhD project in progress at Paris I under the direction of B. Valentin and F. Valentin: *Mesolithic Funerary Practices in France: An archeo-anthropological reexamination and sociological interpretation*.

(6) PhD project in progress at Paris I under the direction of B.Valentin: *The Mesolithic of Northern France in its European Context (X-VI Millenia BC). Activities, mobility and economy: a functional approach to stone tool kits*.

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The Mesolithic site of Haute-Île at Neuilly-sur-Marne (Seine-Saint-Denis): preliminary results

Joël Confalonieri and Yann Le Jeune

Abstract: A Mesolithic site was discovered during an archaeological evaluation of Haute-Île at Neuilly-sur-Marne (Seine-Saint-Denis) carried out by a mixed team from the INRAP and the council of Seine-Saint-Denis. The site is found on the right bank of the Marne River valley at an average altitude of 40 m NGF. This 65 ha area is found some 15 km upstream of Paris in one of the last bends of the Marne and has been designated a departmental park since 2005. The Mesolithic levels identified during a preliminary archaeological diagnostic in 2003 and 2004 lie within a paleosol on the edge of a paleochannel. These well-preserved levels are spread over a surface of a little less than 3 ha of which only 1.5% has so far been excavated. The Mesolithic levels contain abundant lithic artefacts, stone features and a burial. Based on an initial typological study they can be assigned to a succession of Middle and Late Mesolithic occupations fostered by the simultaneous presence of a river ford and open wetland banks creating an ideal location for hunting and setting up camp. The nearby banks of the paleochannel also produced Mesolithic artefacts, while an older level of a seldom-observed Holocene riverbank remains to be investigated. The Mesolithic site of Haute-Île still holds enormous archaeological as well as geoarchaeological potential and will probably be the focus of research in coming years.

This article presents a Mesolithic site identified at Neuilly-sur-Marne during the creation of a 65 hectares departmental park by the council of Seine-Saint-Denis. As the site has not yet been excavated, the data presented here comes from an archaeological diagnostic along with a series of complementary observations. The council plans to further investigate the site integrating other partners for an as yet undefined excavation. The 2 or 3 hectares on which the site is found are no longer threatened by the construction of the park and the fact that the land is owned by the department presents interesting perspectives.

A SPECIFIC ALLUVIAL SEDIMENTARY CONTEXT

Valley floors are well-known for preserving archaeological remains (Brown, 1997); site of Haute-Île in the Marne Valley has produced numerous traces of occupations spanning the Mesolithic to the modern period. Here we discuss the topographic context of the site and present a general stratigraphic model specifically focusing on the stratigraphies associated with the Mesolithic and Neolithic material. These results represent but part of the geoarcheological results obtained during the study of the meander.

A valley open to Holocene sedimentation

The lower Marne Valley represents a hydrological context particularly open to Holocene alluvial sedimentation. Starting from Changis-sur-Marne, 60 kilometres east of Paris, the slope of the Marne lessens and the river begins to form large meanders (fig. 1). This weak neotectonic context linked to minimal uplift (Antoine et al., 2007; Jost et al., 2007) is not conducive to significant incision or the formation of pronounced alluvial terraces. Consequently, the Marne has a weak debit in this low lying

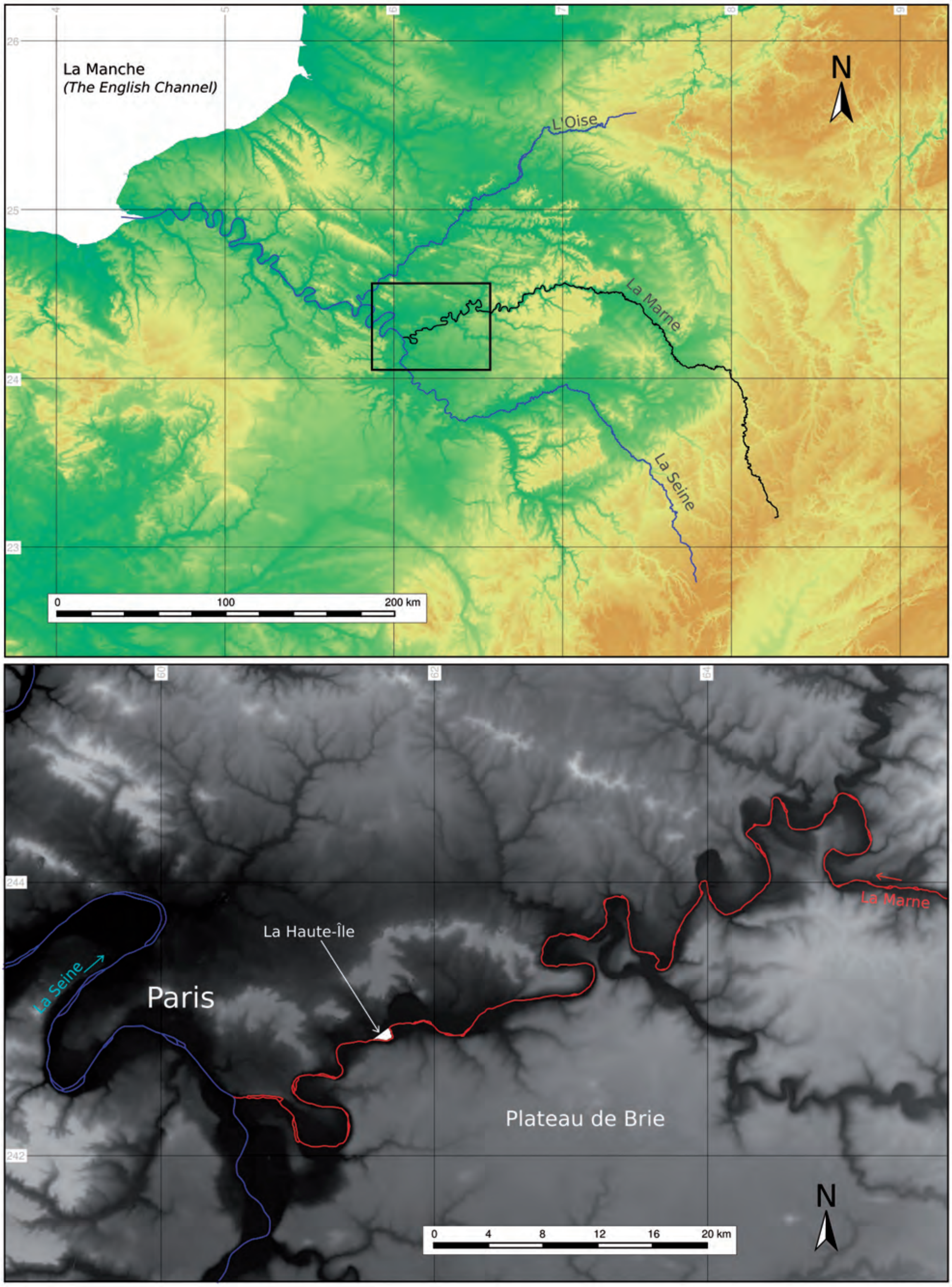


Fig. 1 – Haute-Île at Neuilly-sur-Marne. Topographic position of the meander in the Paris Basin (Lambert II projection, data source SRTM 4.1 – JPL/NASA and BDalti IGN).

valley at the centre of the Paris Basin, as well as a tendency to discharge sediments within meanders readily preserving complex sedimentary records. The Tertiary substrate in the vicinity of Haute-Île, as well as a large portion of its watershed, also present favourable contexts for the mobilisation of silty-clays and calcareous sediments with a significant loess component (Pastre et al., 2006). These types of deposits are especially well-represented in the north-east of the Île-de-France region (fig. 2; Antoine, 2002).

The meander of Haute-Île is currently in a flood zone (fig. 3) and is repeatedly submerged when the river floods despite dams lining the course of the Marne and upstream reservoirs designed to stabilise the course of the Seine (Villion, 1997). Although the course of the river is today significantly altered by human intervention and canalisation, these flood zones can still be considered locations where clayey-silts (overflow silts) were recently or are currently deposited.

A meander-scale stratigraphic model

Research concerning the Haute-Île meander focused on modelling the Holocene stratigraphy in order to evaluate the preservation potential of archaeological remains over the 65 hectares of the future park. As part of this rescue project, the department originally investigated the area upstream from the archaeological diagnostic (Lanchon et al., 1999). A mechanical auger survey, under the direction of Jean-François Pastre, enabled a preliminary schematic stratigraphic model of the meander to be constructed (fig. 4). These results were complemented by an electromagnetic survey detailing the morphology of the ancient island (gravel dome) at the centre of the meander (fig. 5; Vergnaud et al., 1999) where traces of Mesolithic to Late Iron Age occupations were recorded (Lanchon et al., 1999).

The sedimentary sequences that can be associated with the Mesolithic material (corresponding to the Preboreal, Boreal and part of the Atlantic chronozones) are poorly preserved due to significant erosion by later river channels (Le Jeune et al., 2005). Particular attention should however be paid to the clayey organic level (fig. 4, facies no. 7) representing a facies of a slightly sloped wetland bank that gently progrades in concert with the rising level of the Marne during the early Holocene. This depositional context created favourable conditions for the preservation of much deeper Mesolithic occupations

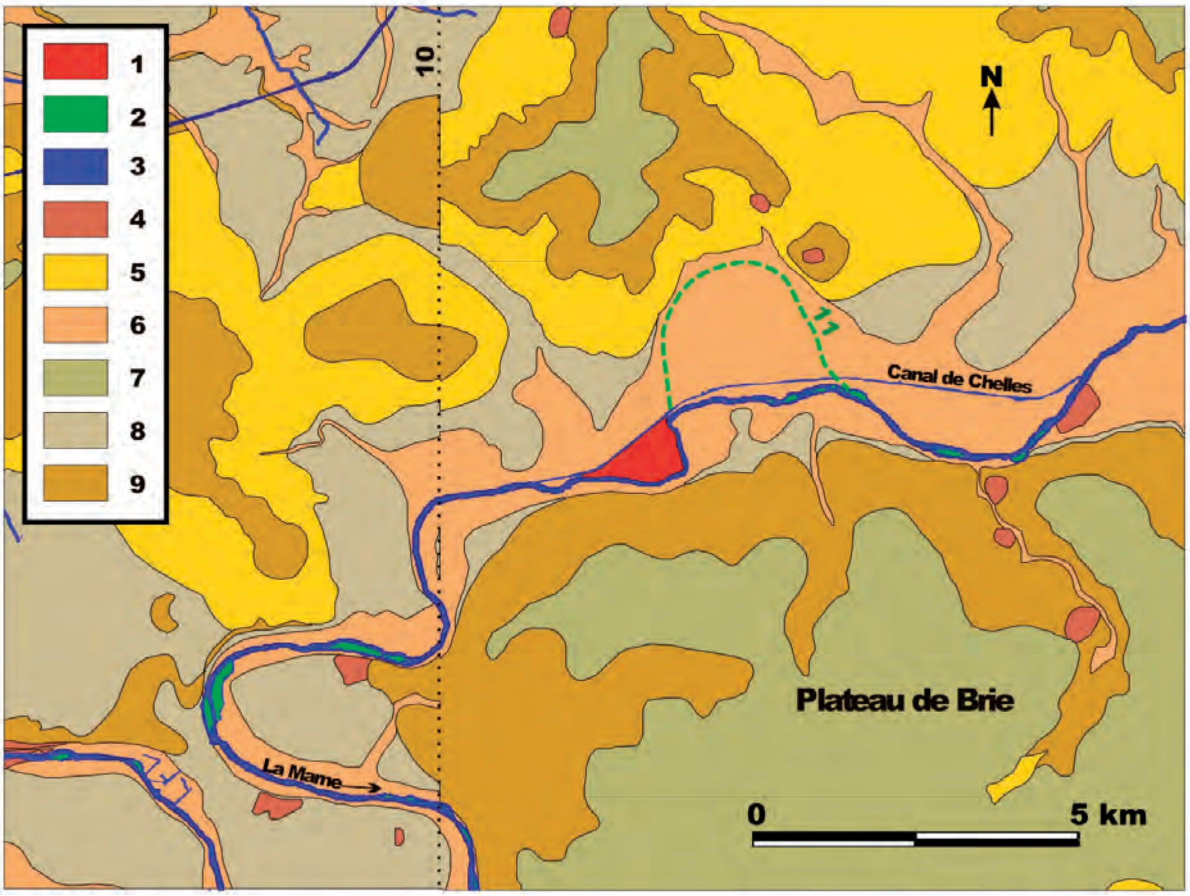


Fig. 2 – Haute-Île at Neuilly-sur-Marne. Geological setting of the site. 1: the site of Haute-Île; 2: islands; 3: present course of the river; 4: fill; 5: colluvium; 6: recent alluvium (Holocene); 7: plateau silts (intact and reworked loess); 8: ancient alluviums; 9: Tertiary deposits; 10: limit between the two geological maps; 11: approximate position of the ancient Chelles meander. Geological data extracted from Lagny geological maps (Caudron and Labourguigne 1971) and Paris (Soyer 1955).

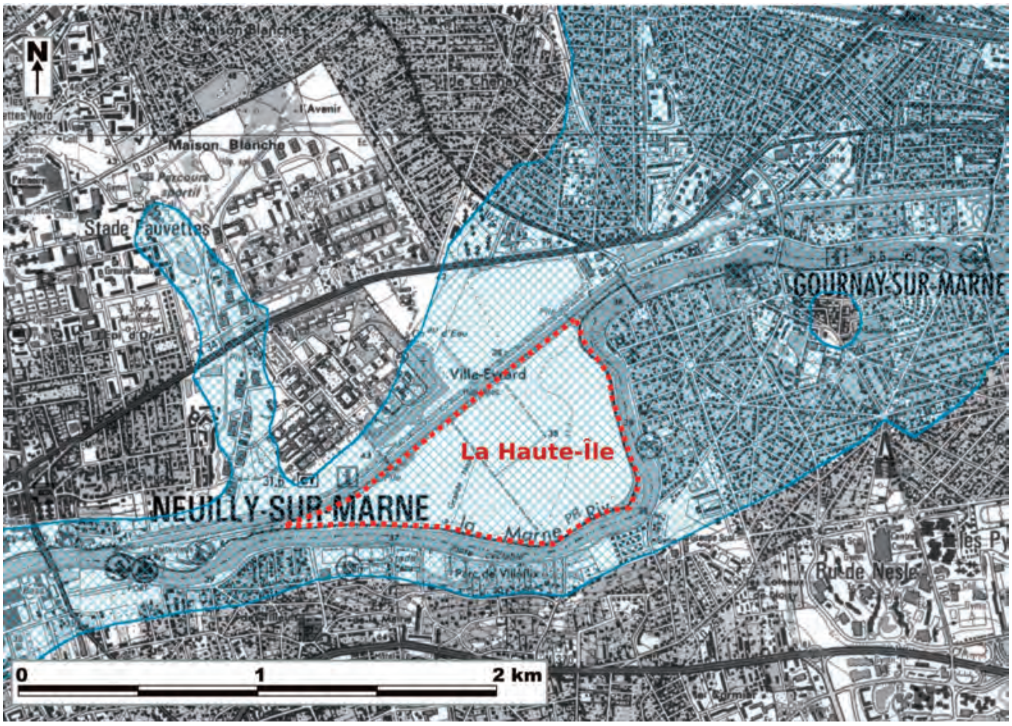


Fig. 3 – Haute-Île at Neuilly-sur-Marne. Topographic map (IGN 1/25000). In blue, high water levels (flood of 1910 based on a document from the DIREN of Île-de-France).

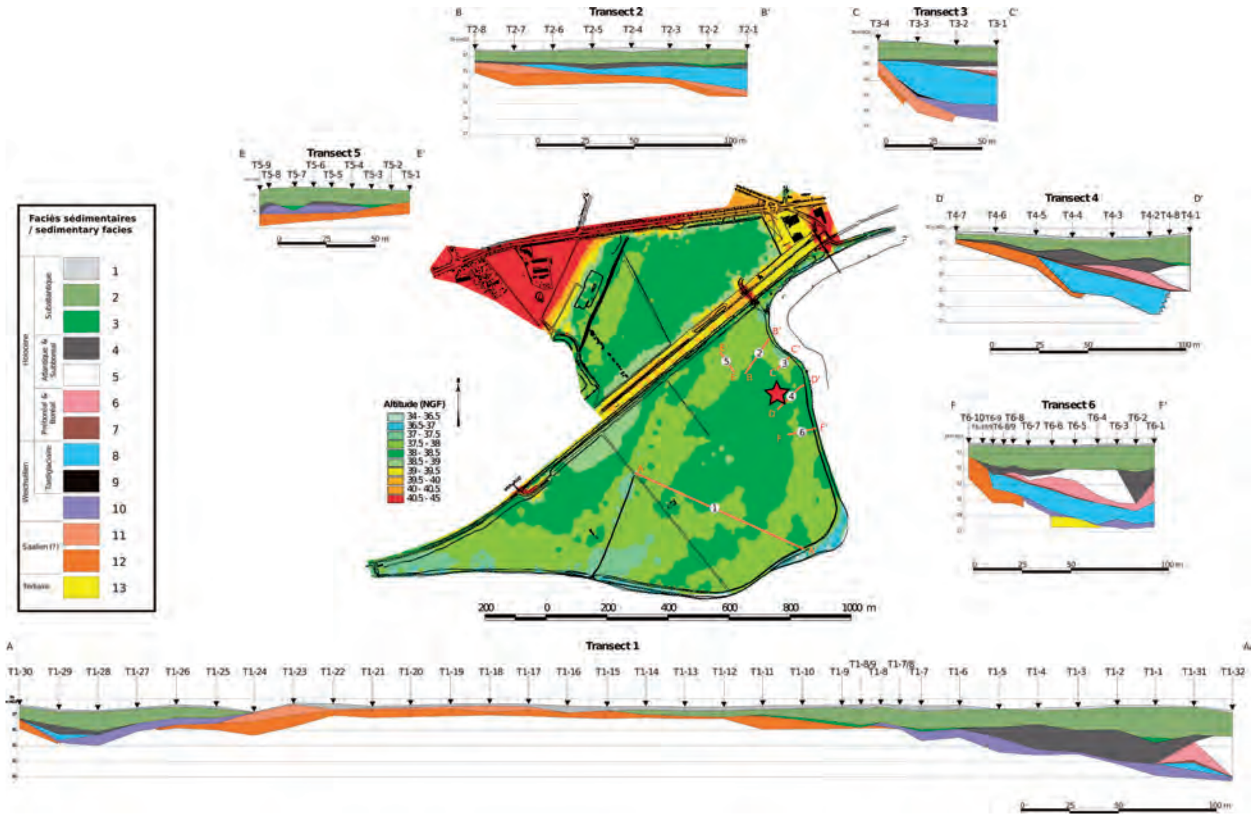


Fig. 4 – Haute-Île at Neuilly-sur-Marne. Schematic sections based on transects of the mechanical auger survey and the position (indicated by a star) of the Mesolithic material documented during the archaeological diagnostic (sections with a depth:length ratio of 4:1). 1: top soil; 2: grey-beige clayey-silts; 3: clayey-silts containing organic debris; 4: organo-mineral silts with vegetal debris; 5: calcareous tufas and peat beds; 6: calcareous silts with organic traces; 7: clayey peat; 8: reduced clayey-sandy silts; 9: clayey silts with organic traces 10: sandy-clayey gravels; 11: silty oxidized sands; 12: partially calcitic, sandy oxidized gravels; 13: compacted brown-green clays (modified after Lanchon et al., 2005).

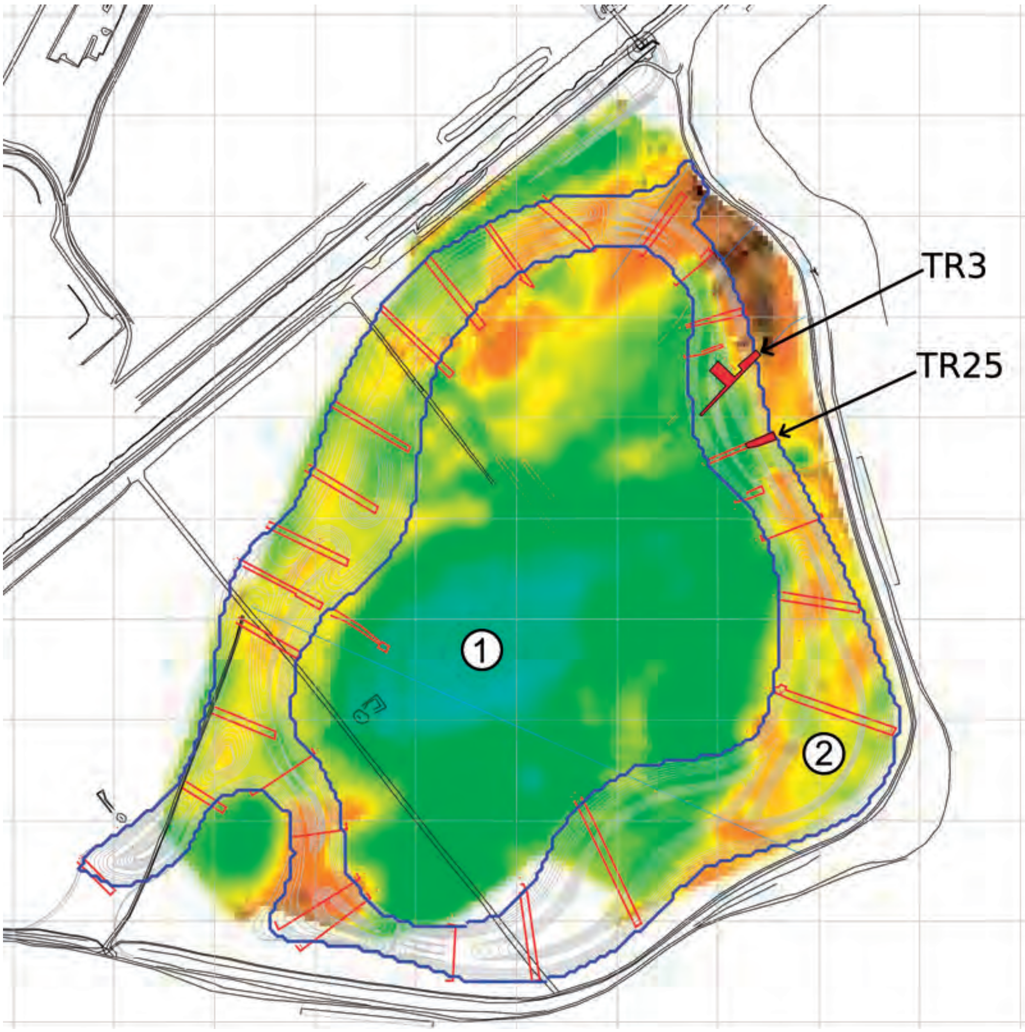


Fig. 5 – Haute-Île at Neuilly-sur-Marne. Synthesis of the geophysical surveys. The background of the map represents measured resistivity (Lambert grid by hectometre). 1: cool colours correspond to resistant surfaces (gravels and sands forming the paleo-island); 2: warm colours correspond to conductive zones (silty-clays and organo-mineral sediments filling the channels). The limits of the project for deepening the park's basins are in blue with the trenches of the diagnostic in red (after Vergnaud et al., 1999 and Le Jeune et al., 2005).

well-below the present low water level of the river situated at around 34 m LGF.

The results of the study carried out before the archaeological diagnostic allowed the initial project for exploiting the gravels forming the island to be modified, while at the same time limiting any possible impact on the archaeological sites. Paradoxically, the archaeological diagnostic concerned surfaces where the risk of disturbing the remains was the weakest, namely the paleo-channels (fig. 5)

Several trenches were dug as part of the preliminary study with the third (fig. 5, TR3) producing Mesolithic and Neolithic material preserved within a complex soil level on the banks of the ancient island and the area bordering the paleo-channel. This archaeological level is located on the section of the island where the bank is most pronounced (fig. 4), perhaps due to the attractiveness of having direct access to a straighter section of water. This diagnostic provided additional geoarchaelogical information allowing the sedimentary dynamic associated with the channel to be characterised (Lanchon et al., 2004; Le Jeune et al., 2005).

Stratigraphy of the channel in proximity to the Mesolithic material

Investigations of trench 25 during the archaeological diagnostic (Lanchon et al., 2004; Le Jeune et al., 2005) provided an occasion for precisely recording the stratigraphy of both the channel and the banks of the island (fig. 6 and fig. 7) in immediate proximity to the bank soil level where a Mesolithic burial was also found (see below).

As the level of the Marne rose at the beginning of the Holocene, the wetland bank progressively overtook the Tardiglacial silts leaving behind organic deposits (fig. 6, no. 10) that were subsequently covered by calcareous sediments (no. 9) associated with deeper waters. The bank's organic deposits also follow the water level

Fig. 6 – Haute-Île at Neuilly-sur-Marne. Trench 25 (see fig. 5: TR 25 and Le Jeune et al. 2005). A: 'accumulated soils'; B: channel; C: basal Holocene peaty clay (photo J. Confalonieri, CG 93).

variations of Marne River forming stratified sequences of peats alternating with calcareous silt deposits. This depositional regime seems to end with the development of a highly erosive channel (fig. 7) that locally remobilised Tardiglacial sediments resulting in the formation of 'soft rollers' (fig. 7, no. 5). Although the formation of this channel has not yet been precisely dated, it could correspond to a hydrological change produced by climatic deterioration at 8200 cal BP (Dansgaard et al., 1993; Orth et al., 2004), increasing river flow and ultimately leading to an incision.

Once the channel had formed, it was first progressively infilled by calcareous tufa and organic sediments which were gradually overlain by clayey silts from the Subboreal onwards (Le Jeune et al., 2005).

THE DEVELOPMENT OF A GEOARCHAEOLOGICAL MODEL

These results form the basis of a geoarchaeological model for evaluating the preservation potential of archaeological material at Haute-Île. Future research will undoubtedly strengthen this approach. Three favourable contexts for the preservation of Mesolithic remains have already been identified (fig. 8).

'Mobile' Early Holocene riverbanks

The connection between rising Holocene river levels and the preservation of Mesolithic material has already been documented for the Somme Valley (Ducrocq, 2001) and at the site of Warluis (Coutard et al., 2010). As the level of the Marne rose, a gently sloping bank emerged in time with the growing level of the river burying the older banks under peats and calcareous sediments (fig. 8, A and B). Although artefacts have not yet been recovered from these levels, their preservation potential is undeniable. Traces of fire (burnt earth and charcoal) have been detected in cores (fig. 4, near T6-5) from a peat level at 31.25 m LGF, more than two meters below the present low water level of the Marne. If these traces of fire are not natural phenomenon, they must be the linked to Mesolithic activity dated to between 8699 and 8347 BC (9295 ± 45 BP, Lyon-3055).

The channel

These organic levels with high archaeological potential were at least partially eroded by the formation of a paleochannel near the banks of the paleo-island and probably resulted from a significant change in the hydrological dynamic (ca. 8200 cal BP?, see above) and an increase in the level of the river (fig. 8, C) entailing the partial erosion of the old banks. This channel seems to have persisted until it was infilled by clayey silts derived from erosion associated with the development of agriculture in the Marne's watershed (fig. 8, D; Pastre et al., 1997; Le Jeune et al., 2005; Pastre et al., 2006).

This channel containing Mesolithic material was rapidly investigated during the archaeological diagnostic (Lanchon et al., 2004). Although the sedimentary facies observed in the fill do not indicate a high-energy depositional context, a mix of artefacts from the eroded bank and paleochannel cannot be ruled out and needs to be reexamined taphonomically in the future.

'Accumulated soils' near the bank

From the early Holocene to about the Iron Age, the residual glacial gravel dome forming the centre of Haute-Île (fig. 5) was spared the flooding of the Marne. Traces of Mesolithic and Neolithic occupations were found near the straight bank adjacent to the paleochannel. The lack of a sedimentary component in the banks' formation explains why Mesolithic and Neolithic material is found mixed within the same complex soil unit that accumulated over several millennia of pedogenesis. Successive deposits of silt overflow from the flooding of the Marne are responsible for the preservation of this level (fig. 8, D; Pastre et al., 1997; Le Jeune et al., 2005; Pastre et al., 2006). Furthermore, pedogenesis, notably connected to biological activity, is itself responsible for the progressive burial of the material (Thinon, 1994; Texier, 2000). This last phenomenon, as well as the local mobilisation of sediment by water action, sometimes allows 'levels'

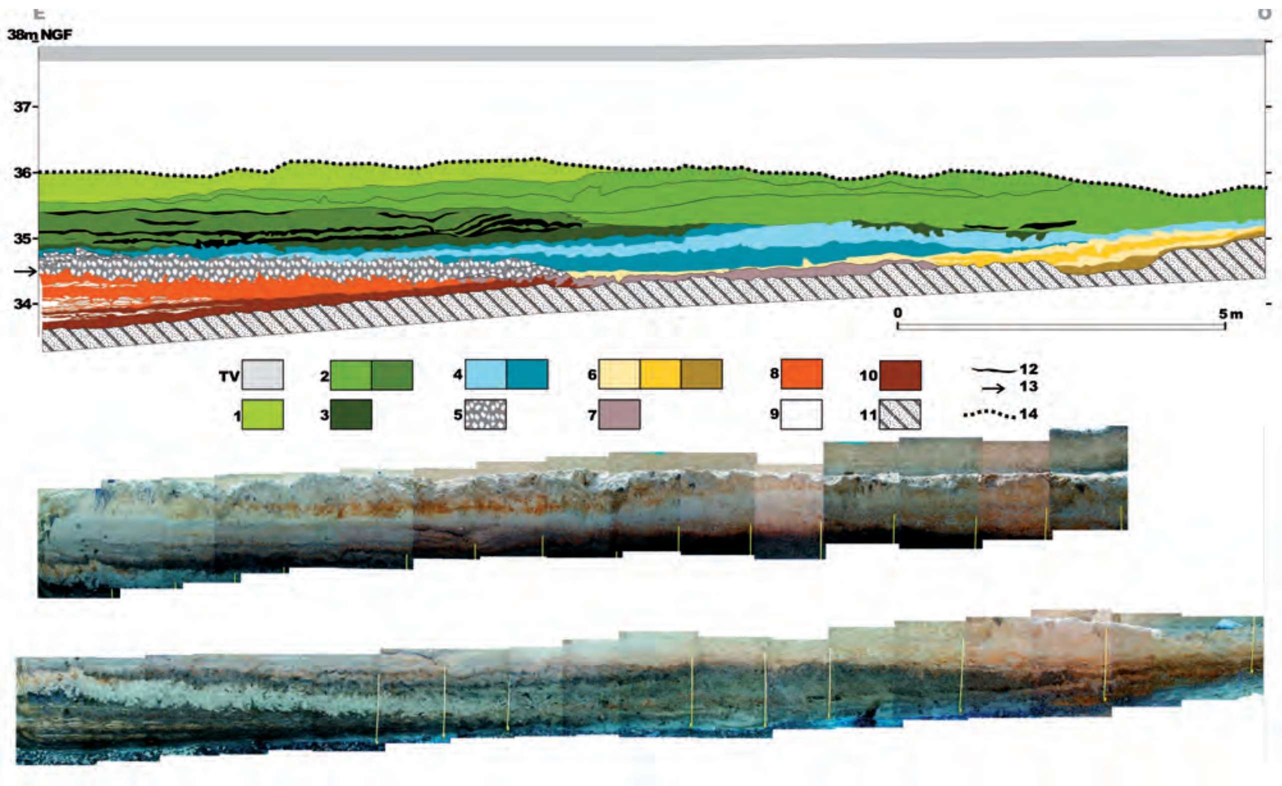


Fig. 7 – Haute-Île at Neuilly-sur-Marne. Simplified profile of the western part of trench 25 (see fig. 5: TR 25 and Le Jeune et al., 2005). Colour gradations indicate a stronger organic material component. TS: top soil; 1: very homogeneous beige to light brown clayey silts with a marked polyhedral structure, numerous channels, traces of roots, brown to ochre coloured oxidation traces (several mm in length) at the base, millimetre sized traces of charcoal and very localised 'horizons' marked by calcite concretions known as loess dolls ('poupées de calcites'); 2: grey to light grey sandy silts, homogeneous and finely stratified at the base with a large polyhedral structure. Millimetre to centimetre sized ochre coloured oxidation stains (at the top) and local centimetre long lenses riche in organic material and millimetre to centimetre sized charcoal; 3: grey-brown clayey-silt, massive, rich in fragments of organic material including millimetre to centimetre sized fragments of wood, wood carbon and numerous mollusc shells ; 4: kaki to grey-brown organo-mineral silt, massive, rich in wood measuring up to tens of centimetres, presence of centimetre sized wood charcoal, very significant presence of mollusc shells sometimes forming beds over several centimetres, the organic material is rich in leaves with a localised felt-like aspect; 5: massive organo-mineral silty clay formed of grey to light blue, millimetre to centimetre sized 'soft rollers' (formed from sediments derived from 11) in a grey clayey matrix rich in fibrous organic material (mix of 8, 10 and 11); 6: shelly tufaceous sand with oncolites, dark grey to whitish, localised presence of millimetre to centimetre sized grey to black beds richer in organic material, numerous centimetre sized wood fragments, oncolites often developed around complete shells, rare traces of centimetre sized charcoal; 7: sandy-clayey sand, rich in centimetre sized wood fragments, presence of centimetre long beds of partially shelly sands; 8: massive sandy peat rich in fragments of organic materials, considerable presence of leaves and centimetre sized wood; 9: massive whitish calcareous silt, finely stratified peats, rich in mollusc shells, rare millimetre sized charcoal fragments; 10: brown-black peat rich in millimetre sized organic material, centimetre sized fragments of wood, considerable presence of millimetre to centimetre sized fragments of charcoal, humified roots and rootlets; 11: very homogeneous grey blue silt-sandy clay, rare gravels; 12: level rich in organic material; 13: low-water altitude of the Marne; 14: limit of investigations (security platform).

within these soil complexes to be distinguished. Further defining the preservation quality of this archaeological signal is one of the future research objectives for the site of Haute-Île.

ARCHAEOLOGICAL RESULTS FROM THE DIAGNOSTIC (TRENCH 3)

The archaeological diagnostic at Haute-Île (fig. 5) took place over several field seasons between 2000 and 2004. The deepening and refilling of the old channels of the Marne had two objectives: encouraging the development of wetland biodiversity and minimising the impact of the construction on any preserved archaeological material. In the end, very little archaeological material was identified during the diagnostic and only a single area in and around trench 3 (fig. 9) to the west of the park produced structured levels dating to the Mesolithic, Neolithic and Bronze Age.

Between 2000 and 2004, 372 m² were excavated in the sector of trench 3 under the direction of Yves Lanchon (INRAP). A significant quantity of archaeological material

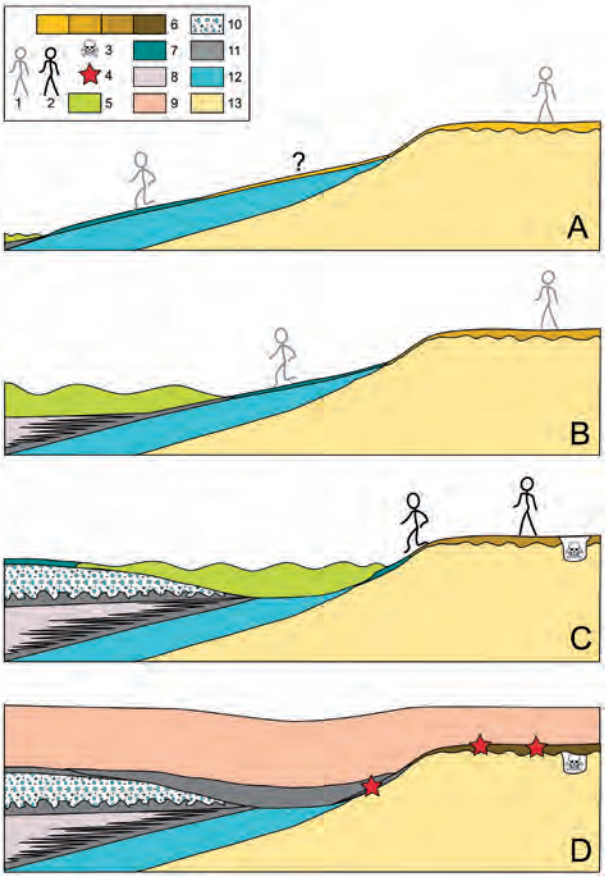
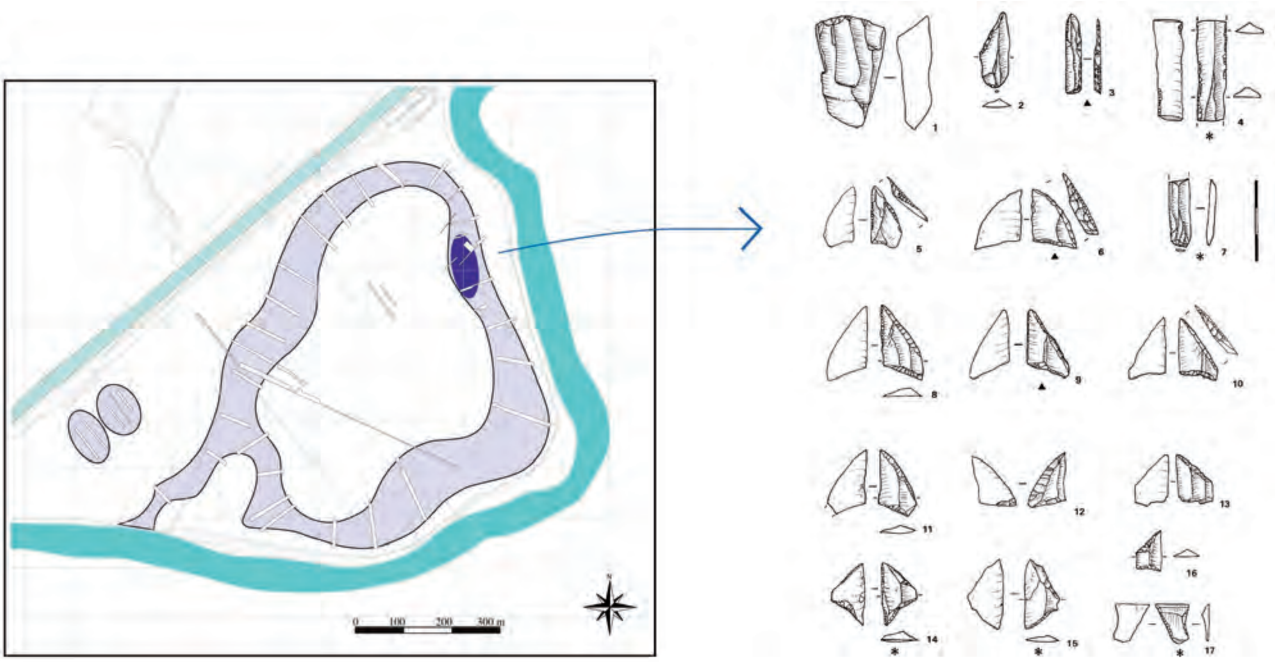


Fig. 8 (left) – Haute-Île at Neuilly-sur-Marne. Geoarchaeological model of the definite or possible Mesolithic occupations. A: early Holocene (Preboreal); B: early Holocene (Preboreal and Boreal), gradual rise in the level of Marne; C: middle Holocene, formation of the erosion channel followed by or contemporaneous with the adjacent occupation (Boreal? and Atlantic); D: late Holocene, massive contribution of silts due to soil erosion (Subboreal and Subatlantic; 1: possible human occupation; 2: definite human occupation; 3: Mesolithic burial; 4: significant presence of artefacts; 5: water level of the Marne; 6: pedogenesis and anthropisation ('accumulated soils'); 7: wetland banks; 8: calcareous silts (see 9 of fig. 6); 9: clayey silts; 10: organic silty clay with 'clay gall' (see 5 of fig. 6); 11: sediments rich in organic material; 12: grey-blue silty-sandy clay (see 11 of fig. 6); 13: sandy gravels, sometimes with calcites (Saalian?).

Fig. 9 (below) – Haute-Île at Neuilly-sur-Marne. Location of the Mesolithic and Neolithic levels in the vicinity of trench 3 identified during the archaeological diagnostic and the lithic industry recovered from trench 3 in 2000 (after F. Bostyn, INRAP).



was recovered over a small area on the edge of the paleochannel and especially in the archaeological level of the bank.

The bank of the paleochannel yielded nearly 10 kg of lithic material, 21 kg of faunal remains and 1 kg of pottery. Difficult excavation conditions starting with the exposure of this extremely waterlogged zone did not permit all the material to be recovered or to treat the organic material, however numerous and well-preserved (leaves, branches, twigs).

The bank zone itself yielded approximately 76 kg of lithic material, 46 kg of faunal remains and 31 kg of pottery. Mesolithic remains were most abundant in this zone and were spread within a very dark and heavily compacted level some thirty centimetres thick. Neolithic material, attributable to a recent phase of the Villeneuve-

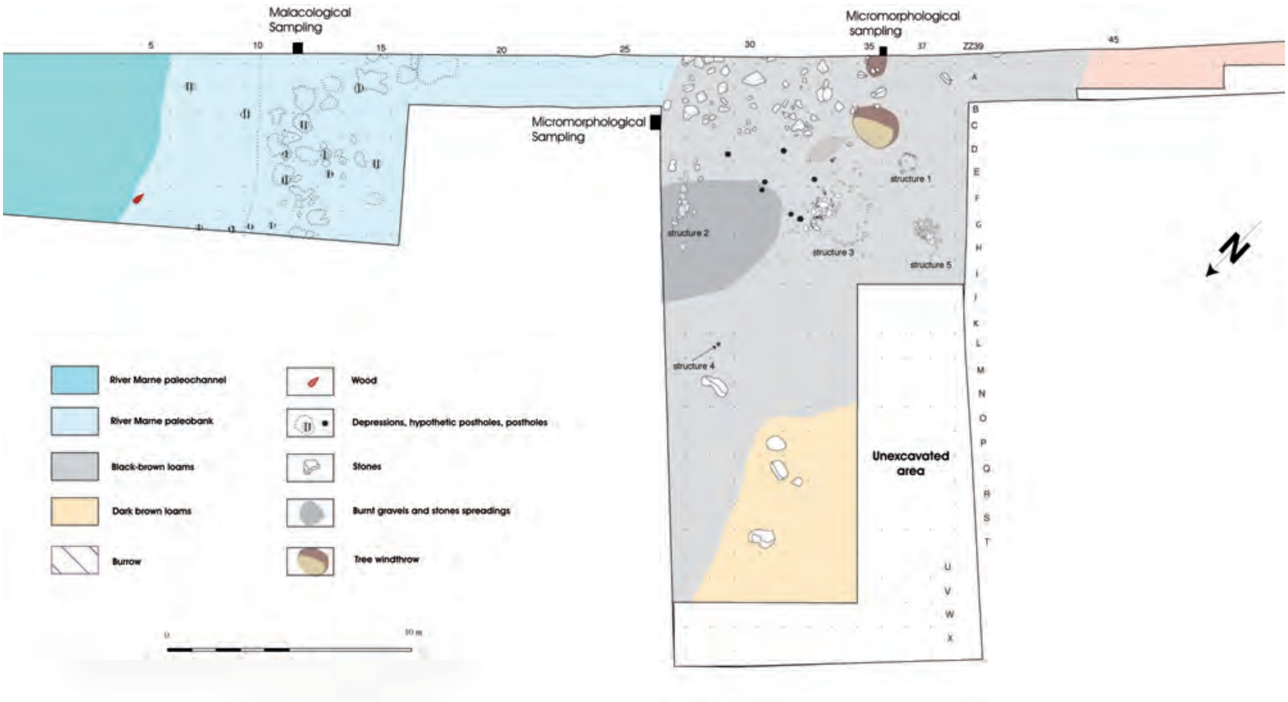


Fig. 10 – Haute-Île at Neuilly-sur-Marne. Extension of trench 3 after the enlargement of the bank zones and the paleochannel between 2000 and 2004. Documentation of the recorded features.

Saint-Germain culture, was found associated with the Mesolithic remains (fig. 10, feature 4; fig. 11 and fig. 12). No clear stratification can be observed within this level overlying the heavily calcitic and indurated banks of the ancient terrace. Excavations were carried out by square metre and included three successive and totally subjective spits (spit 1: upper level; spit 2: intermediate level; spit 3: lower level) enabling the material to be recorded. Artefacts from certain square meters were systematically recorded in three dimensions; however the sediments from the archaeological levels were not sieved.

Even though the archaeological levels seem to have been disturbed, this did not prevent the preservation of clearly discernible features, the most interesting of which are discussed below (fig. 10).

The burial

Cécile Buquet-Marcon (INRAP) was involved in the excavation and examination of this feature (Valentin et al., 2008). This inhumation, whose pit is difficult to discern, was dug into the archaeological level penetrating slightly into the top of the sandy-gravelly terrace. Although no artefacts were associated with the burial, a tooth was dated to 7735 ± 45 BP (6642 to 6477 cal BC, at 2 sigmas, Calib Rev5.0.2: Stuiver and Reimer, 1993). Bone preservation is average and, although the skeleton is incomplete, all of the anatomic regions are represented and appear to belong to a single individual. However, the poorly represented pelvis precluded the determination of sex. Pending a more detailed biological analysis, we can nonetheless note that the remains are that of an adult whose skull bears traits of pronounced robusticity. While the limbs seem dislocated, observations made during excavations argue in favour of a primary deposit in a pit that has been heavily eroded. A taphonomic analysis suggests that the deceased was interred in a sitting position. Furthermore, the reduction of the burial's volume, particularly the collapse of the lower limbs, indicates decomposition to have occurred within an empty space.

A stone feature near the burial

An oval stone feature (1.30 m × 1 m) was uncovered in the square meters (G/H 37/38) adjacent to the burial and comprised a single 10 to 15 cm thick level containing mixed limestone (fig. 10, feature 5; fig. 14), but no diagnostic material. Despite its shape resembling a combustion feature, none of the stones seemed to have been heated. While its contemporaneity with the Mesolithic burial cannot be demonstrated, the proximity of the two features leaves open the possibility of a connection.

Other features

Seven, 10 to 15 cm diameter postholes in the form of a trapezoid contained a dark fill, but were void of material (fig. 10, feature 3; fig. 15). The long side (4 m) opened to the north in the direction of the burnt stone pavements, concentrations of charcoal and the Mesolithic industry identified during excavations. The remains of a stone 'levee' oriented north/south (fig. 10, feature 2) were discovered to the east just above the paleochannel which flows along the same axis. Another stone concentration

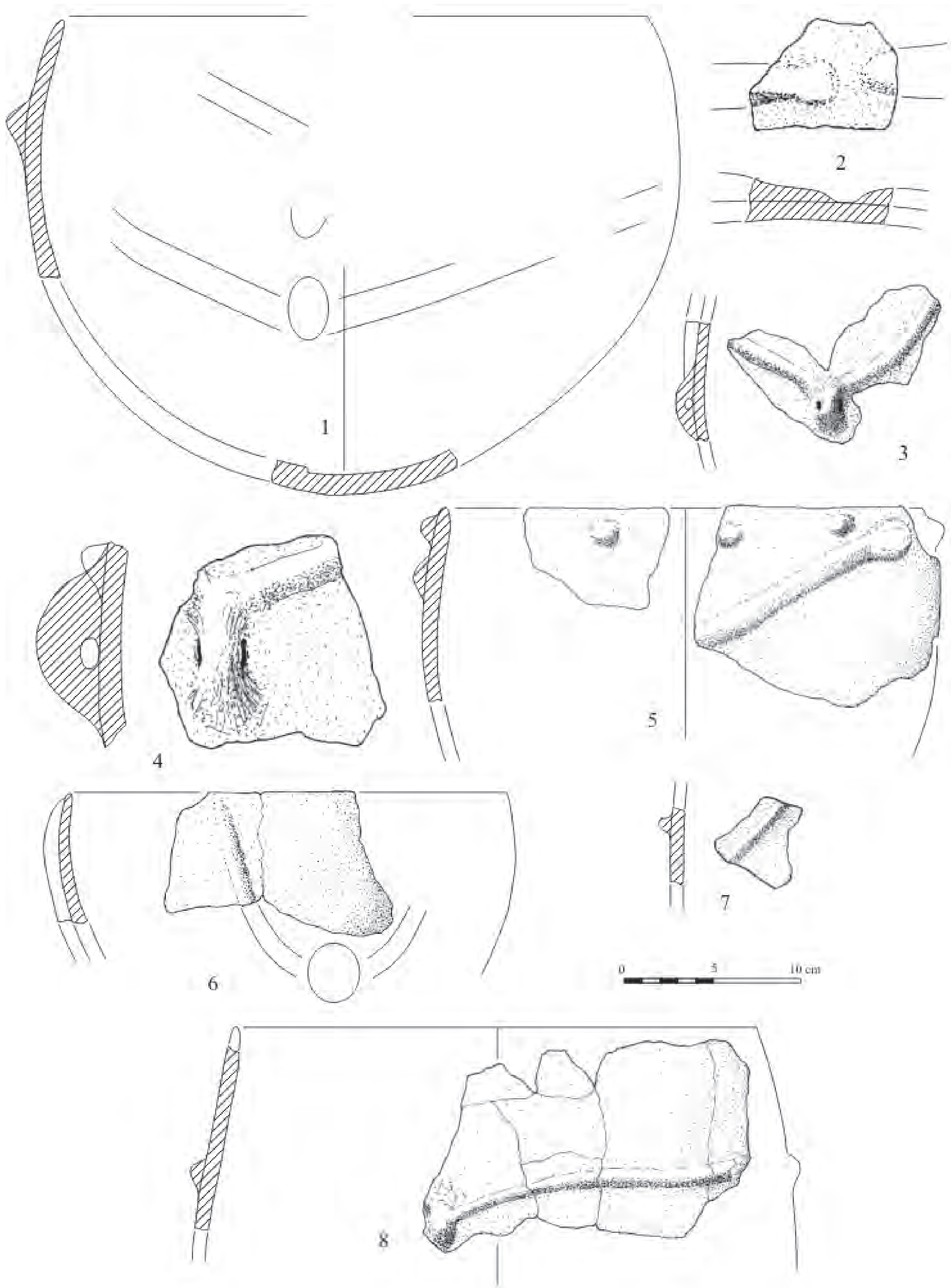


Fig. 11 – Haute-Île at Neuilly-sur-Marne. Trench 3: large vases with 'buttons' and perforated or unperforated cords, Neolithic, Villeneuve-Saint-Germain culture. Several examples were found crushed in-place in the bank zone (drawings SHALE / INRAP).

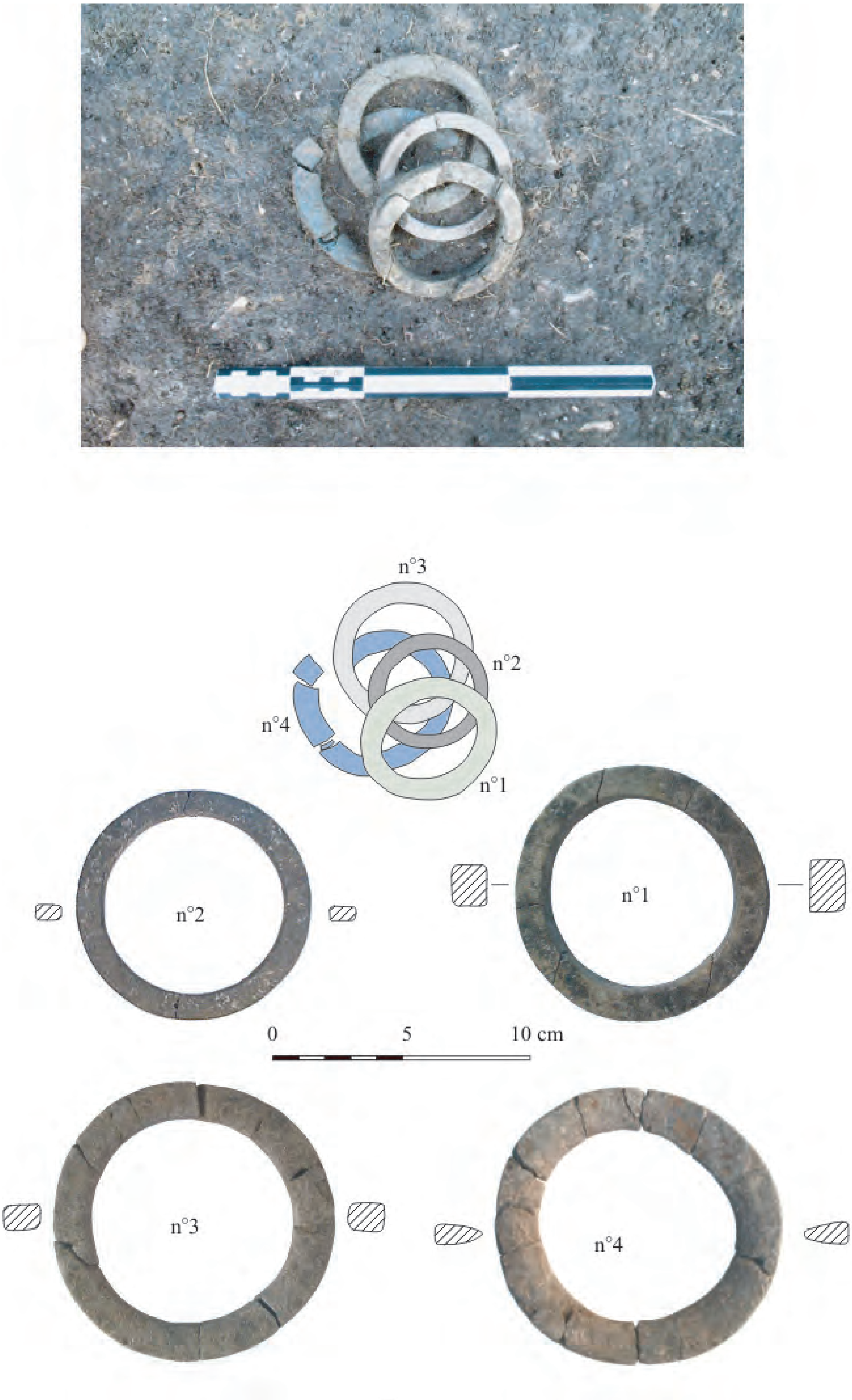


Fig. 12 – Haute-Île at Neuilly-sur-Marne. Trench 3: cache of four bracelets made from micaschist, pelite and primary limestone found in the bank zone, Neolithic, Villeneuve-Saint-Germain culture (photos and drawings Y. Lanchon, INRAP).

Fig. 13 – Haute-Île at Neuilly-sur-Marne. Trench 3: The Mesolithic burial in the bank zone during excavations (photo V. Brunet, INRAP).

Fig. 14 – Haute-Île at Neuilly-sur-Marne. Trench 3: oval stone feature found about one metre from the burial (photo Y. Lanchon, INRAP).

Fig. 15 – Haute-Île at Neuilly-sur-Marne. Trench 3: western view of the trapezoidal feature composed of 7 postholes. Foreground, remains of the stone levee which originates from the bank of the paleochannel. Background, an anthropic organisation of stones on one of the small sides (photo J. Confalonieri, CG 93).

appeared immediately to the east of the postholes (fig. 10, feature 3) and is clearly the product of human activity as certain large stones were wedged in place by smaller ones.

The lithic industries

The study of the lithic material from trench 3 carried out by Françoise Bostyn (INRAP) and Joël Confalonieri did not include a detailed refitting program. The assemblage consists of material from several successive occupations spanning the Mesolithic to the end of the Neolithic. Significant diversity can be noted in terms of the raw materials employed, as well as the presence of pieces, particularly arrow-heads, from different chronological periods (fig. 16 and fig. 17). Bladelet production is easily distinguishable by the presence of cores, un-modified bladelets (fig. 18) and tools made on blond or black Secondary and Bartonian flint.

The microliths consist of a large collection of trapezoidal or asymmetric triangular forms, in addition to rare examples attributable to a phase of the Middle Mesolithic. These comparably sized pieces made on a variety of raw materials present significant morphological and technical similarities. Almost all of these microliths are lateralised to the right and only two pieces have flat inverse retouch on their base. This component of the assemblage hints at an attribution to the Late Mesolithic based on comparisons with assemblages from the Paris Basin (Hinout, 1990 ; Fagnart, 1991 ; Ducrocq, 2001).

Given limitations imposed by the small surface excavated between 2000 and 2004, these preliminary observations concerning the chronology of the Mesolithic occupations will hopefully be refined by future excavations of the more substantial and less-disturbed levels.

Fauna

A preliminary study of the faunal material from both the bank and the paleochannel investigated in the eastern part of trench 3 was carried out in 2001 by Lamys Hachem (INRAP). The preservation of the material is excellent for the levels of the paleochannel, but less so for the levels of the bank. Given the significant number of bones, only a randomly selected sample of the material recovered from the two sectors was considered in the preliminary study. Approximately 1,300 pieces (13 kg), around a thousand from the paleochannel and half as much from the bank,

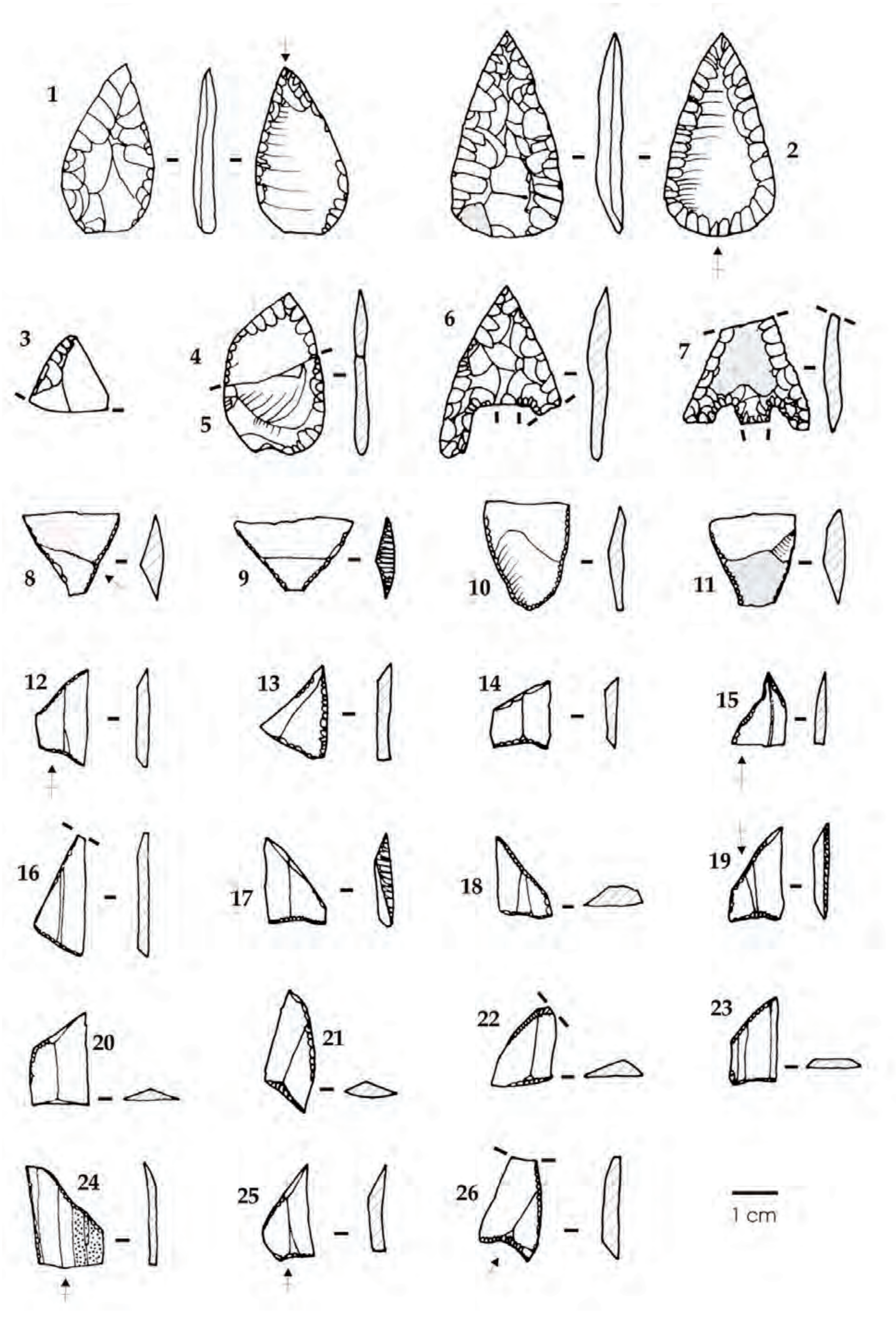


Fig. 16 – Haute-Île at Neuilly-sur-Marne. Trench 3: arrow-heads and microliths (drawings J. Confalonieri, CG 93).

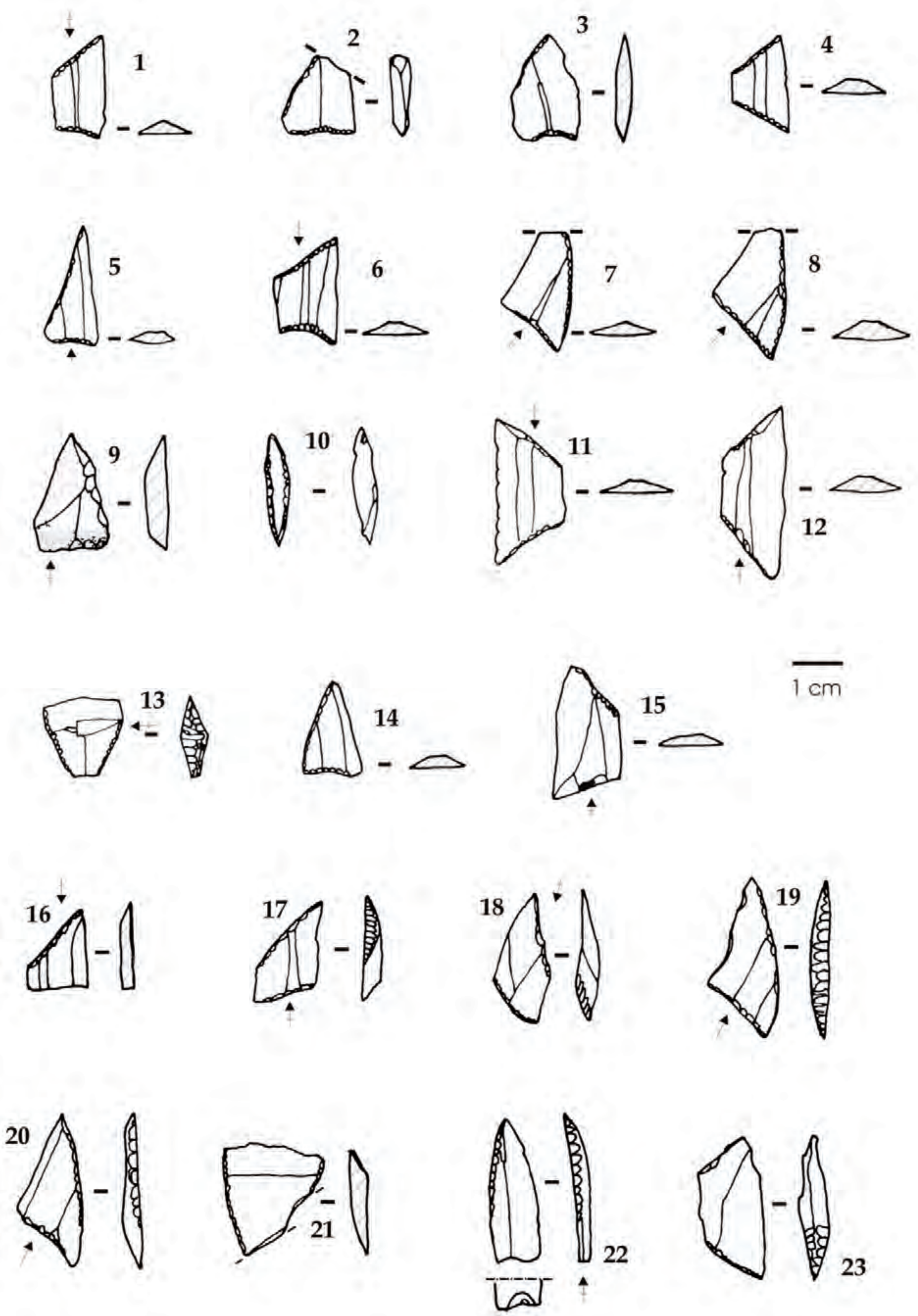


Fig. 17 – Haute-Île at Neuilly-sur-Marne. Trench 3: microliths (drawings J. Confalonieri, CG 93).

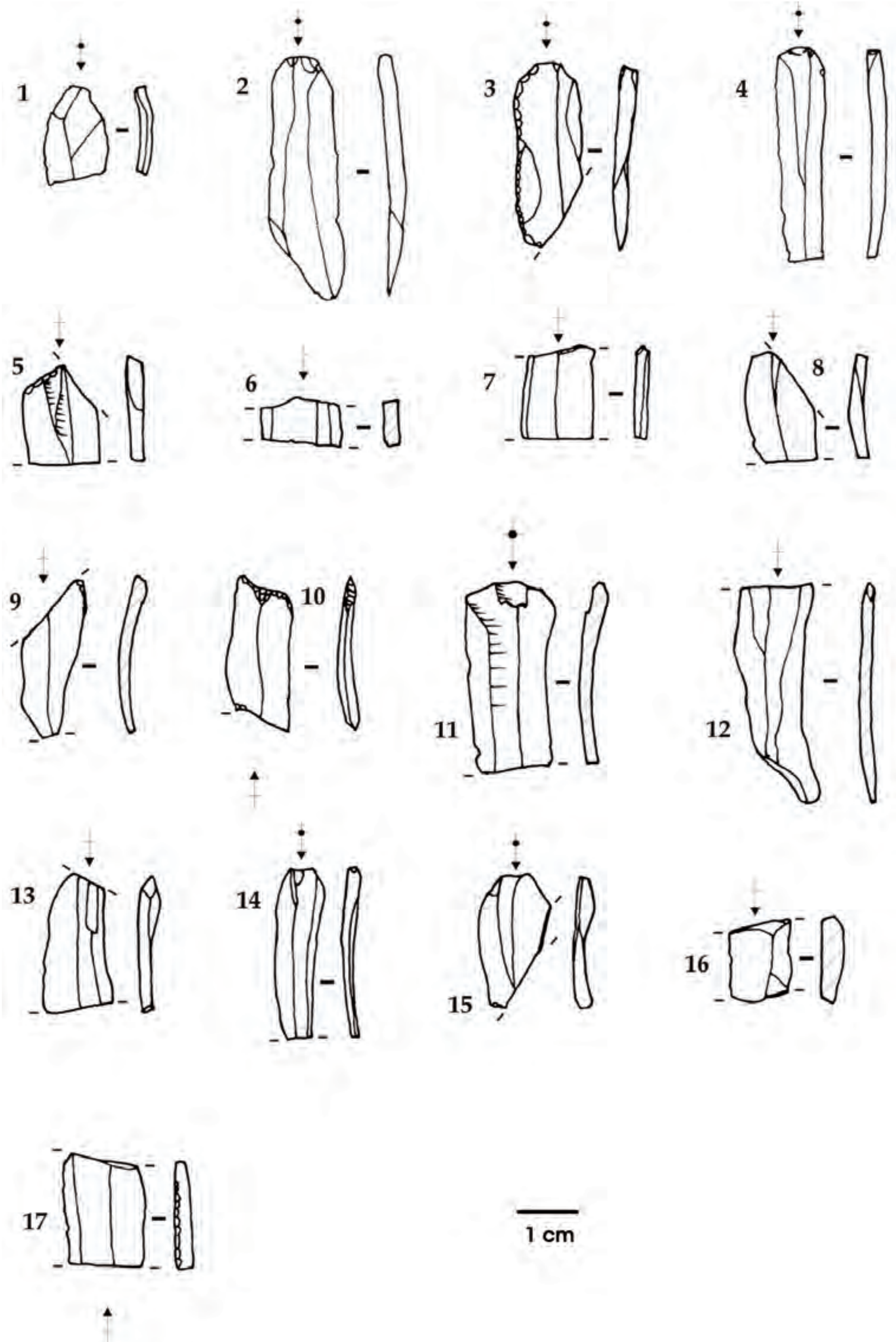


Fig. 18 – Haute-Île at Neuilly-sur-Marne. Trench 3: unretouched and retouched bladelets (drawings J. Confalonieri, CG 93).

were considered in the analysis. In both cases, intentional long bone breakage to recuperate the marrow can be noted. Very few bones are fire altered and are more numerous in the bank sector (7 of 10). The species list demonstrates a very high percentage (96.3%) of wild animals dominated by red deer, followed by roe deer, wild boar and aurochs. Smaller wild fauna are present in very low percentages, principally beaver, with wild cat and pike represented by only a single specimen.

Besides these species, a still undated proximal human femur was found mixed with the fauna from the channel. A series of radiocarbon determinations have been planned in order to clarify the chronological attribution of the fauna.

CONCLUSION

The archaeological diagnostic carried out in a unique institutional context involving both the INRAP and the Centre Départemental d'Archéologie de Seine-Saint-Denis on the site of Haute-Île at Neuilly-sur-Marne has come to an end after five field seasons between 1999 and 2004. The modification of the construction project in accordance with the results of this study represents an aspect of the project that deserves to be stressed. It should also be recalled that if the archaeological potential of the site had not been emphasised from the very beginning of the project by the initial geological study, our concrete understanding of the archaeological occupations would never have been possible.

Regular visits to the site by Mesolithic hunter-gatherer groups produced an abundant lithic assemblage associated with a burial and possibly stone features making 'Haute-Île' an important site for the period. Preliminary typological studies of the lithic industries indicate a succession of Mesolithic occupations fostered by the coexistence of a ford and accessible riverbanks creating an ideal hunting ground.

The Seine-Saint-Denis department is committed to working openly with the scientific community such that the full potential of the site of Haute-Île can be exploited in the future. New artefact studies are already planned as part of the collective research project entitled "The Final Palaeolithic and Mesolithic in the Paris Basin..." Finally, a field school may be launched in partnership with local universities.

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The Mesolithic of the Centre Region: state of research

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Abstract: Following a period that essentially focused on the analysis of collections from pedestrian surveys, our understanding of the Mesolithic period in the Centre region has recently been updated, most notably in connection with the growing number of rescue excavations. Although the chrono-cultural framework has been refined, the majority of dates still fall within a short period between around 8200 and 7600 cal BC, i.e. the end of the Preboreal and the onset of the Boreal. The preservation conditions of most excavations have nonetheless rendered palethnographic information rare.

The Centre region occupies a large part of the western half of the Paris Basin, from the Île-de-France to the borders of the Poitou region up until the northern limits of the Massif Central. It essentially belongs to the Loire watershed and, to a lesser extent, that of the Seine for the north and east of the Loiret, as well as the north of the Eure-et-Loir. More than 200 Mesolithic sites, the majority represented by surface collections, are currently known from this vast territory. However, their distribution is unequal given the nature of certain areas being less propitious for the detection of sites (Sologne, Orléans Forest…), but also due to the fact that surveyors have, for example, been more active in the departments of the Indre-et-Loire, parts of the Indre and in the north of Loiret.

BRIEF HISTORY OF RESEARCH

Initial Mesolithic research in the Centre region represented single notes, artefact inventories and short papers (Giraux, 1912; Cordier, 1955, 1958 and 1965; Nouel, 1963; Rigaud, 1971; Cuffez and Cuffez, 1981; Berthouin, 1986). More in-depth work was carried out in part of the region during the 1970s by J.-G. Rozoy leading to the recognition of a new culture, the Beaugencian, linked with a small excavation in 1971-1972 at Beaugency (Rozoy, 1976 and 1978, p. 825-890). During the 1990s, A. Thevenin led a series of studies with volunteer surveyors that produced a seriation of industries and an overview of the survey results (Audoux and Thevenin, 1995; Bazin et al., 1995; Dufour and Leconte, 1995 and 2001; Girard, 1995a and b). The development of this initial chrono-cultural framework based on microliths demonstrated all phases of the Mesolithic to be represented in surface site collections.

UPDATING OUR UNDERSTANDINGS

During the last two decades numerous academic works, some still employing traditional approaches essentially based on microlith typology (Girard 1994, Violot 1994, Bornet 1997a), along with more recent studies integrating insights from lithic technology (Robbins 2001, Yvert 2002, Ollivier 2003) have generated new information in several different areas. At the same time, paleoenvironmental data has been recovered from rescue excavations such as those at Tours in the Indre-et-Loire (Vivent, 1998) and in the west of the region (Visset et al., 1999;

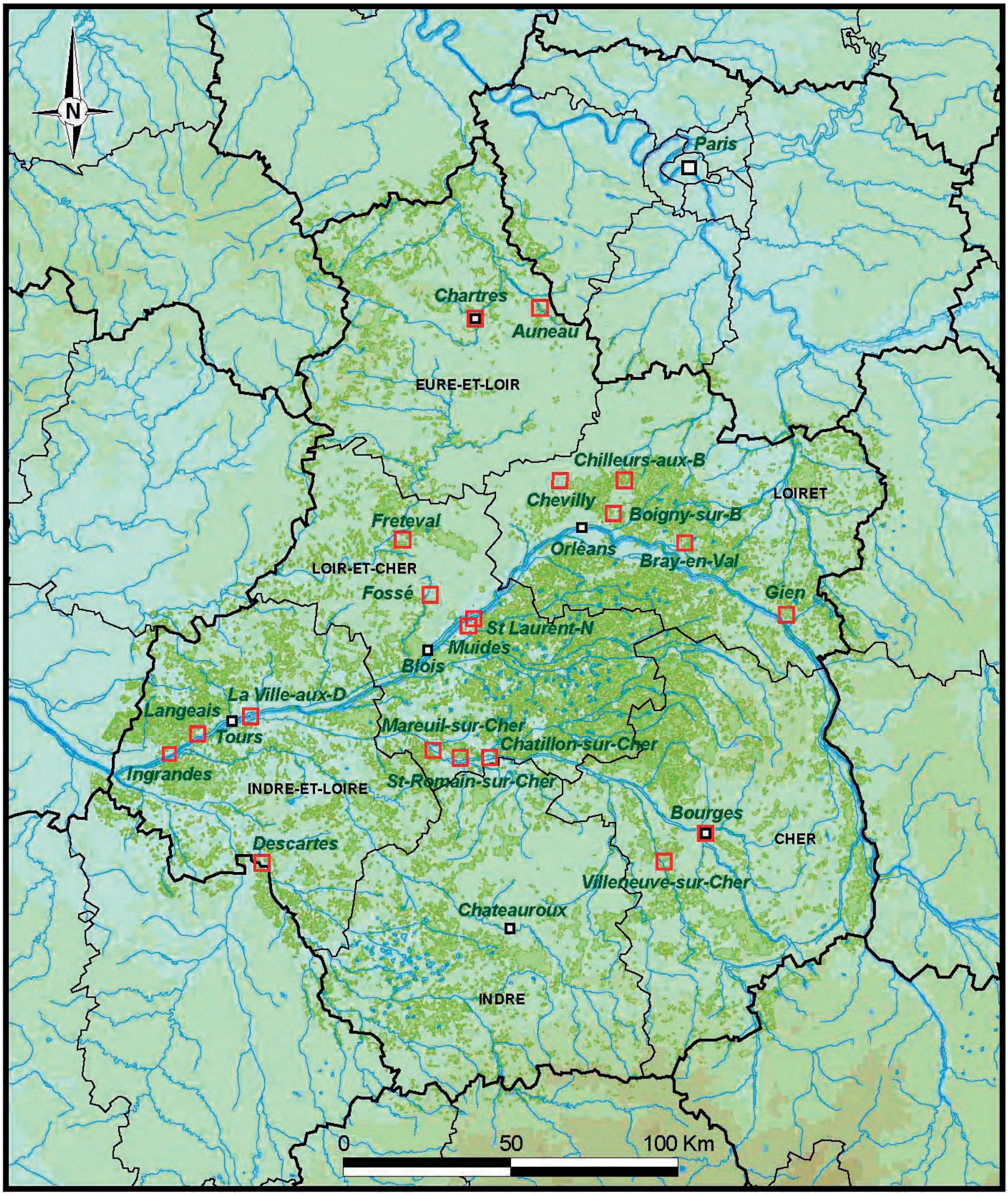

Fig. 1 – Sites and indications of Mesolithic sites discovered in the Centre region during evaluations or diagnostics between 1990 and 2010 (Source SRA Centre – BD Carto). Forest cover is indicated only for the Centre region (map C. Verjux).

Cyprien et al., 2004), as well as in the framework of specific research programs as at Auneau in the Eure-et-Loir (Richard and Limondin *in* Verjux, 2002) and in the Avaray valley in the Loir-et-Cher (Garcin et al., 2001). Several research excavations have also produced Mesolithic remains, for example at Ligueil (Indre-et-Loire), Villentrois (Indre), and Muides (Loir-et-Cher), however without doubt the most important is the site of Parc du Château at Auneau in the Eure-et-Loir (Villes, 1990; Bornet, 1997b; Irribarria, 1997; Verjux, 2000).

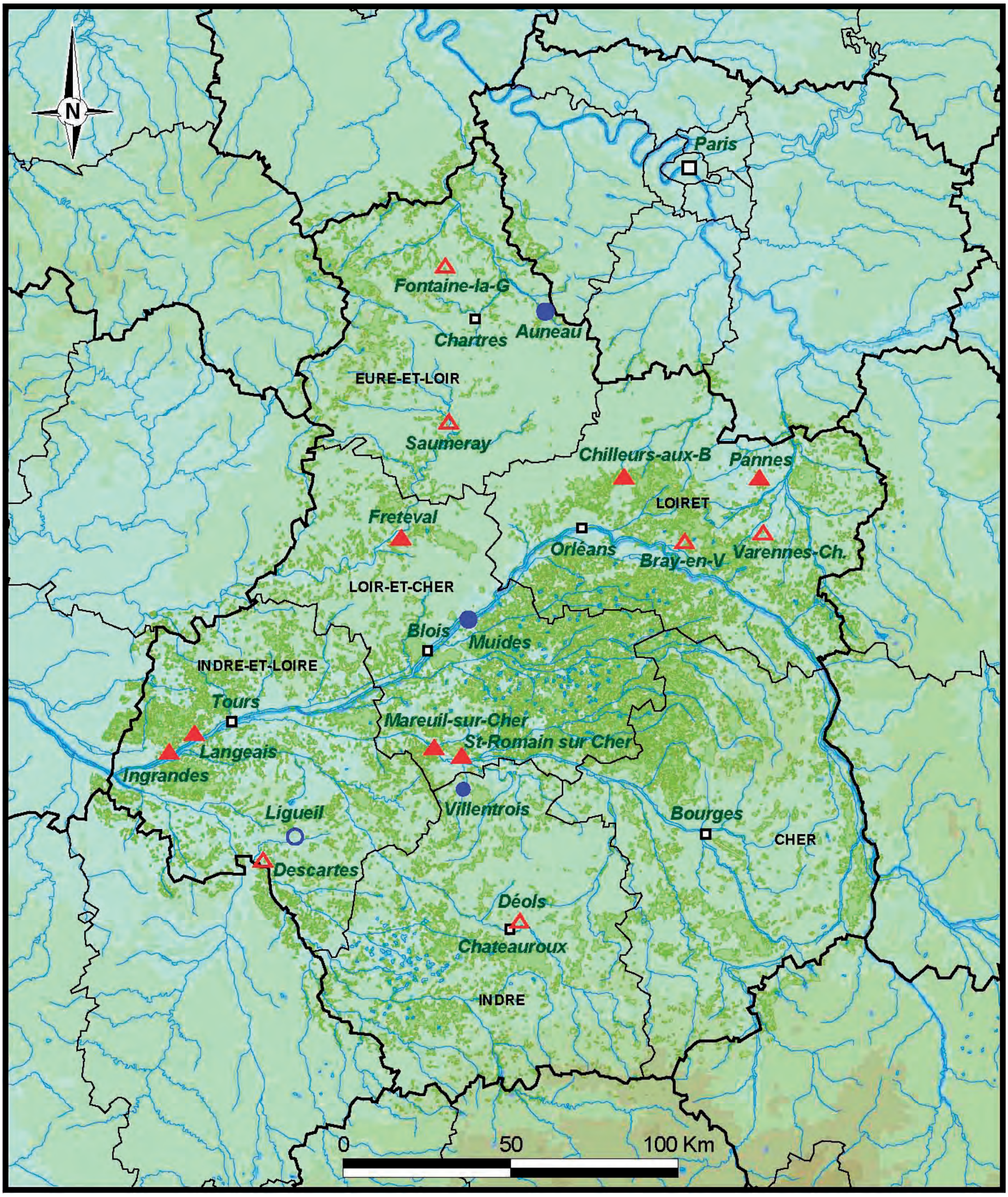

Fig. 2 – Mesolithic research and rescue projects carried out in the Centre region between 1990 and 2010. Blue circles: research excavations; red triangles: rescue excavations. Symbol outlines correspond to the excavation of Mesolithic remains found during projects concerning other periods (map C. Verjux).

Prompted by the Regional Archaeology Service of the Centre Region (Ministry of Culture), particular focus has been placed on the identification and characterisation of Mesolithic sites in rescue contexts (fig. 1 and fig. 2): about twenty Mesolithic sites have been discovered during evaluations and diagnostics between 1990 and 2010, seven of which were thoroughly excavated. At the same time, Mesolithic remains were also discovered on half a dozen projects concerning other archaeological periods.

SEVERAL IMPORTANT FIELDWORK PROJECTS

Although rescue excavations had been carried during the 1990s at Fréteval (Loir-et-Cher), Descartes (Indre-et-Loire) and at Pannes (Loiret) — see Boguzewski et al., 1994; Boguzewski and Le Grand, 1996; Violot, 1997 —, the nine sites presented here (by year of discovery) represent the most significant projects given the considerable quantities of material recovered, their excellent preservation or their location in areas where the Mesolithic is little known.

The majority represent genuine excavations with the exception of the diagnostic at Chevilly and the fortuitous discovery of Mesolithic remains on the proto-historic site of Bray-en-Val (Loiret).

Two sites are found in the department of the Eure-et-Loir, two in the Indre-et-Loire, two in the Loir-et-Cher and three in the Loiret. The south-east of the region (departments of the Cher and Indre) has not seen any recent large-scale excavations. In certain cases, fieldwork or analyses are still ongoing therefore making some data or interpretations subject to revision.

Le Parc du Château at Auneau, Eure-et-Loir (C. Verjux)

This site lies upon a slightly raised confluence zone north of the Beauce plateau, 20 km east of Chartres. During research excavations, nearly 70 features cut into the Fontainebleau sand and often attaining the underlying sandstone bed, were excavated between 1987 and 2001 over a surface of 200 m². Exceptional site conditions, especially the excellent preservation of bone, allowed archaeological analyses to distinguish several functional categories of features (fig. 3, Verjux, 2000 and 2002): burials, intentional deposits of animal remains (aurochs skulls, deer antler), fire pits containing heated stones, postholes sometimes containing large stone wedges, refuse pits, occasional sandstone extraction pits for the manufacture of heavy-duty tools (large scrapers, prismatic tools). The presence of significant numbers of features and the characteristics of certain ones (pits with stratified fills and cylindrical profiles, equivalent diameters and depths between 1 m and 1.5 m), although reused as rubbish dumps, are suggestive of buried storage structures and therefore pose questions as to the nature and duration of the occupations (Verjux, 2004 and 2006). The lithic industry (fig. 4)

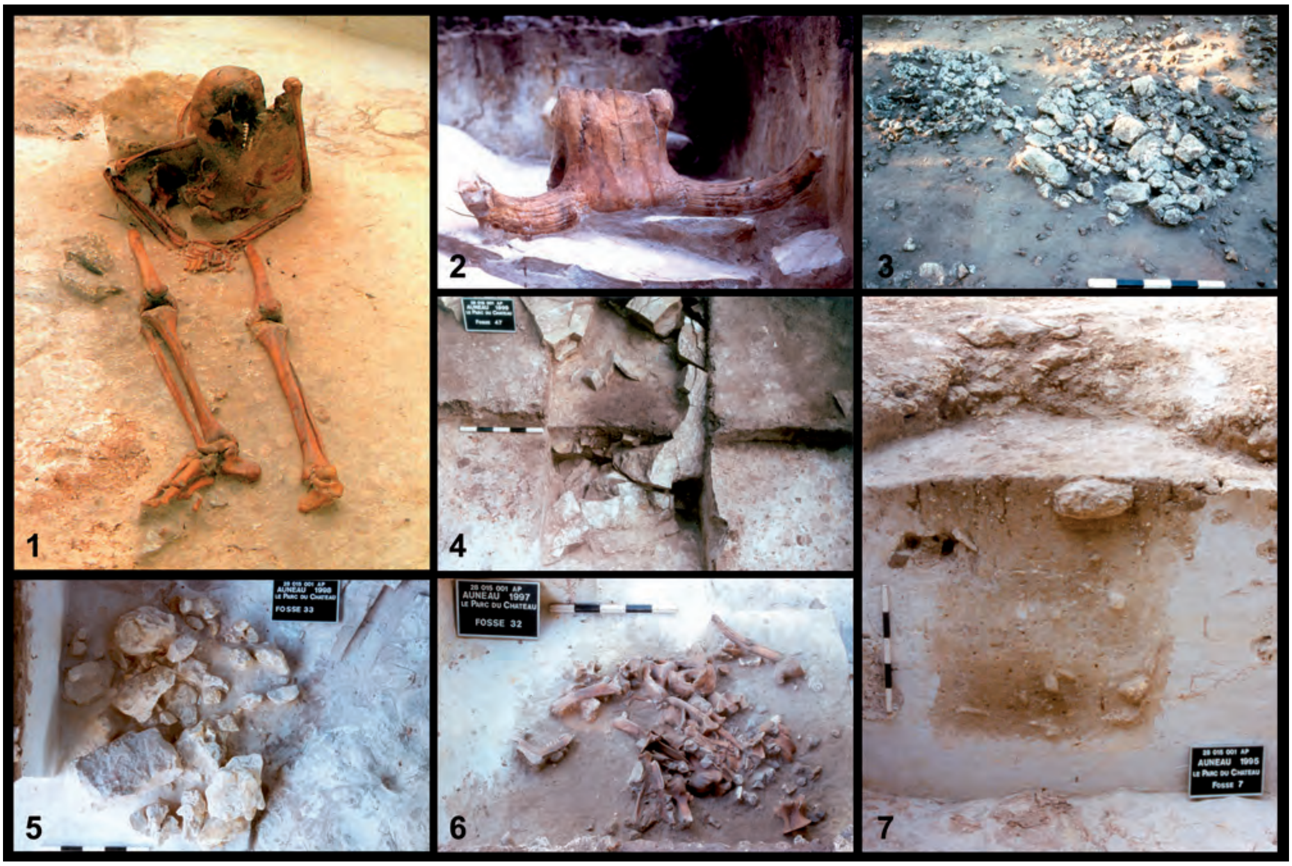

Fig. 3 – Parc du Château at Auneau (Eure-et-Loir), different types of features identified at the site. 1: burial; 2: intentional deposit of faunal remains; 3: hearth; 4: sandstone extraction; 5: posthole; 6: refuse pit; 7: storage pit (photos C. Verjux).

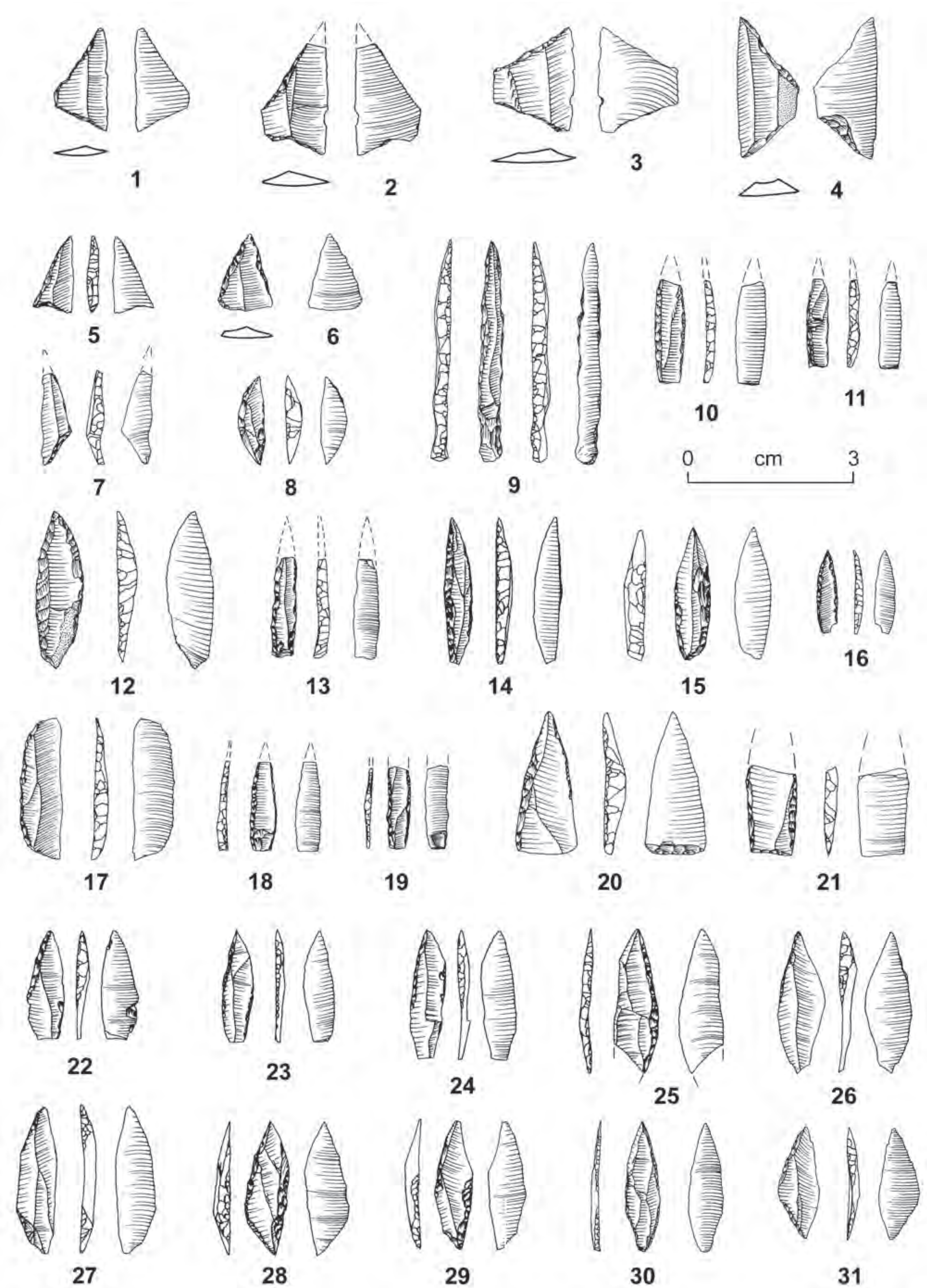

Fig. 4 – Parc du Château at Auneau (Eure-et-Loir), microliths. 1 - 2: pit 1; 3: pit 39; 4: no context; 5: pit 7; 6: no context; 7: pit 8; 8: pit 32; 9 - 11: pit 3; 12 - 13: pit 21; 14: no context; 15: pit 34; 16: no context; 17 - 19: pit 12; 20 - 21: pit 36; 22 - 29: pit 43; 30 - 31: pit B (drawings C. Verjux).

Site	Reference	Sample	Material	BP date	Calibrated date
Auneau	Ly 4731	Grave 3	Bone	6 655 ± 90	-5 870 -5 280
	Ly 5606	Grave 6	Bone	8 350 ± 105	-7 528 -7 069
	Ly 7097	Grave 7	Bone	6 825 ± 105	-5 913 -5 501
	Ly 7972	Fireplace 4	Charcoal	6 930 ± 85	-5 939 -5 623
	Oxa 5643	Aurochs skull 1	Bone	9 010 ± 90	-8 237 -7 834
	Oxa 5644	Aurochs skull 2	Bone	8 710 ± 80	-7 923 -7 560
Bray-en-Val	GrA-38073	983/026 m²	Hazelnut	8 805 ± 40	-8 005 -7 727
Chilleurs-aux-Bois	Poz-27875	F929 M13 A/M12 C P.1	Hazelnut	8 690 ± 50	-7 840 -7 590
	Poz-27876	F929 M13 A/M12 C P.3	Hazelnut	8 790 ± 50	-8 200 -7 650
Ingrandes-de Touraine	Lyon-2168 (OxA)	12/85 m²	Hazelnut	8 730 ± 40	-7 955 -7 604
	Lyon-2169 (OxA)	13/88 m²	Hazelnut	8 695 ± 45	-7 937 -7 598
	Lyon-2170 (OxA)	15/87 (Sd 2) m²	Hazelnut	8 820 ± 40	-8 198 -7 753
Mareuil-sur-Cher	ETH-31853	Sd 288/866 p. 2	Hazelnut	8 980 ± 65	-8 289 à -7 945
	ETH-31854	Sd 288/866 p. 3	Hazelnut	9 015 ± 65	-8 410 à -7 964
	ETH-31855	Sd 288/866 p. 4	Hazelnut	8 850 ± 65	-8 226 à -7 751
Saint-Romain sur-Cher	Lyon-2294 (OxA)	Locus 1	Hazelnut	8 795 ± 45	-8 196 -7 681
	Lyon-2295 (OxA)	Locus 1	Hazelnut	8 785 ± 45	-8 195 -7 654
	Lyon-2311 (OxA)	Locus 3	Hazelnut	8 820 ± 50	-8 201 -7 747
	Lyon-2382 (OxA)	Locus 4	Hazelnut	8 875 ± 50	-8 233 -7 830

Table 1 – ^{14}C dates for Mesolithic sites in the Centre region.

indicates several occupation phases spanning the end of the Early Mesolithic to the Final Mesolithic which is in accordance with the available dates that range between 8200 and 5500 cal BC (table 1). The majority of the features seem however to belong to the Middle Mesolithic.

La Prairie d'Ingrandes at Ingrandes-de-Touraine, Indre-et-Loire (L. Lang and F. Kildéa)

Located in the Loire valley, 20 km south-west of Tours on the recent alluvia of the river, this site was excavated in 2000 over a surface of 120 m² (Lang and Kildéa, 2007). The archaeological level was preserved within a depression and yielded more than 6,000 pieces (fig. 5), including 111 cores and around 1,300 blades and bladelets. Essentially unipolar reduction was preferentially carried out by soft stone-hammer percussion. One hundred and twenty-five microliths were recovered, half of which are isosceles triangles (fig. 6), as well as obliquely truncated points and points with truncated bases, fusiform crescents and points. The series is completed by 69 tools, for the most part on flakes, and small retouched blades. Finally, a crystalline rock grinder with traces of red ochre over its entire surface was also recovered.

A dozen burnt bone splinters were recovered during sieving, as well as fragments of hazelnut shells that produced three radiocarbon dates between 8200 and 7600 cal BC (table 1), however the techno-typological characteristics of the lithic industry link it to the Early Mesolithic.

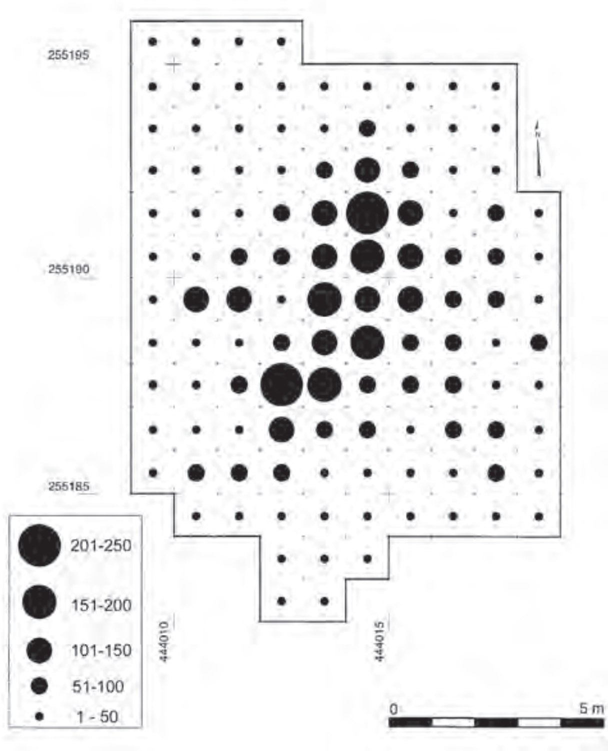

Fig. 5 – La Prairie d'Ingrandes at Ingrandes-de-Touraine (Indre-et-Loire), density of Mesolithic remains (Lang and Kildéa, 2007).

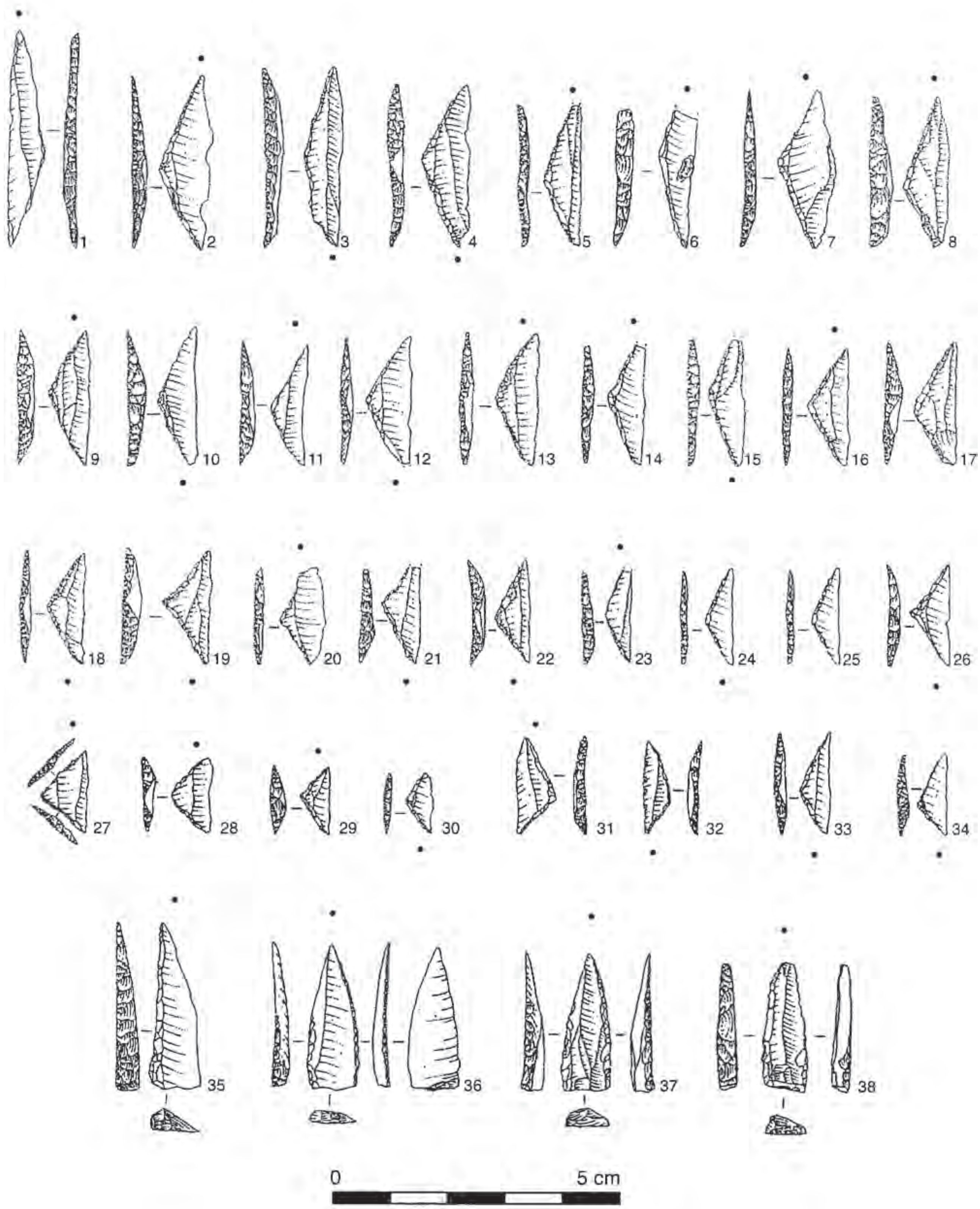

Fig. 6 –La Prairie d'Ingrandes at Ingrandes-de-Touraine (Indre-et-Loire), microliths. 1–34: triangles; 35–38: points with retouched bases (Lang and Kildéa, 2007).

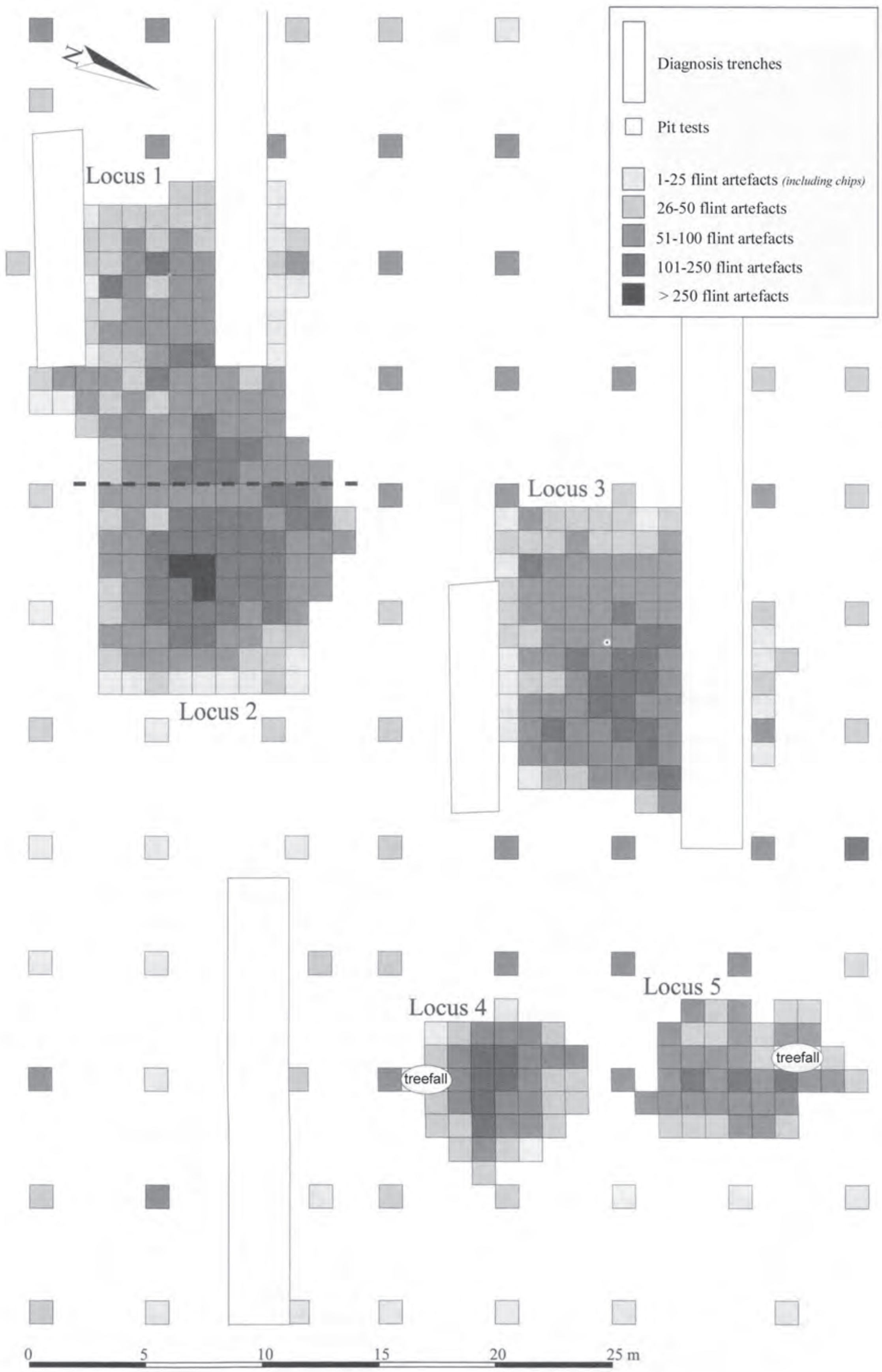

Fig. 7 – Le Chêne des Fouteaux at Saint-Romain-sur-Cher (Loir-et-Cher), general plan of the loci and density of remains by square metre. The dotted line indicates the artificial limit between loci 1 and 2 (Kildéa, 2008a).

Le Chêne des Fouteaux at Saint-Romain-sur-Cher, Loir-et-Cher (F. Kildéa)

This vast site, found some 30 km south of Blois on the sandy Tertiary formations of the plateau bordering the right bank of the Cher river, was identified and excavated in 2001 (Kildéa, 2008a). Following the identification of the lithic concentrations, five excavated loci yielded three distinct assemblages (fig. 7).

Locus 2, excavated over some 100 m², produced 8,000 pieces, including 21 cores, 70 tools, 214 microburins and 220 microliths. The densest concentration extended over some 30 m². More than half of the identifiable microliths

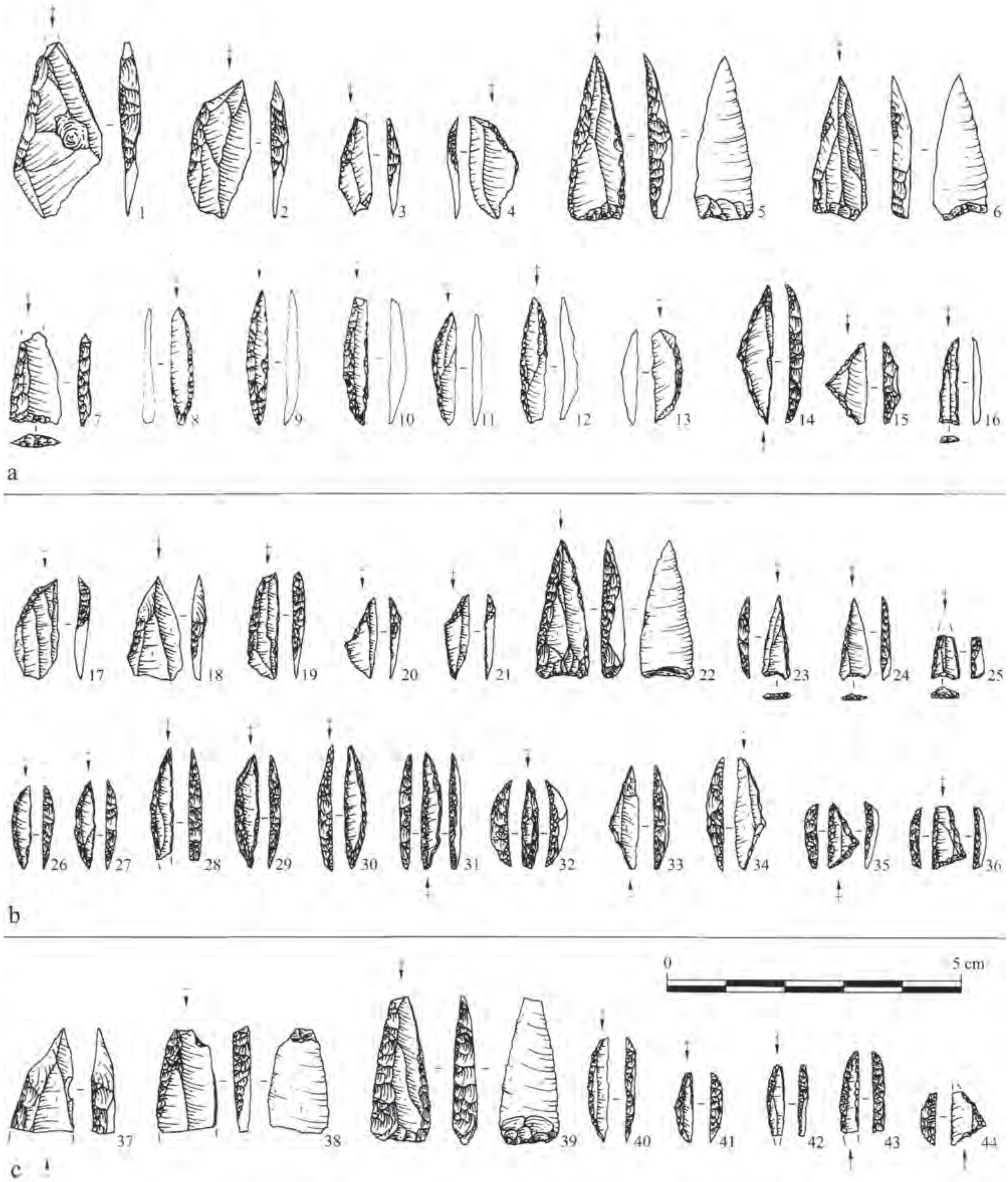

Fig. 8 – Le Chêne des Fouteaux at Saint-Romain-sur-Cher (Loir-et-Cher), crescents and points from the lithic assemblages. a: locus 1; b: locus 3; c: locus 4 (Kildéa, 2008a).

are isosceles triangles, however the assemblage also includes points with transversely or obliquely truncated bases, crescents, scalene triangles and several Montclus triangles. The debitage is of the Coincy style and on typological grounds the assemblage can be attributed to Early Mesolithic, probably the second half of the Preboreal.

Around 15,000 pieces of worked flint were recovered from loci 1, 3 and 4 excavated over surfaces ranging between 40 to 100 m². These loci yielded very similar assemblages that differ significantly however from the one discussed above (fig. 8). The assemblage is composed of 72 cores, 173 tools, 410 microburins and 287 microliths. Although the morphology of the cores and their modes of exploitation vary, they remain within the Coincy style. Fairly fusiform crescents dominate an assemblage that also includes obliquely truncated points, points with retouched bases, scalene triangles, as well as several Sauveterre points or isosceles triangles. These three loci are all attributable to the Middle Mesolithic with dates produced from hazelnut shells placing them to between 8200 and 7600 cal BC (table 1).

Finally, locus 5, excavated over a surface of just 42 m², has produced the smallest assemblage with only 2,300 pieces including 9 cores, 19 tools, 25 microburins and 47 microliths which are mainly scalene bladelets and Montclus triangles. This collection can also be assigned to the Coincy style, however it is made on lesser quality raw materials (gelifracted blocks) in comparison with the other loci and blade production was less important.

La Guériverie at Langeais, Indre-et-Loire (L. Lang)

This site is found on the plateau dominating the Loire valley, a dozen kilometres south-west of Tours (Leroy, 2003). Excavations in 2002 over approximately 250 m² yielded 160,000 pieces, including 1,500 microliths recovered during the hand-sorting of sieved sediments. Artefact distributions indicate several different occupation units. The lithic industry, dominated by isosceles triangles, can be attributed to the Early Mesolithic which is consistent with the radiocarbon dates produced on hazelnut shells.

Fig. 9 – La Croix de Bagneux at Mareuil-sur-Cher (Loir-et-Cher). Plan of the site and the Mesolithic test pits (graphic design INRAP).

La Croix de Bagneux at Mareuil-sur-Cher, Loir-et-Cher (F. Kildéa and B. Souffi)

Excavations of this site found upon the recent alluvia of the left bank of the Cher river, 30 km south of Blois, took place during the winter of 2004 (Kildéa, 2008b). One square metre test pits, distributed every 5 m, were dug over an area of approximately 100 m². A total of 33 test-pits returned 6,940 artefacts greater than 1 cm, together with 37,659 smaller pieces. The Mesolithic

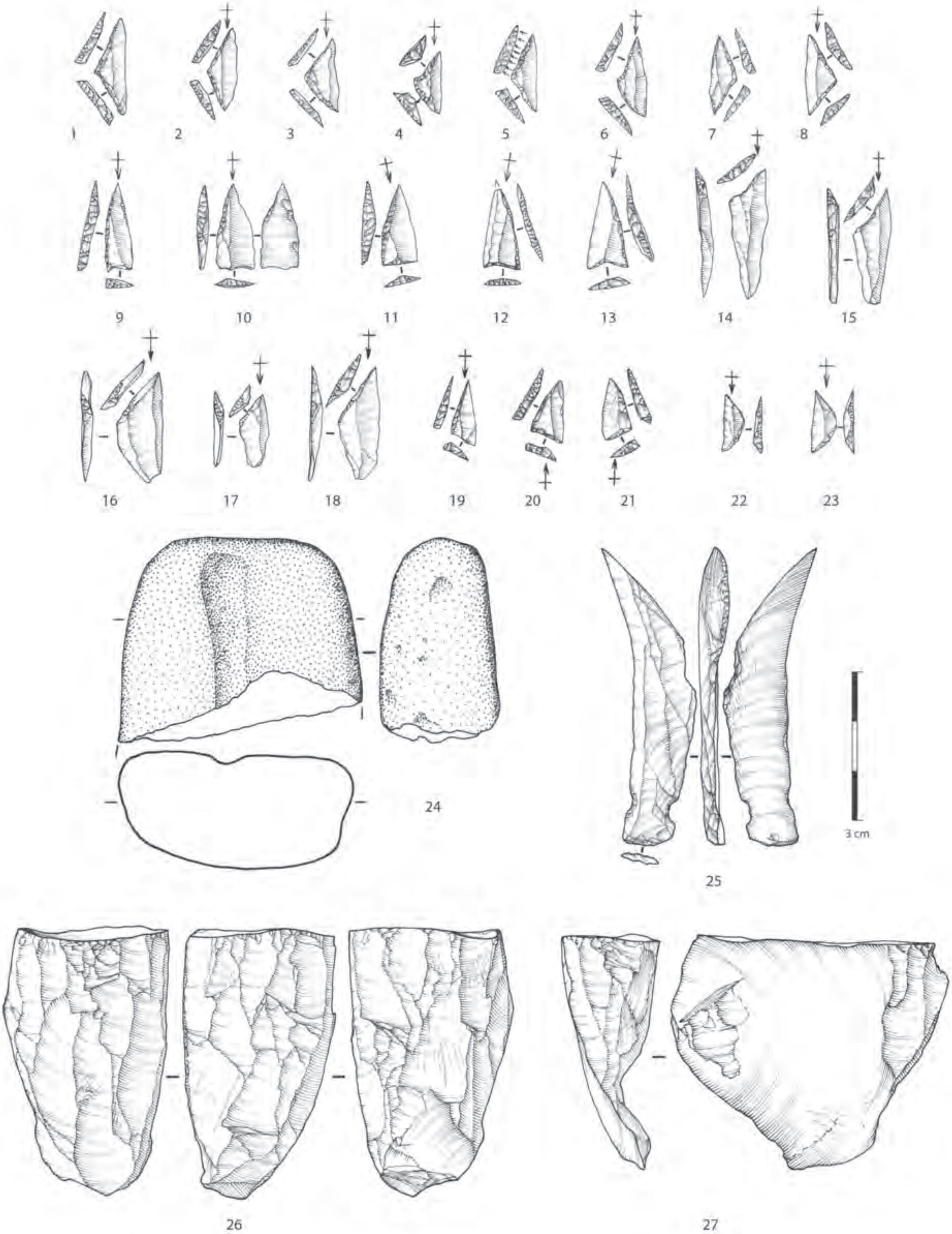

Fig. 10 – La Croix de Bagneux at Mareuil-sur-Cher (Loir-et-Cher), microliths and domestic tools. 1–8: isosceles triangles; 9–13: points with retouched bases; 14–18: obliquely truncated points; 19–21: scalene triangles; 22–23: crescents; 24: fragment of a grooved abrader; 25: blade with basal notches; 26–27: cores (drawings E. Boitard-Bidaut, INRAP).

industry is dispersed vertically (up to 90 cm) with a clear unimodal distribution within a level of localised banded sands derived from the east of the exposed area. In the absence of bone, three samples of burnt hazelnut shells from spits 2, 3 and 4 of the densest test-pit (290/866) were dated to between 8400 and 7750 cal BC (table 1).

The industry is made on locally available Lower Turonian flint cobbles collected from secondary contexts. It is characterised by a prevalence of microliths over the domestic tool component (4% versus 1.2% of the products greater than 1 cm) dominated by retouched flakes, blades and bladelets. We can also note the presence of a blade with a basal notch, otherwise known as a 'Rouffignac knife', and a fragment of a grooved sandstone abrader (fig. 10, no. 24). The microlith assemblage is typologically homogeneous (fig. 10, nos. 1–23) which is coherent with the radiometric dates. The association of isosceles triangles and points with or without retouched bases is generally attributable to a phase of the regional Early Mesolithic, as at the slightly earlier site of Ingrandes-de-Touraine whose lithic assemblage differs in the larger size of certain microliths. The most similar assemblage is that of Saint-Romain-sur-Cher (locus 2), especially the squat morphology of the isosceles triangles and the points with retouched bases.

Vallée du Nant at Chevilly, Loiret (O. Roncin)

Discovered in the small discrete Nant nalley in 2006 during a diagnostic phase preceding the construction of the A19 autoroute, the site is located in the eastern area of the Beauce plateau, 15 km north of Orléans. A concentration of lithic and faunal remains was discovered at a depth of 90 cm and fully excavated over 5 m². However, the extent of this concentration may have surpassed the limits of the autoroute. The site's depositional conditions resulted in the rapid burial of the remains which is responsible for their excellent preservation (presence of bone remains and lithic refits). The assemblage is very coherent in terms of the general freshness of the pieces, as well as their techno-typological homogeneity.

The concentration yielded 966 flint pieces and 7 poorly preserved bones, mainly horse teeth. The lithic assemblage is composed of 925 debitage products, 7 cores, 20 tools and 14 microliths (fig. 11 and fig. 12). Debitage is geared towards the unipolar production of fairly regular and rectilinear bladelets associated with rectilinear blades obtained from very carefully prepared and exploited opposed platform cores. All of these elements indicate direct soft stone-hammer percussion. The microlith component is comprised of backed bladelets and obliquely truncated points. The latter are significantly homogeneous both in their morphology and method of manufacture, despite varying degrees of obliqueness in the truncation. Tools are dominated by retouched or truncated blades and bladelets associated with the occasional flake tools.

The presence of horse and the characteristics of the lithic industry renders the site of Chevilly more comparable with the last industries of the Northwestern European Final Palaeolithic, dated to the Younger Dryas-Preboreal transition (epi-Ahrensbourgian), than with the initial Mesolithic industries (Early Mesolithic derived from the Ahrensbourgian). However, points of comparison still remain rare for Northern France (Fagnart, 2009; Valentin, 2008).

Bois au Cœur at Bray-en-Val, Loiret (B. Souffi)

This site was discovered in 2007 during excavations of a proto-historic site in a quarry exploiting the lower alluvia of the Loire, 30 km east of Orléans (Lardé, 2008). The Mesolithic material is concentrated at the top of an elongated fluvial bar parallel to the present course of the river. The majority of the pieces were found in the first 20 cm below the surface as the Mesolithic level had been significantly disturbed by the proto-historic occupation. Nine test pits produced 137 pieces, mostly flakes, and a further 1,014 were recovered during sieving. The assemblage includes 8 microliths, 8 microburins, two endscrapers and two cores. The raw material is in the form of cobbles with rolled cortex collected from the alluvial deposits. Although generally fragmented and small in size, the microlith component appears homogeneous (fig. 13) and is dominated by un-characteristic points with retouched bases and points with transverse bases. A Sauveterre point and a fragment of point with flat inverse retouch were also recovered.

One of the two dates produced on burned hazelnut shell fragments falls between 8000 and 7700 cal BC (table 1) or the first half of the Boreal and may correspond to the Mesolithic occupation. This small collection once again underlines the potential of the Loire valley for future Mesolithic discoveries.

La Rouche at Chilleurs aux-Bois, Loiret (S. Deschamps)

This site is located on the south side of the small Laye du Sud valley, 20 km north of Orléans. A 70 m² area excavated in 2008 (Fournier, 2010) yielded a lithic assemblage composed of 48 blades, 193 bladelets, 350 flakes, 213 chips, 25 cores and 7 microliths. Debitage was geared towards the production of small, relatively regular blades and bladelets (with 2 or 3 faces) by direct stone percussion using a somewhat simple Coincy style reduction strategy. The few domestic tools (n = 18) are made on flakes, blades and bladelets. Use-wear analysis was not possible due to the significant patina of the pieces. The 7 microliths can be separated into three types: one fusiform point, three points with retouched bases and two crescents.

The presence of bovids and suidae among the 25 bone remains, together with the coexistence of two environments identified by the malacofauna, one forested and the

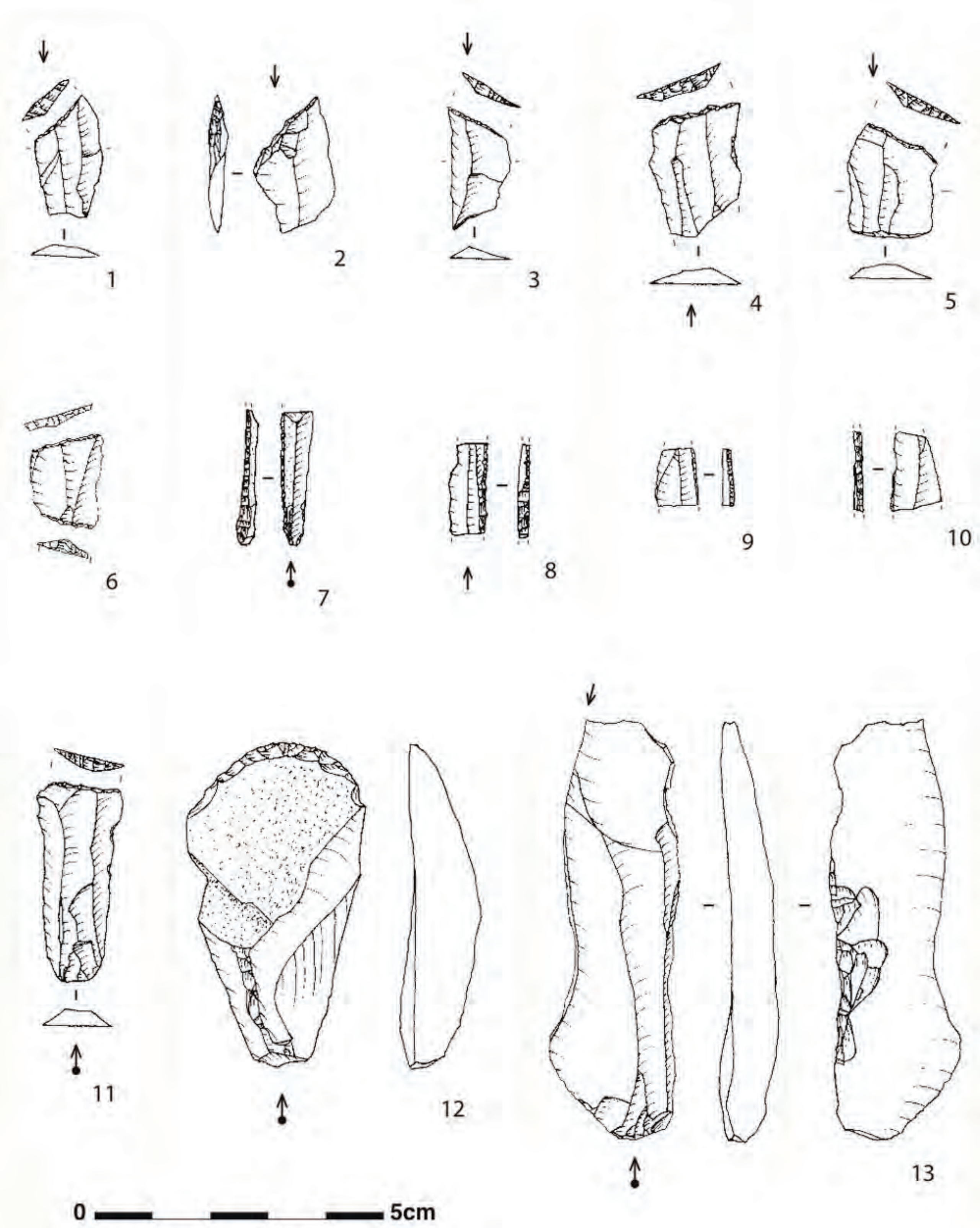

Fig. 11 – Vallée du Nant at Chevilly (Loiret), microliths and tools. 1 – 5: obliquely truncated points; 6: trapeze; 7 – 10: backed bladelets ; 11: truncated bladelet; 12: endscraper; 13: composite blade tool (drawings O. Roncin).

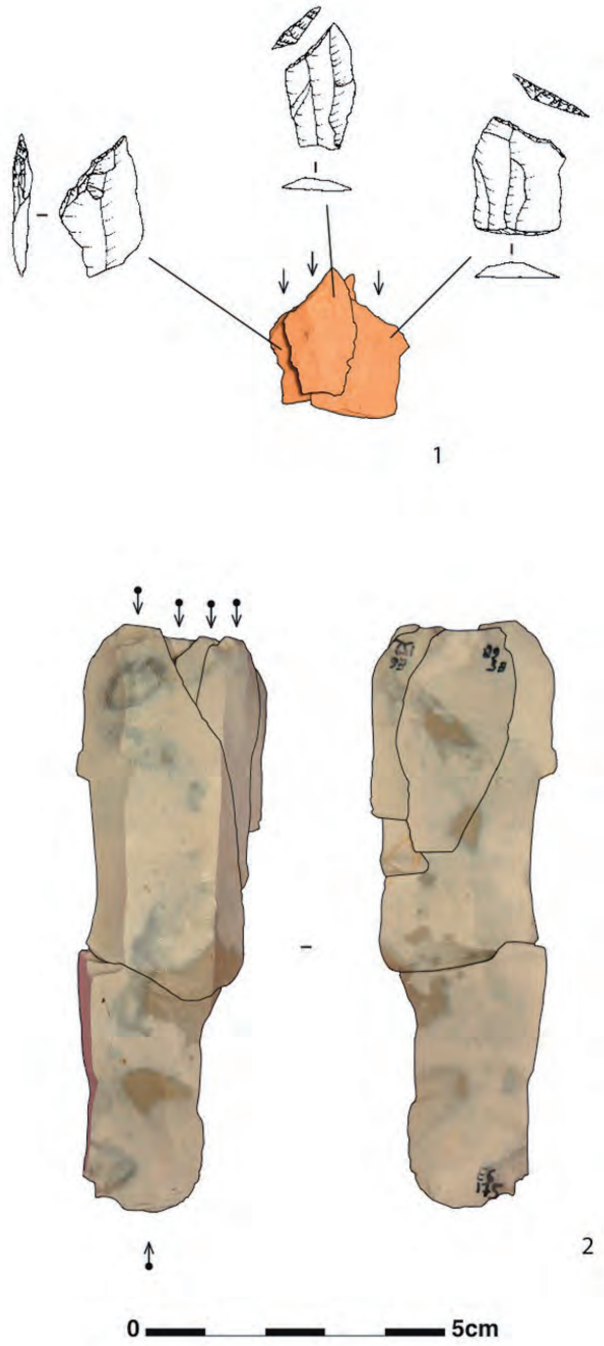

Fig. 12 – Vallée du Nant at Chevilly (Loiret), refits. 1: refits of three obliquely truncated points; 2: refits of blade and bladelet products (drawings O. Roncin).

other humid and open (clearings and woodland edges), is coherent with the Boreal chronozone, while the two dates produced on hazelnut shells fall between 8200 and 7600 cal BC (table 1).

The lithic industry, fauna (mammal and malacofauna) and vegetal remains (shelled fruits) recovered from this site highlights the informative potential of a small plateau watershed often considered as unfavourable to the preservation of Mesolithic remains.

The Hermitage at Auneau, Eure-et-Loir (G. Chamaux)

In 2009 and 2010 several Mesolithic occupations located within a meander of the Aunay river were identified during an archaeological evaluation carried out along the Auneau bypass road (Chamaux, 2009). These different occupations are found in contrasting topographic positions between an abrupt northern bank thinly overlain by silts and a gentler southern bank composed of alluvial and colluvial deposits which cover an ancient terrace. The valley bottom was infilled by fine alluvial formations and peat deposits.

The diagnostic revealed three Mesolithic levels on the valley floor. The first two were found 48 cm below the surface to depths of between 1.5 and 1.8 m. The upper level spread over 27 m² is contained within a 30 cm deep silty alluvial horizon with a colluvial component. Therefore, the primary position of this level cannot be guaranteed. Thirty-eight pieces, a majority of which are flakes, were recovered along with three bladelets and a unipolar bladelet core. The second level, found within a fluviatile silty-clay deposit sealed by a highly organic clay level, yielded 49 lithic elements over a 15 m² surface. A test-pit 4 m from the banks of the Aunay identified a third extremely well-preserved archaeological level within a fluviatile grey clayey silt horizon 1.9 m below the surface. This level, excavated over only 3 m², produced 111 pieces of worked flint: 57 flakes, 24 blades and bladelets, two cores and some technologically characteristic pieces (half-core tablets, microburins). Two pieces could be refit. Debitage was oriented towards the production of fairly regular blades and bladelets by soft stone-hammer percussion. Burnt animal bones were also recovered during sieving. At the base of the slope, 75 m south of the Aunay, an extensively exposed area connected to the excavation of proto-historic and historic structures revealed a scatter of lithic remains and a combustion feature on a surface of approximately 900 m². One hundred and sixty-three worked flints were recovered, including 7 unipolar bladelet cores, 22 blade or bladelet elements, 2 large tools, 2 points with retouched bases and a crescent. The debitage style and the microliths place this assemblage to the Middle Mesolithic.

These new discoveries in the village of Auneau, 3 km downstream and northwest of the site of Parc du Château, indicates a high-density of Mesolithic occupations in the small Aunay Valley.

PRELIMINARY ASSESSMENT

Both plateau and valley floor sites are equally well-represented in this series of nine sites. However, some of these plateau sites are themselves located in small valleys. Specific excavations methods adapted to the preservation conditions of the Mesolithic levels were employed on most sites. In fact, the frequency of sandy

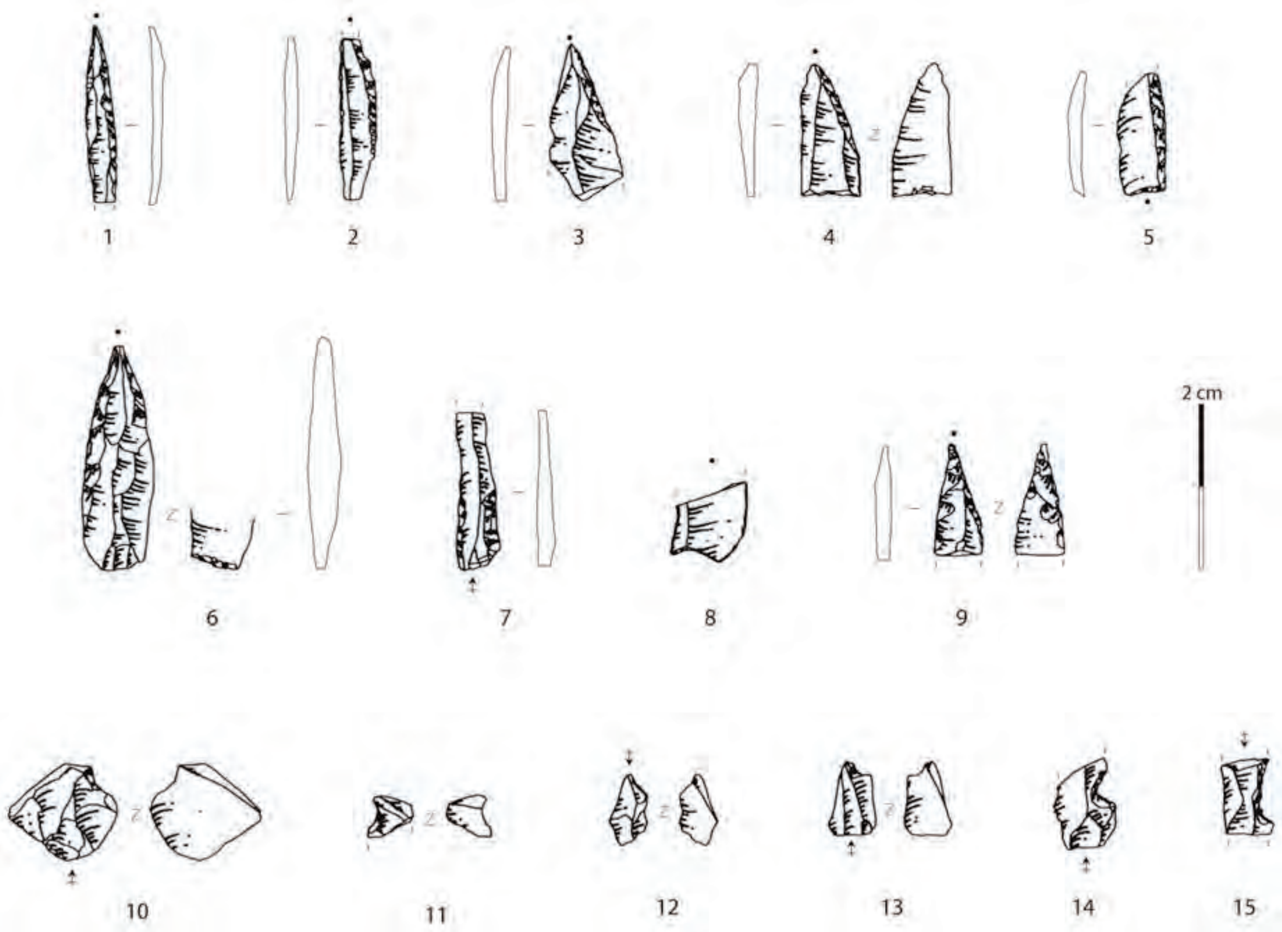

Fig. 13 – Bois au Cœur at Bray-en-Val (Loiret), microliths and microburins (drawings B. Souffi).

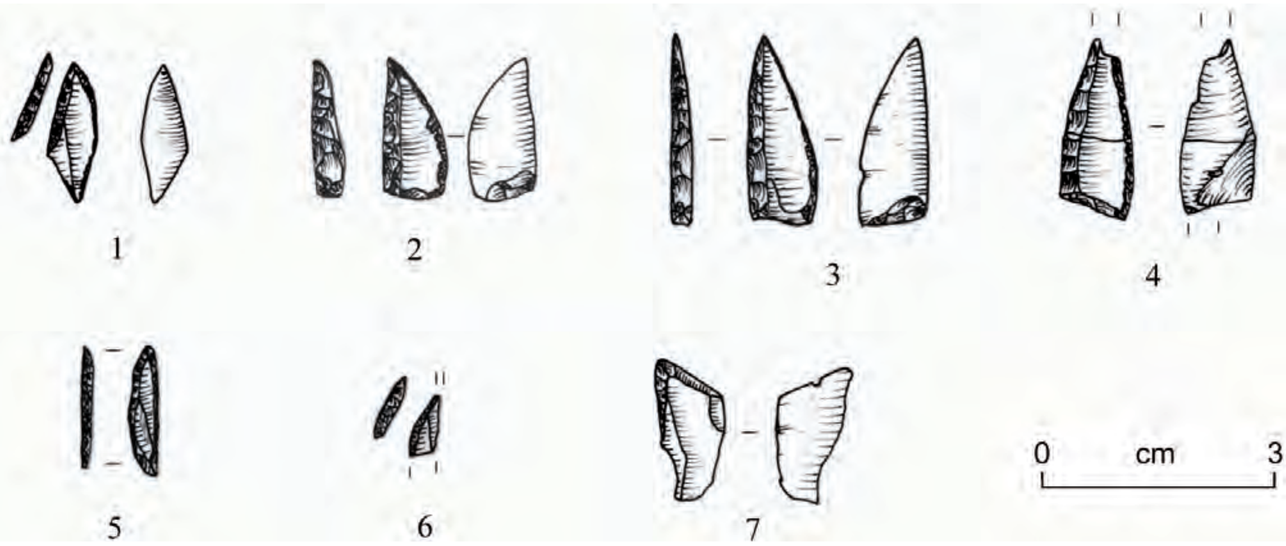

Fig. 14 – La Rouche at Chilleurs aux-Bois (Loiret), microliths (drawings S. Deschamps).

substrates and the near absence of bone led to the systematic sampling of sediments by ¼ m² collected from spits of 5 or 10 cm, followed by wet sieving. The three-dimensional recording of the archaeological material was however done only in certain cases. The planning of the remains was carried out in parallel with the excavation in order to detect any artefact concentrations and adapt the excavation accordingly.

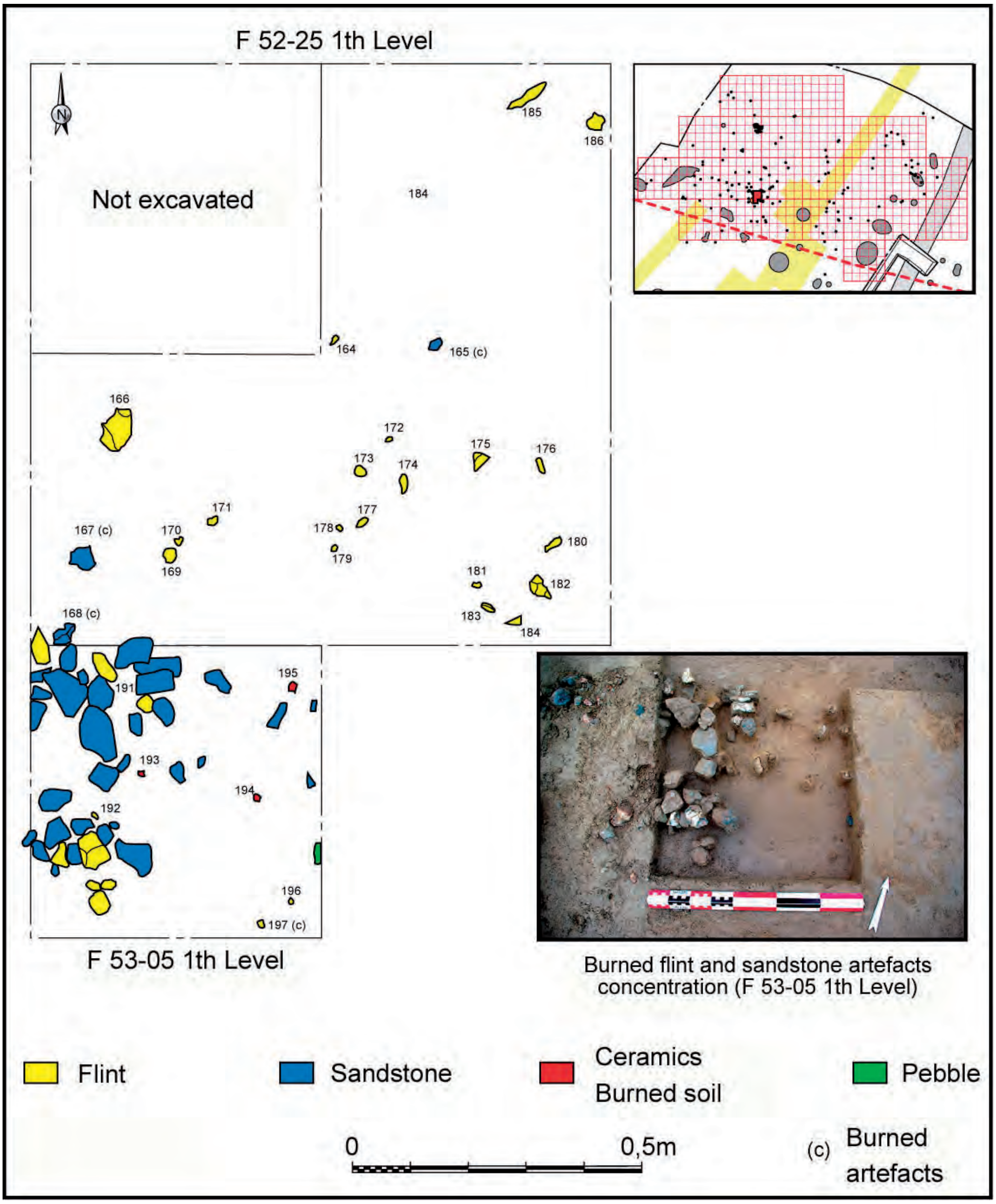

Fig. 15 – L'Hermitage at Auneau (Eure-et-Loir), mesolithic material discovered at the base of the hillside (after G. Chamaux).

In chrono-cultural terms, the information provided by these discoveries permits a re-evaluation of the region's Early and Middle Mesolithic phases. New data concerning the Early Mesolithic (end of the Preboreal / onset of the Boreal) was also collected and complements already available information derived from surface surveys (fig. 17), most notably in the Loiret (Attray, Autry-le-Chatel, Beauchamps-sur-Huillard, Quiers-sur-Bezonde…). While the small collection from Chevilly is more appropriately attributed to the Final Palaeolithic, the industry from locus 2 of Saint-Romain-sur-Cher is comparable with the Early Mesolithic of Northeastern France given the high proportion of isosceles triangles. The sites of Ingrandes, Langeais, and Mareuil-sur-Cher also belong to the Early Mesolithic, as does the material recovered from several pits at Parc du Château in Auneau. The most well-represented period is however the Middle Mesolithic from the first half of the Boreal (fig. 18). Three assemblages from Saint-Romain-sur-Cher (loci 1, 3 and 4) containing crescents and points are also attributable to this period, while the industry from locus 5 belongs to the southern facies of the Middle Sauveterrian with Montclus triangles (Kildéa, 2008a). The majority of features identified at Parc du Château at Auneau also date to the Middle Mesolithic,

Fig. 16 – L'Hermitage at Auneau (Eure-et-Loir), lithic industry. 1–3: microliths; 4–5: cores; 6–7: macro-tools; 8–10: blades and a bladelet. (after G. Chamaux).

as do the small assemblages from Bray-en-Val, Chilleurs-aux-Bois and the Hermitage at Auneau.

Dates produced on hazelnut shells (table 1) fall for the most part between 9000 and 8600 BP (8200 and 7600 cal BC) during a period that covers the end of the Preboreal and the beginning of the Boreal. Given the plateau in the calibration curve (Blanchet et al., 2006), these dates preclude establishing a more precise chronology of these occupations within the 'First Mesolithic' (Costa and Marchand, 2006) despite the microlith assemblages presenting marked differences. Late and Final Mesolithic sites, while well-represented in surface surveys, were only rarely encountered during diagnostics or excavations, as at Ligueil, Muides and Auneau for example.

PERSPECTIVES

Recent archaeological projects in the Centre region have confirmed its rich potential for recovering Early Holocene archaeological material from various contexts such as the bottom and lower slopes of valleys or even plateaus. Paleoenvironmental data remains rare and should become a research priority in the coming years.

Information concerning the spatial organisation of sites and, by extension, the nature and function of the occupations is still limited. In fact, a majority of sites were excavated only over small surfaces and the methods

Fig. 17 – Main Early Mesolithic sites in the Centre region. Grey circles: surface surveys; blue circles: research projects; red squares: diagnostics; red triangles: rescue excavations (map C. Verjux).

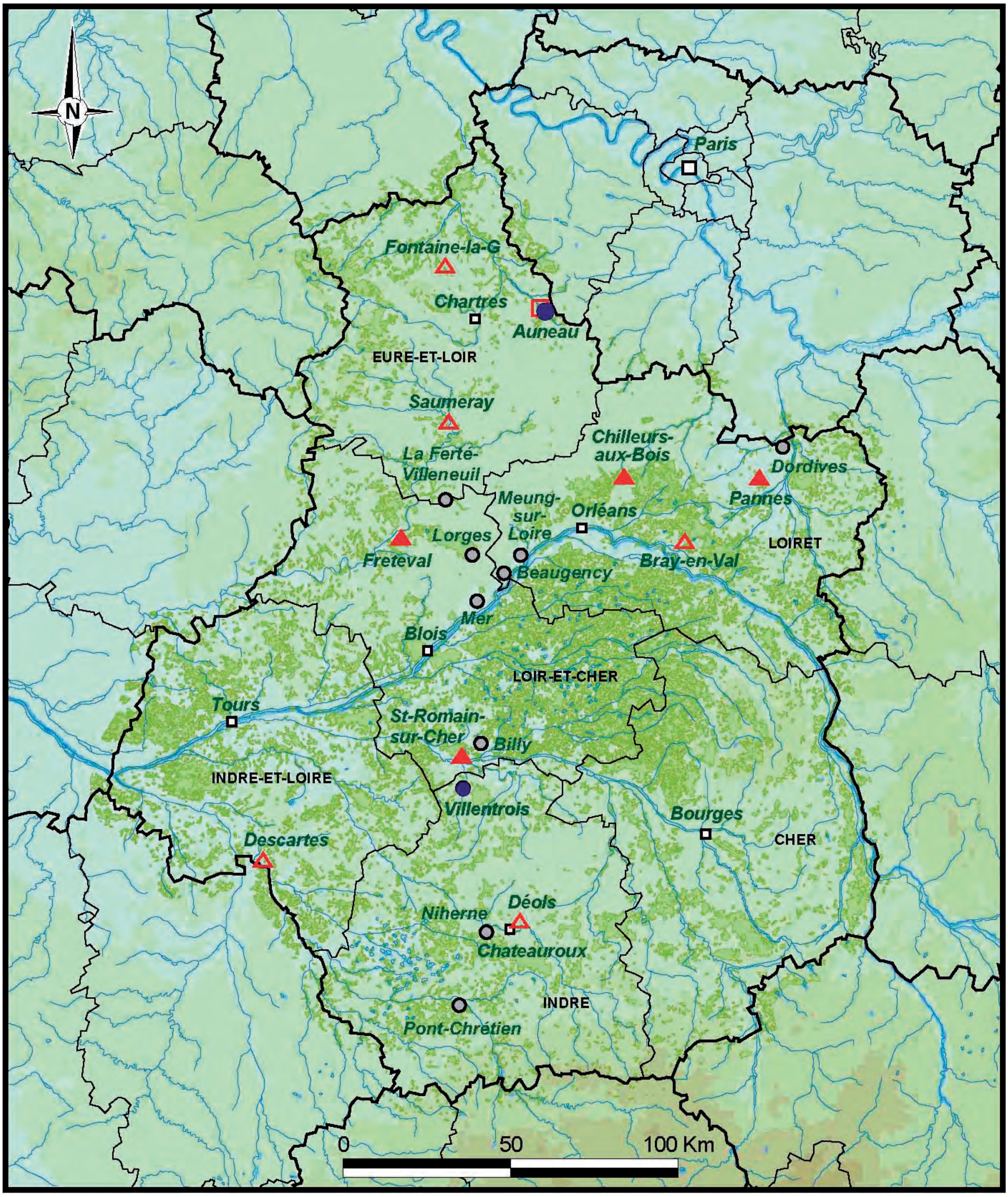

Fig. 18 – Main Middle Mesolithic sites in the Centre region. Grey circles: surface surveys; blue circles: research projects; red squares: diagnostics; red triangles: rescue excavations. Symbol outlines correspond to the excavation of Mesolithic remains found during projects concerning other periods (map C. Verjux).

Fig. 19 – Main Late and Final Mesolithic sites in the Centre region. Grey circles: surface surveys; blue circles: research projects. Symbol outlines correspond to the excavation of Mesolithic remains found during projects concerning other periods (map C. Verjux).

employed, although well-adapted to the nature of the remains and their state of preservation (sediment sampling and sieving), permitted only the production of density maps, but not detailed plans of artefact distributions. Furthermore, the near absence of faunal material and the extreme rarity of features are a regular aspect of these sites. Not surprisingly, occupations seem most often related to hunting activities as is evinced by the production and maintenance of hunting weaponry. No new funerary information is available and the burials at Auneau still remain the only known examples for the whole Centre region.

It is also difficult to be more precise concerning occupation durations. Certain sites identified during pedestrian surveys, as well as the results of certain excavations, raise the possibility of successive or recurrent occupations either during the same chronological phase (Langeais, Mareuil-sur-Cher) or spread out over time (Saint-Romain-sur-Cher, Auneau).

Particular attention paid to the detection of this type of site by implementing appropriate means and methods, especially for finding favourable preservation contexts, will enable this potential to be fully exploited in the future.

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Mesolithic valley floor occupations: The case of Dammartin-Marpain in the Jura

Frédéric Séara and Olivier Roncin

Abstract: Preliminary information from the site of Dammartin-Marpain further highlights the key role played by valley floors for the study of prehistoric populations. At Dammartin we note important Mesolithic activity linked to a succession of camps radiocarbon dated to between 8300 and 7200 BC, as well as a Final Mesolithic occupation identified by typological criteria. The intensity of occupation is reflected in the more than 27,000 lithic elements recovered, including 620 microliths, to which can be added used and unused cobbles, occasional bone remains, ochre fragments and hazelnut shells. Beyond these initial assessments, petrographic determinations, a preliminary functional analysis, initial lithic refits, as well as the beginnings of a spatial analysis also reveal interesting perspectives. The overall aspect of the cultural material is clearly Sauveterrian, which to some extent redraws the boundaries of Beuronian techno-complex still considered as the main cultural component of the regional Mesolithic.

EXCAVATION CONTEXT

The project for a bypass road around the small village of Pesmes in the Haute-Saône (fig. 1) allowed this valley floor site to be investigated over an area of approximately 10,000 m². The site's particular topographic position on the left bank of the Ognon River at the base of a line of cliffs cut by a well-defined valley could partly explain the repeated occupation of this alluvial plane (Seara et al., 2010). The natural corridor created by this small valley channelled the movement of animals thus making it a particularly favourable landscape for hunting from the Mesolithic onwards (fig. 2). This feature is but one of many that probably drew Mesolithic groups to this location.

The nature of the construction project largely determined the limits of the excavation area resulting in the exposure of a narrow 250 m by 40 m rectangle perpendicular to the river (fig. 3). The spatial distribution of the archaeological material reflects variable occupation intensities which are particularly dense at the edges of the main paleochannel ('chenal 2') and considerably less substantial to the east of a small, more central channel (fig. 4).

GENERAL STRATIGRAPHIC INFORMATION

An approximately 180 m long profile made it possible to define the composition and geometry of the generally very homogeneous deposits that vary little throughout the sequence. The Mesolithic material was found systematically at the top of a horizon composed of silty clays with fine sands which was consistently present across the excavated area, apart from the banks of the present river (fig. 5). The geometry of the deposits demonstrates a clear incision within the main paleochannel, while the more pronounced profile of the central paleochannel indicates low-energy hydrological activity or standing water.

The small number of fairly linear paleochannels combined with the geometry and nature of the deposits depicts a different alluvial dynamic than that of the Seille River characterised by numerous, sometimes sinuous channels (Rotillon *in* Séara et al., 2002). The situation at Dammartin-Marpain seems most similar with the Doubs floodplain near Dole at the level of the site of Choisey *(ibid.)*.

1 : Les Basses Veuves à Pont-sur-Yonne (Yonne); 2 : Le Haut des Nachères à Noyen-sur-Seine (Seine-et-Marne); 3 : La Presle à Lhéry (Marne); 4 : Les Closeaux à Rueil-Malmaison (Hauts-de-Seine); 5 : Le Marais de Merlemont à Warluis (Oise); 6 : La Grippe à Lihus (Oise); 7 : Le Marais à Conty (Somme); 8 : Le Marais à Thennes (Somme); 9 : Le Marais à Boves (Somme); 10 : Les Baquets à Saleux (Somme); 11 : Étouvie à Amiens (Somme); 12 : Le Petit Marais à La Chaussée-Tirancourt (Somme); 13 : Gravières à Hangest (Somme); 14 : Les Varennes à Val-de-Reuil (Eure); 15 : Déviation à Saint-Pierre-du-Bû (Calvados); 16 : La Canne à Pannes (Loiret); 17 : Le Chêne des Fouteaux à Saint-Romain-sur-Cher (Loir-et-Cher); 18 : La Croix de Bagneux à Mareuil-sur-Cher (Loir-et-Cher); 19 : La Guériverie à Langeais (Indre-et-Loire); 20 : La Prairie d'Ingrandes à Ingrandes-de-Touraine (Indre-et-Loire); 21 : L'Essart à Poitiers (Vienne); 22 : La Grange à Surgères (Charente-Maritime); 23 : La Grande Pièce à La Vergne (Charente-Maritime); 24 : La Pierre-Saint-Louis à Geay (Charente-Maritime); 25 : Al Poux à Fontanes (Lot); 26 : Le Camp de Jouannet à Réalville (Tarn-et-Garonne); 27 : Le Gournier à Montélimar (Drôme); 28 : Blachette-Sud à Sinard (Isère); 29 : A Dauepharde à Ruffey-sur-Seille (Jura); 30 : Aux Champins à Choisey (Jura); 31 : Prairie du Milieu à Dammartin-Marpain (Jura); 32 : La Croix Audran à Carnac (Morbihan); 33 : Rue Farman à Paris (Hauts-De-Seine); 34 : La Haute-Île à Neuilly-sur-Marne (Seine-Saint-Denis)

Fig. 1 – Main Mesolithic sites excavated in rescue contexts over the last 20 years in France (F. Séara).

Fig. 2 – Dammartin-Marpain. View of the excavation from the valley. The small rockshelters are found on the left side of the valley (F. Séara).

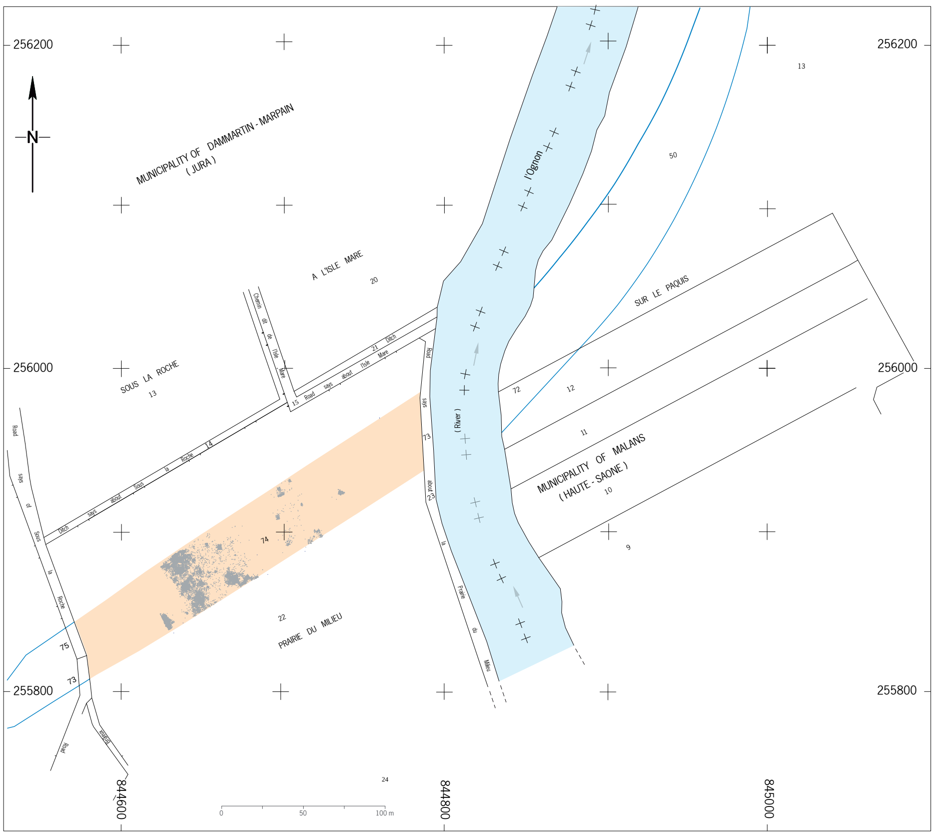

Fig. 3 – Dammartin-Marpain. General context of the excavation (F. Séara).

Repeated occupations of the edges of the main paleochannel reflect the attractiveness of this particular area of the site. While the archaeological material is most dense at the edges of the channel, the fairly well-defined boundaries of concentrations is especially noteworthy as the various occupations are spread over time (see below).

NUMEROUS AND DIVERSE ARCHAEOLOGICAL DATA

The considerable quantity of archaeological material (more than 30,000 artefacts comprised mainly of lithics) illustrates the intensity of the occupation. Unfortunately the acidity of the sediment limited bone preservation to the occasional series of teeth and burnt elements from which Charlotte Leduc (*in* Séara and Roncin, 2010) could nonetheless identify aurochs, wild boar and deer.

The extremely abundant lithic industry is composed of 25,576 pieces including 12,800 chips, 2,100 bladelets,

Fig. 4 – Dammartin-Marpain. General plan of the Mesolithic artefacts.

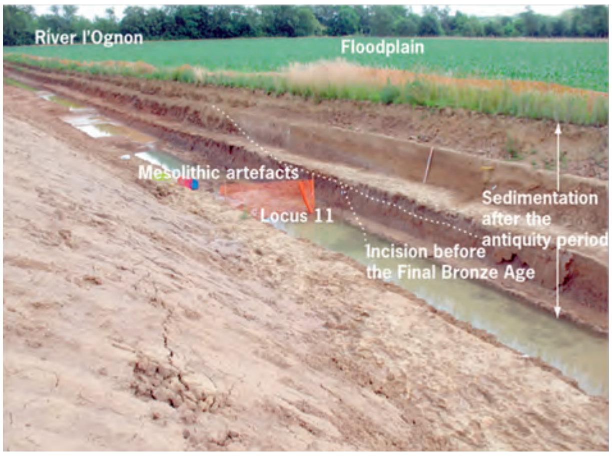

Fig. 5 – Dammartin-Marpain. Central part of the stratigraphy at the the level of the main channel incision.

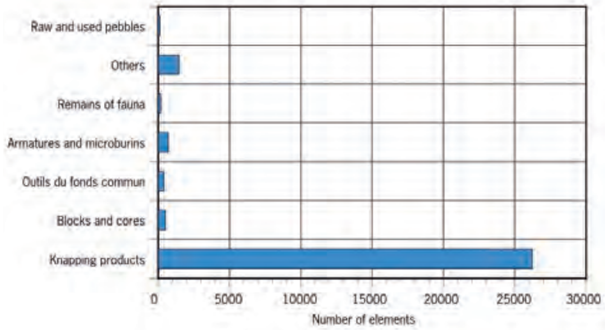

Fig. 6 – Dammartin-Marpain. Composition of the Preboreal/Boreal Mesolithic assemblage by major artefact categories (F. Séara).

500 cores, 300 domestic tools and 620 complete or broken microliths (fig. 6). These elements are distributed across 16 loci representing well-demarcated artefact concentrations whose size or function were not considered in their definition (fig. 7). This explains the significant variability in the numbers of remains found within each locus, ranging from 27 pieces in locus 15 to more than 8,000 in locus 7, which probably reflects very different archaeological realities (table 1).

It could be expected that high artefact densities in certain loci represent the accumulation of material from successive occupations. Such a scenario is confirmed by a series of 25 radiocarbon dates made possible by the presence of numerous burnt hazelnut shells. Four major occupation phases could be distinguished (fig. 8 and fig. 9): the first between 8350 and 8200 BP, the second between 8150 and 8000 BP, the third between 7650 and 7450 BP and the fourth between 7250 and 7150 BP. A fifth Late/Final Mesolithic occupation phase also was identified based solely on the associated lithic industry.

Lithic Industry

Raw material provenances

Despite the considerable size of the lithic assemblage, preliminary studies concerning the major aspects of the lithic industry have already produced very interesting results supplementing already available information for the region. This is especially the case for the petrographic determinations made by Jehanne Affolter (in Séara and Roncin, 2010). For the moment, only the industry from locus 2 has been examined, revealing extremely diverse raw material procurement strategies primarily centred around local sources such as chert from the Serre Massif or flint from the Tertiary Haute-Saône Basin (Cupillard et al., 1995). While these two sources comprise 95% of the exploited raw material, other materials were introduced to the site from considerable distances, for example Swiss Intingen flint transported 170 km (Affolter, 2002). At least three provisioning territories with distances equal to or greater than 100 km were identified (fig. 10). Although locus 7 has not been the subject of a detailed petrographic analysis, two small rock crystal flakes, whose provenance could not be precisely determined,

	L1	L2	L3	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	Cleaning	Total
Chips	815	3591	19	30	1305	3572	104	239	817	1954	120	22	95	15	21	173	12892
Flakes	1148	2041	33	93	1111	3318	144	204	319	1076	162	71	125	11	28	164	10048
Bladelets	200	444	12	23	255	589	18	64	189	133	36	6	25	0	9	99	2102
Blades	74	94	1	3	51	123	10	18	16	43	7	5	0	0	2	0	447
Bladelets with crest	19	19	0	0	15	24	1	11	7	12	0	0	0	0	1	13	122
Chunks	21	42	2	6	54	203	4	0	0	61	3	3	1	0	0	36	436
Cores and blocks	75	83	4	5	33	160	5	5	0	34	6	6	4	0	1	81	502
Microburins and bladelets broken in a notch	17	15	0	0	18	34	1	0	0	13	2	0	0	0	0	1	101
Armatures	65	146	3	4	61	217	5	1	8	51	36	2	5	0	0	19	623
Outils du fonds commun	44	63	3	0	41	54	7	6	2	32	5	0	5	1	0	40	303
TOTAL	2478	6538	77	164	2944	8294	299	548	1358	3409	377	115	260	27	62	626	27576

Table 1 – Dammartin-Marpain. Number of lithic pieces by category and locus.

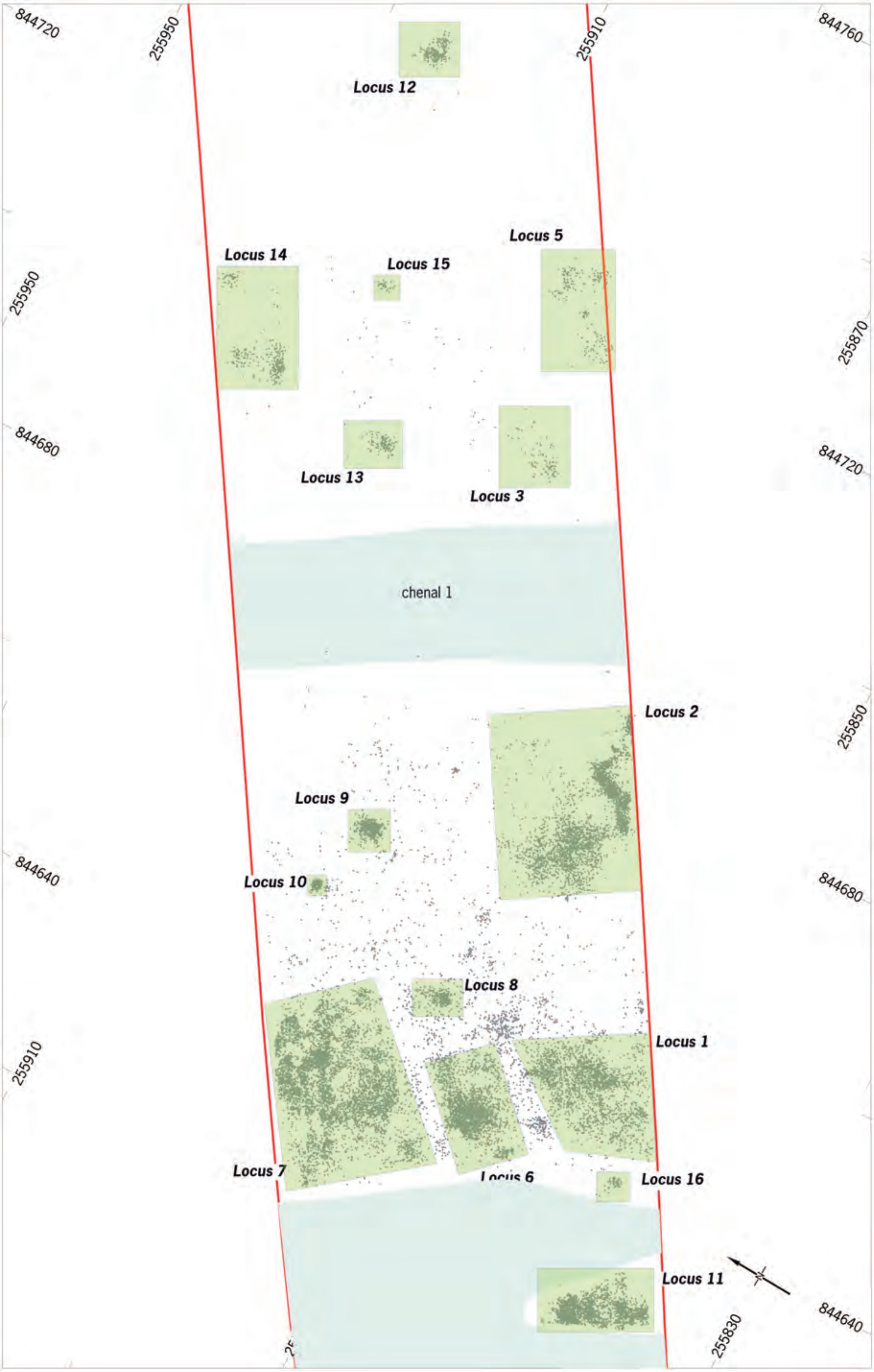

Fig. 7 – Dammartin-Marpain. Arrangement of the loci (F. Séara).

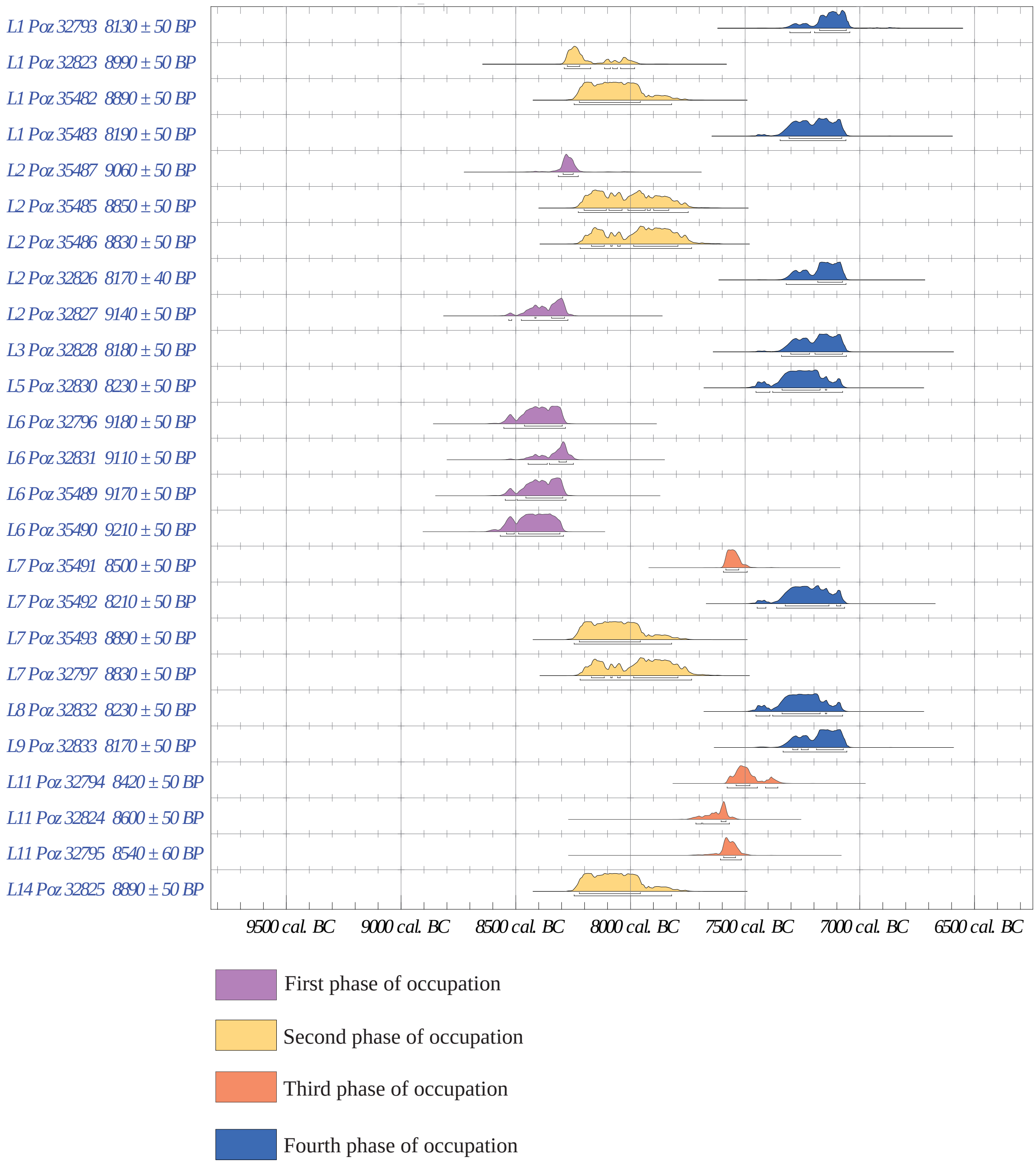

Fig. 8 – Dammartin-Marpain. Chronological framework of the occupations based on radiocarbon dates (F. Séara).

were however identified. Mapping these two major categories of raw materials (flint and chert) reveals a certain spatial integrity within this apparent hodge-podge of occupations that incorporates discrete procurement zones defined by different raw material types (fig. 11).

Debitage

Furthermore, this spatial coherence is reinforced by the existence of very clearly demarcated debitage posts (fig. 12). These sometimes very small posts, for example cluster 1, generally involve a single raw material category. Their composition exposes a general lack of bladelets, apart from cluster 2 composed of 1,220 lithic artefacts including 184 bladelets and cluster 3 containing 36 bladelets amongst 998 lithic artefacts. The 14 cores recovered from cluster 3 demonstrate a significantly more important production of bladelets that can be deduced from the number of debitage products alone and can only be explained by the transport of bladelets. This sorting and selective transport of bladelets also constitutes one of the main factors underlying the dispersion of certain knapping posts (Séara, 2008). In fact, taphonomic factors do not satisfactorily explain the coexistence of concentrated and diffuse debitage posts in a limited area and within same sedimentary context.

Cluster 3 also produced numerous refits further demonstrating the selective transport of bladelets. Amongst

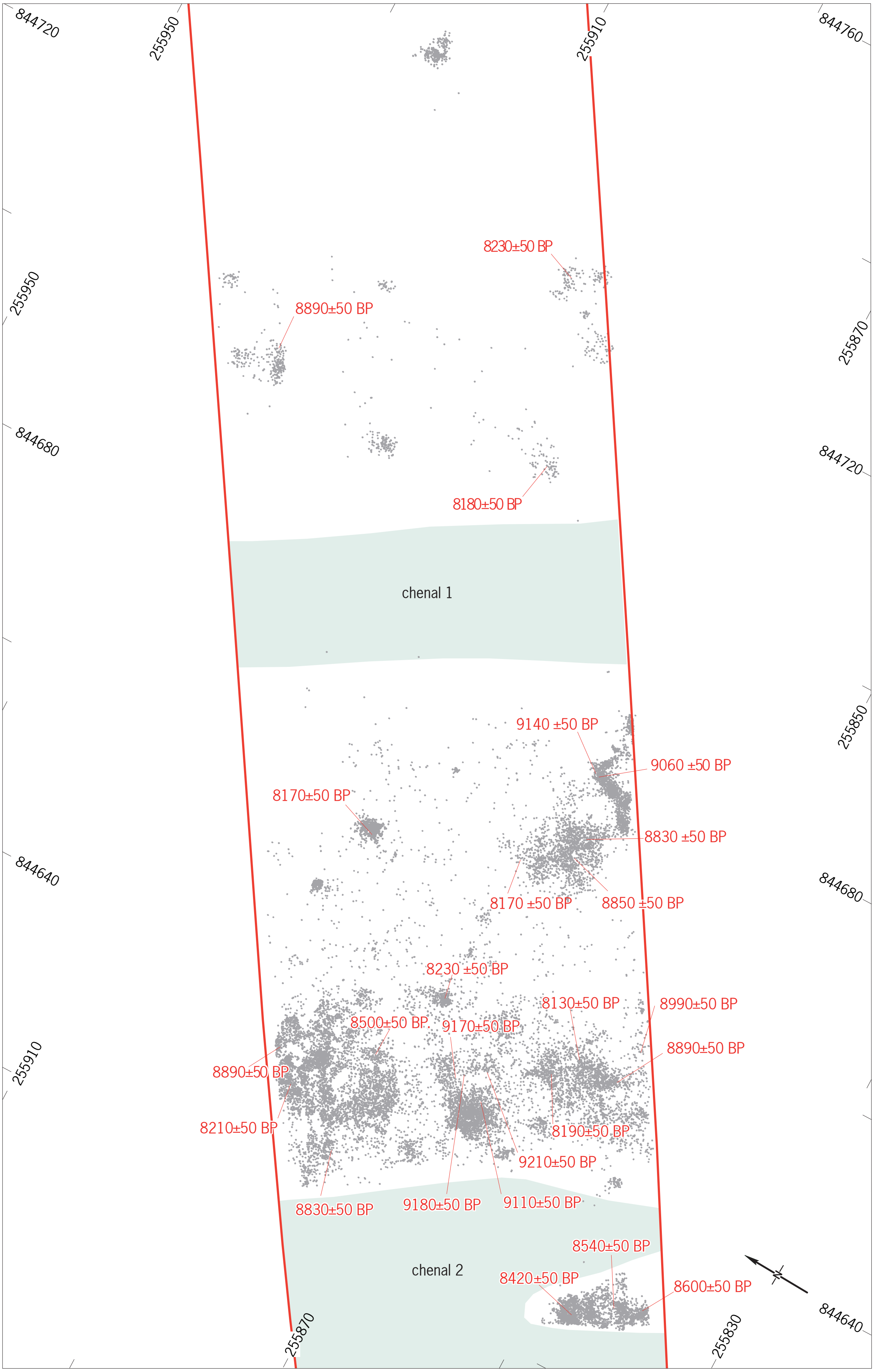

Fig. 9 – Dammartin-Marpain. Location of the radiocarbon dates (F. Séara).

the most significant elements is a small slab of flint from the Tertiary Haute-Saône Basin broken into six units along natural cleavage planes and composed of 91 different elements weighing a total of 740 grams (fig. 13). The exploitation of this block involved seven more or less intensively reduced bladelets cores. Refitting represents an essential key for understanding the activities carried out at each locus, a fact illustrated by our first very productive results.

The 500 cores demonstrate extremely varied production strategies — one or two striking platforms, *tournant* or *semi-tournants* reduction patterns. Raw material was introduced to the site as unaltered or tested blocks, very occasionally represented by small caches or simple stock piles. The majority of the cores measure between 2 and 4 cm when discarded with the negatives observable on the cores. The intense exploitation of these blocks partly explains the numerous knapping accidents apparent on the cores corresponding perfectly with the length of the unmodified bladelets. Evidence for on-site knapping also takes the form of spherical quartz cobbles and elongated cobbles used as hammers. The frequency of elongated examples could be explained by the technical advantage they afforded when used with a tangential motion. This elongated character is reflected in the fact that the majority measure between 6 and 8 cm, although examples with lengths around 12 cm are also well-represented. The greater part of the cobbles fall within the 150-200 gram weight class.

Réf. Locus	Réf. labo.	Date BP	Date cal. B.-C.
Locus 1	Poz-35482	8890 ± 50 BP	8242 - 7936
Locus 1	Poz-35483	8190 ± 50 BP	7338 - 7066
Locus 1	Poz-32793	8130 ± 50 BP	7310 - 7040
Locus 1	Poz-32823	8990 ± 50 BP	8300 - 8160
Locus 2	Poz-32826	8170 ± 40 BP	7310 - 7060
Locus 2	Poz-32827	9140 ± 50 BP	8490 - 8270
Locus 2	Poz-35485	8850 ± 50 BP	8220 - 7788
Locus 2	Poz-35486	8830 ± 50 BP	8022 - 7749
Locus 2	Poz-35487	9060 ± 50 BP	8351 - 8208
Locus 3	Poz-32828	8180 ± 50 BP	7330 - 7060
Locus 5	Poz-32830	8230 ± 50 BP	7380 - 7070
Locus 6	Poz-32796	9180 ± 50 BP	8550 - 8280
Locus 6	Poz -32831	9110 ± 50 BP	8460 - 8240
Locus 6	Poz-35489	9170 ± 50 BP	8489 - 8285
Locus 6	Poz-35490	9210 ± 50 BP	8557 - 8298
Locus 7	Poz-35491	8500 ± 50 BP	7596 - 7492
Locus 7	Poz-35492	8210 ± 50 BP	7356 - 7071
Locus 7	Poz-35493	8890 ± 50 BP	8242 - 7936
Locus 7	Poz-32797	8830 ± 50 BP	8210 - 7740
Locus 8	Poz-32832	8230 ± 50 BP	7380 - 7070
Locus 9	Poz-32833	8170 ± 50 BP	7320 - 7060
Locus 11	Poz-32794	8420 ± 50 BP	7580 - 7350
Locus 11	Poz-32824	8600 ± 50 BP	7730 - 7540
Locus 11	Poz-32795	8540 ± 60 BP	7680 - 7480
Locus 14	Poz-32825	8890 ± 50 BP	8250 - 7910

Table 2 –Dammartin-Marpain. References and results of radiocarbon dating.

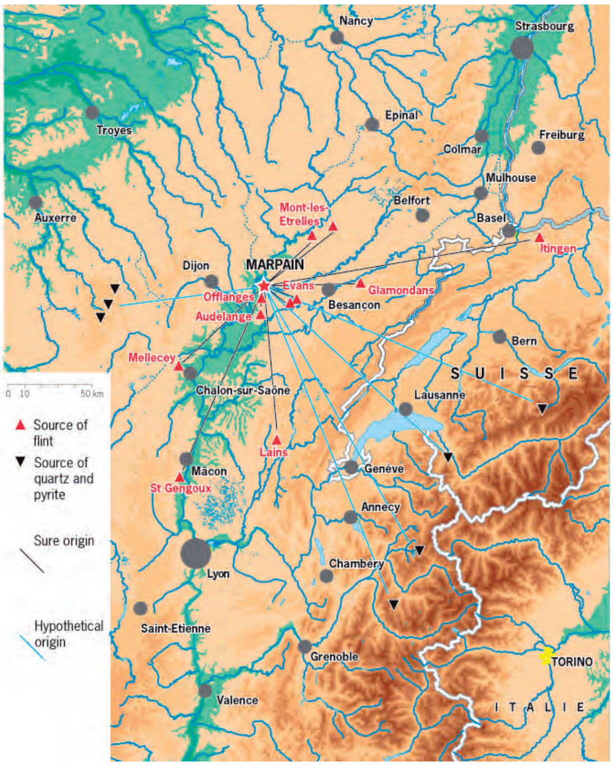

Fig. 10 – Dammartin-Marpain. Provenance of the various flints exploited on the site (J. Affolter).

The toolkit

Domestic tools

Although domestic tools are well-represented with more than 300 examples, they portray no specific character, apart from the low number of endscrapers

However, the presence of a knife with a basal notch, or 'Rouffignac knife', should be mentioned. This particular tool type is known from only a small number of sites (Dujardin, 1999 and 2009; Gouraud and Thévenin, 2000) divisible into two groups: one on the western edges of France and the other gradually emerging in the east (fig. 14). The example from Dammartin-Marpain can be compared with the one recovered from the Sauveterrian at Ruffey-sur-Seille and dated to the end of the Preboreal.

Microliths and the cultural framework

The diversity of the 620 microliths expresses an occupational diachrony which is sometimes difficult to discern based solely on typological grounds. In locus 1, crescents, well attested to it regionally from final Preboreal and early Boreal sites where they are associated with points with transversely retouched bases, portray the older character of the assemblage (fig. 15; Thévenin, 2008). On the other hand, elongated scalene triangles

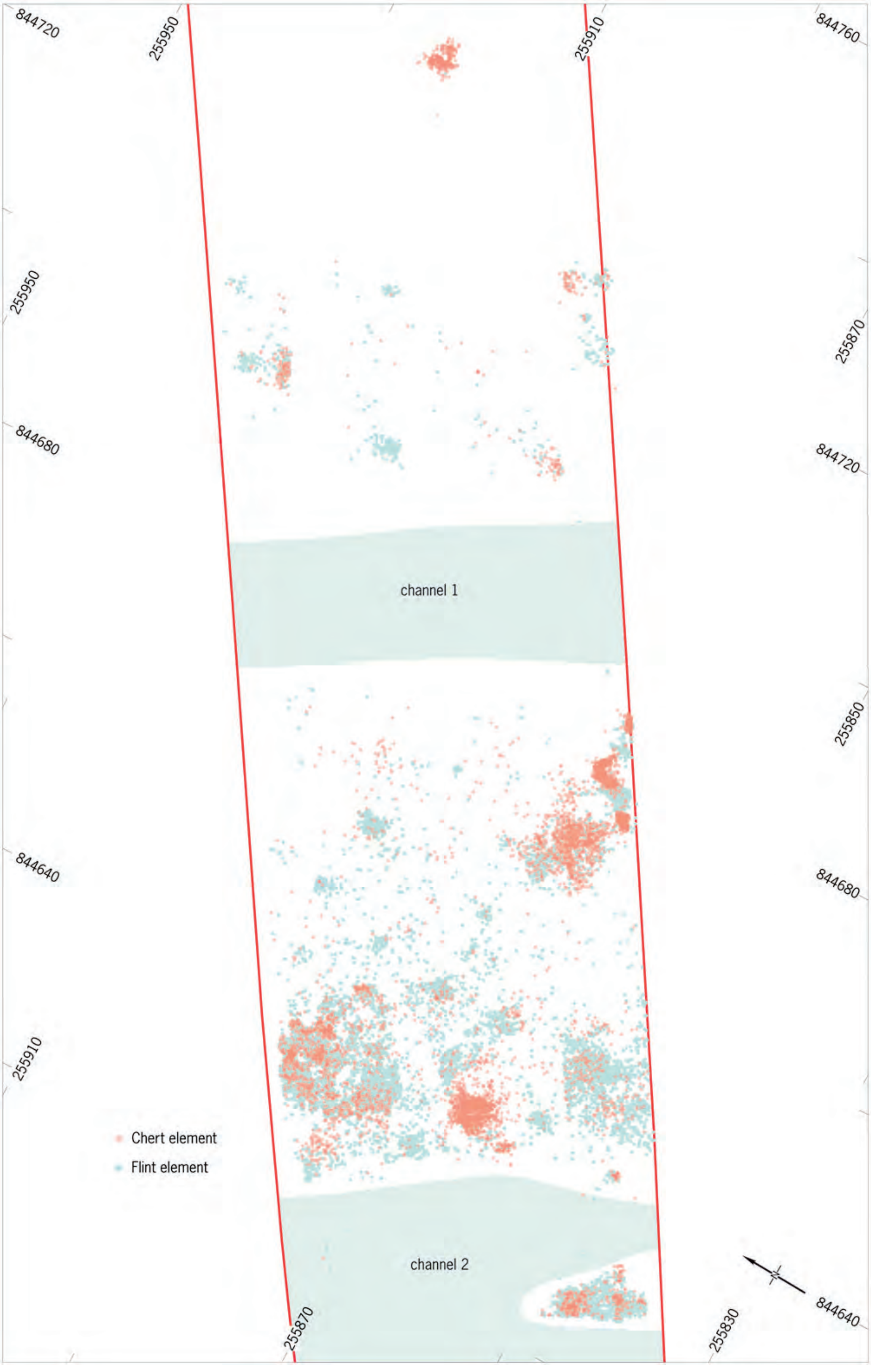

Fig. 11 – Dammartin-Marpain. Distribution of chert and flint (F. Séara).

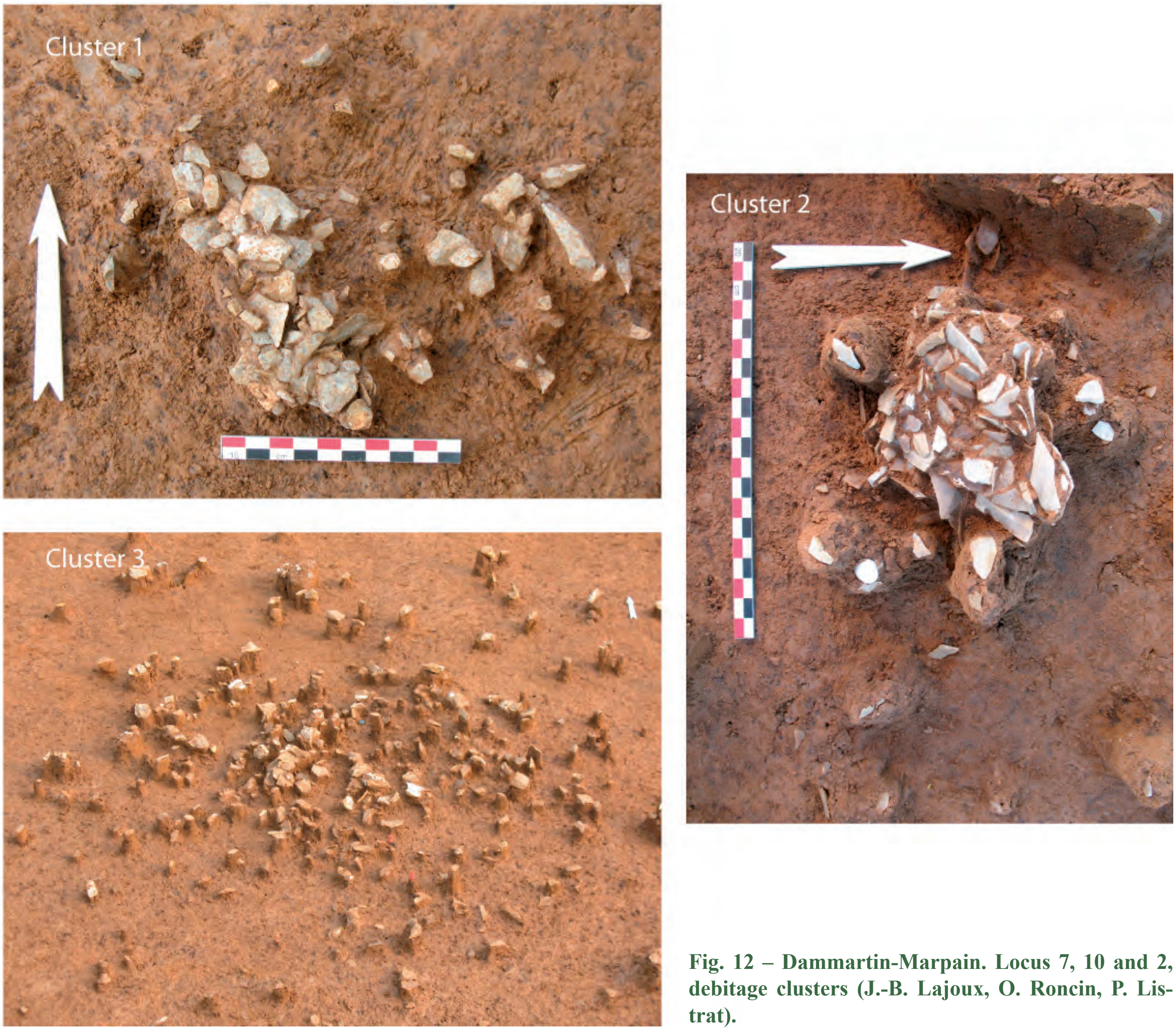

Fig. 12 – Dammartin-Marpain. Locus 7, 10 and 2, debitage clusters (J.-B. Lajoux, O. Roncin, P. Listrat).

Fig. 13 – Dammartin-Marpain. Refit composed of several bladelet cores derived from the same small slab of flint from the Tertiary Basin of the Haute-Saône (P. Haut).

seem to be more characteristic of final Boreal assemblages (Aimé, 1993).

Microliths from locus 2 demonstrate the same diachrony (fig. 16) with several relatively tapered isosceles triangles possibly correlating with the oldest dates (Séara, 2002). The presence of several crescents and points with transversely retouched bases are reminiscent of the assemblage from locus 1. Fusiform elements, similar to Sauveterre points, provide evidence of a Sauveterrian component forming at least part of the assemblage, while micro-isosceles triangles also represent a distinctive character specific to final Boreal assemblages (Pignat and Winiger, 1998; Bintz and Pelletier, 2000).

The assemblage from locus 11 shows the same characteristics with micro-isosceles and scalene triangles associated with bilaterally retouched points (fig. 17). An invasively retouched point (fig. 17, no. 25) and a scalene triangle bearing the same type of retouch are conspicuous elements of the assemblage (Gob, 1985). Furthermore, this type of retouch is equally found, although somewhat more marginally, in the assemblage from locus 7. However, these assemblages are far from comparable with

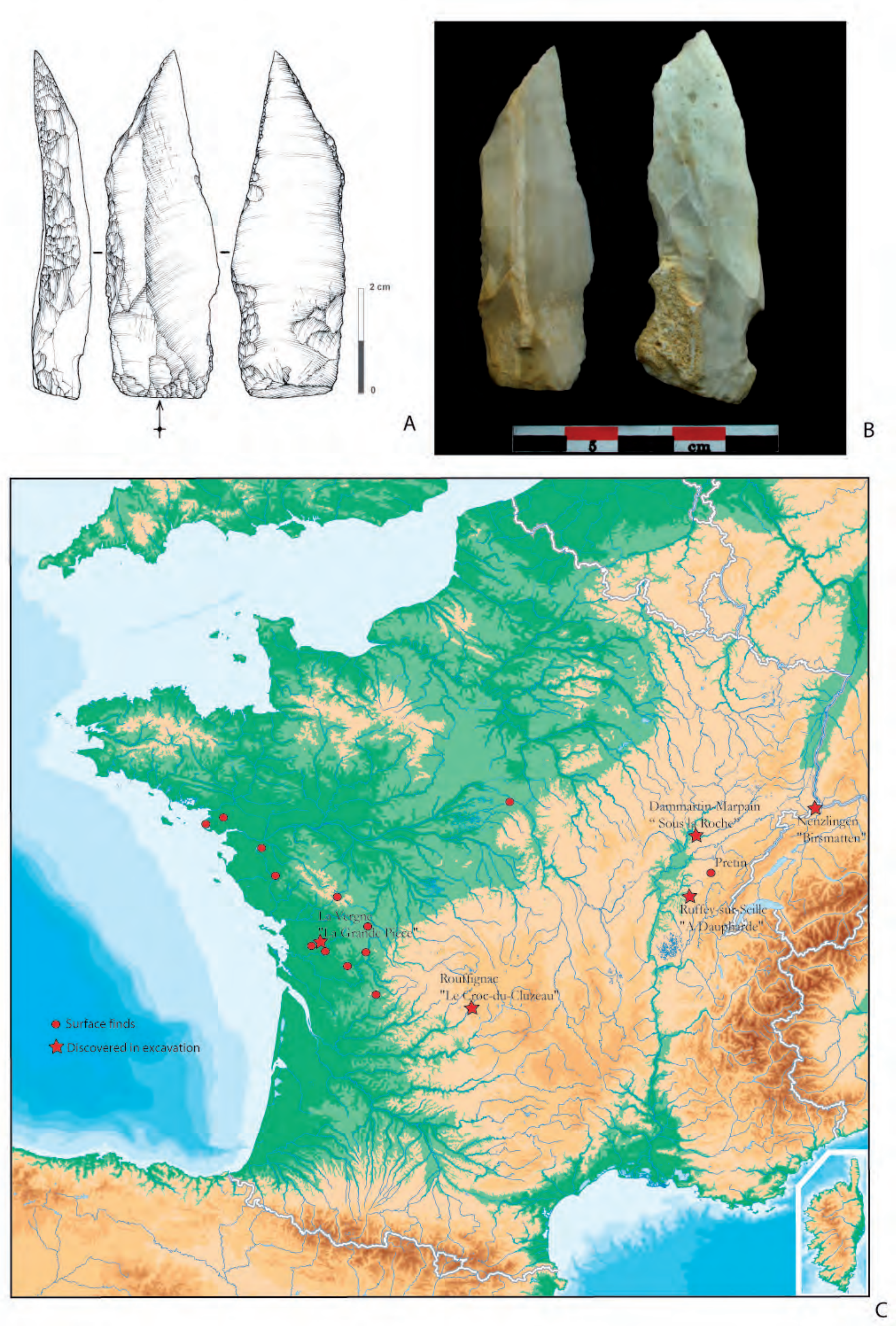

Fig. 14 – Rouffignac knives. A: Dammartin-Marpain, locus 6 (E. Boitard-Bidault); B: Dammartin-Marpain, left (photo E. Boitard-Bidault) and Ruffey-sur-Seille, right (photos P. Haut); C: Distribution of Rouffignac knives (F. Séara).

'mistletoe point' assemblages from Northern France dated to around 8200 BP (7400 to 7000 calBC). While the precise chronological context of locus 7 remains difficult to untangle, radiocarbon dates from locus 11 are more uniform, but still do not connect this assemblage to the 'mistletoe point' traditions. As a reminder, layers 6 and 7 from the site of Bavans in the Doubs, with dates 8560 ± 100 (7939 to 7367 calBC), 8190 ± 85 (7471 to 7050 calBC) and 8180 ± 80 BP (7467 to 7042 calBC), has produced a similar assemblage but with backed bladelets (Aimé, 1993). Although this data clearly needs to be treated with caution, the coherence of the assemblage from locus 11 is undeniable and it is clear that the invasively retouched components are not intrusive.

The last Mesolithic occupation of Dammartin is represented by an industry composed of Montbani bladelets associated with the microburin technique which is practically absent from the Preboreal/Boreal Mesolithic occupations at the site. Trapezes, for the most part asymmetrical, are generally very small and associated with darts with concave bases, as well as two 'Bavans points'. This combination demonstrates that at least part of the assemblages can be attributed to the Final Mesolithic (fig. 18; Perrin, 2002; Perrin et al., 2010). Based on available information, it is difficult to be certain about the clear association of trapezes with 'evolved' microliths. It is equally possible that the Late/Final Mesolithic is represented by several phases of occupation.

Grooved cobbles and polishers

Particular attention should be paid to the elongated cobbles, especially those with flat surfaces, given their frequency at certain Mesolithic sites. All the occupation phases from Ruffey-sur-Seille, apart from those assigned to the Late Mesolithic, produced several examples with only one from the early level bearing traces of use — striations, a worn face and traces of crushing on a corner. We have previously suggested that these objects could be connected to fracturing bladelets supported on the most acute angle formed between an edge and the flat surface of these objects. (Séara et al., 2002). Recent work by Sylvain Griselin (this volume) on prismatic sandstone tools with a flat surface delimited by edges with sharp angles also connected this type of sandstone object to the fracturing of bladelets (Griselin et al., 2009). While this type of function can be envisaged for several objects from Dammartin, it is likely that these cobbles served multiple purposes.

Sandstone is also well-represented on the site; however elements bearing traces of use are rare. Two small grooved polishers suggest a very particular type of use probably connected to the abrasive properties of this material. The first example is made from a small block of fine sandstone (fig. 19, no. 1), measuring 40 mm by 28 mm by 14 mm, and comes from locus 1. The second slightly curved example (56 mm by 50 mm by 20 mm) was made from significantly less granular sandstone and bears a much deeper groove than the previous example (fig. 19, no. 2). The flat surface presents fairly pronounced traces of use and poses questions as to whether this flattening can be connected to the use of the object or results from a compulsory preparation prior to use.

The cobbles, sandstone blocks, as well as at least one polisher were generally found interspersed with the archaeological material. However, three other isolated elements made from different materials could be considered as a cache - a block of slightly heat-altered ferruginous sandstone on which lay an elongated cobble of an indeterminate greenstone, as well as a sandstone polisher with a curved groove (fig. 19, no. 3). This association poses questions as to the nature of this grouping (reserves or abandoned objects), as well as a possible functional complementarity between the different components.

SPATIAL STRUCTURE

Hearths

This type of feature, although normally well-represented on this type of site, could only be clearly identified in locus 11. The predominately clayey soil preserved thermal alterations in the form of rubified sediments (Sergent et al., 2006). This evidence, coupled with traces of charcoal and several burnt elements, indicates the existence of essentially simple flat hearths. The small number of heated stones from locus 11 attests to the almost exclusive use of this type of hearth often found on Mesolithic occupations. Only a single example takes the form of an indistinct and irregular ring of heated cobbles.

In the sandier sectors, two hearths could be distinguished based on concentrations of significant numbers of burnt hazelnut shells (fig. 20). The first (locus 8) is dated to 8230 ± 50 BP (7380 to 7070 calBC) [Poz-32832] and the second (locus 9) to 8170 ± 50 BP (7320 to 7060 calBC) [Poz-32833]. The distinctiveness of these hearths is linked to their marginal position on the site and the under-representation of lithic artefacts. Similar cases are known from Germany at the site of Duvensee-Wohnplatz 13 and the recently excavated site of Siebenlinden-Horizon IV (Bockelmann, 1986; Kind and Beutelspacher, 2009; Kind, this volume). The presence of large numbers of hazelnuts clearly highlights the interest of this resource for Mesolithic groups. These concentrations could simply represent areas where fire cracked fruits were consumed after having being roasted on embers at the edges of a hearth.

Spatial analysis

Given the small size of the study area a focused spatial analysis was decided upon (Kind, 2003 and 2006; Crombé et al., 2006; Séara, 2008). Questions concerning the internal chronology of the loci aside, several very general patterns can already be noted.

Locus 2 shows the coexistence of a uniform area of material alongside a partially excavated sector composed

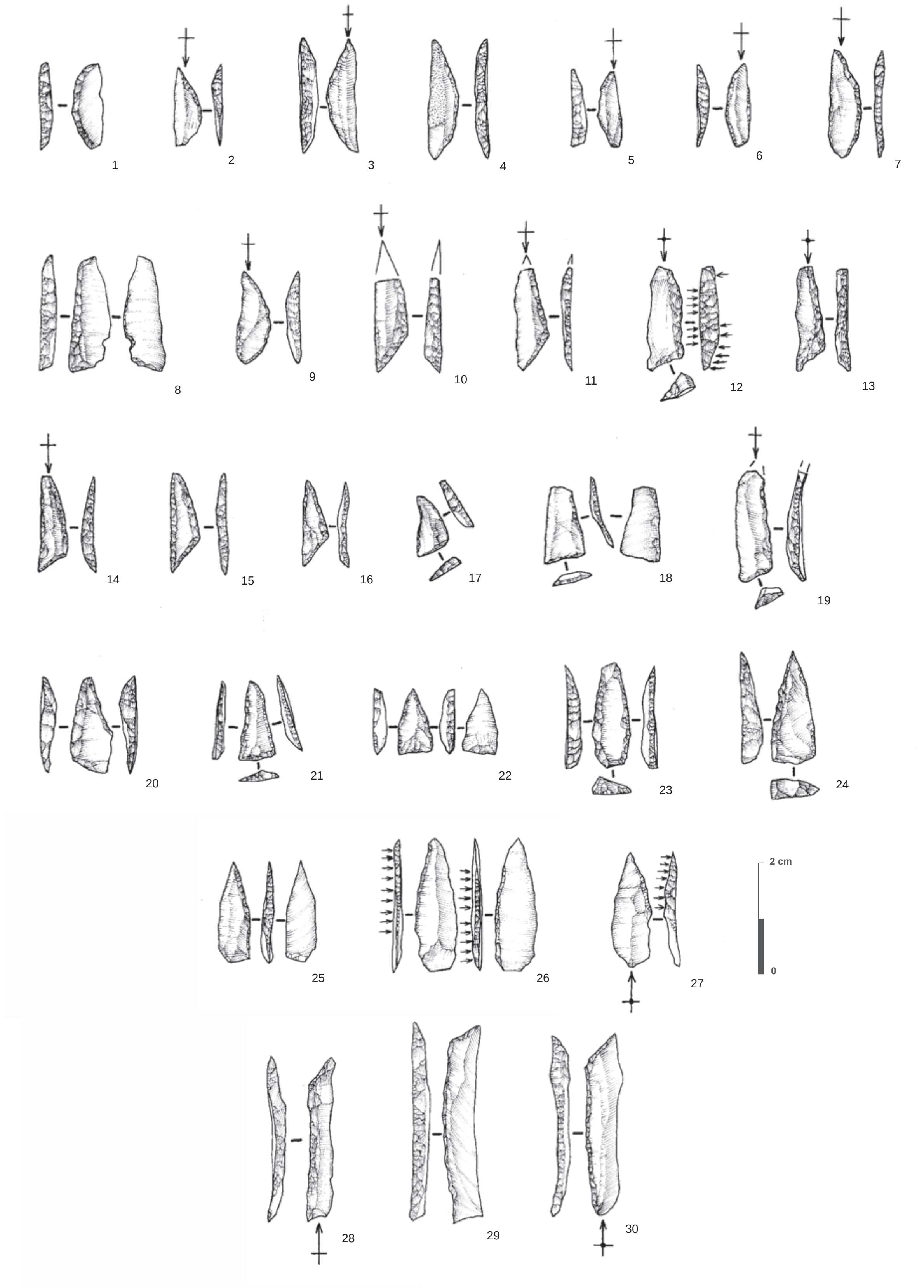

Fig. 15 – Dammartin-Marpain. Locus 1: microliths. 1-7 and 9: crescents; 8: indeterminate microlith; 10-17: scalene triangles; 18, 19, 28-30: scalene bladelets; 20-25: points with transversely retouched bases; 26-27: points with unretouched bases (E. Boitard-Bidault).

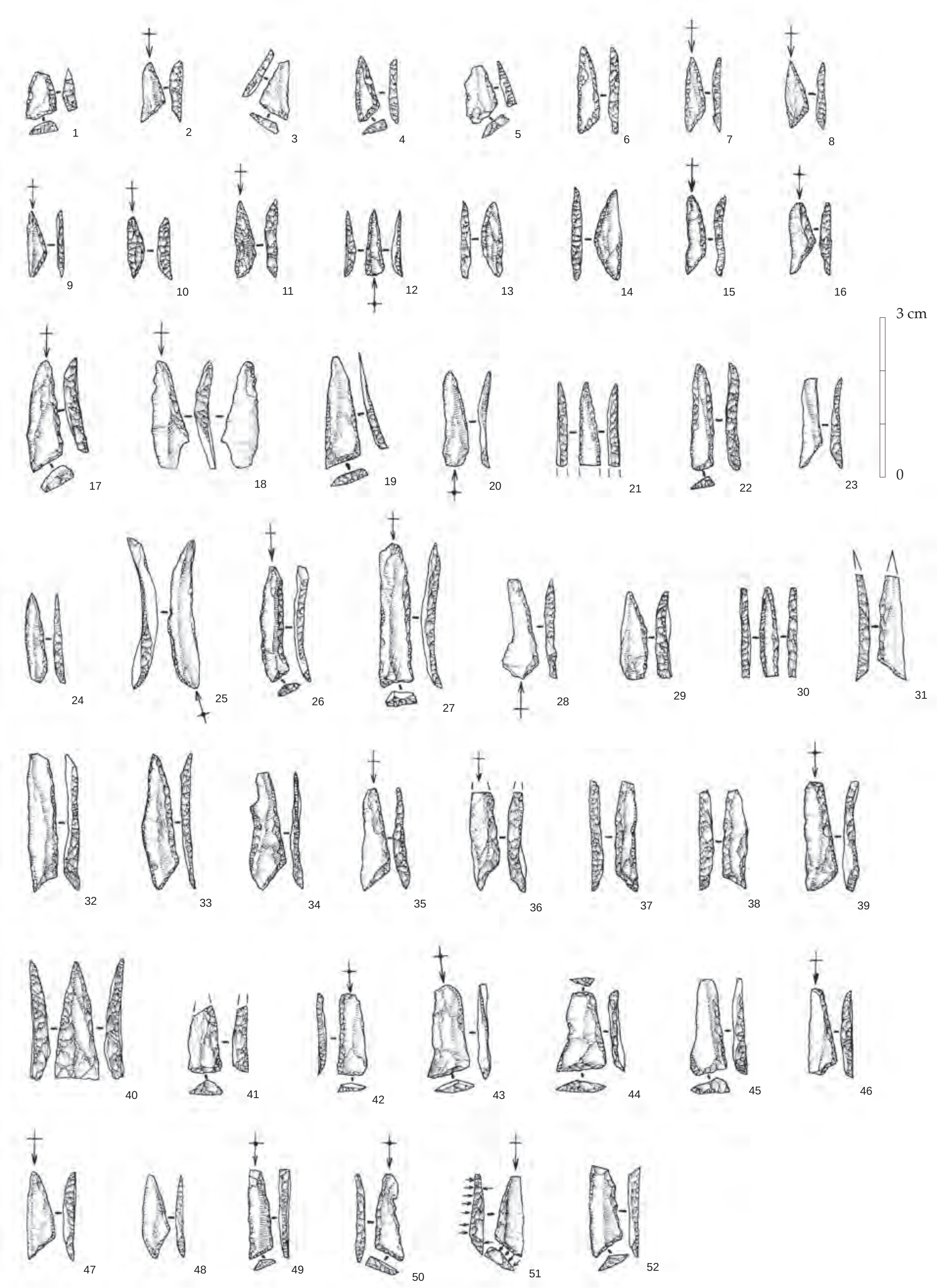

Fig. 16 – Dammartin-Marpain. Locus 7: microliths. 1: micro-scalene; 2-9, 15-17, 19, 31, 33-38, 46, 51: scalene triangles; 10, 11, 20, 21, 25: indeterminate microliths; 13-14: crescents; 18: point with an unretouched base; 22, 26, 27, 32 : scalene bladelets; 23, 39, 42-46, 52: blunted scalene triangles; 24, 30: Sauveterre points; 40-41: points with transversely retouched bases (E. Boitard-Bidault).

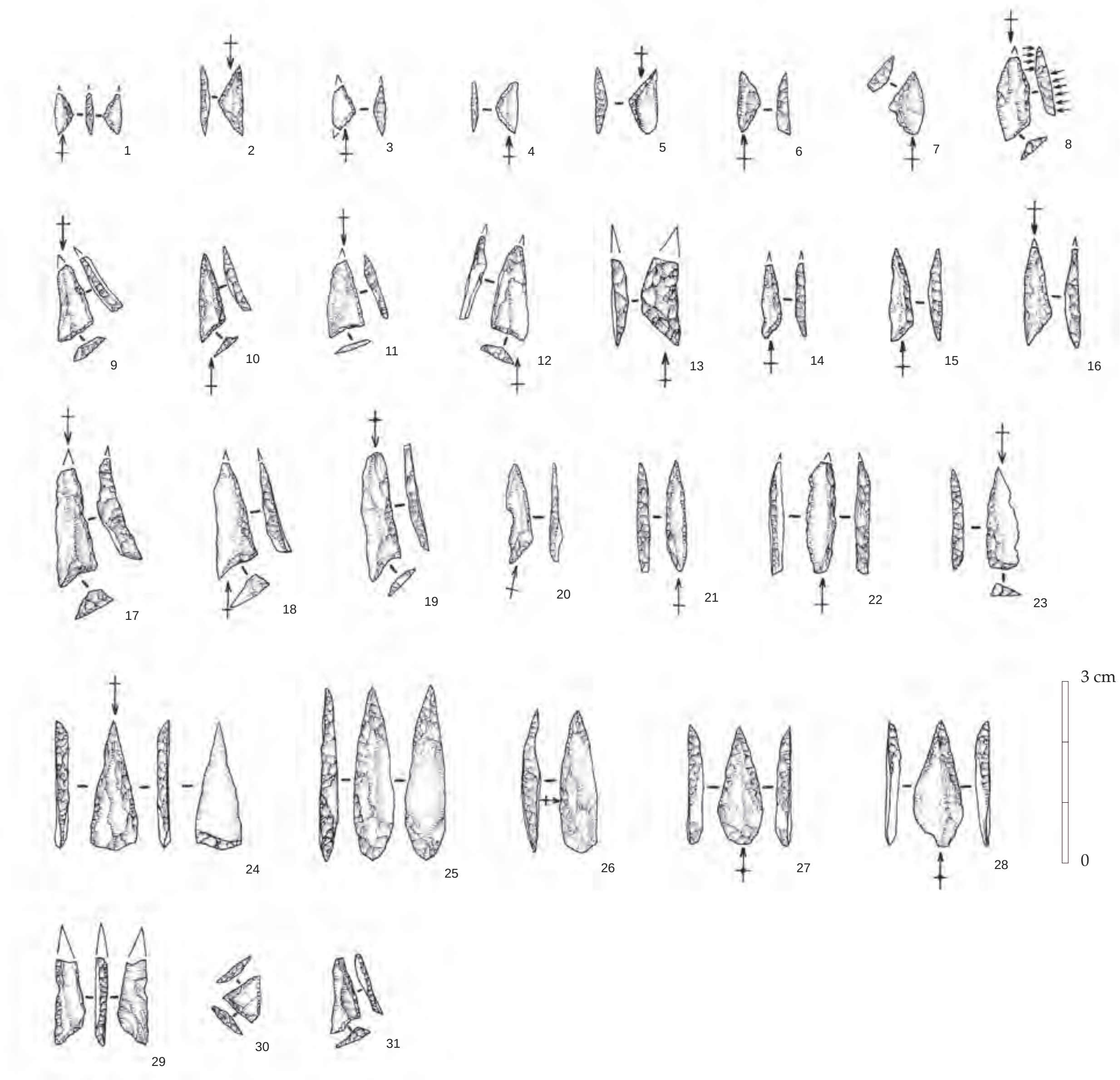

Fig. 17 – Dammartin-Marpain. Locus 11: microliths. 1-7, 30: micro-isosceles; 8-20, 29, 31: scalene triangles; 21: Sauveterre point; 22: Sauveterre point?; 23-24: points with transversely retouched bases; 25: point with invasively retouched and ogival base; 26: point with unilateral retouch; 27-28: points with bilateral retouch (E. Boitard-Bidault).

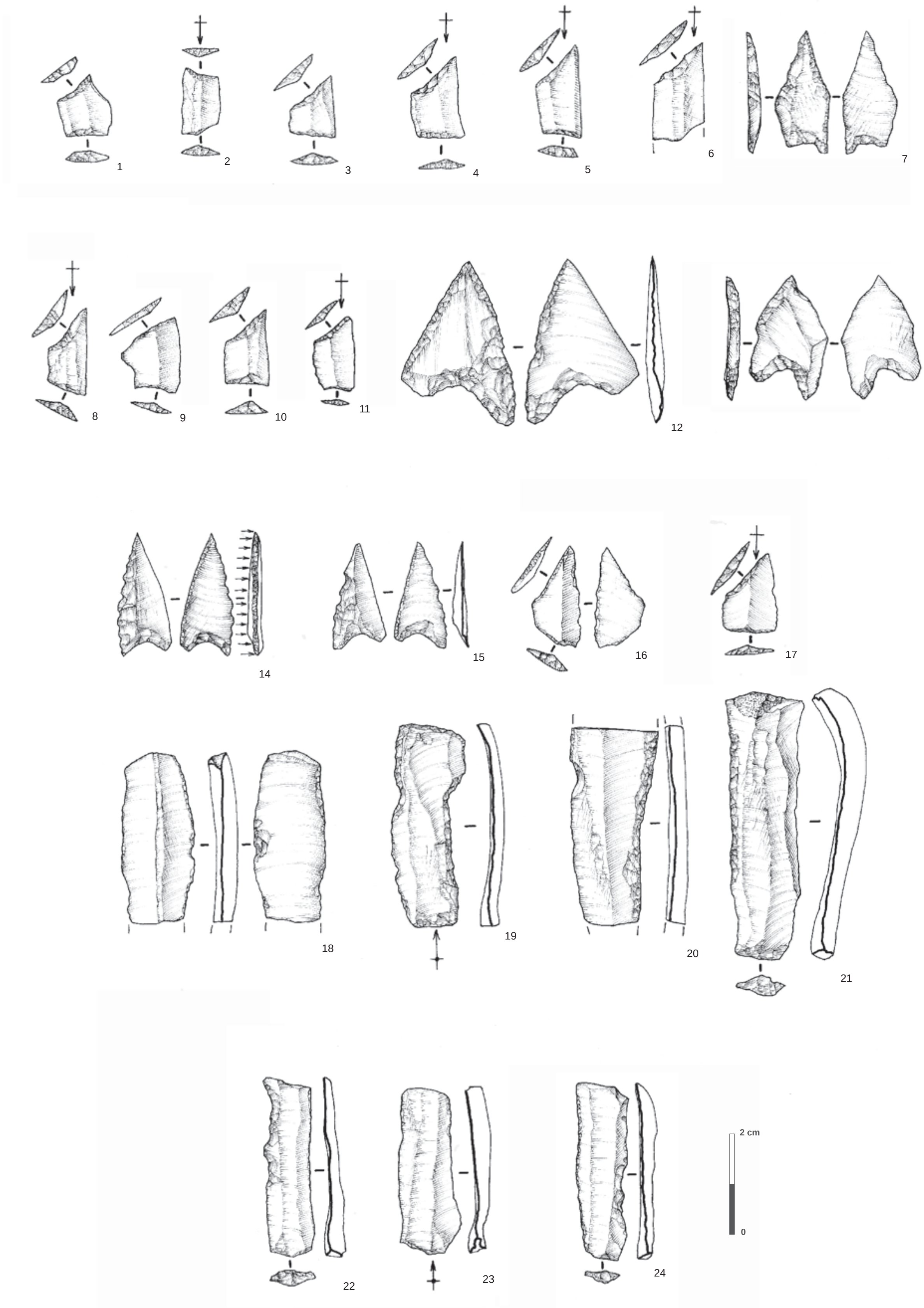

Fig. 18 – Dammartin-Marpain. Locus 1, 6, 7, 14 and removal of top soil: microliths. 1 and 2: locus 6, symmetric trapezes; 3-5 and 8: locus 6, asymmetric trapezes; 6: locus 6, fragment of a trapeze; 7: locus 6, dart with a concave base; 9: locus 7, symmetric trapezes; 10 and 11: locus 7, asymmetric trapezes; 12: locus 7, dart with a concave base; 13: removal of top soil, dart with a concave base; 14 and 15: locus 1, Bavans points; 16 and 17: locus 1, trapezes; 18-21: locus 1, Montbani bladelets; 22-24: locus 14, Montbani bladelets (E. Boitard-Bidault).

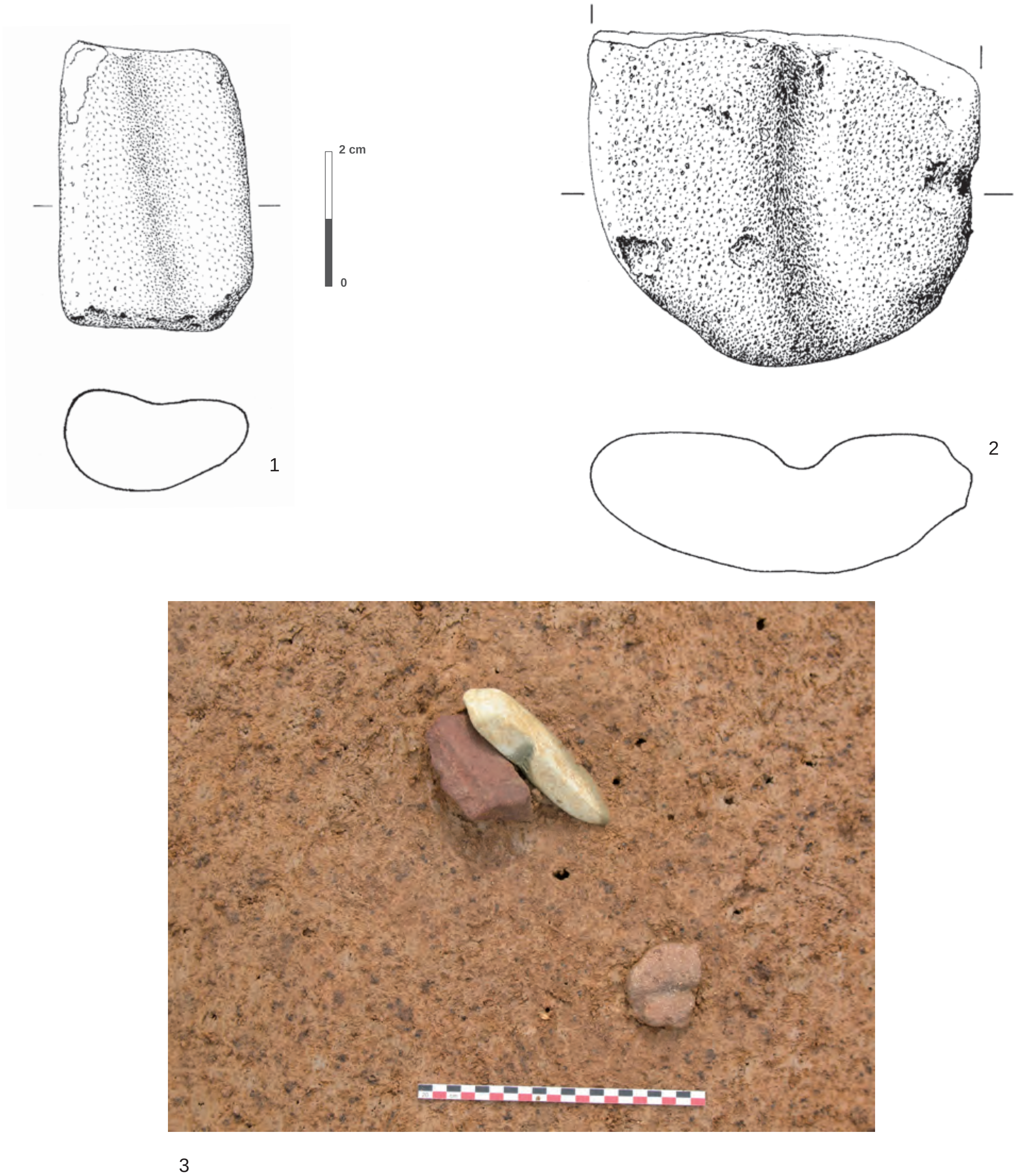

Fig. 19 – Dammartin-Marpain. 1: locus 1, grooved sandstone polisher; 2: locus 8, grooved sandstone polisher associated with the above deposit (J. Gelot); 3: deposit containing a greenstone cobble, a block of sandstone and a grooved polisher (F. Séara).

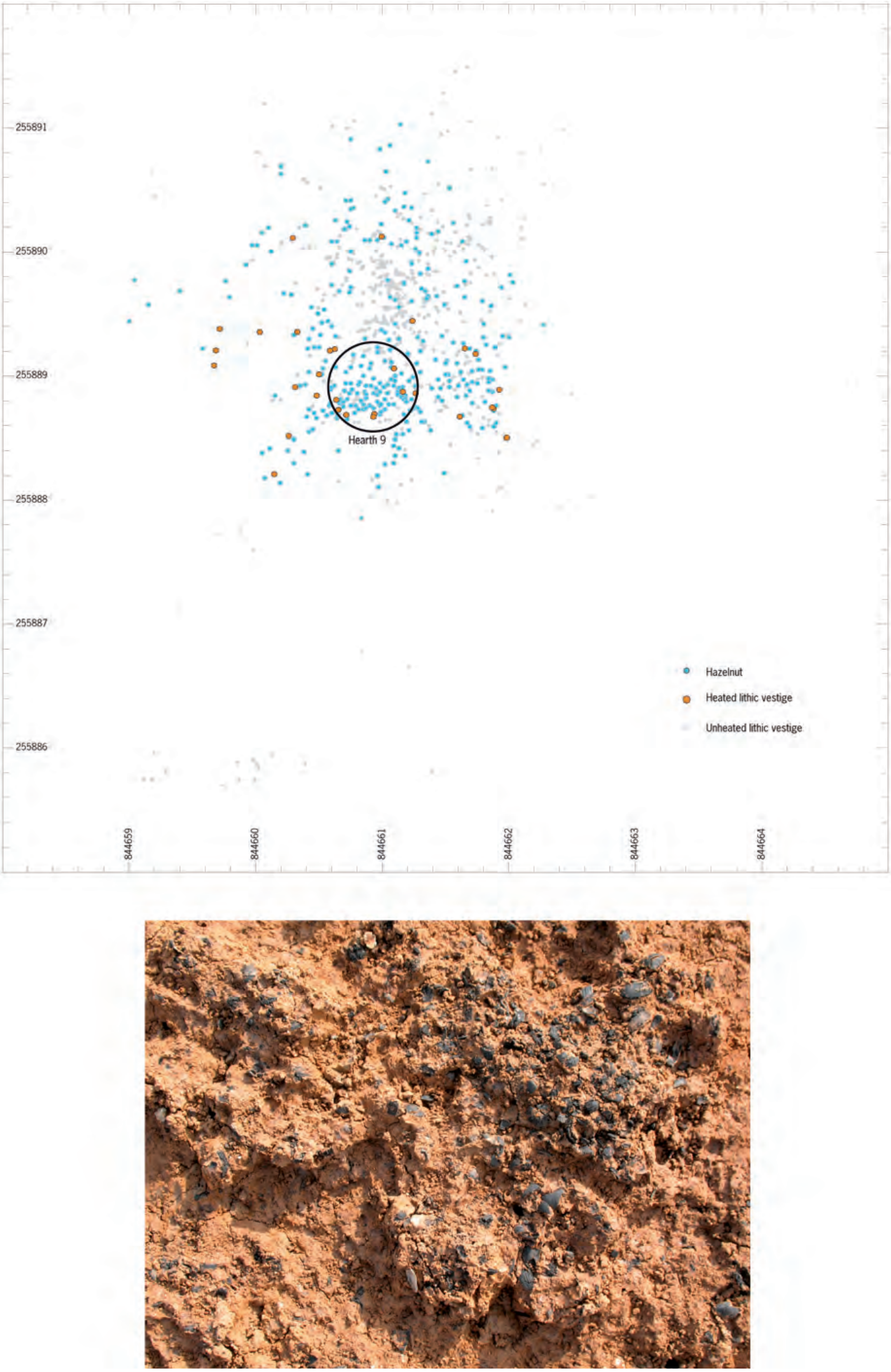

Fig. 20 – Dammartin-Marpain. Locus 8: distribution of burnt hazelnut shells outlining the location of a hearth (V. Merle, O. Roncin) and a more detailed view of a dense concentration of large remains (F. Séara).

of knapping zones possibly associated with a hearth at the immediate limits of the exposed area (fig. 21). The near total absence of preserved faunal remains renders even the zones apparently devoid of material difficult to interpret and provides only a partial picture of the original spatial organisation.

The spatial distribution of debitage products by type for the densest locus 7 does not reveal any particular patterns. In fact, bladelets and cores are uniformly spread across the entire surface. Despite important chronological differences implied by the associated radiocarbon dates, the existence of debitage clusters suggests the commixture of different industries to be relatively limited. Refitting may represent a means for not only isolating the different occupations, but also defining their composition and spatial distribution (fig. 22). It should be noted that the most substantial cluster 7.3 is very similar to the large cluster from locus 2 (numerous cores, small numbers of bladelets and significantly diffuse remains). Although the distribution of microliths in locus 7 is no more distinct, they are centred around two large zones.

To conclude this very general overview, locus 12 represents a well-defined occupation zone with a fairly average density of material (fig. 24). Its spatial configuration was the easiest to establish and is similar in many respects to one of those documented at Ruffey-sur-Seille. This configuration corresponds to what we have previously referred to as 'simple activity units' (Séara, 2000, 2006 and 2008).

CONCLUSION

The numerous results of this phase of the study open new perspectives for the site of Dammartin-Marpain. This new data provides additional information regarding a pronounced regional chronological hiatus at the second half of the Boreal, previously documented only from the site of Bavans (Aimé, 1993; Thévenin, 1990 and 1991). Despite the less reliable chronological framework for both the beginning and the end of the Mesolithic, certain cultural influences are more easily perceptible and are probably connected to the fact that the Franche-Comté region witnessed complex demographic phenomenon linked to its position as a geo-

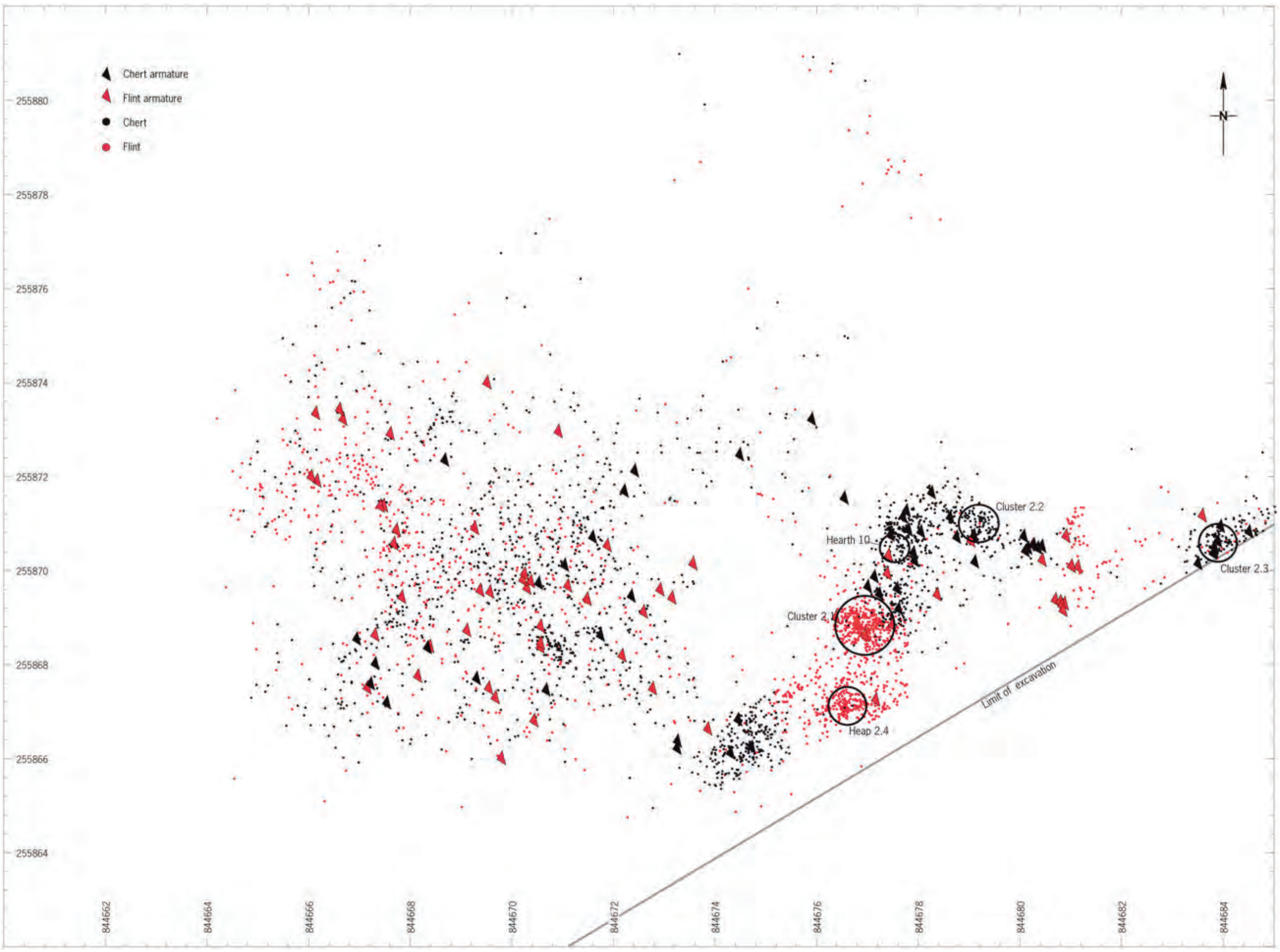

Fig. 21 – Dammartin-Marpain. Locus 2: spatial distribution of lithic remains and microliths by major raw material categories (V. Merle, O. Roncin).

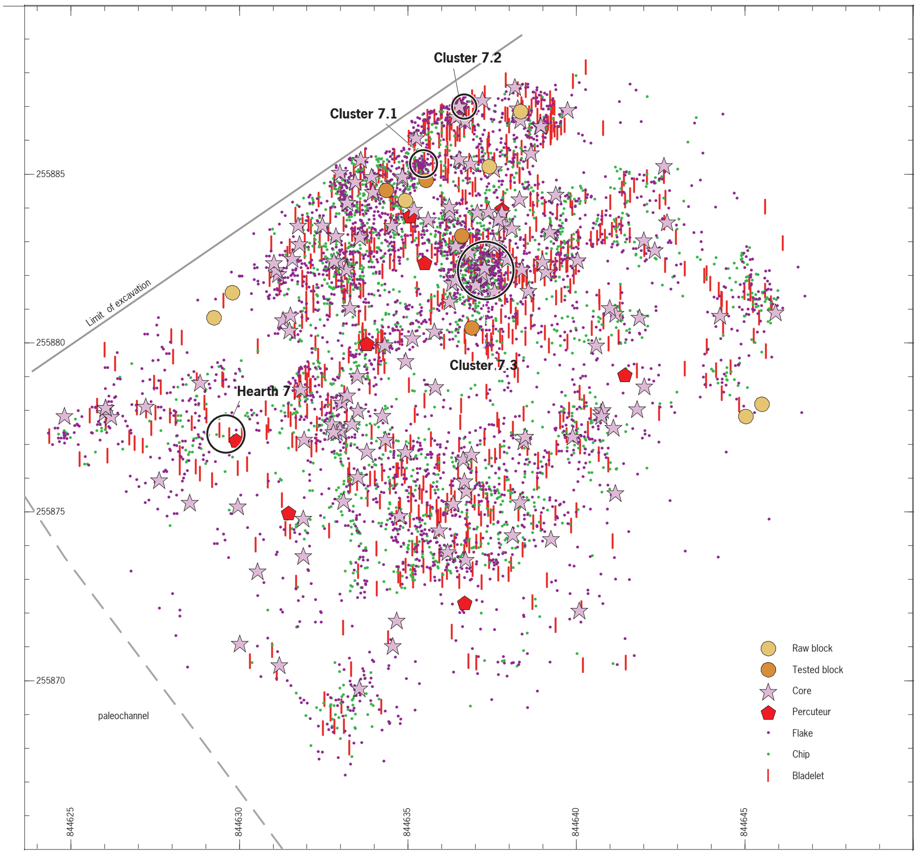

Fig. 22 – Dammartin-Marpain. Locus 7: spatial distribution of the major categories of debitage products (V. Merle, O. Roncin).

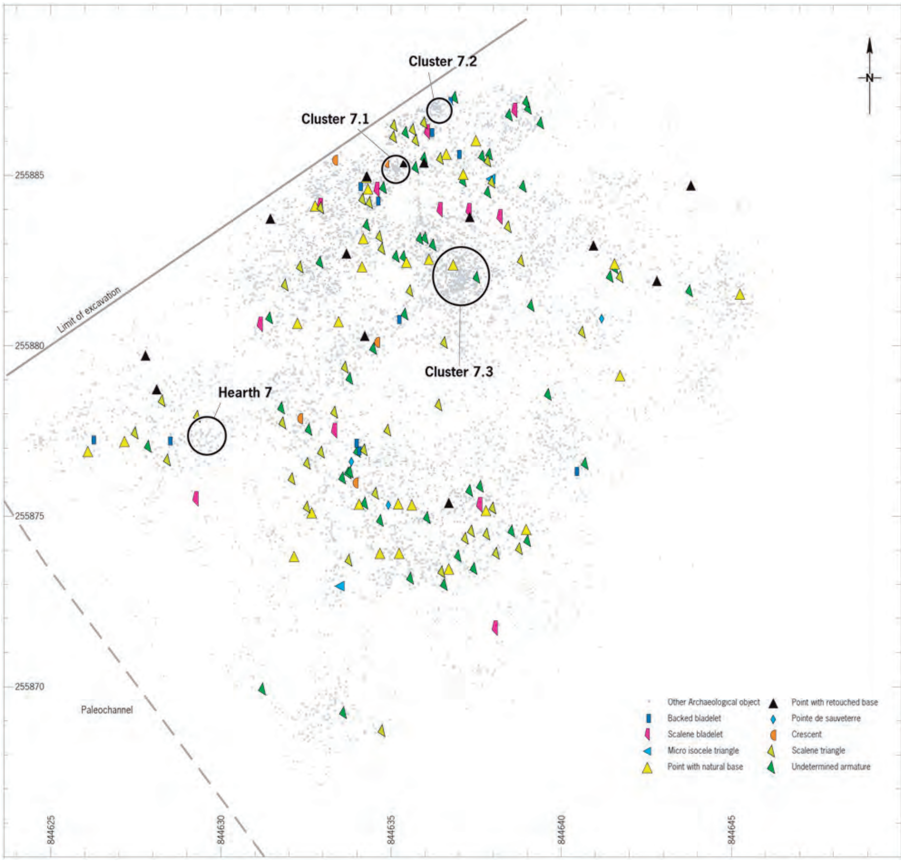

Fig. 23 – Dammartin-Marpain. Locus 7: spatial distribution of microliths by type (V. Merle, O. Roncin).

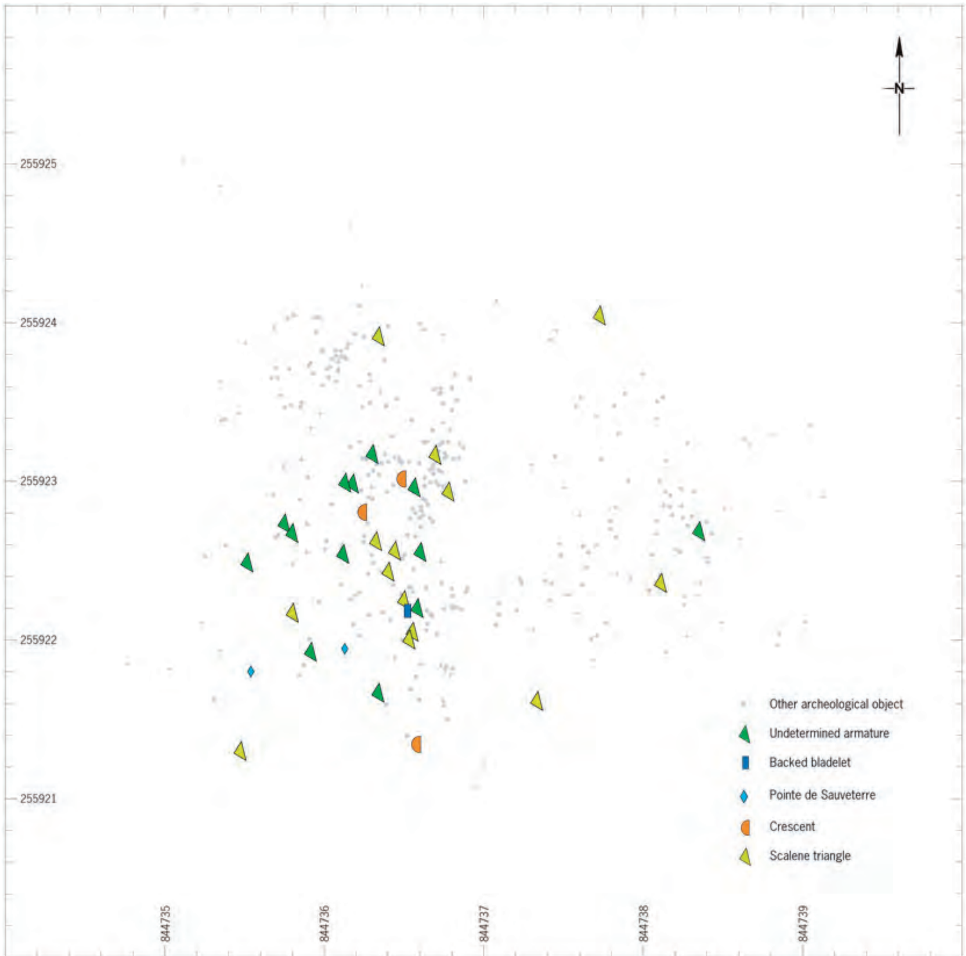

Fig. 24 – Dammartin-Marpain. Locus 12: spatial distribution of microliths by type (V. Merle, O. Roncin).

graphic cross-road (Thévenin, 1995). Until recently the Beuronian was considered as the principal regional culture, however new evidence demonstrates a much larger Sauveterrian territory than previously envisaged. It is present at Ruffey-sur-Seille (Séara et al., dir., 2002) from the end of the Preboreal and continues throughout the Boreal, however the situation becomes less clear from the middle Boreal onwards where the Sauveterrian takes on particular form. The matter is complicated by the lack of comparable assemblages in the region, but especially hindered by inadequate theoretical considerations in terms of available datas. Finally, the appearance of particular elements such as micro-isosceles triangles and occasional pieces with invasive retouch should not be neglected when adding further detail to this still very general chrono-cultural framework.

The context of the site and the general configuration of the occupations at Dammartin-Marpain are similar to those frequently identified from other valley floor sites, namely large floodplain areas occupied over very long periods, but without a sustained frequentation. This character is reflected in the maintenance of the same type of territorial exploitation throughout most of the Mesolithic with valley floors ecosystems playing an important role (Ducrocq, 2001; Séara et al., 2002 and, 2008; Kind, 2003 and 2006, Fagnart et al., 2008).

Although it is still necessary to further clarify the exact role and function of these occupations, the density of material together with the weak spatial structure seems to reflect short occupations probably connected to high group mobility. The valley floor site of Ruffey-sur-Seille presents a slightly different case with the clear spatial and chronological separation of the different zones suggesting that generalised occupation patterns are only partially transferable to other sites. These different occupations were adapted to both environmental variability and the role played by valley floors in the settlement system.

The site of Dammartin-Marpain has enormous potential for addressing numerous regional and extra-regional questions. To this end, we have emphasised approaches that are still in their early phases, such as a functional analysis of stone tools which clearly has a significant role to play for the study and interpretation of this type of occupation (Crombé et al., 2001; Claud in Séara and Roncin, 2010).

The existence of occupation types specific to valley floors remains difficult to address given the lack of comparable data from other contexts. A more detailed characterisation of these floodplain sites, including the continuation of the promising studies already begun at Dammartin, is necessary before we can hope to answer this question.

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Microliths from 62 rue Henry-Farman, Paris (15th arrondissement): specific arrows for different types of game hunted in particular places?

Lorène Chesnaux

Abstract: This chapter presents a functional analysis of Beuronian microliths from the site of 62 rue Henry-Farman in the 15th arrondissement of Paris. The combination of use-wear and experimentation brings to light an unexpected spatio-temporal separation of hunting related activities. Points, just like triangles and crescents, were manufactured on-site and abandoned before being used. Whereas triangles and crescents, employed as barbs or point-barbs, were reintroduced into the assemblage within carcasses, 80% of which were wild boar.

This study, financed by the 'Collective Research Project' *The Final Palaeolithic and Mesolithic in the Paris Basin and its margins. Habitats, societies and environments* (dir. B. Valentin), forms part of a multidisciplinary project investigating Mesolithic occupations belonging to the Boreal period at Paris, 62 rue Henry-Farman led by Bénédicte Souffi (Souffi and Marti, 2011).

We have attempted to document the technical variability of microliths from loci 1, 2, 3 and 5 by reconstructing the final stage of their *chaînes opératoires*. These results are then integrated within a broader consideration of weapon maintenance and manufacture at Farman and their palethnographic implications.

THE FARMAN MICROLITHIC ASSEMBLAGE: NEW TYPOLOGICAL PROPOSITIONS

The analysis of 279 microliths revealed a certain variability in the way that the desired form is obtained by retouch, i.e. different shaping modes of the functioning parts.

An examination of these different modes, i.e. the shaping of the microlith's functioning part, either a type of point (all extremities having acute angles) or a cutting edge, alternatively a combination of the two, provides insights into their intended uses (Christensen and Valentin, 2004; Valentin, 2005 and 2008; Marder et al., 2006; Chesnaux, in prep.). Points may serve as the leading tip of the projectile, enabling its penetration and retention in prey, or serve as side elements, facilitating their insertion along the shaft.

The classification of microliths by their functioning parts (active or hafted) overcomes problems of traditional typologies that often rely on subjective criteria based on the general form of microliths (e.g. GEEM, 1969).

Combining the two major categories of functioning parts at Farman, points (defined as all extremities with acute angles) and cutting edges, resulted in the recognition of four different morpho-technical types (fig. 1). This identification enabled the development and testing of hypotheses concerning the role of certain forms – axial points, point-barbs or barbs — and their hafting modes — axial, disto-lateral or lateral (fig. 2):

– *Type 1*, Axial-points (and cutting edge): these are obliquely truncated points and certain points with transversely retouched bases in the traditional typology. The

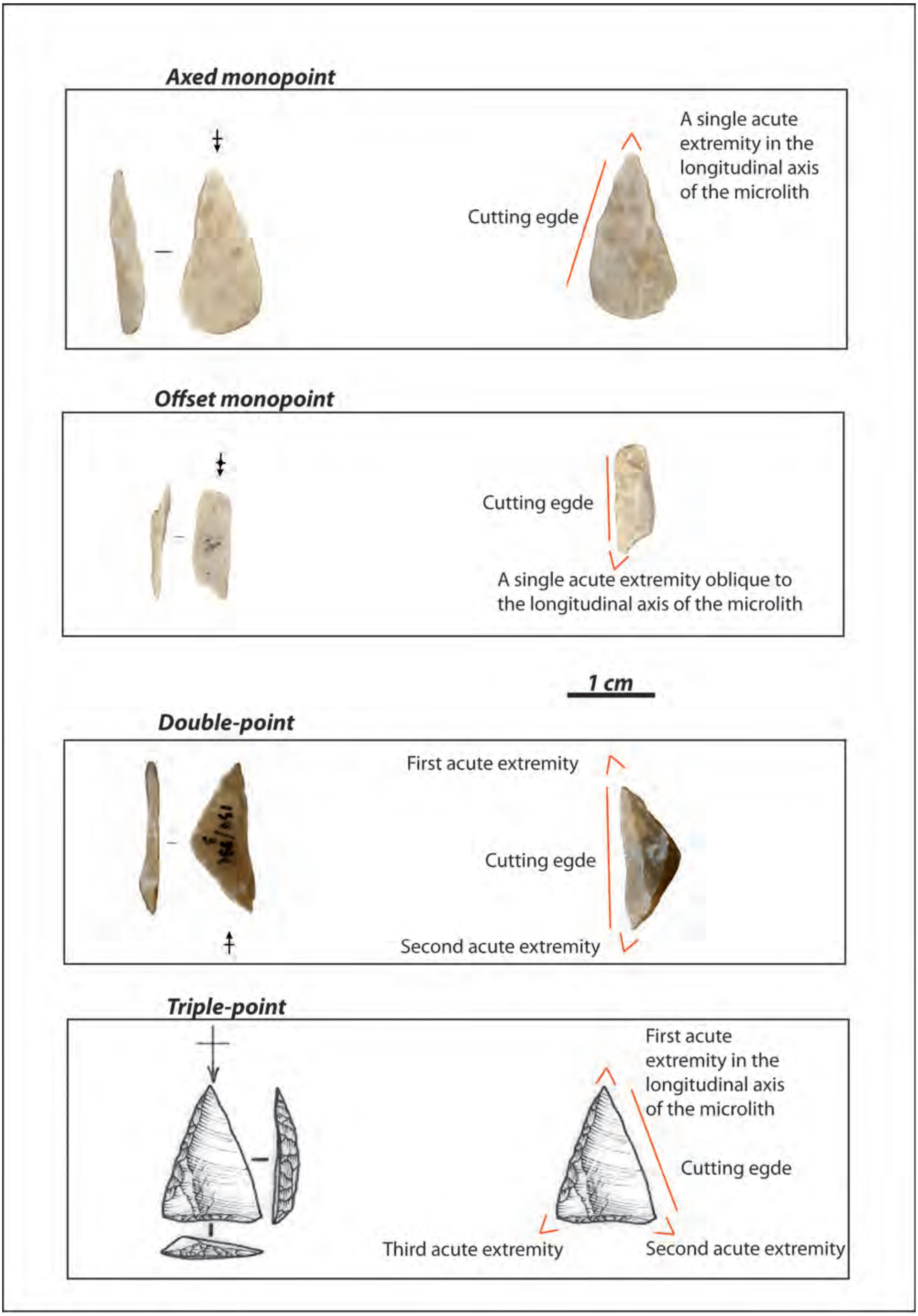

Fig. 1 – 62 rue Henry-Farman, Paris. Microlith typology based on shaping by retouch (drawings by E. Boitard-Bidaut).

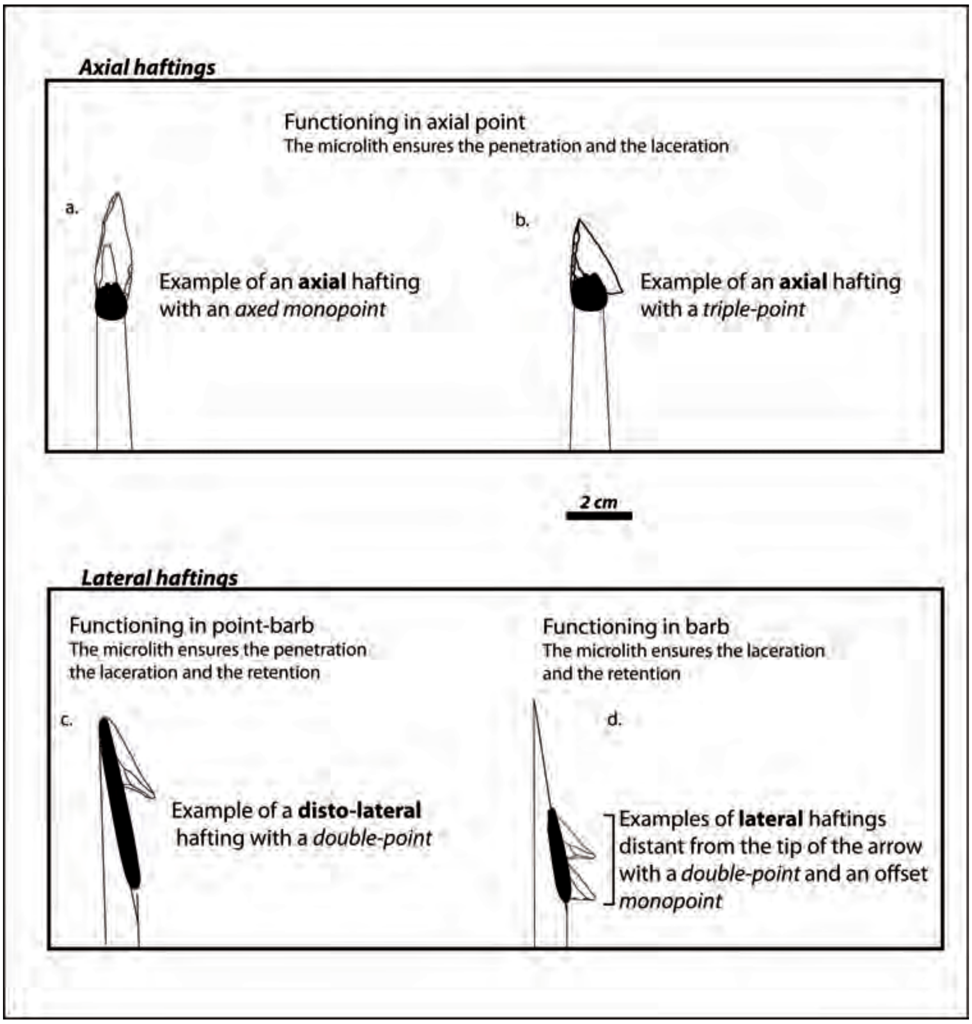

Fig. 2 – Hafting modes.

point is created in the distal or proximal end of the blank, parallel to the *longitudinal axis* of the microlith (hypothetical axial hafting: fig. 2a).

– *Type 2*, Offset-points (and cutting edge): several crescents and scalene triangles having a single point formed either in the microlith's distal or proximal part. The point is *offset to the longitudinal axis* of the microlith (hypothetical lateral hafting, fig. 2d). Although rare at Farman, this type is well-represented in the early phases of the Sauveterrian in southeastern France, notably at Grande Rivoire (Chesnaux, 2010).

– *Type 3*, Double-points (with or without a cutting edge): this type is represented at Farman by the majority of crescents and scalene triangles, all isosceles triangles and certain points with transversely retouched bases. These microliths have two opposed points in the blank's mesial section, perpendicular to the transversal axis of the piece. All scalene triangles and certain crescents have a point in the microlith's longitudinal axis and another, sharper point, offset to this axis (hypothetical disto-lateral hafting as point-barbs or laterally as barbs: fig. 2c and fig. 2d).

– *Type 4*, Triple-points (and cutting edges): certain pieces with retouched bases (a concave basal truncation) with a point created in the blank's distal or proximal part, parallel to the microlith's axis, and two opposed basal points (hypothetical axial hafting: fig. 2b).

The distribution of these different types by locus can be found in tables 1 and 2. This variability may be explained by successive occupations and an evolution of weaponry at Farman. B. Souffi has also noted that locus 3, containing both obliquely truncated points and isosceles triangles, can be attributed to an earlier occupation dated to the Preboreal / Boreal transition that is earlier than the other loci (Souffi and Marti, 2011). However, given the absence of a dated micro-stratigraphy it is difficult to precisely reconstruct the different stages of occupation. Therefore we have chosen to explore this variability in functional terms by reconstituting the different uses of microliths based on observable damage patterns.

MICROLITH BREAKAGE PATTERNS: AN EXPERIMENTAL MODEL

An experimental protocol was established in order to formally identify impact damage connected to

	Locus 1	Locus 2	Locus 3	Locus 5	Total
Triple-points					40
PTRB	9	6	0	19	
Scalene triangles	0	0	0	6	
Double-points					142
Crescents	12	22	3	33	
Scalene triangles	22	6	6	20	
Isoscele triangles	1	3	5	1	
PTRB	2	2	2	2	
Offset monopoints					14
Crescents	0	2	0	0	
Scalene triangles	2	2	2	6	
Axed monopoints					60
PTRB	3	2	3	7	
OTP	8	8	7	12	
Undetermined	0	1	3	6	
Undetermined	1	9	2	11	23
Total	60	63	33	123	279

PTRB : **Points with transversely retouched bases**
OTP : **Obliquely truncated points**

Table 1 – 62 rue Henry-Farman, Paris. Shaping by retouch according to locus (numerically).

	locus 1	Locus 2	Locus 3	Locus 5	Total	%
Axed monopoints	18%	16%	39%	20%	59	21%
Triple-points	15%	9,5%	0	20%	40	15%
Double-points	62%	52,5%	49%	46%	142	51%
Offset monopoints	3%	8%	6%	5%	15	5%
Undetermined	2%	14%	6%	9%	23	8%
				Total	279	100%

Table 2 – 62 rue Henry-Farman, Paris. Shaping by retouch according to locus (percentages).

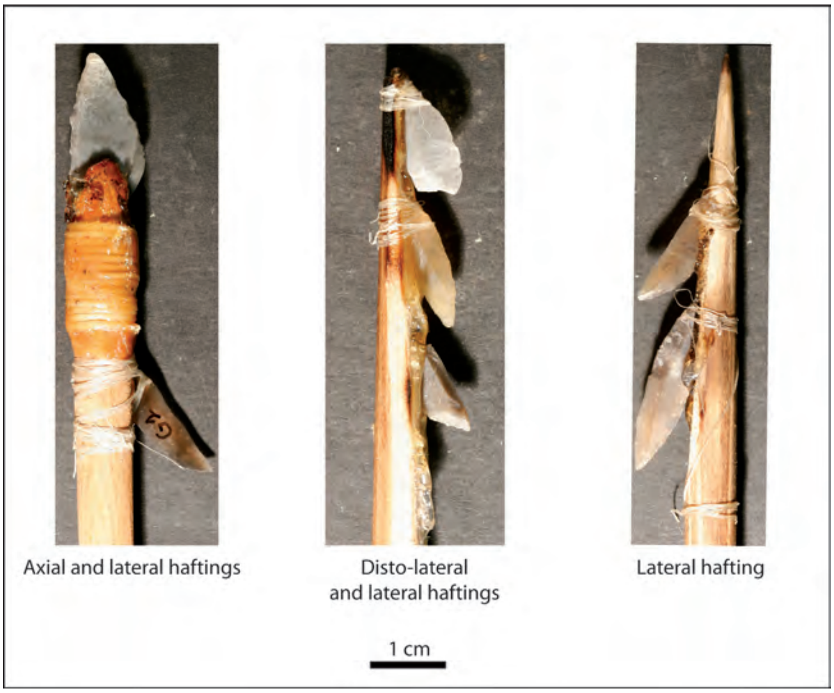

Fig. 3 – Experimentation. Arrows with three different types of haft settings.

the use of microliths as projectile elements, compared to those produced during manufacture or trampling. This protocol was built on the work of M. O'Farrell (2004) and the TFPPS study group (see notably Geneste and Plisson, 1986 and 1989). A second aim of this study is to distinguish breakage patterns which are characteristic of the microlith's position on the shaft as Crombé et al. (2001), Philibert (2002) or Yaroshevitch et al. (2010) have done. The originality of this study lies in the fact that we have sought to identify patterns of microlith damage and dispersal according to three precise haft settings (axial, disto-lateral or lateral, figs. 2a, 2c, 2d, 3) and to understand the factors underlying these patterns (position of the microlith on the shaft, adhesive type, contact with bone, anatomical zone impacted).

We have employed the terminology published by the *Ho Ho Nomenclature Committee* (1979) and updated by Fischer et al. (1984) to describe different fracture types observed on lithic material. Microscopic observations were carried out according to the accepted protocol based on the work of S. Semenov (1964), L. Keeley (1980) and H. Plisson (1985).

Breaks during manufacture

One hundred microliths manufactured from 122 bladelets and lamellar flakes were tested (fig. 4). The majority of the 22 knapping accidents were produced by an overly penetrating retouch gesture that led to a transverse bending/torsion fracture, sometimes in the form of a Krukowski microburin. In 15 of the 22 accidents, fracture negatives have a flat (or smooth) morphology or clearly show a well-defined lip. The seven other cases correspond to smooth, coned spin-off or bending fractures whose lengths do not exceed 1.8 mm.

Trampling Fractures

One hundred microliths, buried within and spread across the surface of a silty-clay matrix containing abundant blocks of limestone between 1 and 10 cm in length, were trampled. Only 19 microliths were damaged, however only 12 edges were recovered with chipped or micro-chipped edges (barely visible to the naked eye), 9 had snap terminating transverse bending fractures (fig. 5) or with lips that did not surpass 1.5 mm in length of which 3 also displayed 1 mm long dorsal spin-off fractures. Finally, one example portrayed a 1.7 mm long burin-like removal originating from the pointed extremity (fig. 6).

Diagnostic Impact Damage

Whether occurring during manufacture or trampling, no lip or spin-off fracture exceeding 1.8 mm was observed. During the four experimental archery sessions (see below) the same types of fractures were obtained, in addition to fractures where the lip or spin-offs did surpass 1.8 mm. We therefore considered these latter fractures types, never replicated during manufacture or trampling, as diagnostic of microliths used as projectile elements and to increase confidence, we raised the fracture cut-off from 1.8 mm to 2 mm.

Fig. 4 – Experimentation. Two microliths fractured during manufacture. a: Krukowski microburin; b: clean transverse bending fracture.

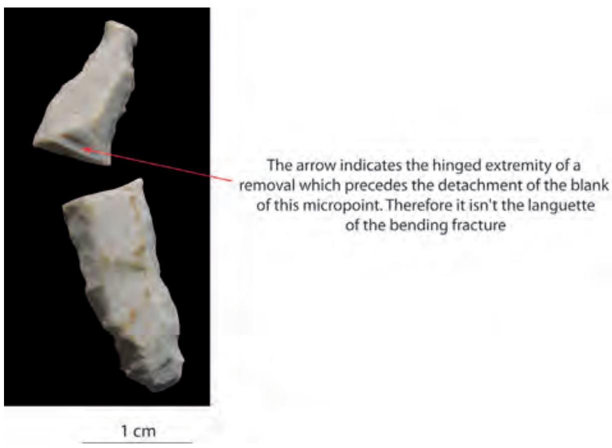

Fig. 5 – Experimentation. Micropoint bearing a transverse bending fracture with a snap termination from trampling.

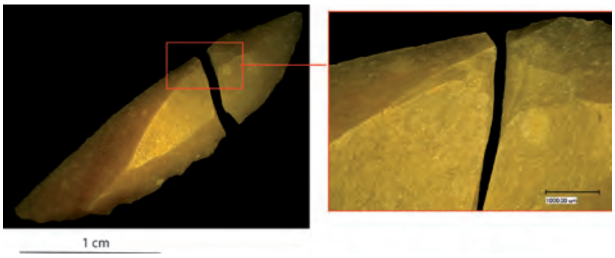

Fig. 6 – Experimentation. Crescent with a transverse bending fracture with a snap termination from trampling, including the formation of a spin-off on the dorsal surface (right-hand insert).

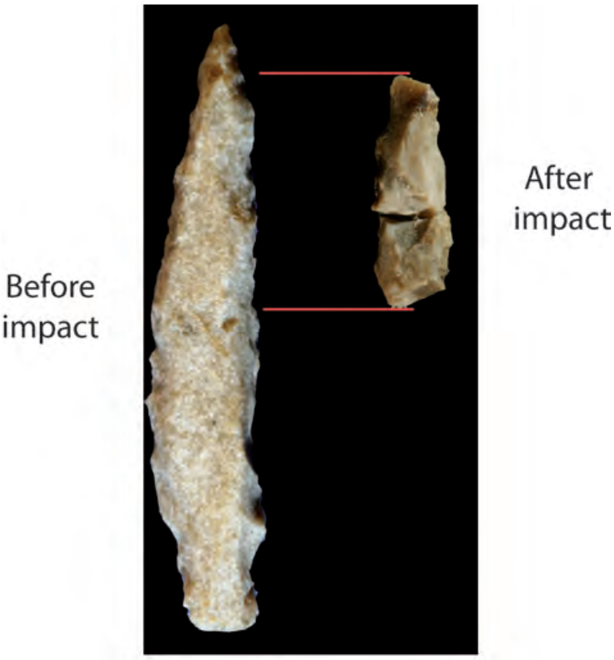

Fig. 7 – Experimentation. Axially hafted point broken into at least four parts on impact.

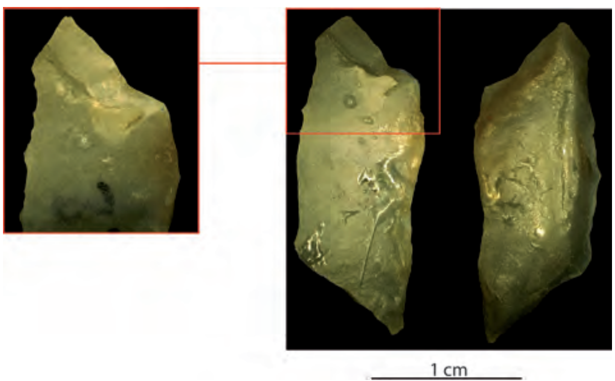

Fig. 8 – Experimentation. One of the rare examples of a lipped transverse fracture on a disto-laterally hafted triangle.

During the experiments, two other damage types were also produced (solely along the cutting edges of the microliths) that did not occur during manufacture or trampling: tiered (Gassin, 1996) or hinged terminations perpendicular or oblique to the cutting edge. These scar types were also considered diagnostic of microliths hafted as projectile weaponry elements.

Damage and microlith shaft position

During the four experimental shooting sessions involving the carcasses of recently killed sheep and wild boar, it became clear (*contra* Yaroshevitch et al., 2010) that impact damage types and frequencies do not directly depend on the microlith's shape, but rather its exposure to impact and thus position on the shaft.

One hundred and forty three arrows were fired at distances of 10 and 15 m from simple 40 and 45 pound bows. The effects were noted on 66 *axial-points* hafted in the axis of the piece (obliquely truncated points or points with transversely retouched bases, Sauveterre points and pointed backed bladelets), 45 *double-* and *triple-points* hafted disto-laterally forming barbed points (points with retouched bases, scalene and isosceles triangles and crescents) and on 293 *double-points* and *offset-points* hafted laterally as barbs (of a total of 484 microliths tested, 80 were not recovered).

After a single shot we noted, regardless the type of microlith:

1) That axially hafted microliths suffered the full force of the impact resulting in a fracture frequency of 52% (35% of which were diagnostic). The damage was mostly in the form of transverse fractures (47% of all points observed, breakage in more than two parts was frequent, fig. 7), but also very occasionally (5%) long, burin-like fractures originating from the distal extremity (> 4mm). These percentages are comparable with other experiments that tested axially hafted microliths (notably Fischer et al., 1984; Crombé et al., 2001).

2) The disto-laterally hafted microliths were less frequently fragmented (27%) and seldom diagnostic (13%). It seems that the lithic element was subjected to a less violent impact as the force was distributed between the microlith and the shaft. As with axial microliths, the damage noted on the two pointed extremities of the disto-laterally hafted microliths was transverse and/or burin-like (fig. 8).

3) On the other hand, it is rare for microliths hafted laterally, away from the piercing end of the arrow, to fracture transversely. The frequency of damage is 21% (14% with edge damage, 5 % with a burin-like removal—fig. 9—and 2% presenting both edge damage and transverse fractures). Only 8% of this damage (burin-like fractures and chipping only) was diagnostic.

Disto-lateral haft settings present qualitatively similar damage to axial settings, but in similar proportions

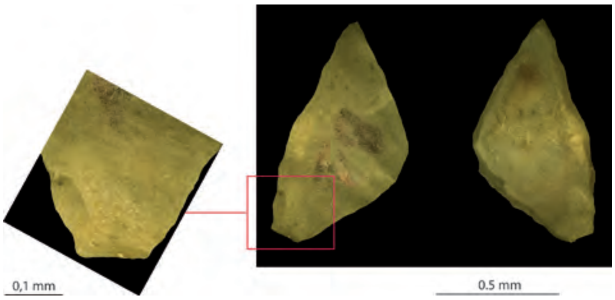

Fig. 9 – Experimentation. Diagnostic burin-like impact removal on a laterally hafted crescent.

as the laterally hafted microliths. While no single damage type alone is indicative of the microlith's position on the shaft, the representation of burin-like and transverse damage in the assemblage may indicate the function(s) of the microlithic component (table 3). Even if chipping is sometimes diagnostic of impact, it is inconsequential for recognising the microlith's position on the shaft. In fact, chipping can occur all along the unmodified cutting edge of a microlith no matter its position on the shaft.

Performance and dispersal of microliths

When axially hafted microliths broke (52%), the proximal fragment remained almost systematically in the shaft (48% of cases), while one or several distal fragments became lodged in the carcass. In three rare occurrences (n = 3), dislodged points were recovered intact in the carcass. This dispersal model for axially hafted points is therefore very similar to the one proposed by Chadelle et al. (1991), whereby upon returning from the hunt proximal parts of microliths were introduced to the site still intact in the arrow shafts, while mesial or distal fragments were lodged in the game.

Experimental microliths hafted disto-laterally and laterally had a different trajectory. Indeed, having been hafted along the arrow's shaft and not in its axis, they easily became dislodged and were either lost in the carcass or fell to the ground when the arrow was removed (similar to what was observed by Crombé et al., 2001). A second mechanical aspect may explain the dislodgement of these microliths: the wave produced by the arrow's impact was transmitted through the shaft and induced a shock that brought about the detachment of the microlith. During the penultimate experiment employing sheep carcasses, including the careful examination of the skeleton and the viscera, of the 111 laterally hafted microliths, 52 were recuperated in the carcasses (viscera, muscles and bones), amongst which 21 (or 38% of the detached microliths) were damaged and 32 remained intact.

The disto-laterally and laterally hafted microliths damaged upon impact were often recovered within the animal. As a general rule, the lateral microliths seldom broke, but frequently detached within the carcass.

MICROLITH DAMAGE AT FARMAN

The entirety of damage incurred by the microliths from Farman was compared with the experimental reference collection (see above). Diagnostic and non-diagnostic impact damage by microlith type can be found in tables 4, 5, 6, 7 and 8.

Generally speaking, total diagnostic damage is low: 5% (n = 2) for *triple-points* (points with transversely retouched bases and scalene triangles), 6% (n = 4) for *axial-points* (points with transversely retouched bases or obliquely truncated points) and 11% (n = 15) for *double-points* (crescents and triangles). *Offset-points* presented no traces of diagnostic impact. Non-diagnostic damage is more frequent across all microlith types: 47% (n = 19) for *triple-points* and 43% (n = 26) for *axial-points* (points with transversely retouched bases or obliquely truncated points), 53% (n = 75) for *double-points* and 14% (n = 2)

	POSITION ON THE SHAFT		
DIAGNOSTIC DAMAGES	AXIAL	DISTO-LATERAL	LATERAL
Transversal fractures	+++	++	-
Burin-like fractures	+	++	++
PERCENTAGE OF THE DIAGNOSTIC DAMAGES	35%	13%	8%

Table 3 – Experimentation. Burin-like and transversal impact damage according to the microlith's position on the shaft.

	Locus 1	Locus 2	Locus 3	Locus 5	Total
PTRB					PTRB
Non diag. dam.	5	4	0	8	17
Diag. dam.	0	0	0	1	1
Undam.	4	2	0	10	16
Scalene triangles					Scalene triangles
Non diag. dam.	0	0	0	2	2
Diag. dam.	0	0	0	1	1
Undam.	0	0	0	3	3
				Total	40 / 100%
				Total diag. dam.	2 / 5%
				Total non diag. dam	19 / 47%

PTRB : Points with transversely retouched bases
diag. : diagnostic
dam. : damage(s)
undam. : undamaged

Table 4 – 62 rue Henry-Farman, Paris. Breakage of triple-points.

	Locus 1	Locus 2	Locus 3	Locus 5	Total
PTBR					PTRB
Non diag. dam.	2	2	1	1	6
Diag. dam.	0	0	0	1	1
Undam.	1	0	2	5	8
OTP					OTP
Non diag. dam.	1	3	3	4	11
Diag. dam.	0	0	1	0	1
Undam.	7	5	3	8	23
Undetermined					Undetermined
Non diag. dam.	0	1	2	6	9
Diag. dam.	0	0	1	0	1
				Total	60 / 100%
				Total diag. dam.	4 / 6%
				Total non diag. dam	26 / 43%

PTRB : Points with transversely retouched bases
OTP : Obliquely truncated points
diag. : diagnostic
dam. : damage(s)

Table 5 – 62 rue Henry-Farman, Paris. Breakage of axial-points.

	Locus 1	Locus 2	Locus 3	Locus 5	Total
Crescents					Crescents
Non diag. dam.	10	12	1	22	45
Diag. dam.	0	4	2	1	7
Undam.	2	6	0	10	18
Scalene triangles					Scalene triangles
Non diag. dam.	11	4	2	8	25
Diag. dam.	2	0	1	3	6
Undam.	9	2	3	9	23
Isoscele triangles					Isoscele triangles
Non diag. dam.	0	2	0	0	2
Diag. dam.	0	0	2	0	2
Undam.	1	1	3	1	6
PTRB					PTRB
Non diag. dam.	1	1	1	0	3
Diag. dam.	0	0	0	0	0
Undam.	1	1	1	2	5
				Total	142 / 100%
				Total end. diag.	15 / 11%
				Total non diag. dam.	75 / 53%

PTRB : Points with transversely retouched bases
diag. : diagnostic
dam. : damage(s)

Tabl. 6 – 62 rue Henry-Farman, Paris. Breakage of double-points.

	Locus 1	Locus 2	Locus 3	Locus 5	Total
Crescents					Crescents
Non diag. dam.	0	1	0	0	1
Diag. dam.	0	0	0	0	0
Undam.	0	1	0	0	1
Scalene triangles					Scalene triangles
Non diag. dam.	1	0	0	0	1
Diag. dam.	0	0	0	0	0
Undam.	1	2	2	6	11
				Total	14 soit 100%
				Total diag. dam.	0
				Total non diag. dam.	2 soit 14%

diag. : diagnostic
dam. : damage(s)
undam. : undamaged

Tabl. 7 – 62 rue Henry-Farman, Paris. Breakage of offset-points.

Undetermined	Locus 1	Locus 2	Locus 3	Locus 5	Total
Non diag. dam.	1	8	2	10	21
Diag. dam.	0	1	0	1	2
				Total	23 / 100%
				Total diag. dam.	2 / 9%
				Total non diag. dam.	21 / 91%

diag. : diagnostic
dam. : damage(s)

Tabl. 8 – 62 rue Henry-Farman, Paris. Breakage of indeterminate microliths.

for *offset-points*. Finally, while 23 microliths were far too damaged to be attributed to a type, two were however definitely broken on impact.

All of the material was also observed microscopically (× 100 and × 200). Despite the flint's sometimes heavily altered microtopography, wear associated with a non-identifiable grainy micro-polish at the interface of the backed edge and ventral surface was noted on 10 *double-points* from locus 2 (fig. 10). It is possible that this wear, having smoothed over the protuberances produced by the proximal retouch negatives, represents a technical action.

Non-Diagnostic impact damage

Non-diagnostic impact damage is generally very difficult to interpret given its equivocal nature (see below). Nevertheless, a portion of the Farman microliths demonstrating snap terminating transverse bending fractures or having a lip of a non-diagnostic length were certainly damaged during manufacture, which we know took place on-site given the significant number of microburins present in all loci (Souffi and Marti, 2011).

Diagnostic impact damage: different traces for different types of microliths

Diagnostic impact damage differs (tables 9 and 10) between double-points (triangles and crescents) or triple-

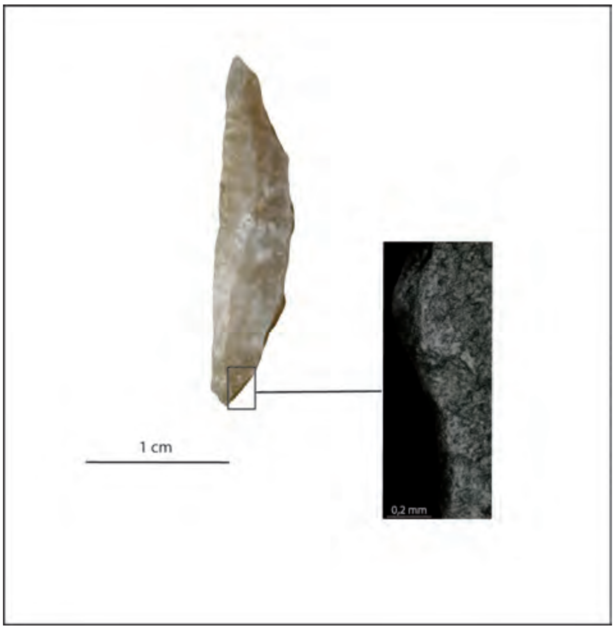

Fig. 10 – 62 rue Henry-Farman, Paris. Crescent with detail of the worn ventral edge representing a faded grainy micropolish.

	TRADITIONAL TYPES				
DIAGNOSTIC DAMAGES	CRESCENTS	TRIANGLES	POINTS WITH TRANSVERSELY RETOUCHED BASES	OBLIQUELY TRUNCATED POINTS	TOTAL
Transversal fractures	1	2	2	1	6
Burin-like fractures	6	4	1	0	11
Edge damages	0	3	0	1	4

Table 9 – 62 rue Henry-Farman, Paris. Diagnostic damage by traditional types of microliths.

	MORPHOTECHNICAL TYPES			
DIAGNOSTIC DAMAGES	AXED MONOPOINTS	TRIPLE-POINTS	DOUBLE-POINTS	OFFSET MONOPOINTS
Transversal fractures	2	1	3	0
Burin-like fractures	0	1	10	0
PERCENTAGE OF THE DIAGNOSTIC DAMAGES	5%	6%	11%	0

Table 10 – 62 rue Henry-Farman, Paris. Burin-like and transversal diagnostic impact damage by major morpho-technical categories.

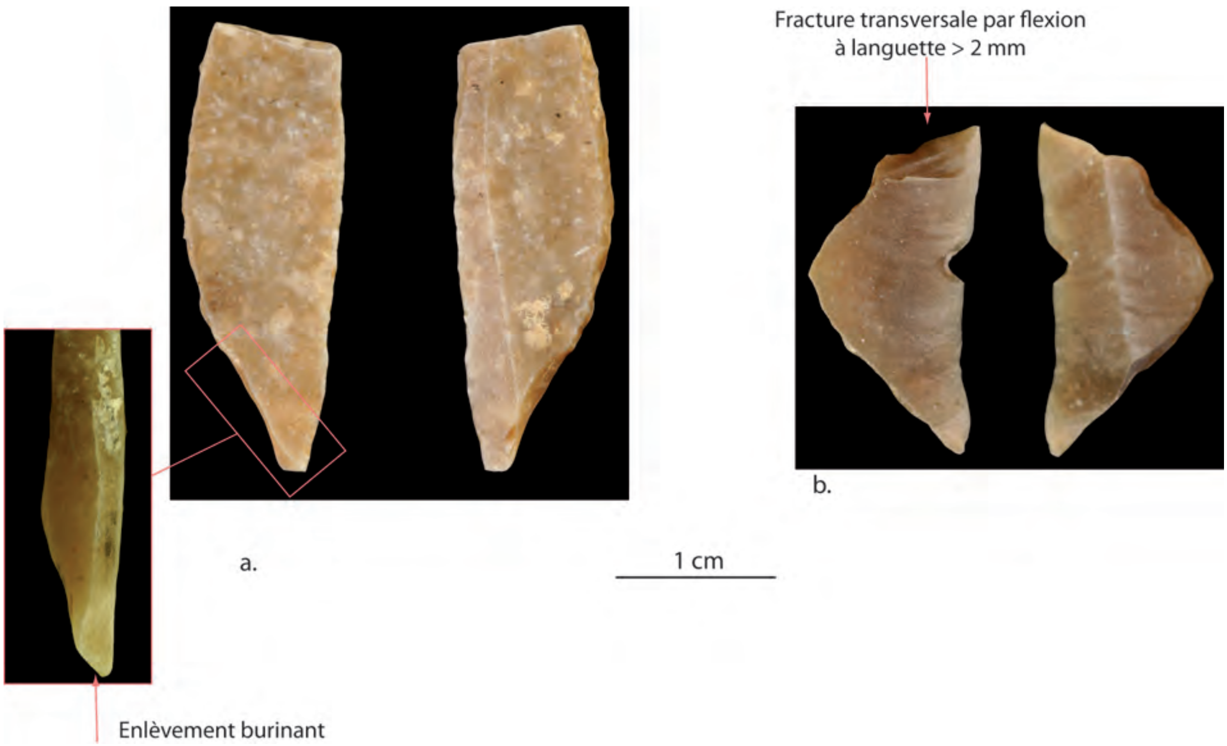

Fig. 11 – 62 rue Henry-Farman, Paris. Two examples of diagnostic impact damage on double-points. a: crescent with a burin-like removal along the backed edge originating from an extremity; b: triangle fractured transversely by bending with a lip greater than 2 mm.

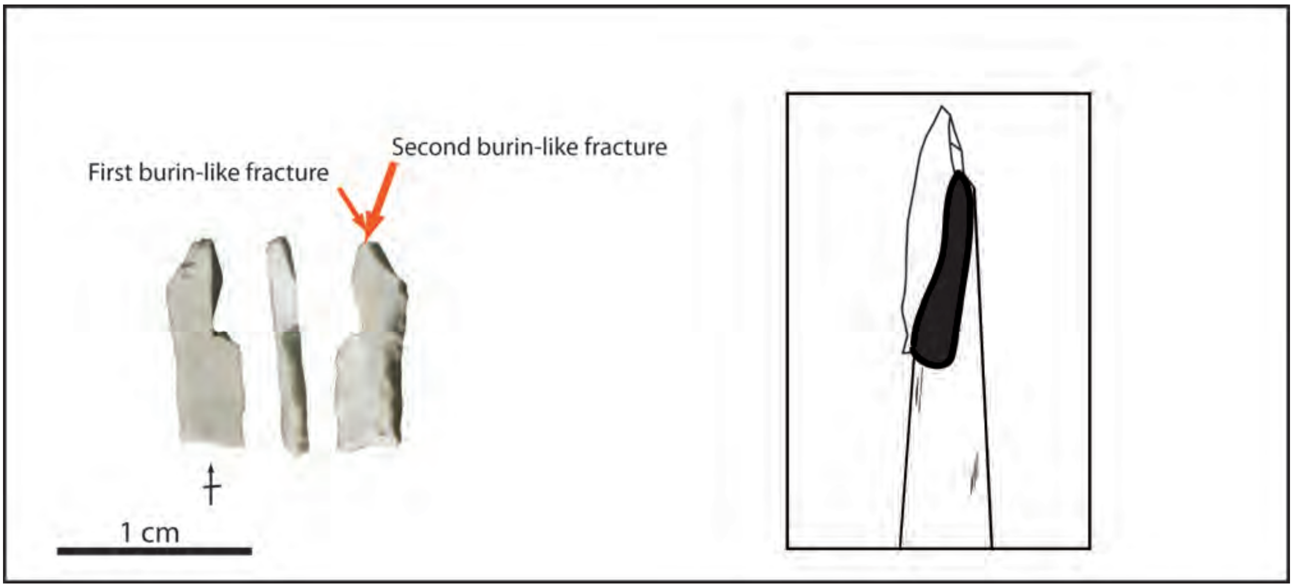

Fig. 12 – 62 rue Henry-Farman, Paris. Diagnostic impact damage on a triangle which could indicate hafting on the distal part of the shaft (see insert).

points / axial-points (points with transversely or obliquely truncated bases).

Of the 15 double-points (7 crescents, 6 scalene triangles and 2 isosceles triangles) damaged on impact, most (n = 10) incurred burin-like fractures (fig. 11a) with transverse impact damage found only on two triangles and a crescent (fig. 11b). In comparison with our experimental model (cf. table 3), the over-representation of burin-like fractures compared with transverse fractures on double-points from Farman, as well as the under-representation of diagnostic impact damage, argues in favour of the majority being hafted laterally on the shaft as barbs. Nevertheless, the presence of double-points with transverse fractures and diagnostic lips indicative of violent impact (similar to the burin-like fracture on a triangle from Farman: fig. 12) and absent from experimental barbs suggests that at least several double-points were hafted disto-laterally as part of barbed points.

On the other hand, the majority of diagnostic damage observed on axial-points and triple-points (n = 3) demonstrates a haft setting at the end of the shaft (fig. 13). Had axial-points and triple-points from Farman functioned in the same way as double-points, therefore as barbs, they would have presented higher frequencies of burin-like damage. Moreover, three of them bear damage referable to violent shocks (transverse fractures with a diagnostic lip) and are therefore indicative of hafting on the tip of the shaft as either barbed or axial-points. Given the shape of these microliths, their axial hafting is almost certain.

This being the case, the percentage of impact damage observable on experimental axial-points is much more significant (35%) than that seen with axial (5%) and triple-points (6%) from Farman. Given the small number bearing traces of impact (returned from the hunt) and the significant number of complete abandoned pieces (manufacture defaults?), it appears that points manufactured at the site were designed to hunt game, which was for a large part not brought back and processed at Farman.

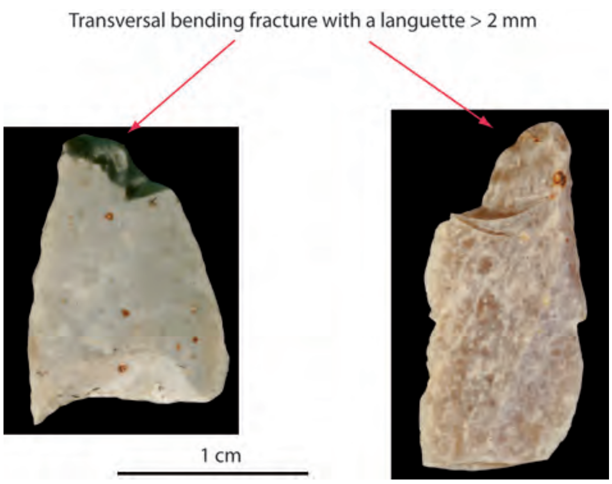

Fig. 13 – 62 rue Henry-Farman, Paris. Diagnostic impact damage on a triple point (left, point with a transversely retouched base) and on an axial point (right, obliquely truncated point).

DISCUSSION

Manufacture and use of microliths at Farman: an assessment

At Farman, double-points (triangles and crescents) were not uniquely mounted as barbs, but also as part of point-barbs. This demonstration contradicts the model proposed by A. Thévenin (1990) in which crescents and

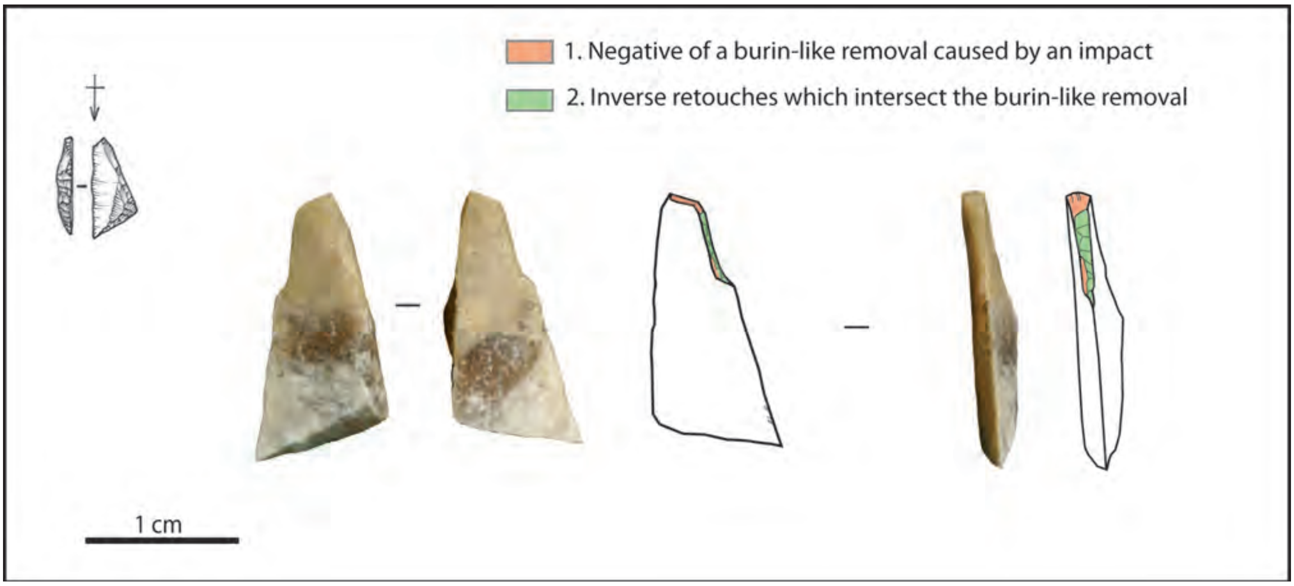

Fig. 14 – 62 rue Henry-Farman, Paris. Triangle having been repaired after its use (drawing after E.Boitard-Bidaut).

triangles served as barbs for arrowheads, whereas points with transversely retouched bases or obliquely truncated points constituted elements of axial tips (see Loshult arrowheads; Rozoy, 1978). The double-points appear instead to have been hafted as a lateral alignment of barbs beginning from the distal extremity of the arrow (see fig. 3, middle). Of course, it cannot be excluded that certain triangles and crescents may also have been designed to be hafted on the same shaft as axial-points (points with transversely retouched bases or obliquely truncated points, see fig. 3, left).

Furthermore, triangles and crescents appear to have functioned in a very similar manner and grouping them together based on intended use (double points) seems entirely justified as only their method of retouch differs.

Manufacture and use of triangles and crescents: unity of time and place

Double-points were manufactured at each locus, used on-site or in the vicinity of the site, and ultimately reintroduced to the site in the unprocessed carcasses of game (Leduc and Bridault, 2009) or on the shafts of arrows according to our dispersal model for laterally hafted microliths. This is illustrated by the refitting of an isosceles triangle damaged upon impact and its microburin by B. Souffi at locus 3. This microlith, hafted as a barb or part of a point-barb, was reintroduced to the assemblage upon return from the hunt in either a carcass or still hafted on the shaft of an arrow. As the microlith was too badly damaged, it was abandoned at the site. A triangle and a crescent (see double-points), probably used to rearm an arrow on-site, were also repaired. Both had suffered diagnostic burin-like fractures originating from one of the two points, continuing 4 mm along triangle's edge and 3 mm along the crescent's truncation. These two burin-like removals were then partially retouched by a semi-abrupt inverse backing on their third edge. This type of repair attests to the care taken in maintaining hunting weapons, as has already been demonstrated in the completely different context of the Magdalenian (Q31) at Étiolles (Christensen and Valentin, 2004).

Manufacture and use of axial-points and triple-points: a spatio-temporal segmentation

These microliths, designed to serve as axial-points, were manufactured on-site and were exported on the shafts of arrows to be used in an unidentified location; if damaged, they rarely returned to Farman. Were their blanks produced from the same debitage sequences as those of crescents and triangles? In the future it would be interesting to explore the precise implications of the different locations where these artefacts were used vis-à-vis the *chaîne opératoire* of their production.

Specific arrows for different game hunted in particular places?

The zooarchaeological analysis demonstrates that the faunal spectrum from each locus is dominated by wild boar brought whole to site. The kill was then initially processed and certain parts exported from the site (Leduc and Bridault, 2009). These results are in general agreement with our model for the use of triangles and crescents. Can we perhaps deduce that the occupants of Farman preferentially hunted wild boar with arrows equipped with these sorts of microliths? This hypothesis invites comparison with similar collections from northern France where sites with wild boar are well-represented (notably Les Closeux, in the Hauts-de-Seine: Lang et al., 2008; Saleux in the Somme: Fagnart et al., 2008; Bignon et al., this volume or Warluis in the Oise: Ducrocq et al., 2008). Another question emerges: what happened to the axial-points manufactured at Farman? Did they essentially serve to hunt other species besides wild boar? Were these other species, which were not processed at Farman, brought to another location in the territory after the hunt?

CONCLUSION

The traditional typology of Mesolithic microliths based on simple morphometric criteria cannot alone provide answers to the economic questions we pose today. Such a typology may actually be at an impasse as it classifies microliths simply by their general shape and not the intention underlying it. A classification that takes into account shaping by retouch seems to constitute the essential first step for a functional analysis of microliths as it aims to identify intentions based on their use. This theoretical model, in conjunction with the compilation of experimental traces, informs our interpretations of microlith breakage patterns.

At Farman, two distinct contexts of microlith use were reconstructed; only triangles and crescents were used (and re-used) on-site, whereas axial-points were mostly manufactured at the site.

This differential treatment of projectile weaponry elements, whose possible recurrence elsewhere ought to be investigated, opens new perspectives for our conception of Beuronian microliths and the organisation of Mesolithic hunting practices.

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Manufacture and use of Montmorencian prismatic tools:

The case of 62 rue Henry-Farman, Paris (15th arrondissement)

Sylvain Griselin, Caroline Hamon and Guy Boulay

Abstract: The Mesolithic site of 62 rue Henry-Farman in Paris' 15th arrondissement, excavated by the INRAP in 2008, has produced a series of prismatic tools whose mode of production, maintenance and use are investigated here. These macrolithic tools are known from numerous Middle Mesolithic sites in and around the Île-de-France and occasionally in the rest of the Paris Basin. At the Paris site, these quartzite tools are generally broken, but can measure up to 10 cm in length when whole. They have triangular and / or trapezoidal cross-sections with a flat un-retouched face characteristic of Montmorencian tools. The shaping of these pieces is relatively simple as it aims to shape-out the sides and the dorsal face, forming the tool's lateral longitudinal ridges. Different degrees of repair are observable on the tools, indicating a fairly long period of use. Use-wear referable to contact with a mineral material is visible along the longitudinal ridges of both the flat and opposing faces, while the prominences of the sides show a distinct undetermined type of wear. The ridges seem to constitute the main working surfaces of these objects and, despite some wear on the extremities of several examples, the overall use-wear distribution refutes their supposed main use as 'picks'. Further functional hypotheses may be formulated and several preliminary tests have been carried out to evaluate them, including the use of these tools as retouchers to fracture bladelets using the microburin technique. This hypothesis is discussed in the light of use-wear observed on archaeological and experimental tools.

The site of 62 rue Henry-Farman in Paris' 15th arrondissement, excavated in 2008 as part of a rescue operation by the INRAP under the direction of Bénédicte Souffi and Fabrice Marti (Souffi *et al*., this volume), has produced numerous Montmorencian prismatic tools from 6 loci and their periphery (fig. 1). These long, narrow macrolithic quartzite tools have triangular and / or trapezoidal cross-sections with plano-convex profiles (fig. 2). The un-modified ventral face, or 'flat face', is smooth and can be rectilinear, concave or convex with denticulated edges. The object's contours are sinuous with numerous small prominences. The average width and thickness of these tools is 2.4 cm with the length of whole tools ranging between 9.6 and 17.7 cm. Whole objects therefore present a natural extremity perpendicular to the flat face, opposite another transversely bevelled extremity which is partially retouched. In total, thirteen tools of this type were found at Farman, including 5 extremities, 2 mesial fragments and 6 whole tools (three represented by conjoined fragments), and form the basis of our investigation concerning the modes of production, maintenance and use of Montmorencian tools[1].

After presenting the chrono-cultural and geographic context of this tool type, its technological and functional characteristics are described in more detail and a functional hypothesis, guided by experimentation, is discussed.

CHRONO-CULTURAL CONTEXT

At Farman, the use of quartzite for the manufacture of prismatic tools and their general morphology tie them to the Montmorencian industries which were defined following discoveries spanning the 19th century to the 1970s and thanks to an important synthesis by Jacques Tarrête (1977). 'Montmorencian' sites are found

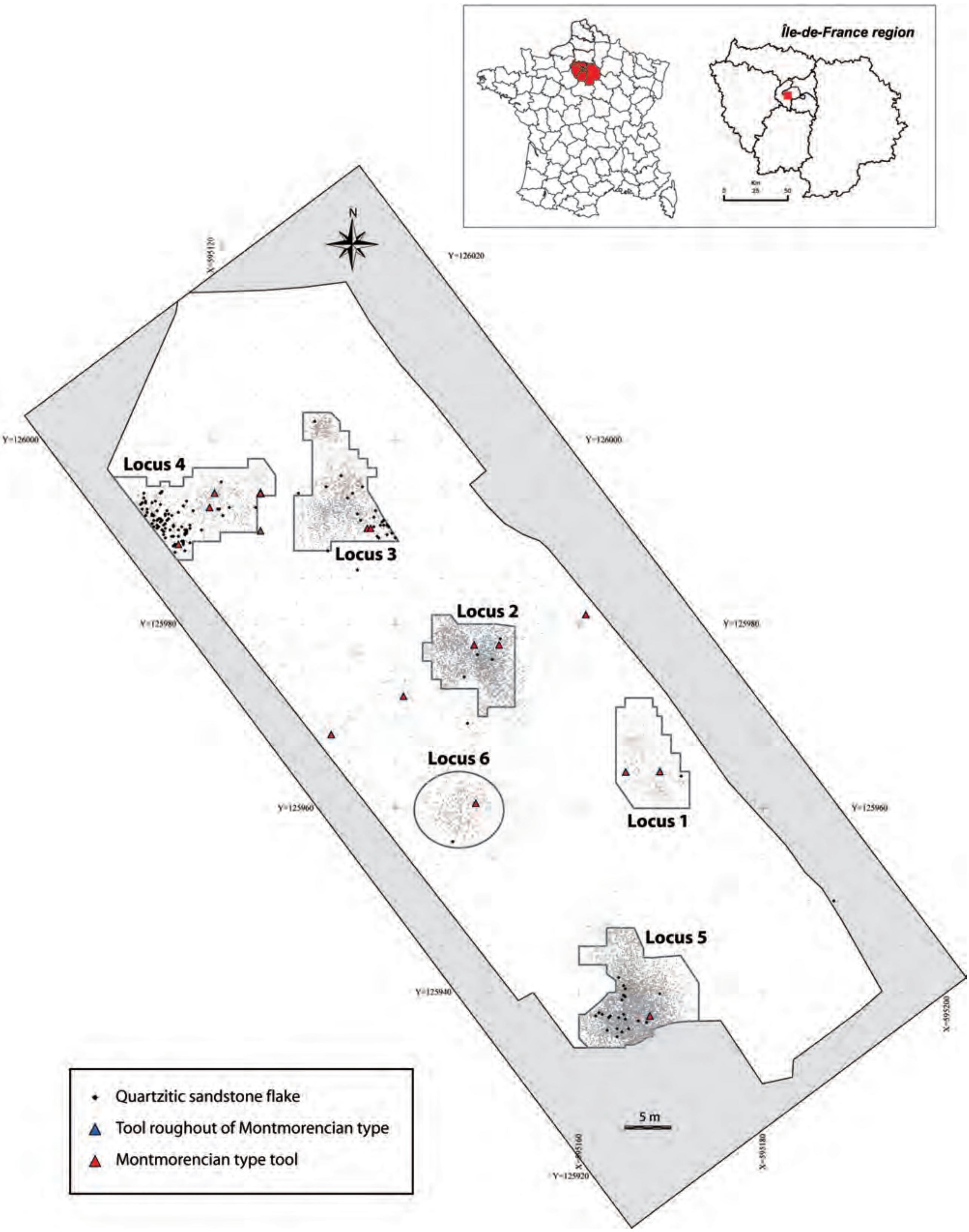

Fig. 1 – 62 rue Henry-Farman, Paris. Distribution of quartzite artefacts.

Fig. 2 – 62 rue Henry-Farman, Paris. Locus 4: Refit of two Montmorencian tool fragments (photo L. Petit).

along the quartzite outcrops of the Stampian massifs and hills of the Île-de-France and are distinguishable by the presence of specialised zones of quartzite extraction and exploitation, essentially composed of rough-outs and tool preforms, often broken during manufacture and associated with significant shaping waste.

Similar tools from other Mesolithic assemblages had already been noted prior to excavations at Farman, for example at the following sites where finished, often broken, tools with traces of use have been recovered: Onglais at Acquigny in the Eure (see Souffi, 2004), Les Closeaux (sectors II and VIII) at Rueil-Malmaison in Hauts-de-Seine (Lang and Sicard, 2008) or Parc du Château at Auneau in the Eure-and-Loir (see Verjux et al., this volume). These recent excavations demonstrate that Montmorencian prismatic tools are well-represented at Middle Mesolithic campsites, revealing a strong territorial connection between Montmorencian 'production and/or extraction' sites and essentially 'tool-use sites' such as Farman (fig. 3). The geographic distribution of these objects depicts a regional phenomenon centred around the Île-de-France and less pronounced in the rest of the Paris Basin. Exploitation of Stampian quartzites represent a regional idiosyncrasy that could be partly explained by specific geological features of the Francilian landscape and its margins.

TECHNOLOGICAL CHARACTERISATION OF TOOLS FROM FARMAN

Tools were manufactured from a Stampian quartzite that is amenable to conchoidal fracture and thus enables a technological analysis of the pieces (fig. 4). The mechanical qualities of this material and its presence in outcrops in the form of large blocks from which blanks (knapped or gelifracted fragments) could be extracted and/or collected may have influenced the production of macrolithic tools.

Tools abandoned at the site have three or four faces, one of which is devoid of any modification (the ventral face or 'flat face'). Their cross-section is triangular and/or trapezoidal resulting from modifications of the sides and dorsal face. Only three longitudinal ridges, two on the sides of the tool's flat face and one on its back, received particular attention during their shaping and maintenance.

Shaping

The precise nature of the blanks employed (natural or knapped fragments) is generally indeterminable. Nevertheless, their original morphology must have at least partially corresponded to that of the tools. Indeed, certain pieces retain non-worked faces other than the flat unmodified debitage face (fig. 5).

The shaping of the tool consists of two main stages: roughing-out and finishing the tool (fig. 6). The roughing-out stage corresponds to reducing the size of the block and framing the eventual tool, effecting all or part of the sides and dorsal face, generally determining the cross-section, thickness and contour of the tool. This stage also establishes the tool's future working zones. One or two of the flat faces' lateral ridges are shaped by a series of unipolar removals originating from the flat face serving as the striking platform. The dorsal ridge is then retouched, reducing the thickness of the piece by unifacial, and on

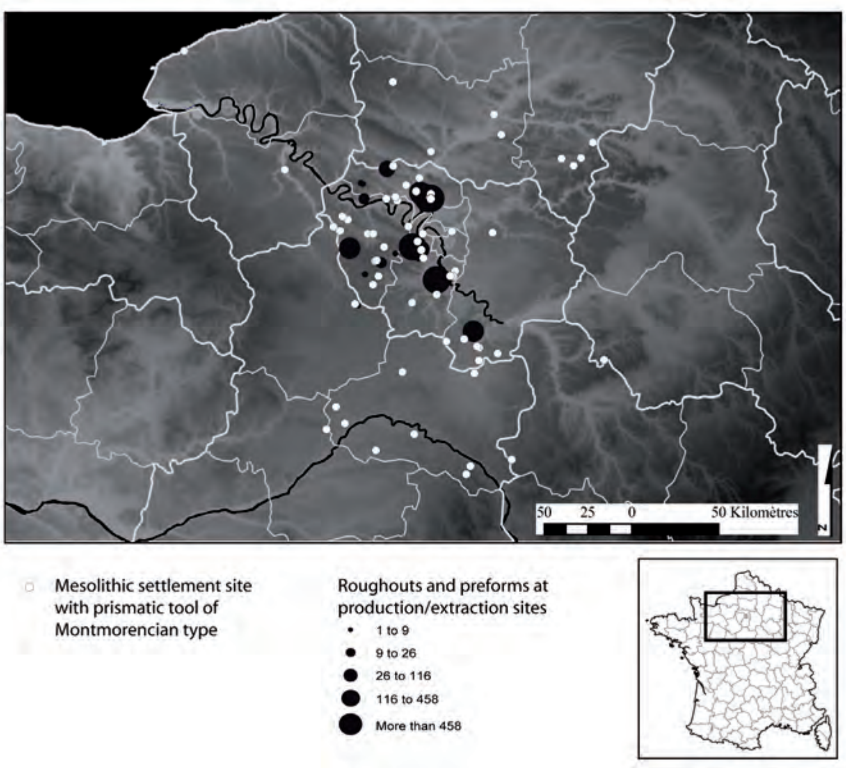

Fig. 3 – Distribution of Montmorencian prismatic tools from Mesolithic sites; number of prismatic tool rough-outs and preforms recovered from quartzite extraction or exploitation sites (datas from Tarrête, 1977).

Fig. 4 – 1: outcrop of quartzite on the commune of Bièvres (Essonne); 2: experimentally knapped block of quartzite; 3: shaping of experimental tools by Guy Boulay; 4: scars on an experimental tool.

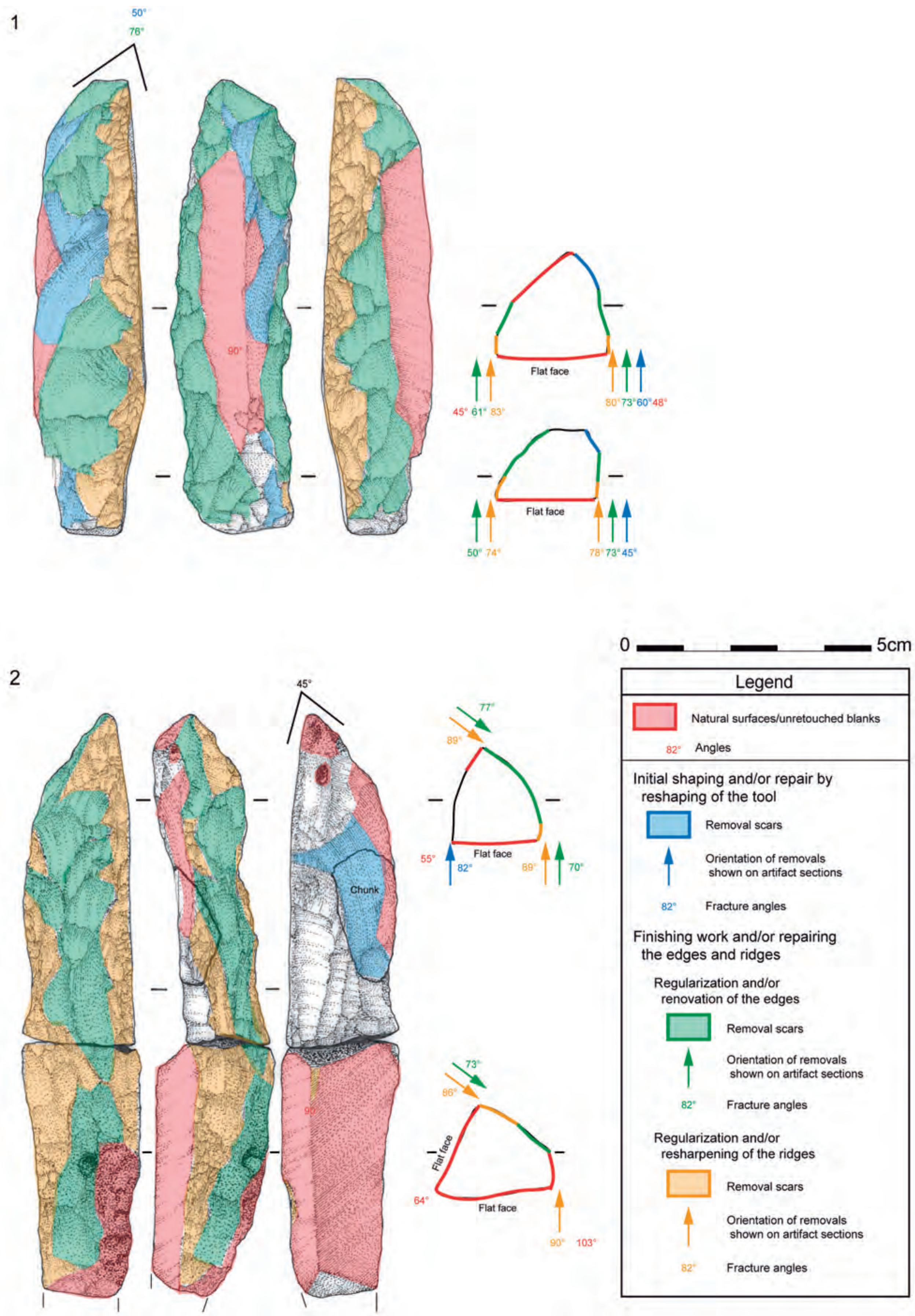

Fig. 5 – 62 rue Henry-Farman, Paris. Diacritic schemes for two Montmorencian tools. 1: locus 2, tool 151/977-9; 2: locus 4, refit of tools 119/992-15, 120/994-21 and 119/989-6 (drawings E.Boitard).

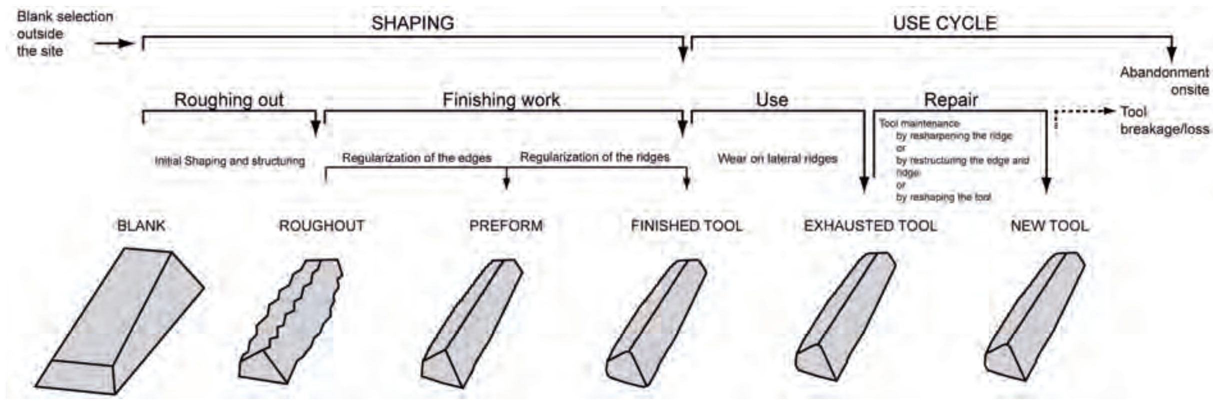

Fig. 6 – 62 rue Henry-Farman, Paris. Overall *chaîne opératoire* for Montmorencian tools.

rare occasions bifacial, removals. Before being repaired, certain tools may have had two adjacent un-retouched faces corresponding to the initial stage of shaping and use (fig. 5, no. 2). This type of tool, referred to as 'slices' or 'orange quarters' "based on analogous pieces from the Belgian Neolithic" (Tarrête, 1977, p. 28), is common in Montmorencian industries.

Following the roughing-out phase, the finishing of the tool can be broke down into two main operations. The first consists of a series of removals rectifying the edges and creating numerous prominences on the sides and denticulations on the longitudinal ridges. The second operation smoothes the contour of the ridges by removing a portion of the small prominences remaining from the earlier stage and regularising the 'line' of the sides and their angle. This stage is characterised by a series of abrupt unipolar retouch that is often discontinuous, scaled and scalariform.

The extremities bear no sign of specific modifications which aren't directly tied to the shaping of the sides or their subsequent management during repairs.

Tool repair

The tools from Farman show evidence of multiple repair episodes, indicative of occasionally long periods of use. This repair also seems to be the main cause of their breakage. The simplest form of management concerns the ridges (fig. 7, nos. 2a and 2c): when they become too dull a series of retouch rejuvenates their entire length. This type of repair can be repeated several times and explains the occasionally very scaled and 'stepped' character of the retouch (fig. 7, no. 3).

When the ridges become too damaged by repeated rejuvenation, repair consists of a complete modification of the ridges' entire length (fig. 7, no. 2b). This type of repair entails a partial or total transformation of the sides' morphology or the initially modified dorsal face.

If the ridges can no longer be rejuvenated or reinstalled, the active surfaces of certain tools are reoriented, sometimes leading to a renewed shaping-out of the tool (fig. 7, no. 4), including a redistribution of its active edges.

Functional characterisation of the tools

Brief History

Questions concerning the function of Montmorencian tools are not new; woodworking (Reynier, 1910; Guichard, 1941), agricultural activities (Franchet and Giraux, 1923) or even the processing of skins and bones have all been suggested. Given the fact that certain extremities had been shaped, their use as 'picks' has often been put forward. However, from the 1930s onwards, the use of their sides as 'pick-planes' has been suggested based on the presence of edge damage and breakage of the mesial section of the pieces (Breuil and Lantier, 1951; Daniel, 1956).

Laurent Lang reaffirmed the hypothesis of their lateral use in 1997 following a study of Montmorencian tools recovered from different sectors of Les Closeaux at Rueil-Malmaison, Hauts-de-Seine (Lang and Sicard, 2008). The author notes that all the quartzite tools present traces of abrasion on the lateral ridges which could have resulted, awaiting confirmation by use-wear analysis, from contact with a fairly hard material "during grinding with a gesture parallel to the axis of the piece" (Lang et al., 1997, p. 184).

Sylvie Philibert was the only person to carry out use-wear analysis on an analogous object, a flint tool recovered from the Mesolithic site of Les Baraquettes in the Cantal. This piece bore scars and micropolish on one of its extremities, suggesting its use as a 'pick' for transverse abrasion or percussion on "hard materials with an abrasive mineral component" (Surmely et al., 2003, p. 191-193).

Use-wear analysis of tools from Farman

Use-wear analysis was carried out on all Montmorencian tools and demonstrates that the main traces of use are found on the lateral ridges and occasionally on the flat face and topography of the sides (figs. 8a and 8b). The backs sometimes have one or two ridges bearing similar, but less intense, traces to those found on the flat

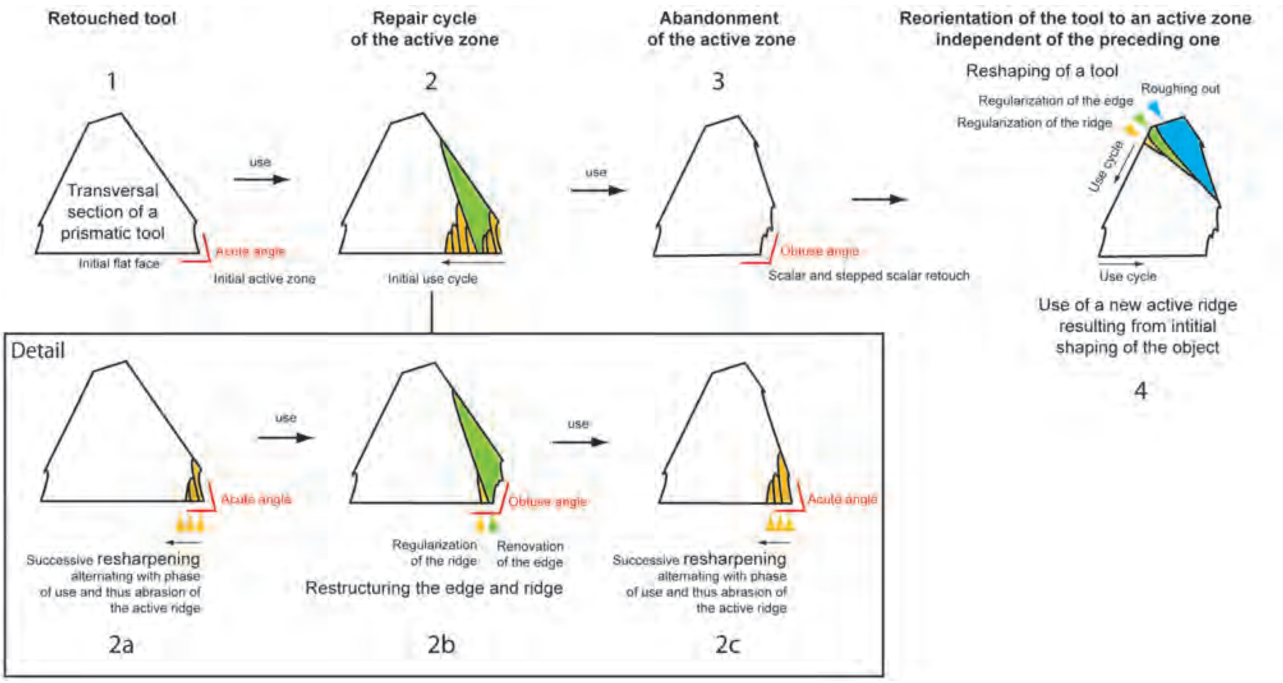

Fig. 7 – 62 rue Henry-Farman, Paris. Overall use / repair cycle for Montmorencian tools.

face. Contrarily to what was observed at Les Baraquettes, the extremities were rarely used which, in our opinion, excludes this tool functioning mainly as 'picks': only one tool presents bifacial edge damage, while two others bear slight wear on their extremities extended from the longitudinal ridges.

A first type of smoothing found along the longitudinal ridges, as well as the adjacent surfaces, appears macroscopically as a levelling of grains with altered faces and, microscopically as a semi-hard, convex and loosely welded coalescence (fig. 8c). This wear, indicative of contact with a generally hard mineral material, is distributed almost continuously between the hollows and raised areas resulting from edge-damage during use and / or repair (fig. 8d). On the other hand, traces on the ridges show no specific orientation. Smoothing is therefore accompanied by edge-damage, however it is difficult to distinguish traces of use from retouch designed to repair the edges since these tools all appear to have been rejuvenated (fig. 8e). Less intense smoothing of certain recessed surfaces may however attest to alternating phases of repair and use of the ridges.

The topography of the tools' sides and the flat face's asperities carry a second, significantly less pronounced, type of wear. Its arrangement and aspect indicate an unexplained secondary friction whose use-wear signature is however reminiscent of contact with dry hides.

The distribution of use-wear on prismatic tools from Farman leads us to consider that their longitudinal ridges (along the flat face or back) were in fact the working surfaces. Smoothing, and possible associated edge-damage, results from a single action combining percussion and abrasion on a fairly hard material. In the absence of an *ad hoc* reference collection, we cannot yet distinguish a mobile or fixed use for these tools based solely on the interpretation of use-wear patterns.

New functional hypotheses

The results of the use-wear analysis lead us to believe that these tools, particularly their ridges, were used on hard mineral materials. Different functional hypotheses can therefore be advanced, notably their use as strike-a-lights, 'saws' or scrapers. As a first step, we have chosen to test their usage for fracturing bladelets using the microburin technique to create microlith blanks. This hypothesis considers the hard mineral materials most frequently worked during the Mesolithic and is complemented by several basic morphological and technological observations: the notches present on the majority of failed microburins from Farman are often asymmetrical and form an angle generally close to 90°, corresponding to that of the longitudinal ridges of prismatic tools which slot into these notches (fig. 9).

In order to verify this hypothesis, three main methods for fracturing bladelets were tested (figs. 10 and 11):

– *test A*: the prismatic tool is used as an anvil on which the bladelet is struck by a stone retoucher;

– *test B*: the mobile prismatic tool is used to transversely grind the edge of the bladelet held on its side;

– *tests C to C"*: the mobile prismatic tool serves as a retoucher for non-tangential (test C) and tangential percussion (test C') on the edge of a bladelet laid flat and obliquely on a stone anvil. The hardness of the anvil (see below) also plays a role in the C" variant.

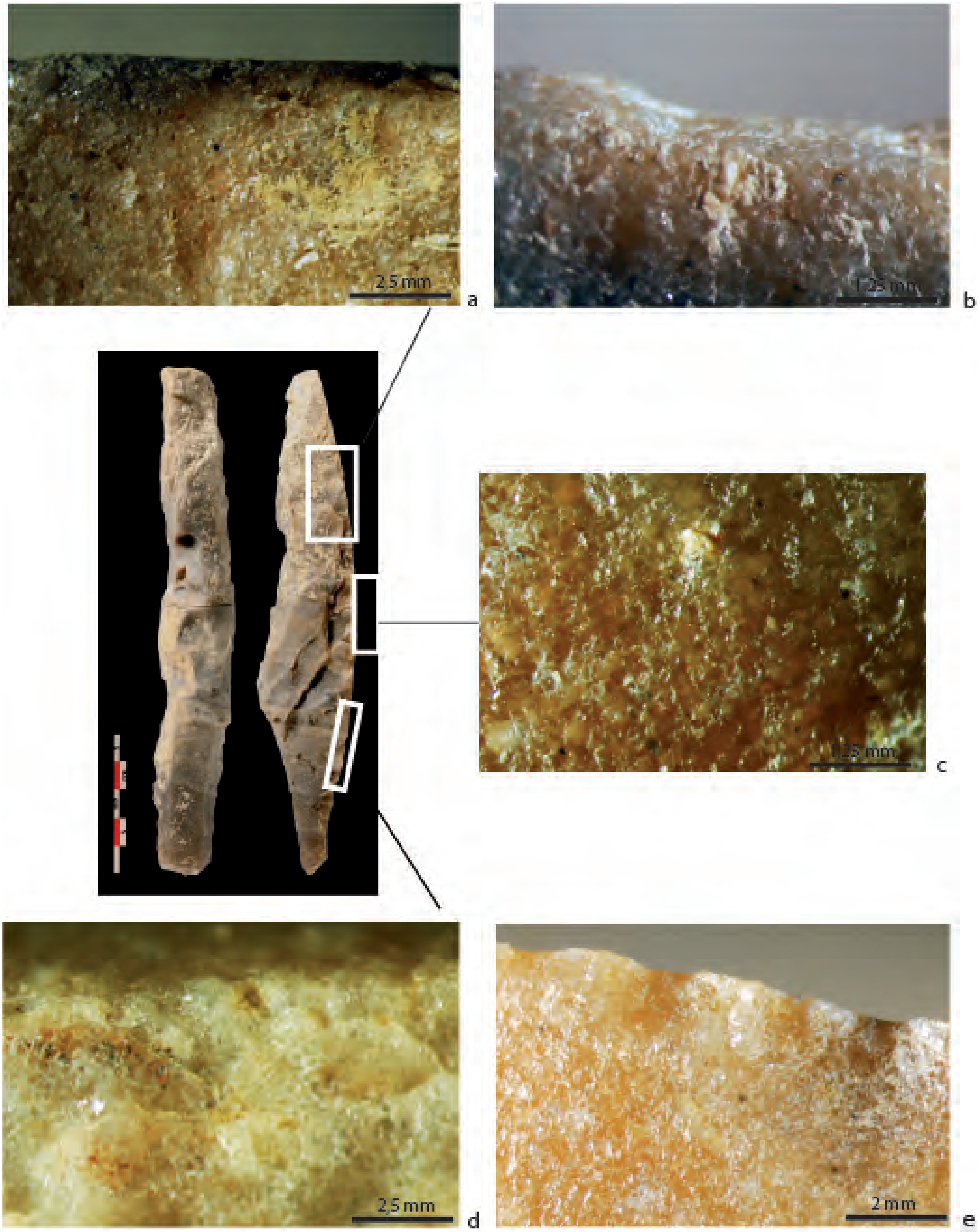

Fig. 8 – 62 rue Henry-Farman, Paris. Schematic distribution of use-wear identified on prismatic tools. a: tool 140/972-5, longitudinal ridge smoothed across its entire length, a similar smoothing is also found on its side (× 10); b: tool 148/977-2, this smoothing also affects the flat face (× 20); c: tool 160/981-1, polish on the asperities of the flat face (× 20); d: tool 119/989-6, distribution of smoothing in the hollows and on the asperities of the ridge; e: tool 160/981-1, repeated chipping of the retouched or working zone (× 15).

Test A did not produce characteristic trihedral point fractures, instead bladelets broke perpendicularly during the creation of the notch (fig. 12). This method's failure lies in difficulties holding both the bladelet and prismatic tool, used as an 'anvil', in place during successive blows. The percussion point cannot be accurately controlled, resulting in random fractures. Furthermore, this method does not explain the presence of use-wear across the length of the tool's longitudinal ridges. We therefore quickly excluded this type of use for the prismatic tools.

Test B was also inconclusive, as no characteristic trihedral point fractures were produced (fig. 12). The wear that developed on the tools was however similar to that observed on archaeological specimens (polish on the line of the ridges). The bladelet was positioned on its edge with the prismatic tool used for longitudinal abrading; the tool's ridge transversely abraded one of the bladelet's cutting-edges, rapidly wearing it and producing random bladelet fractures.

Although *test C* produced characteristic trihedral point fractures, the use-wear formed on the prismatic tools differed from that observed on archaeological specimens. The bladelet was placed flat and obliquely on the edge of the anvil with part of the dorsal face resting upon it (future microlith) and the remainder hanging off the anvil (eventual microburin). The prismatic tool was used for non-tangential percussion with a rectilinear motion. One of the tool's lateral ridges strikes the edge of the bladelet, on the outside and close to the edge of the anvil, until the bladelet breaks. The resulting microburins are

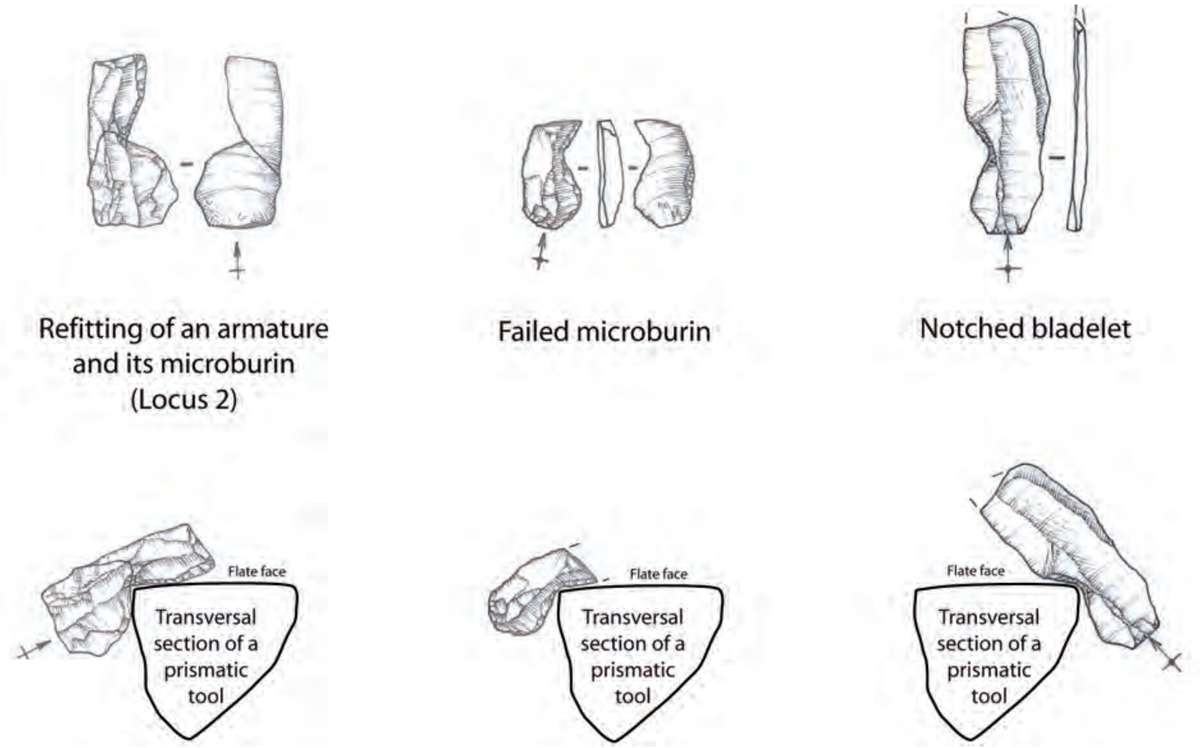

Fig. 9 – Morphological similarity between the working zones of Montmorencian tools and notches made on bladelets for the microburin fracture (drawings E. Boitard).

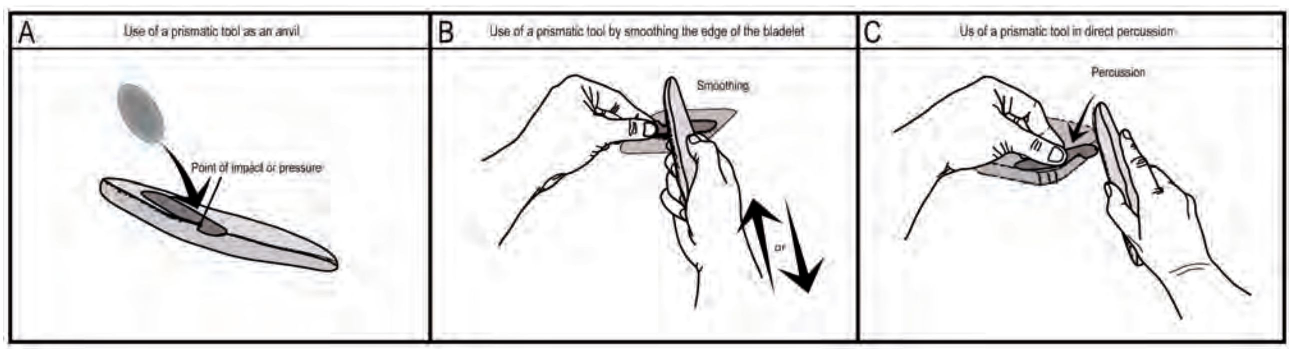

Fig. 10 – Test using Montmorencian tools for segmenting bladelets by the microburin technique.

Test	Number of active surfaces used on prismatic tools	Number of used bladelets	*Piquant-trièdre* fractures	
			Number	Frequency
A	1	13	0	
B	3	82	0	
C	1	34	14	41,20%
C'	1	48	20	41,60%
C"	1	60	29	48,30%

Fig. 11 – Trihedral point fracture frequencies according to different modes of use tested.

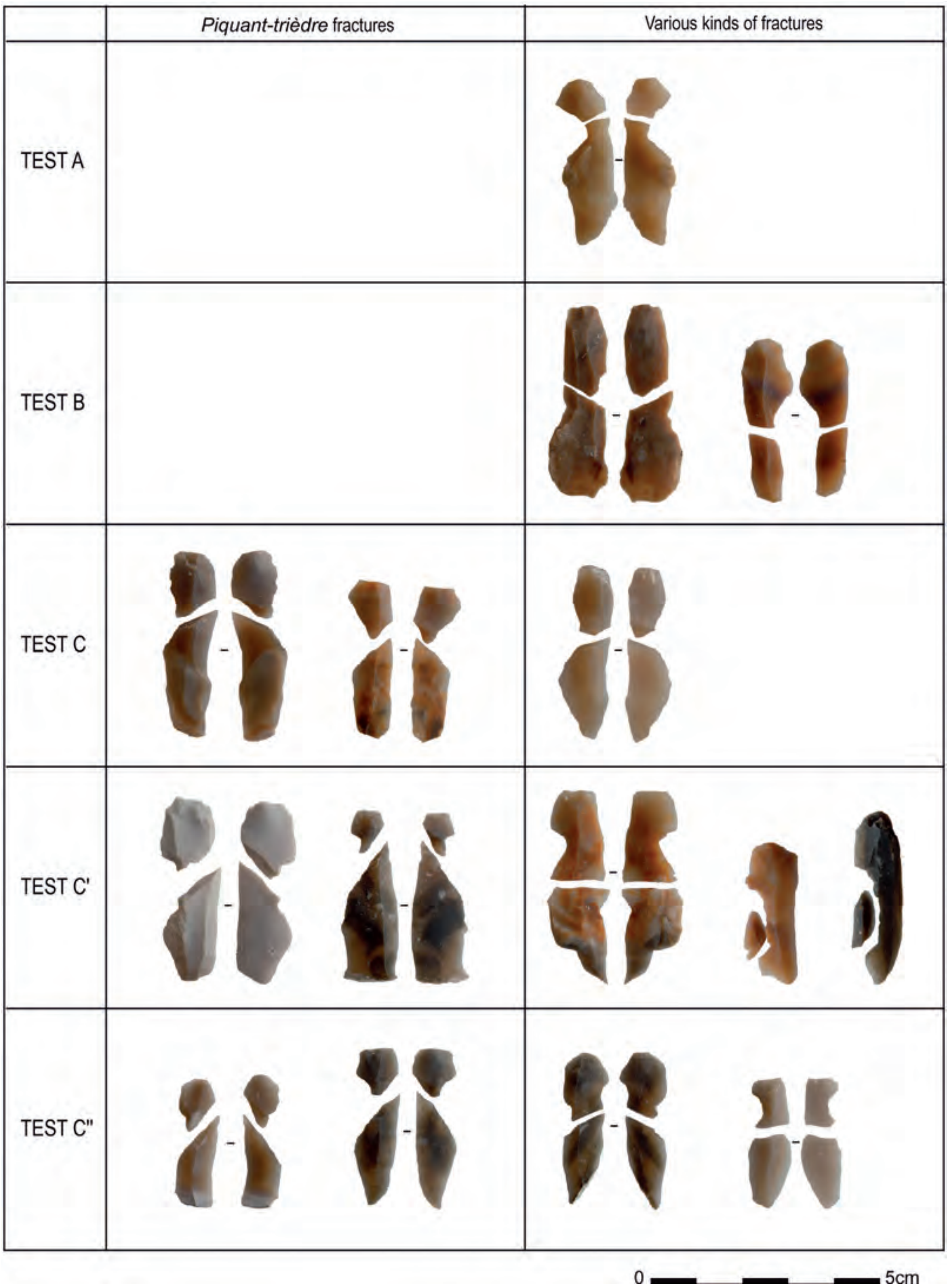

Fig. 12 – Examples of bladelets broken during experimental tests.

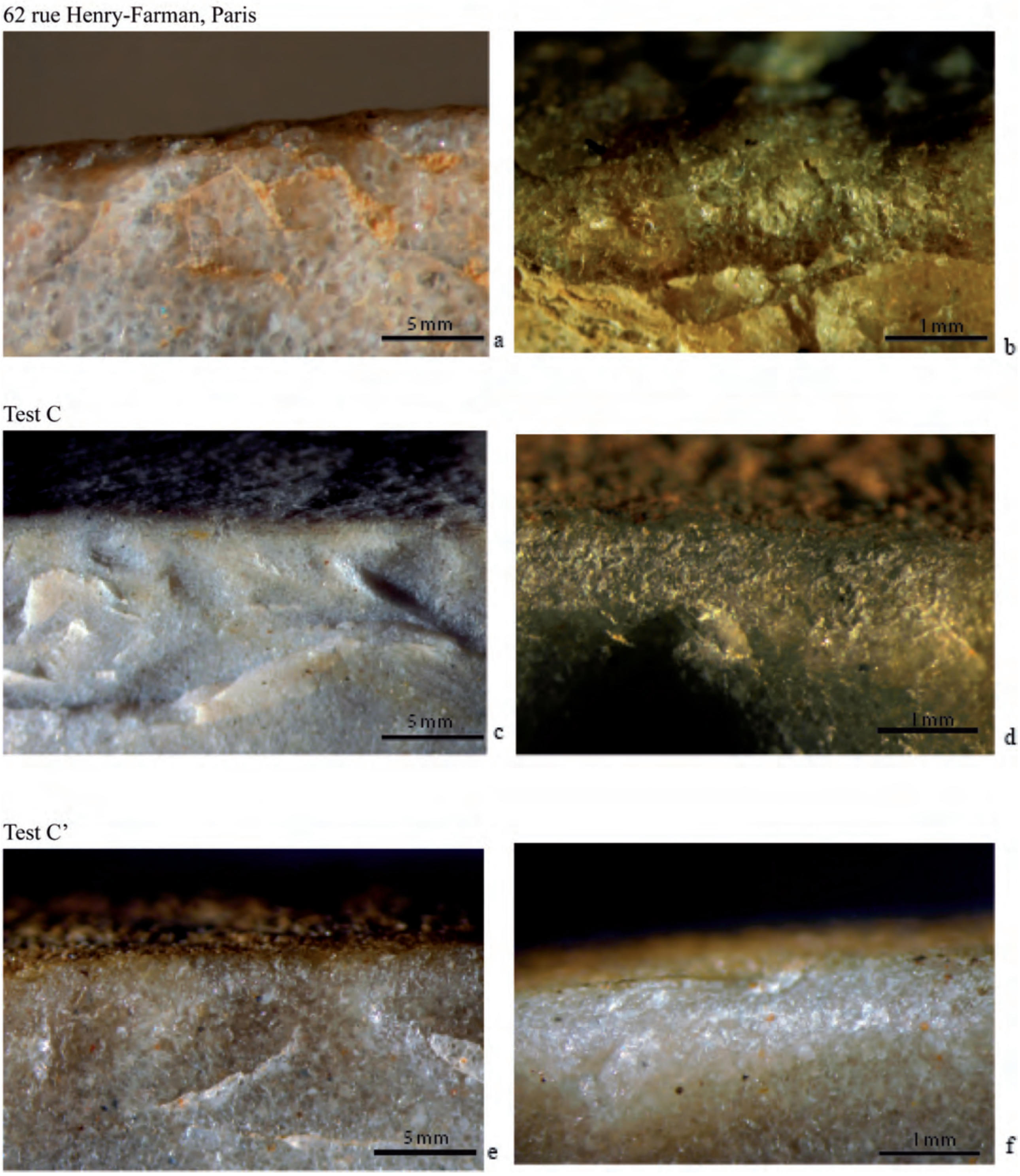

Fig. 13 – Comparison of use-wear on the longitudinal ridges of archaeological specimens and experimental pieces. A: 62 rue Henry-Farman, Paris, tool 151/977-9 (× 5); b: 62 rue Henry-Farman, Paris tool from locus 1549 (× 50); c: experimental tool used in test C (× 5); d: experimental tool used in test C (× 50); e: experimental tool used in test C' (× 5); f: experimental tool used in test C' (× 50).

characteristic and have part of the directly retouched notch on their dorsal face and a fracture facet on the ventral face that formed between deepest part of the notch and the opposite edge (fig. 12; Inizan et al., 1995). This method 'bruised' the ridges of the experimental prismatic tools, leaving traces unlike those observed on archaeological specimens, thus making this method highly unlikely (fig. 13).

Test C' appears the most suitable for fracturing bladelets while producing a trihedral point (fig. 12) and leaving traces that most accurately correspond to those observed on archaeological prismatic tools: blunting which extends slightly to the flat face and sides, together with a fluid polish and longitudinal striations (fig. 13). The bladelet is placed in similar manner to test C, although the tool is used for tangential percussion with a curvilinear motion. The series of precise blows from the tool's ridge creates a notch that is then shaped by fuller blows guided by the notch's morphology until the bladelet fractures, leaving a trihedral point. The denticulated length of the tool's ridge produces several small successive impacts within the notch.

It should also be noted that the type of anvil influences the conditions in which the bladelet is supported and the quality of the fractures. The use of a mineral anvil (in this case, sandstone) requires the bladelet to be firmly held and may result in different knapping accidents, notably a partial, longitudinal break produced by a counterblow from the anvil (fig. 12). In order to reduce the counterblow's effect, a piece of hide was placed between the bladelet and the anvil, producing good results, as well as better supporting the bladelet on the anvil (Test C"). The use of a wooden anvil is also possible.

The hypothesised use of Montmorencian tools according to methods C'-C" described above is therefore plausible. Further experiments are however necessary to evaluate other variants and, in particular, better characterise the scars and micro-scars left on microburins and use-wear on prismatic tools. Future more exhaustive experiments will also aim to test other modes of use for this tool type, as a strike-a-light for example.

CONCLUSION

The present study of Montmorencian prismatic tools demonstrates that their relatively simple shaping was designed to produce tools with fairly standardized morphologies. Several faces are transformed from an un-modified flat face serving as the striking platform. The lateral ridges, unlike the extremities, comprise the functional surfaces thus contradicting their functioning mainly as 'picks'. The use of these ridges on hard mineral materials has been highlighted. Based on preliminary experiments, the use of prismatic tools as retouchers for fracturing bladelets using the microburin technique seems plausible, however future experiments are necessary to validate this hypothesis.

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NOTES

(1) This study was carried out as part of a doctoral dissertation directed by B. Valentin entitled *Mesolithic prismatic tools from the Paris Basin: manufacture, function and circulation on a territorial scale*.

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Character and variability of Early Mesolithic toolkits in Belgium and Northern France: the contribution of a functional approach

Colas Guéret

Abstract: The technological and typological study of Mesolithic domestic tools has often been hampered by their un-standardised nature. This study presents the results of a functional approach to three Early Mesolithic (Preboreal and Boreal periods) assemblages from Northern France and Belgium. Use-wear analysis has made it possible to identify different materials worked by Mesolithic groups, especially plants probably used in basketry and weaving. The examination of un-modified blanks sheds new light on the very significant use of the un-retouched pieces which dominate the toolkits. Furthermore, a more detailed analysis of different functional modes suggests that technical attitudes varied between different sites. Site functions, together with chronological and geographic differences were also factors likely to have played a role in the contrasts observed between sites. Functional studies, which are still too sporadic, undoubtedly have a part to play in untangling these factors.

'Atypical', 'poorly made' or 'rare' are just some of the expressions frequently associated with Mesolithic domestic toolkits. These qualifications succinctly illustrate the difficulties researchers have encountered for over a century in attempting to define these often flake based assemblages other than by simply resorting to the term 'un-standardised'. These features contrast with the Final Palaeolithic laminar blanks employed for the production of tools often more easily identified by typology (for example, Fagnart, 1997).

Beginning in the 1960s, J.-G. Rozoy insisted that domestic tools could be useful for differentiating Mesolithic cultural groups (Rozoy, 1978); while at the same time J. Hinout (1990) defined the Sauveterrian *with denticulates* in the southern Paris Basin. However, for the last twenty years criticisms of the contexts studied by pioneers of Mesolithic research often resulted in focusing typological approaches on the omnipresent microliths used to arm arrows.

The widespread adoption of technological approaches certainly narrowed the question of technical decision making during the Mesolithic, however they too inevitably ran up against the same difficulties confronted by traditional typologies. It is now clear that flakes transformed into domestic tools essentially represent waste products from bladelet debitage geared towards the production of microlith blanks (Souffi, 2004). However, the inclusion of retouch techniques did not significantly refine tool categories (GEEM, 1975).

Questions concerning the use of un-modified blanks also remain unresolved. This hypothesis, already defended by J.-G. Rozoy, has been unevenly acknowledged. For certain researchers, supposedly used tools with marginal removals were classed as 'retouched blanks' rendering their frequency in assemblages difficult to estimate (for example, Lang et al., 1997). While other researchers prefer to consider them as a type in their own right: for example at Chaussée-Tirancourt (Somme) 428 un-modified 'used' pieces were classed versus 237 retouched objects, excluding microliths (Ducrocq and Ketterer, 1995). This difficulty is further complicated by the definition of edge-damage: criteria for differentiating taphonomic alterations, functional modifications and genuine retouch remain difficult to distinguish using only basic macroscopic observations.

However, the frequency in which these seldom classified objects were used could become central to palethnographic and paleohistoric considerations progressively emerging in Mesolithic research. This question not only leads to an examination of the factors influencing toolkit transformations that began with the onset of the Holocene, but also invites us to reconsider the

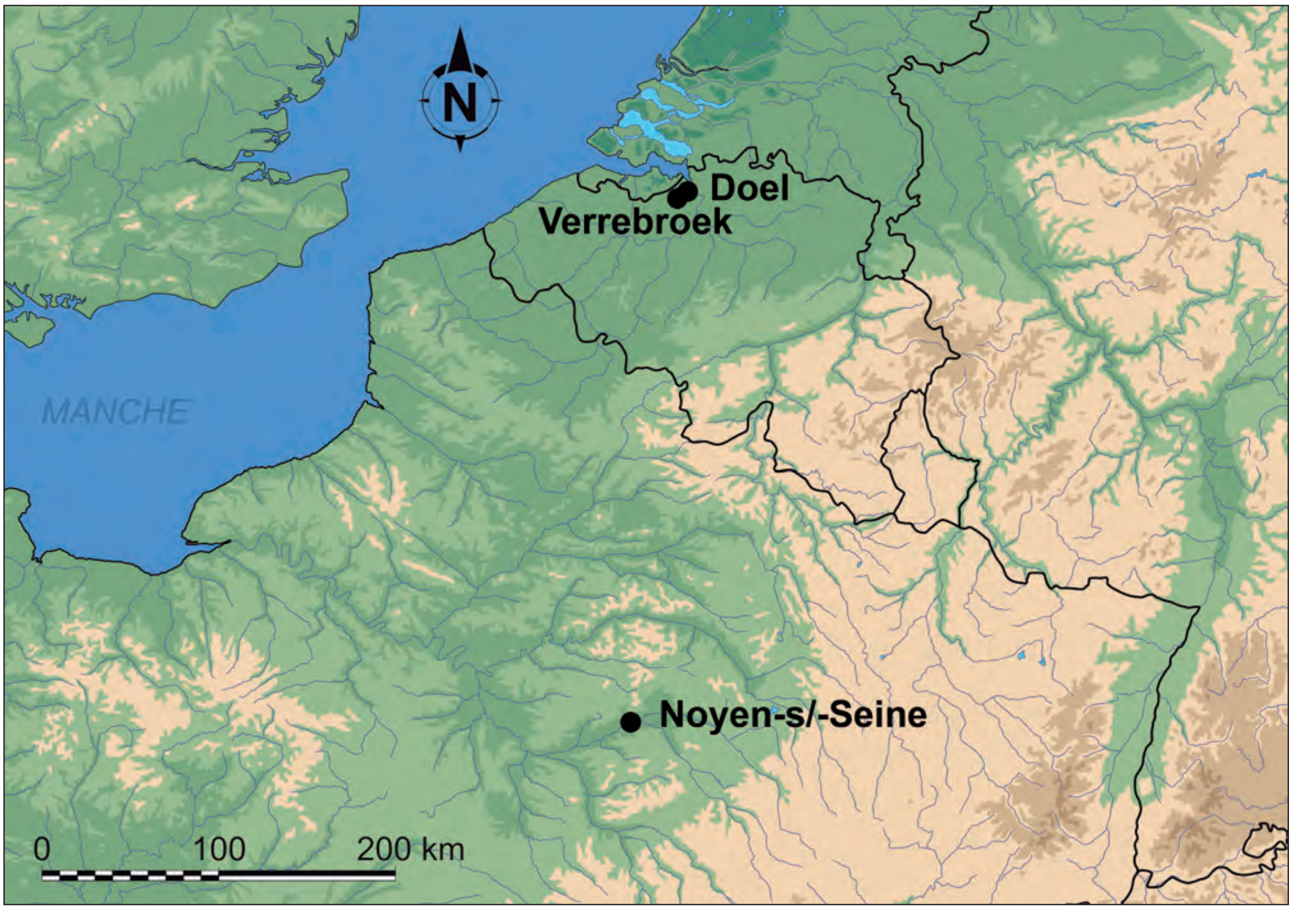

Fig. 1 – Location of the three sites studied.

role and function of different occupations. Are domestic tools really that rare or do they represent a tool category that traditional methods are somewhat at pains to recognise? Furthermore, is the uniformity apparent in these assemblages linked to a general simplification of technical systems or simply the product of a greater flexibility in Mesolithic technical choices? In order to address these questions we have favoured a use-wear approach employing traditional methods: all pieces were examined using both a stereo-microscope (5-40 ×) and a metallographic microscope (50-400 ×) with the observed traces of use compared to an experimental reference collection in order to determine the mode of tool function (motion and material worked). This article presents preliminary results obtained from several Early Mesolithic sites (Preboreal and Boreal periods *sensu* Costa and Marchand, 2006) in Belgium and Northern France.

DATASET AND SAMPLING STRATEGY

The collections examined here derive from three well-documented sites (fig. 1) that are the subject of several articles in this volume (Crombé et al., this volume; Mordant et al., this volume; Noens, this volume).

The sites of Dok at Verrebroek and Deurganckdok J/L at Doel are found in Sandy Flanders (Belgium). Rescue

	Noyen	Doel C2	Verrebroek C17
Scraper	3 (2)	12	33
Denticulated flake	64 (4)		2
Burin	2	7	9
“Pièce esquillée”	13		2
Retouched flake	20	13	17
Fragment of retouched artefact			12
Truncation		1 ?	1
Notch	2	1	2
Backed piece	1	1	1
Other		2	1
Total	105	37	80

Table 1 – Typological composition of the studied assemblages. Tools to be considered with caution are in parentheses.

	Noyen s/ S.	Verrebroek	Doel
Flint nodules	+ 20 cm	- 10 cm	- 10 cm
Fire activities	limited	intense	limited
Archeological and taphonomic bias	no chips	no bias	no bias
Sieving	yes	yes	no

	Noyen s/ S.	Verrebroek	Doel
Number of lithic artefacts	1468	50691	671
Retouched tools	++	+	+
Usable pieces (edge > 2cm)	+++	+	+
Chips	-	++	+
Overheated artefacts and debris	-	+++	-

Studied corpus

Noyen s/ Seine	Verrebroek C17	Doel J/L C2
→ A preliminary macroscopic selection A first study : 49 used tools	→ Retouched tools + macroscopic selection 141 artefacts	→ Exhaustive study of the usable artefacts 252 artefacts

Fig. 2 – Factors influencing lithic assemblage composition. Relative proportions of the different artefacts categories and sampling strategies for the functional study.

excavations of Lateglacial dunes carried out between 1992 and 2003 by a team directed by P. Crombé from the University of Ghent exposed several dozen lithic concentrations dated mainly to the Preboreal/Boreal transition. These well-preserved occupations have already been the subject of several detailed use-wear analyses carried out by V. Beugnier concerning eight loci from Verrebroek and one from Doel (Beugnier and Crombé 2005; Beugnier, 2007). Our examination of concentration C17 from Verrebroek and locus C2 (sector J/L) from Doel (Jacops et al., 2007) builds directly upon this work. The regional lithic industries are characterised by the generally small size of the material, coupled with an often weak retouched tool component dominated by endscrapers and occasionally burins (table 1). Excluding the significant proportion of thermally altered material from C17, the preservation of two loci is very good; the material is unpatinated and soil sheen is within reasonable limits.

The site of Haut-des-Nachères at Noyen-sur-Seine (Seine-et-Marne, France) has become famous since its discovery in 1983 (Mordant and Mordant, 1987). Rescue excavations directed by D. and C. Mordant of a peaty paleo-channel recovered exceptional vegetal remains (basketry and a dugout canoe) associated with abundant fauna. Several dates place the occupation that interests us here (system 9: Mordant et al., this volume) to around 8000 BP (non-calibrated) or the Boreal/Atlantic transition. The rather modest amount of lithic material is characterised by an extreme paucity of bladelets and microliths. Denticulates are the most common retouched tool

	Noyen	Doel	Verrebr.	Total
Plant working (stricto sensu)	32	9	23	64
Cutting, sawing	3			3
grooving	1		1	2
scraping	16 (1)		1	17 (1)
transversal oblique motion		9	21	30
undetermined	12			12
Vegetal fibers stripping	3	17	1?	21
Vegetal material working (including wood)	23	2	3	28
scraping	17		3 (1)	20 (1)
grooving	3			3
splitting	1			1
undetermined	2	2		4
Skin processing	21	8	26	55
scraping	19 (1)	6	25	50 (1)
cutting	1 (1)	2 (1)	1	4 (2)
undetermined	1			1
Animal hard material working	1	2	0	3
scraping	1 (3)	2 (1)		3 (4)
grooving		0 (5)		0 (5)
undetermined				
Animal soft material working	1	3	7	11
butchery	1		7 (1)	8 (1)
cutting	0 (2)	3 (1)		3 (3)
Mineral material working	8	1	4	13
Strike-a-light	3		2 (1)	5 (1)
ochre working	2			2
other	3	1	2	6
Other	5	2	16	22
undetermined material scraping	4 (1)	1	8	12 (1)
grooving			1	1
cutting, sawing	1		1	2
percussion			1	1
undetermined		1	5	6
Total	94	44	80	218

Table 2 – Activities identified by the use-wear study (in numbers of use-zones). Uses to be considered with caution are in parentheses.

in an assemblage otherwise dominated by flakes (table 1). The preservation of the material varies as a function of its proximity to the peat levels, but is generally satisfactory for a microscopic examination.

The three collections were analysed with the same level of detail, all domestic tools were examined for use-wear, including the maximum number of un-modified pieces. However, for these latter pieces, it was necessary to select a sample adapted to the extremely variable composition of assemblages. The major characteristics of each assemblage and a synthesis of the choices made during this phase of the study are detailed in figure 2.

The results of the use-wear study are first presented by worked material and then considered from a more general techno-functional perspective.

THE WORKED MATERIALS AND *CHAÎNES OPÉRATOIRES*

Overall, the study of Doel and Verrebroek, as well as provisional observations of 49 pieces from Noyen, uncovered definitive evidence of 218 use-zones (UZ, table 2).

The large-scale working of vegetal materials

The working of vegetal material is represented by a very significant number of use-zones in all three assemblages. At Doel and Noyen, they represent by far the largest proportion of identified UZ. Overall, 113 of the 218 almost always un-modified edges were involved in this type of activity.

At Noyen, distinguishing between working wood or plants (in a strict sense) for the 58 UZ concerned was not always possible, however non-woody materials were worked the most often. Scraping, as well as several unidentified transverse actions, are almost exclusively represented; cutting or grooving is limited to just a handful of UZ (fig. 3). All of the pieces showing evidence for scraping plant materials are marked by a fairly flat, very shiny asymmetric polish often visible to the naked eye and sometimes very invasive on the ventral face of the piece. However, apart from these shared characteristics, differences observed between UZ complicate classifying different uses (figs. 4 and 5). This diversity of wear probably reflects the variety of worked species, as well as the freshness of the material which is still difficult to determine.

The situation is very different for the Belgian sites. At both Doel and Verrebroek, 30 oblique transverse actions, with a leading edge angle greater than 90° (positive-rake angle), involving plant materials were recognized (fig. 6). The fine, often slightly concave edges carry a very shiny polish oriented obliquely to their edges. This fairly flat polish is regularly marked by fine striations uniquely on the ventral face (fig. 7). These traces have already been largely described by V. Beugnier (2007), who observed

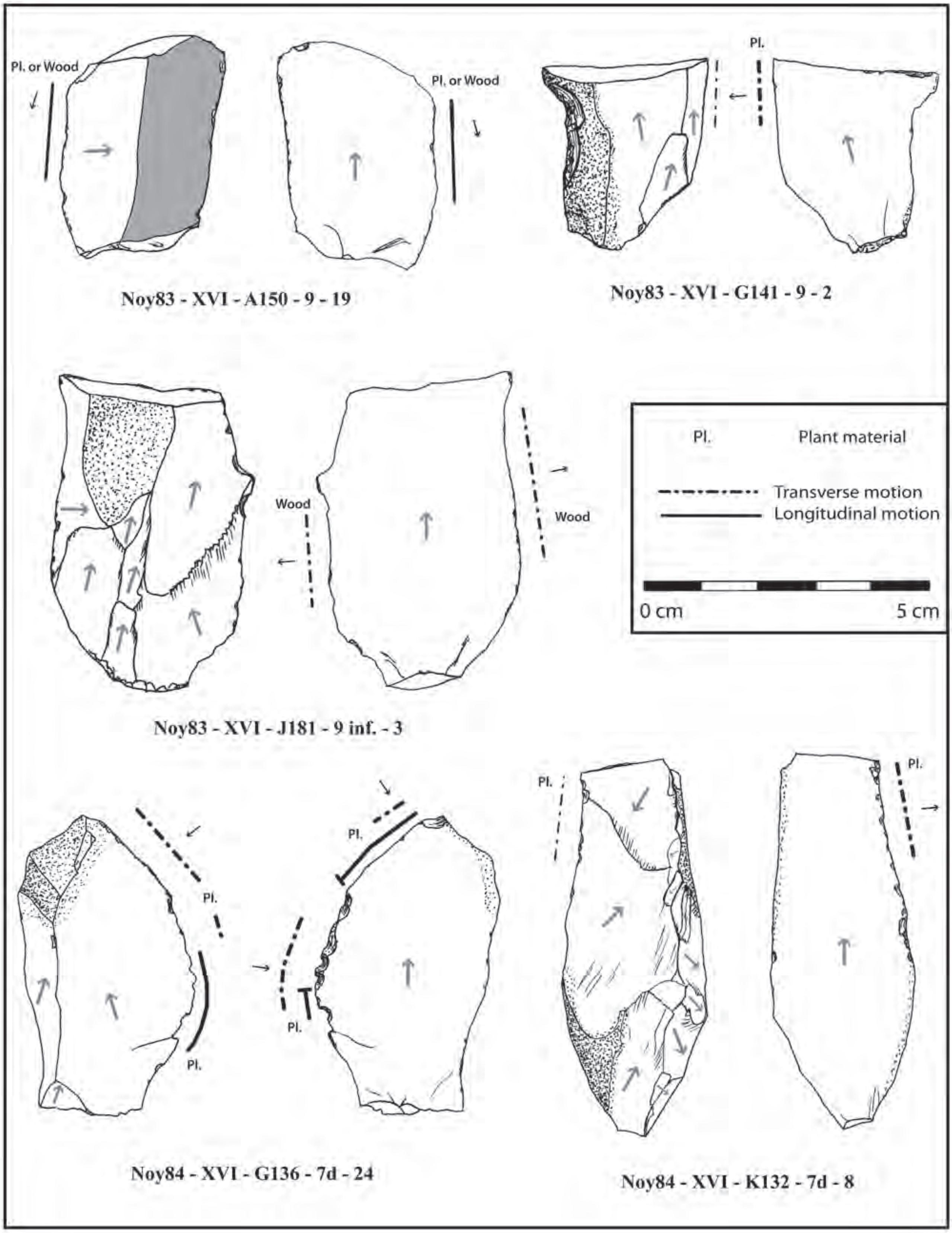

Fig. 3 – Noyen-sur-Seine, system 9. Several tools associated with working vegetal material.

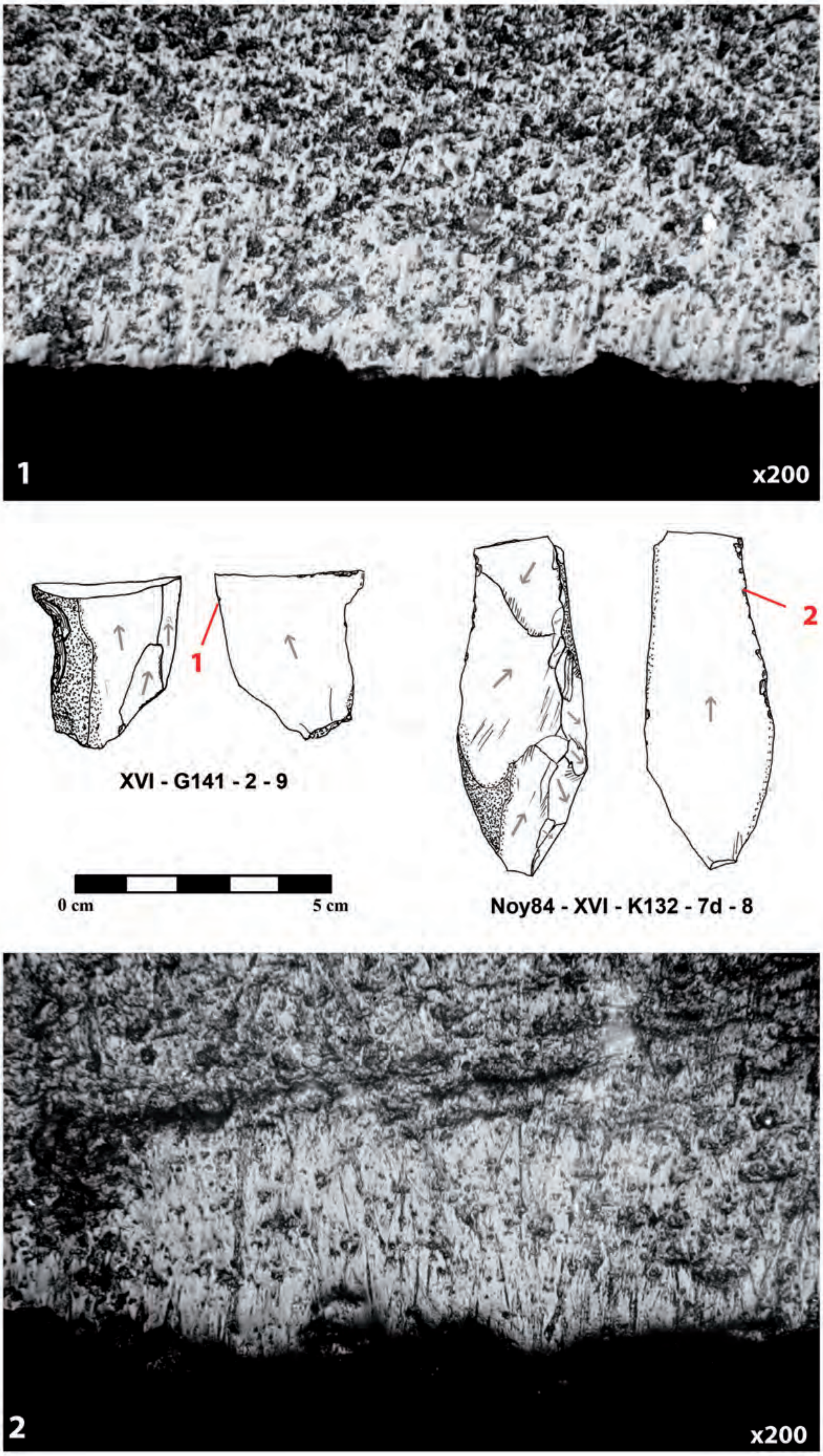

Fig. 4 – Noyen-sur-Seine, system 9. Two examples of scraping plant material with a leading edge angle greater than 90° (positive-rake angle). In both cases, the photograph of the ventral face corresponds with the flank face.

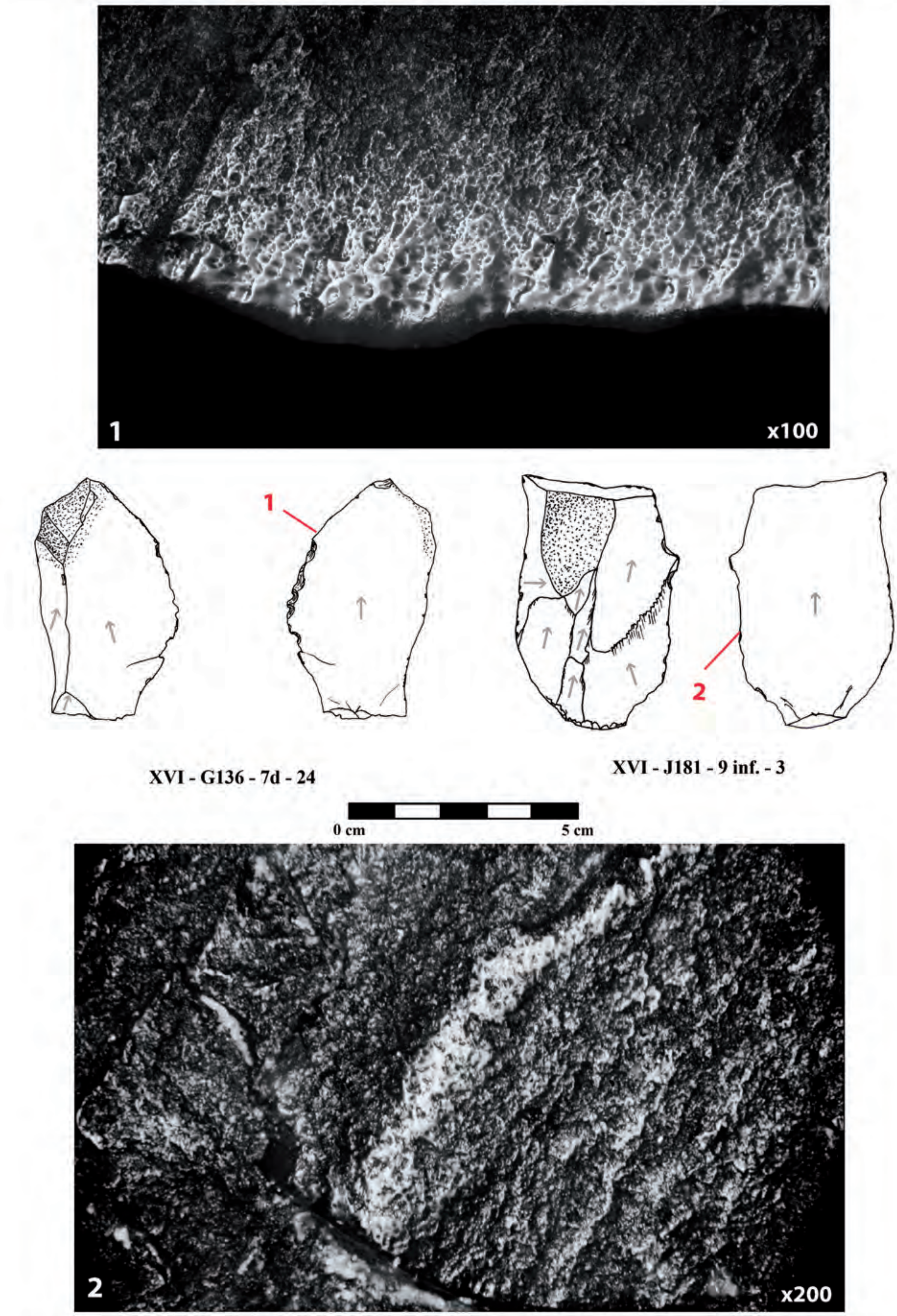

Fig. 5 – Noyen-sur-Seine, system 9. Top, very bright polish associated with cutting fairly rigid siliceous plant material (perhaps reeds). Bottom, smooth domed polish on a hackle characteristic of scraping wood with a leading edge angle greater than 90° (positive-rake angle).

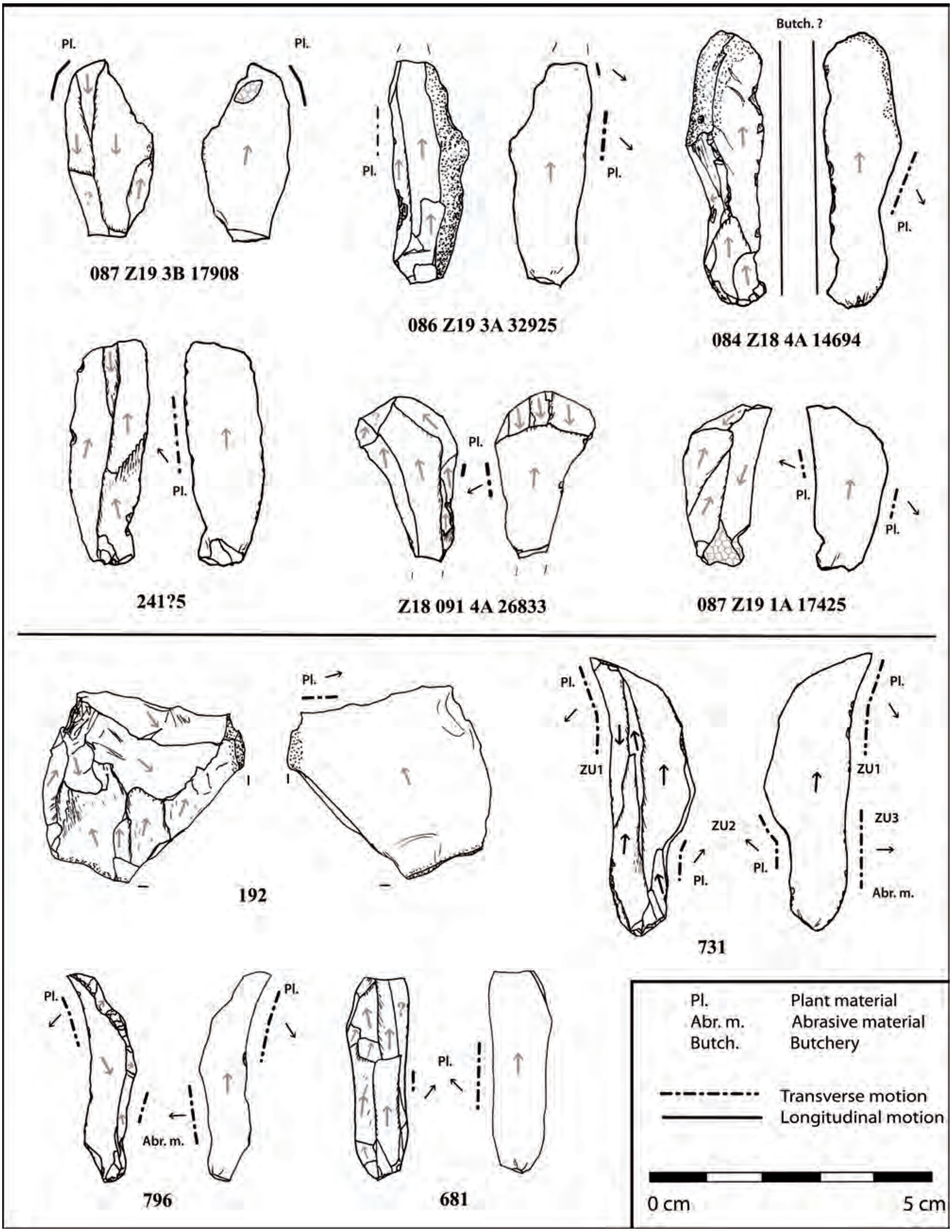

Fig. 6 – Verrebroek C17 (top) and Doel C2 (bottom). Characteristic tools from Sandy Flanders' assemblages used on plant materials with an oblique transverse motion.

this type of use in 8 out of the 9 concentrations studied from the two sites. Despite certain variations, especially in the frequency of striations, these 30 UZ constitute a very homogeneous group both at the level of the traces themselves, as well as the edges used. The obliqueness of the motion, sometimes close to 45°, most likely suggests the splitting of siliceous plants such as rushes or reeds.

Finally, at Doel 13 of 17 edges bear very particular abrasive traces. The dorsal faces of concave or straight cutting-edges are micro-damaged with a very specifically localised rounded edge bearing matte wear on both faces: more invasive on the ventral face and often more striated on the dorsal face (fig. 9). Although this type of use-wear approximates that produced by the working of dry skins, the UZ's morphology and the distribution of the traces are most similar to those observed by J.-P. Caspar for the scutching of vegetal fibres now well-known from Neolithic contexts (Caspar et al., 2005). The tools from Doel are therefore amongst the oldest known depicting this type of action.

This new evidence of a well-developed vegetal handicraft during the Mesolithic complements several other studies carried out over the last twenty years (Juel Jensen, 1994; Van Gijn et al., 2001; Beugnier, 2007), as well as discoveries of basketry and weaving from waterlogged contexts (Mordant and Mordant, 1987; Mertens, 2000; Fitzgerald, 2007; McQuade and O'Donnell, 2007). The fish-traps and the basket from Noyen are the oldest examples known from Europe to this day. Although in terms of use-wear, the exact nature of the plants worked, and by what motions, remains however difficult to determine. Experimentation carried out by other researchers (Beugnier, 2007) has not succeeded in succinctly reproducing most of the polishes observed on tools and, furthermore, the archaeological objects made from these plants are still unknown. The rarity of tools presenting evidence for working woody materials in the assemblages studied is equally surprising. Perhaps it is necessary to look for such tools amongst the osseous and stone macro-tools?

The working of soft animal materials

Fifty-five UZ definitely connected to the working of skins were identified from the three sites considered here. In 50 of these cases, a scraping action could be identified, associated once again with limited longitudinal traces. In Belgium, apart from a few examples, this wear is found on small endscrapers (figs. 10 and 11) that, not surprisingly, were used fairly intensively to work often dried skins with a positive-rake angle, sometimes with a help of an additive. Their small size and method of use implies the presence of a haft which has not left any detectable traces. At Noyen, the three endscrapers present no wear, however 19 generally convex un-modified edges served to scrape cutaneous tissue with a negative-rake angle when identifiable (figs. 12 and 13). In our opinion, the rarity of cutting tools (cf. longitudinal traces) associated with the working of dried skins raises questions concerning a possible spatial and temporal separation of *chaîne opératoires*, notably in Belgium where this infrequency has already been noted by V. Beugnier.

Evidence of butchery, as is normally the case, is largely under-represented in the functional spectrum; only seven cutting-edges from Verrebroek and a single one from Noyen have edge-damage associated with several hard spots indicative of contact with bone. At Doel, only three UZ suggest cutting actions on a soft animal material. This low frequency is easily explained given the faint traces left by this type of use, coupled with taphonomic factors rendering it difficult to accurately interpret this type of wear. However at Noyen, the significant number of osseous remains present clear evidence of intense butchery activities carried out on the site. The possibility that denticulates were also involved in carcass processing remains unresolved (fig. 14), however their use in butchery activities has been advanced for the south-western French Middle Palaeolithic based on the macroscopic analysis of this type of tool (Thiebaut et al., 2007). Preliminary microscopic observations of the Noyen material have demonstrated an association of edge-damage, small amounts of wear, a soft fluid polish and 'osseous' spots on the points of certain denticulates. This evidence, although compatible with butchery, is only occasional and requires further analyses in order to be properly interpreted.

Occasional working of hard animal materials

Evidence for working hard animal materials is rare, only three UZ bear marks consequential enough to be definitively attributed to the scraping of bone or antler with a leading edge angle less than 90° (negative-rake angle) (fig. 15). Certain other traces referable to scraping hard materials are good candidates, but do not provide definitive evidence for the working hard animal materials. It is still a bit premature to deduce a lower investment in osseous tools during the Mesolithic. At Noyen, where faunal remains are remarkably well-preserved, bone tools and significant quantities of manufacture waste attest to sawing and grooving, a practice that has not yet been identified from the lithic material (David, submitted). Furthermore, it is common to find several bone tools or technical pieces abandoned on relatively brief Early Mesolithic campsites in Northern France and Belgium. The osseous industry probably had a longer use-life than stone tools and these technical elements, linked to short occupations, argue in favour of a continually renovated *toolkit* that responded to the needs of these groups, but quite unlike toolkits known from around the Baltic region.

FUNCTIONAL DATA AND TYPO-TECHNOLOGICAL APPROACHES

Very occasionally retouched tools

From a techno-functional standpoint, the ubiquitous unmodified tools constitute the structuring element of the

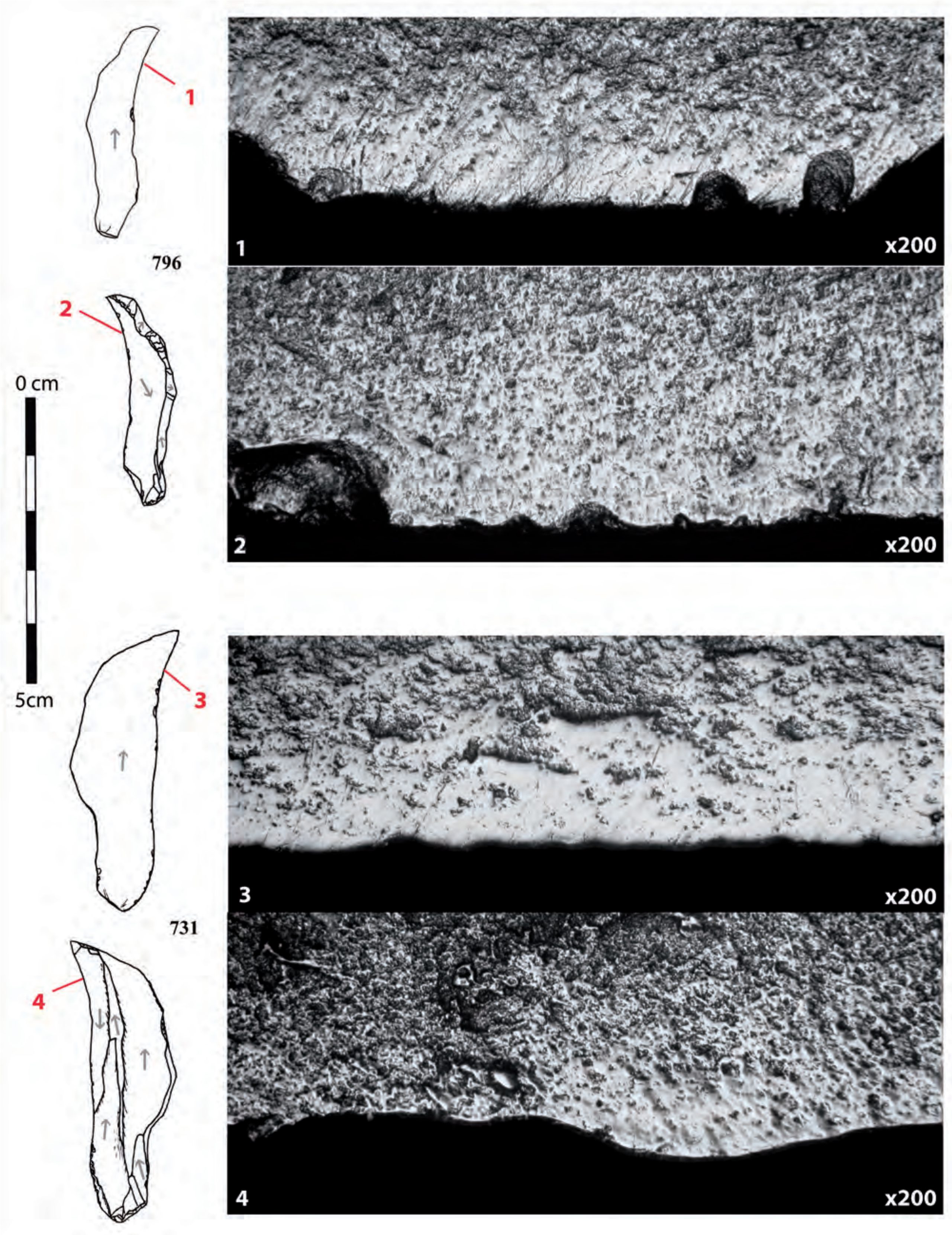

Fig. 7 – Doel C2. Two tools used on plant materials. The very bright polishes result from a transverse oblique motion with a leading edge angle greater than 90° (positive-rake angle). The asymmetry between the rake face (dorsal face) and the flank face (ventral face) is systematically evident.

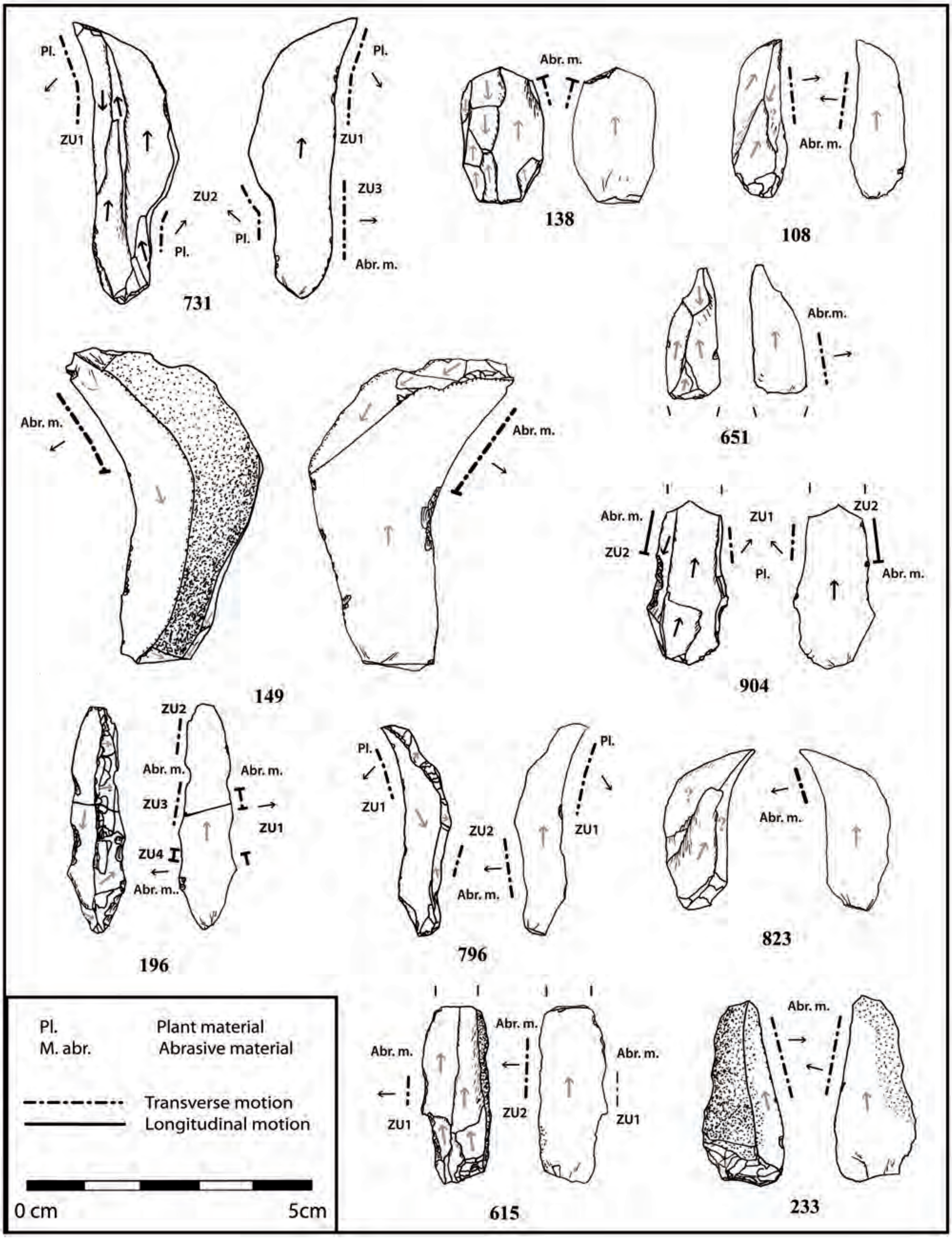

Fig. 8 – Doel C2. 12 of the 13 tools associated with the scutching of vegetal fibres. Pieces 731 and 796, already illustrated in figs. 6 and 7, both bear traces associated with the scutching of vegetal fibres, in addition to traces of working plant materials.

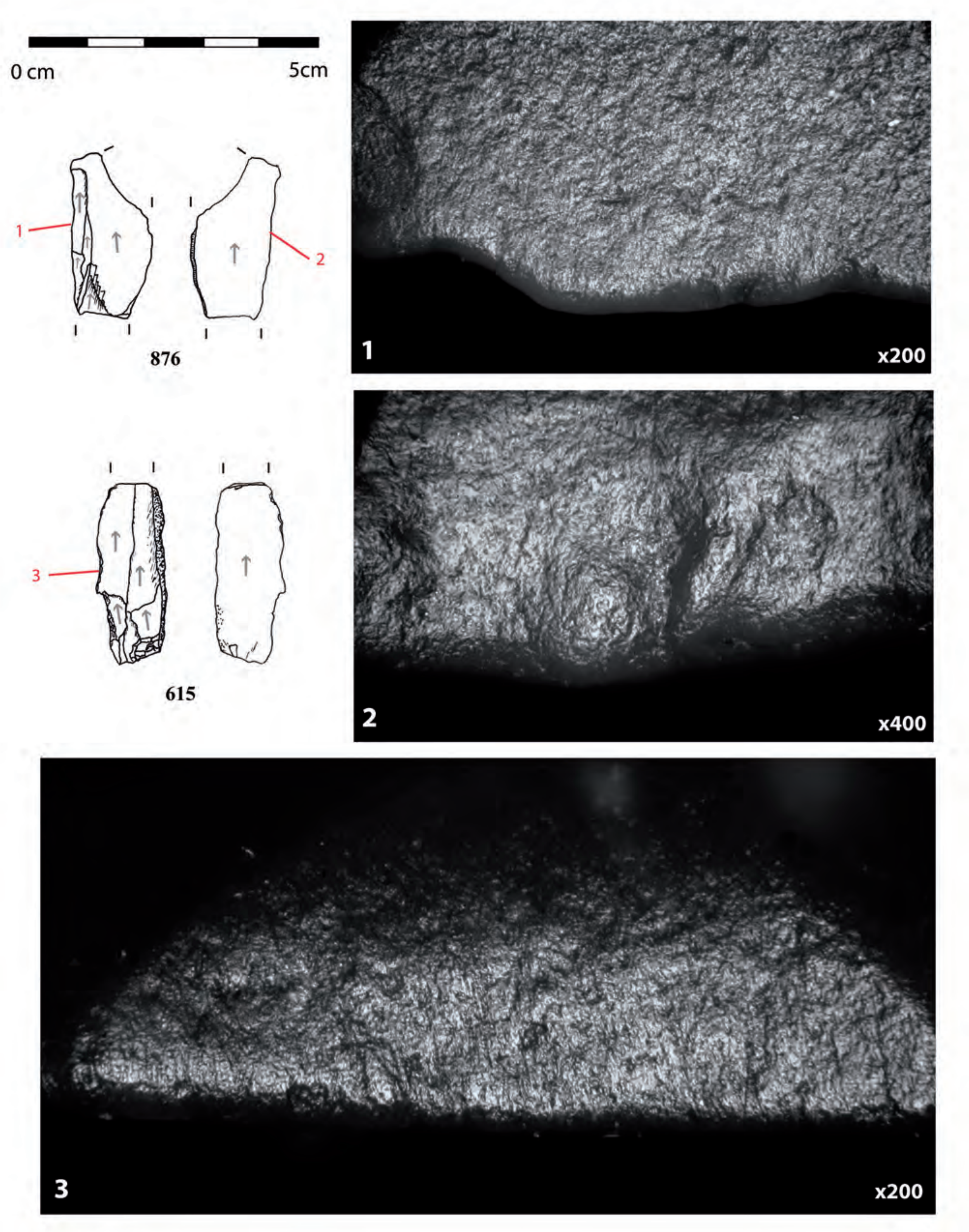

Fig. 9 – Doel C2. Matte blunting typical of scutching. 1: blunting regularly marks the line of the ventral face; 2: it penetrates the hollows of the removals on the dorsal face; 3: the striations are sometimes abundant on the dorsal face, even in the most concave zones.

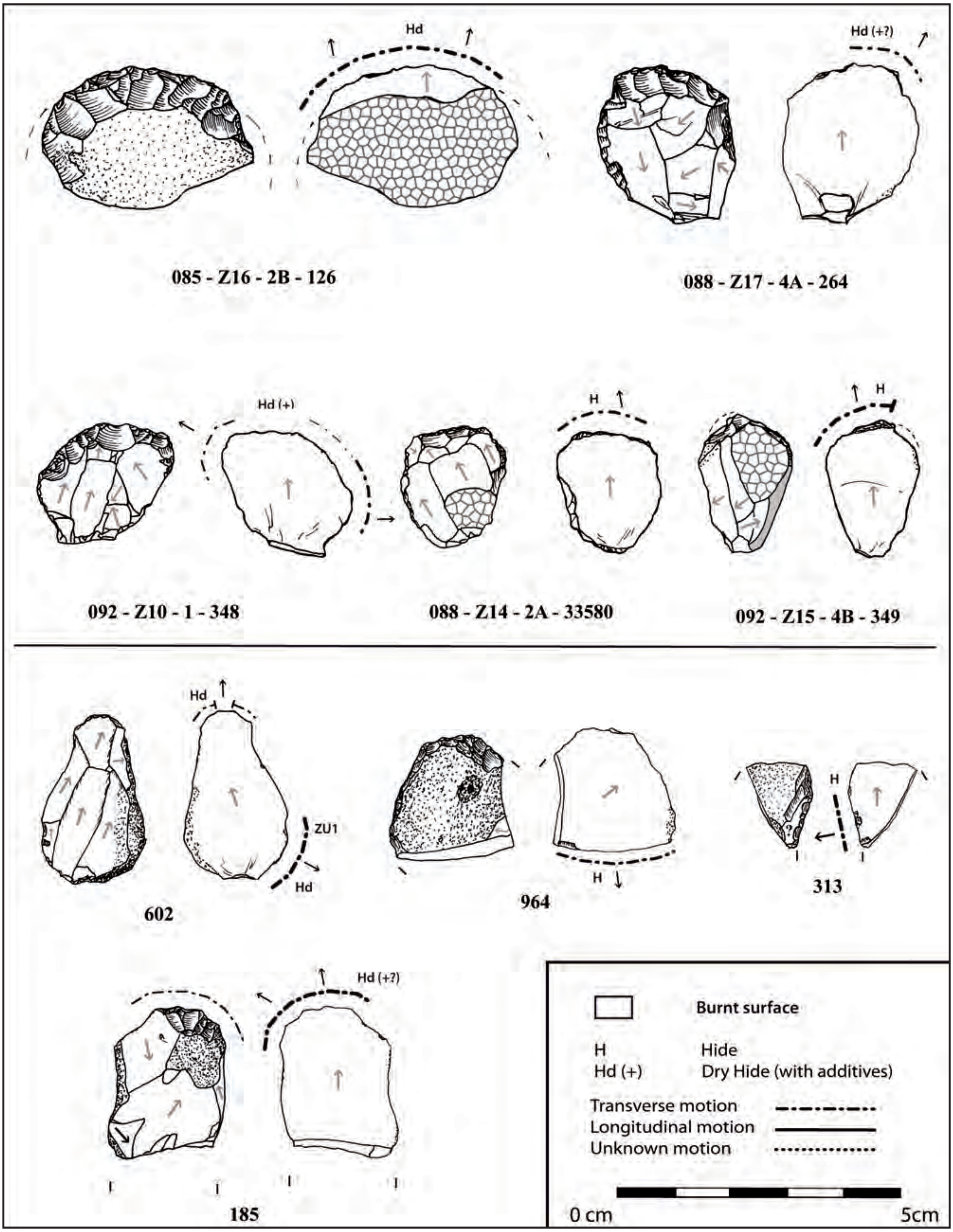

Fig. 10 – Verrebroek C17 (top) and Doel C2 (bottom). Several used endscrapers (top) and the four pieces bearing wear from scraping skins (bottom).

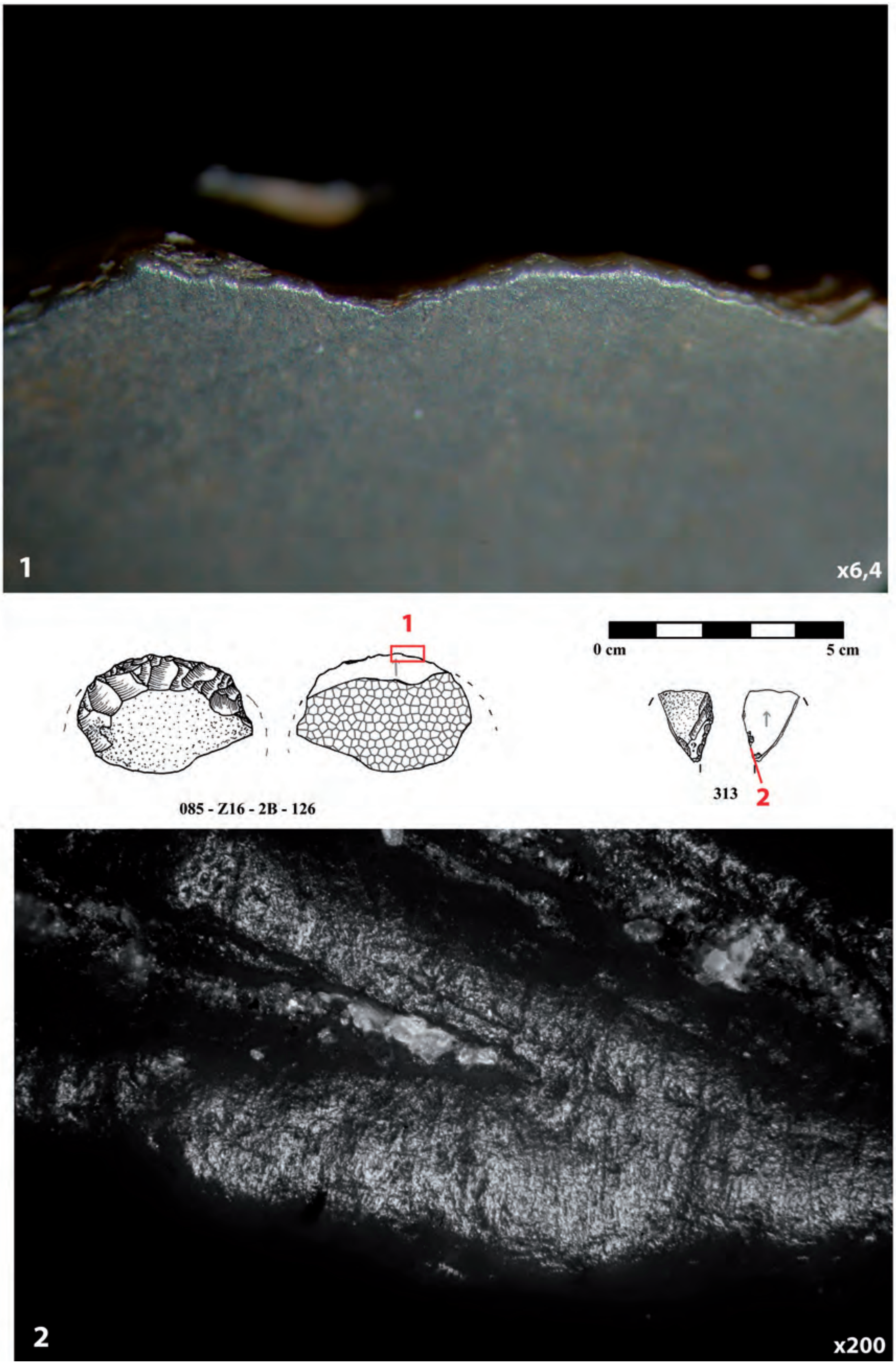

Fig. 11 – Verrebroek C17 and Doel C2. Two scales of observation. 1: endscrapers are regularly worn macroscopically at Verrebroek; 2: microscopically, the rough polish and the sometimes abundant striations most often demonstrates the scraping of dried skins with a leading edge angle greater than 90° (positive-rake angle), as here with Doel.

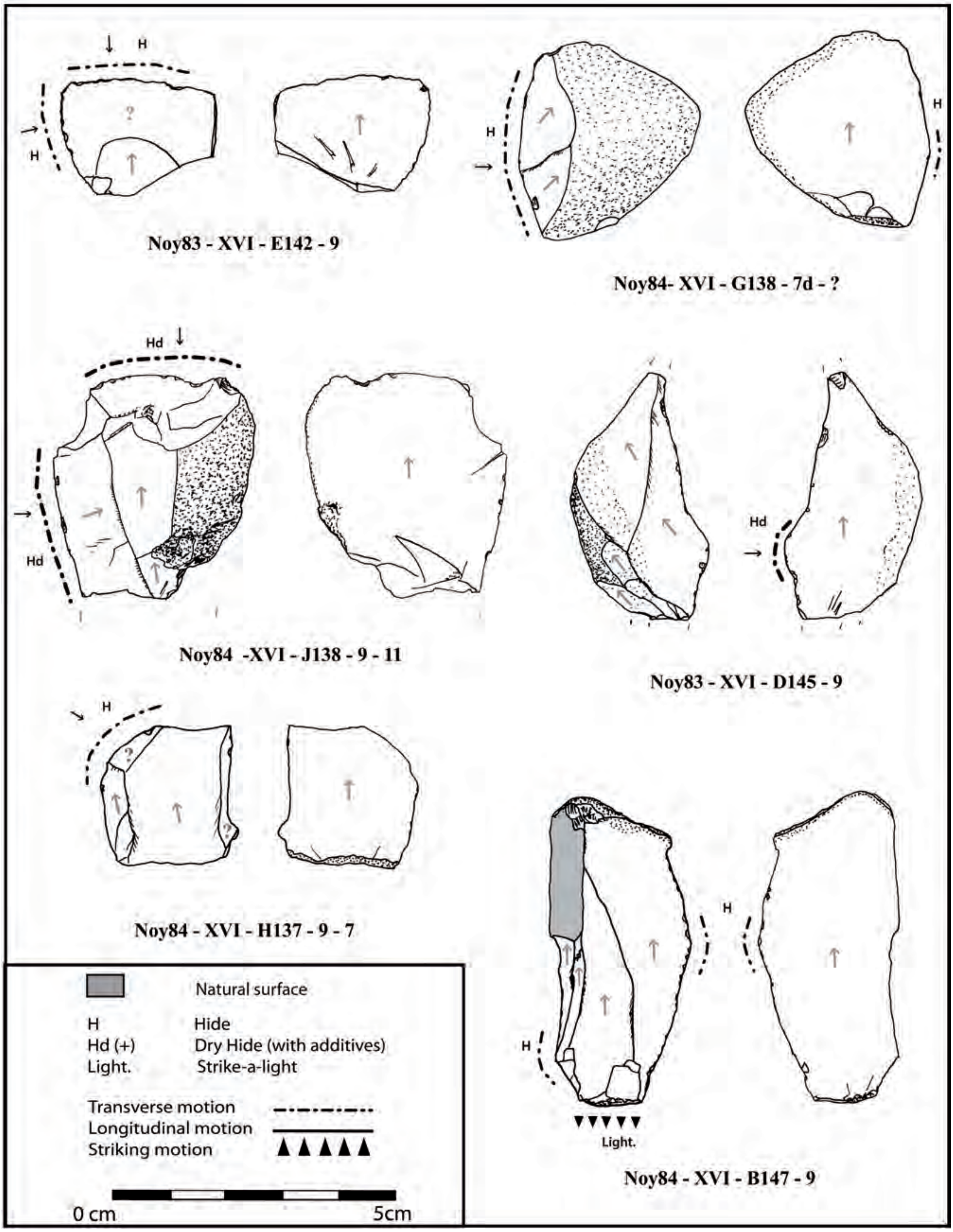

Fig. 12 – Noyen-sur-Seine, system 9. Some of the un-modified convex edges used to scrape skins.

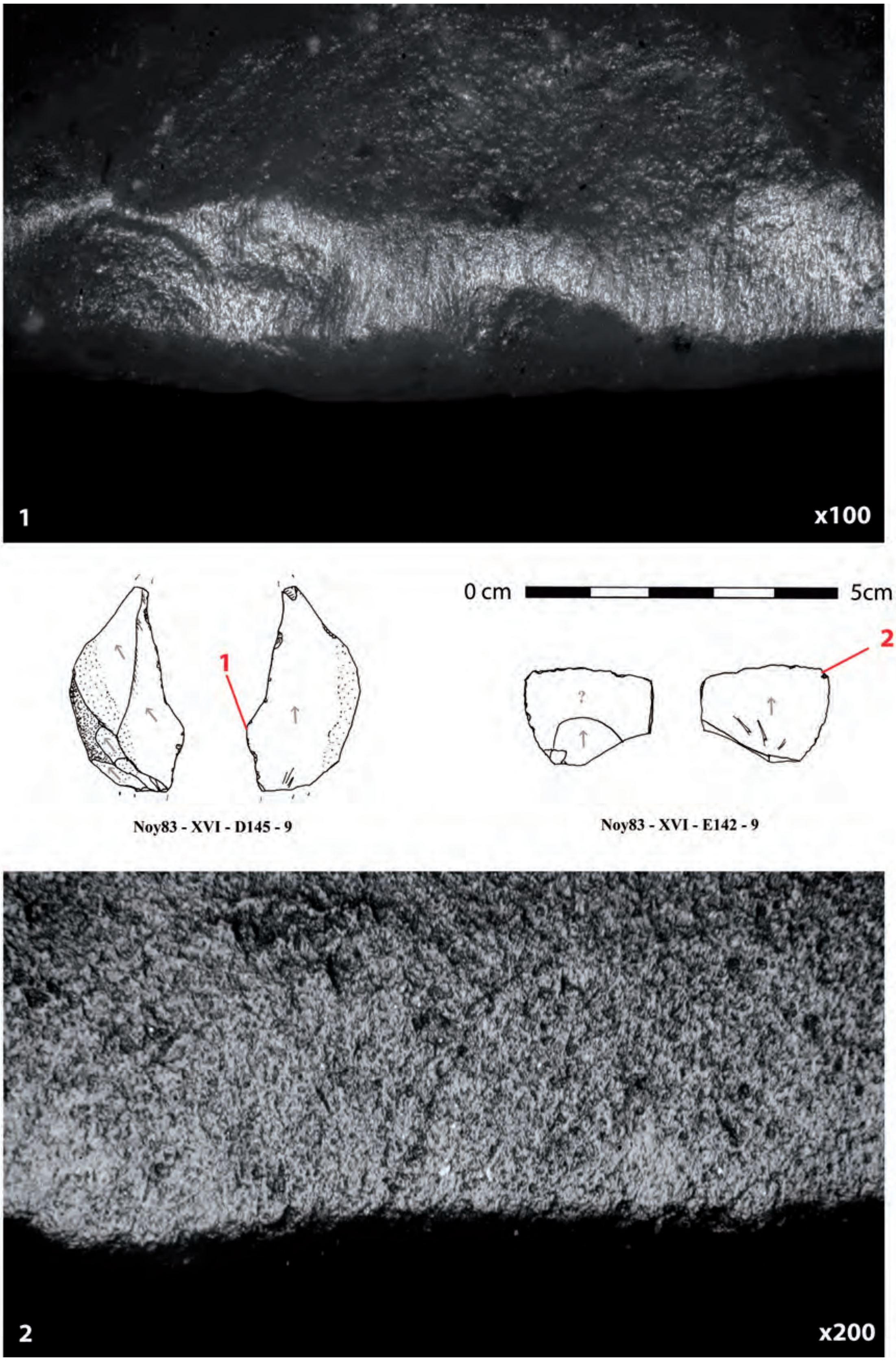

Fig. 13 – Noyen-sur-Seine, system 9. Rounded edges and rough polishes produced by scraping skin with a leading edge angle less than 90° (negative-rake angle) aided by un-modified convex edges.

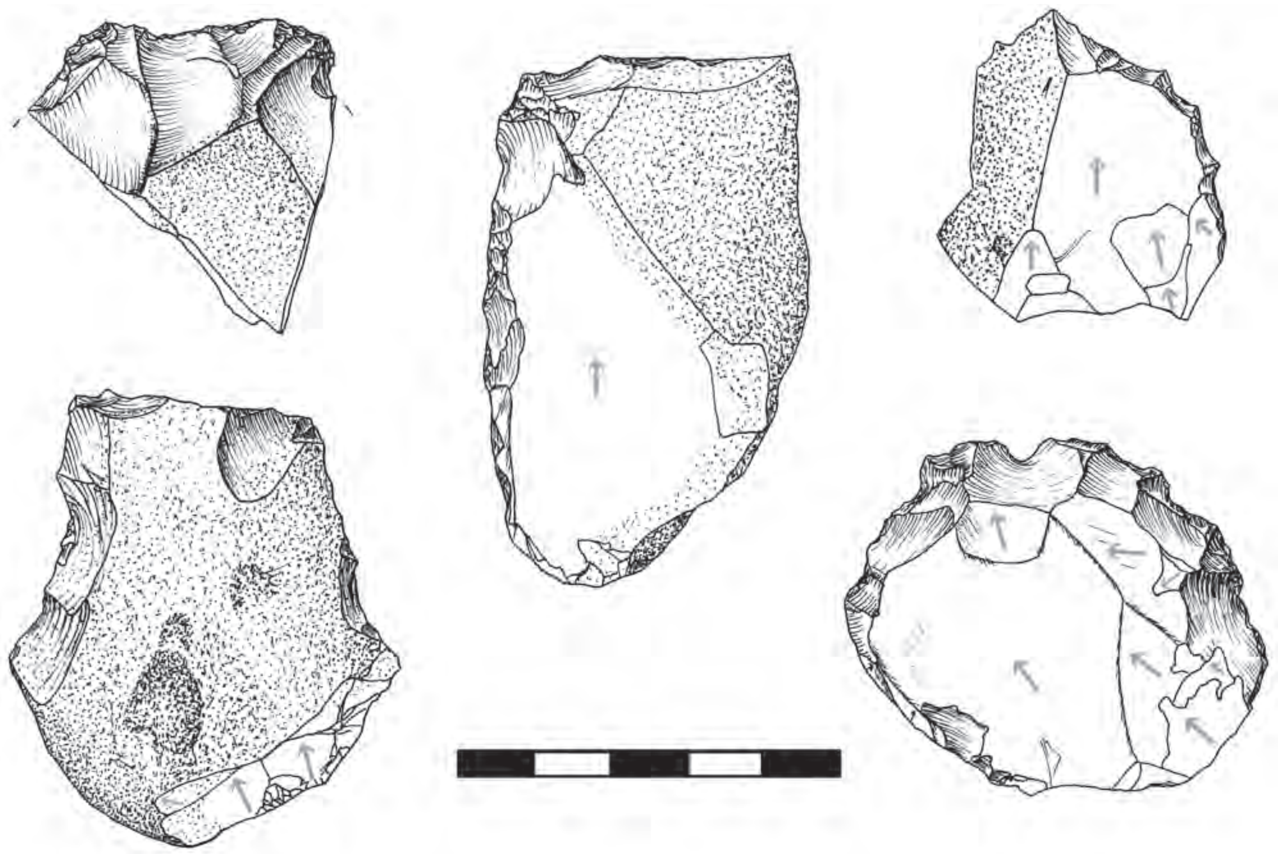

Fig. 14 – Noyen-sur-Seine, system 9. Five typical denticulates.

studied assemblages. Of the 218 UZ identified, only 43 were intentionally retouched, amongst which 24 were the fronts of endscrapers. Doel is the best example: of the 44 tools identified, only four were modified before being used, while oddly, 28 retouched pieces bore no evident functional traces. All types of activities can be performed with un-modified edges, ranging from basketry to lighting a fire, or even tanning dried skins. Piece E186-11-1 from Noyen is a perfect example of the functional potential of a simple thick blade: no less than 8 UZ correspond to the working of at least five different materials (bone, skins and three types of vegetal matter)!

The intense use of intentionally un-retouched tools is clearly not a big surprise as it confirms what many have suspected for some time in recognising pieces with ‘retouch’ derived from use, as well as edge-damaged blanks. However, it should be noted that part of the chipped cutting-edges identified macroscopically in this study were not connected to a use and in numerous cases, the active edges bear no removals recognisable to the naked eye. Moreover, in the absence of use-wear analysis, a major aspect of these stone tools ultimately remains invisible, one which may have repercussions for palethnographic interpretations. This especially concerns the working of vegetal matter: almost every tool used for this activity remained un-retouched despite the processing of plant materials being central to Mesolithic technical systems in Northern Europe.

Towards an integration of functional information with chrono-cultural considerations

Some of our functional observations could contribute to more general chrono-cultural considerations commonly focused on elements of projectile weapons. In fact, certain very specific functions do not appear consistently in all the assemblages.

In Belgium, specific tools used to work plant material could become signature elements of Preboreal/Boreal Mesolithic occupations in Sandy Flanders (Beugnier, 2007). The concave or rectilinear morphology of their edges coupled with the general fineness of cutting-edges and their oblique use on plant materials with leading edge angles greater than 90° (positive-rake angle) connected to well-individualised *chaîne opératoires*, unite bladelets and several flakes within a very significant and homogeneous group. However, this type of object was not recognised at Noyen despite the large number of pieces used to work non-woody materials. The situation is the same for the site of Swifterbant d’Hardinxveld (Holland), although the motions employed do not seem quite as oblique (Van Gijn et al., 2001). On the other hand, the Flandrian tools are comparable with numerous pieces from Late Danish Mesolithic contexts described by H. Juel Jensen (1994) as ‘curved knives’. In this case, while the blanks were definitely produced by indirect

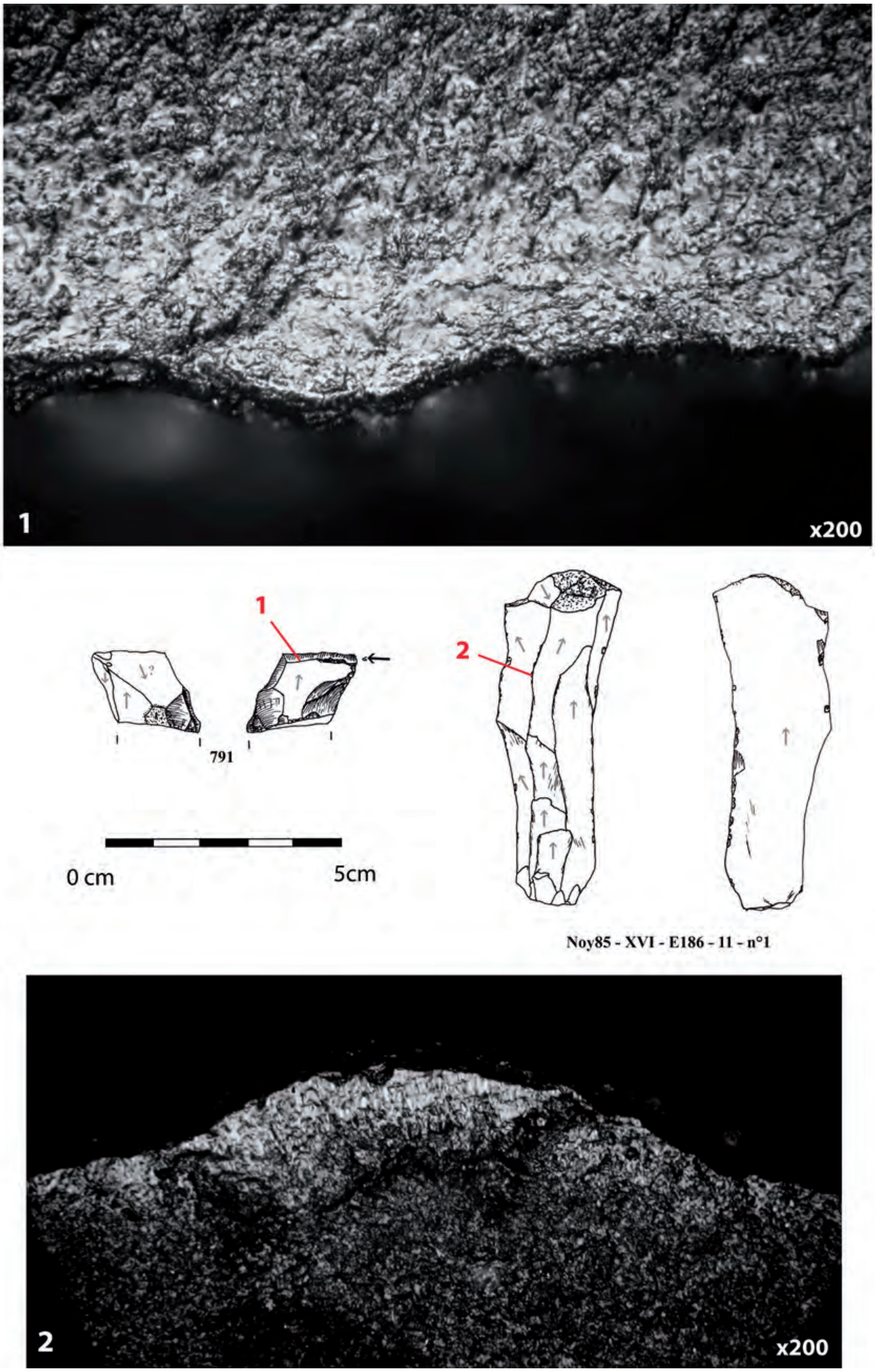

Fig. 15 – Doel C2 and Noyen-sur-Seine, system 9. Two episodes of scraping osseous material with a leading edge angle less than 90° (negative-rake angle). 1: with a burin facet at Doel; 2: with an arris at Noyen. Photograph of the polish on leading face.

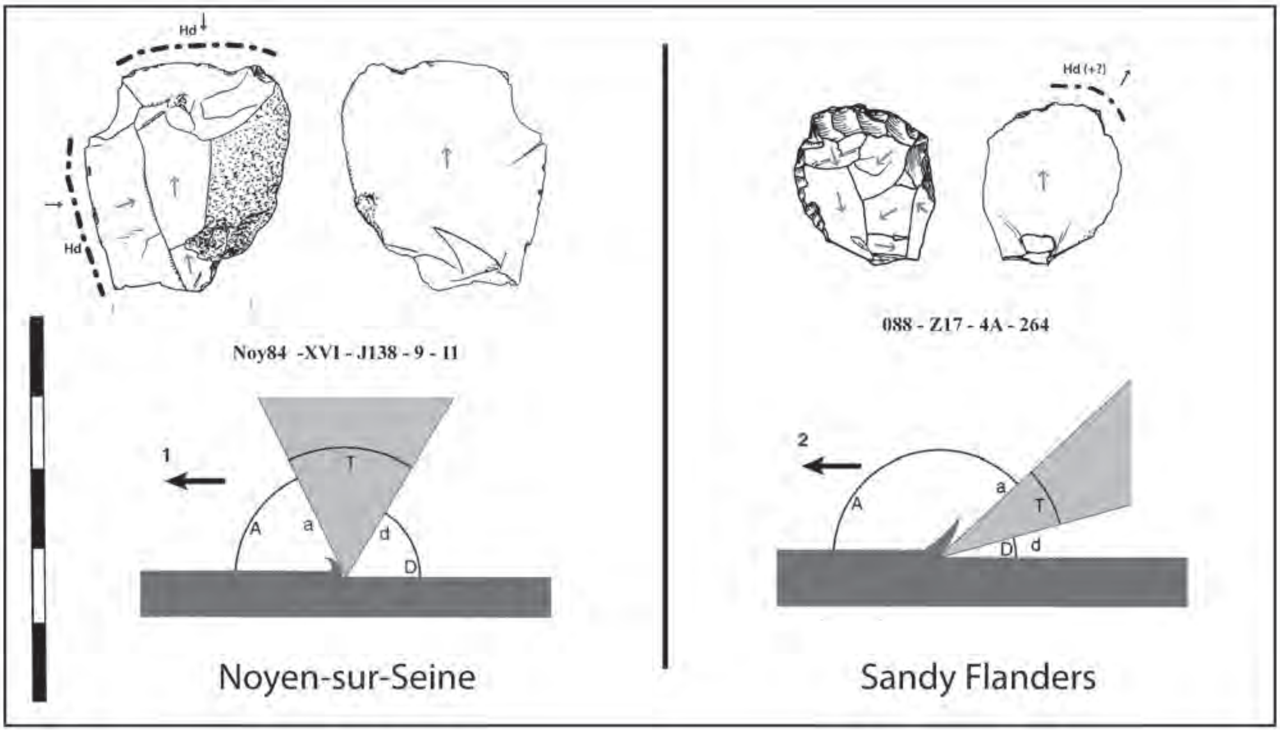

Fig. 16 – Noyen-sur-Seine and sites from Sandy Flanders. Technical contrasts in the scraping of skins (illustration of cutting types borrowed from B. Gassin).

percussion, other characteristics such as the location of the UZ coupled with the orientation and morphology of the polish seem to match patterns seen with the Belgian material. In the future, it may be necessary to consider the 'curved knife' as a tool in its own right, much like certain objects occasionally recognised in traditional typologies based on clear macroscopic traces (splintered pieces, strike-a-lights, or sickle elements).

Our results concerning the working of skins are also informative for this comparison. At both Doel and locus C17 of Verrebroek, the manner in which endscrapers were used (scraping skins with a positive-rake angle, as well as hafting) suggests a particular technical context also recognised in concentration C57-C58 of Verrebroek, although not part of this study. However, the situation is completely different at Noyen where skin working was more readily carried out using un-modified cutting edges with leading edge angles less than 90° (negative-rake angle). Once again, these functional differences (fig. 16) portray a variety of technical choices despite these tools being integrated within the same *chaîne opératoire*, in this case hideworking.

Finally, there remains the question of denticulated flakes. Their abundance at Noyen places these pieces at the centre of considerations concerning the different activities carried out on this site. It has already become possible to exclude their use on wood, contrarily to what has been proposed in the past (Mordant and Mordant, 1987). However, their precise function remains difficult to establish. This is especially relevant for questions concerning their significance in assemblages from the south of the Seine referred to as 'Sauveterrian with denticulates' by J. Hinout (1990). Even if we now know the layers from these sites to be systematically mixed, the possible existence of a specific technical facies remains plausible.

PATHS YET TO BE EXPLORED

This initial functional study of domestic tools from three early Holocene sites approached the material from several different angles. First from a general perspective, emphasizing the particular character of toolkits from this period, followed by a chrono-cultural perspective that documented the existence of discrete elements calling into question the apparent uniformity of the studied material.

The different functional attitudes identified remain to be explained. Furthermore, the numerous factors underlying these contrasts, and the influence of each, still remain difficult to evaluate. The sites compared were clearly discovered from varying contexts probably linked to different types of occupation: the diversity of remains and activities identified at Noyen most likely reflect a multi-functional riverbank occupation, while smaller loci in Sandy Flanders may correspond to occupations with more restricted, probably seasonal functions.

Furthermore, these three sites are far from being contemporaneous: the meander of the Seine at Noyen was occupied nearly 1,000 years after Verrebroek and the distance between the south of the Seine-et-Marne and

Belgium is 350km as the bird flies. The more reliable contexts in which work has recently been carried out in Picardy (Ducrocq, 2009) has brought to light a succession of cultural influences acting within the same territory and tend to show that the Early Mesolithic is far from being an entirely homogeneous and monolithic entity. The Paris Basin also experienced instances of northern, followed by eastern influence. These various influences, that we are only beginning to appreciate in all their complexity, suggest exchanges, loans, or even population displacements. Contributing to this difficulty is the fact that research has for some time now emphasised fairly local technical features forming part of much larger assemblages characterised by microliths. For example, the prismatic Montmorencian or Beaugencian tools from Northern France (Rozoy, 1978; Griselin et al., 2009; Griselin et al., this volume), to which can be added the well-known 'Rouffignac knives' from the Sauveterrian (Dujardin, 2009; Séara and Roncin, this volume).

Clearly it is not solely the functional study of these three different sites that will produce the answers to such complicated questions. However, the results presented here already highlight the role that domestic toolkits can play in palethnographic and paleohistoric debates currently taking place between Mesolithic researchers. One cannot help but conclude that despite their sometimes unattractive aspect, Mesolithic toolkits have not yet had their final word!

Acknowledgements: I would like to thank Philippe Crombé and the entire team from the University of Ghent for granting me access to the material from Verrebroek and Doel, as well as for providing the best possible conditions for its study. I am also grateful to Valérie Beugnier for making available all of their data, to Daniel Mordant for allowing me to work with the precious material from Noyen-sur-Seine and to Patrick Gouge for his welcome at the Centre archéologique de la Bassée. Finally, I would like to thank the reviewers of this article for having clarified and highlighted small imprecisions and errors spread throughout this article.

NOTES

(1) This study was carried out as part of doctoral research at the University of Paris I under the direction of B. Valentin: *The Mesolithic of Northern France in its European context. A functional approach to stone tools*.

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To the memory of Fabrice Nicolle and to his family

Preliminary data concerning the spatial organisation of Mesolithic remains from locus 295 of Saleux (Somme): a faunal perspective

Olivier Bignon-Lau, Paule Coudret, Jean-Pierre Fagnart and Bénédicte Souffi

Abstract: Locus 295 from Saleux is one the best documented and preserved of the site. A Boreal peat covered the vestiges of this Mesolithic camp shortly after it was abandoned. Preservation conditions of the archaeological level and organic remains are thus ideal for reconstructing the space occupied by Mesolithic groups during the Boreal around 8500 BP (7550 calBC). The study of the spatial distribution of lithic artefacts, as well as several refits, compared with zooarchaeological analyses shed light on the internal organisation of space and the nature of the activities carried out on the site. Taken as a whole, this information suggests a relatively short occupation by a small human group whose main objective was the hunting of wild boar.

The site of Saleux in the Somme Basin is especially well-known for its Lateglacial occupations attributed to the *Federmesser* tradition, one of which produced a skull of a *Homo sapiens sapiens* in 1998 (Fagnart, 1997; Coudret and Fagnart, 2004 and 2006). In parallel with work carried out on the Final Palaeolithic since 1993, ten Mesolithic occupations have also been studied (Fagnart et al., 2008). The spatial organisation of the Mesolithic remains from locus 295, excavated in 2003 and 2004, is the focus of this contribution given the excellent depositional and preservation conditions of the archaeological occupation, the legibility of the spatial organisation and well-preserved osseous remains.

LOCATION AND STRATIGRAPHIC CONTEXT OF THE SITE OF SALEUX

The site of Saleux is found in the Selle Valley, one of the main affluents of the left bank of the Somme, some 6 kilometres south-west of Amiens and its confluence with the Somme (fig. 1). It is located on the lowest terrace of the Selle that borders the present river floodplain. Discovered at the beginning of the 1990's during work prior to the construction of the A16 autoroute, an ongoing research excavation has been carried out since 1993 following an initial rescue operation. The site is in a key position as it lies on the border of the alluvial formations of the Selle Valley and the loamy slope deposits (fig. 2). Mesolithic occupations are found at the edge or in immediate proximity of a paleochannel that skirts the present alluvial plain and scatters into smaller well-defined loci over approximately 400 m (fig. 3, no. 1). The camps considered here occupy a gentle alluvial slope of the lowest terrace of the Selle and are therefore in a slightly higher topographic position in relation to the present alluvial plain. The other bank of the channel, which lies in an area liable to flooding, has not produced any archaeological traces. Unlike the majority of Mesolithic occupations studied from Saleux, locus 295 is found in a lower topographic position, immediately bordering the Holocene paleochannel. As a result, it was rapidly covered after its abandonment by organic deposits or Boreal age peats, followed by Atlantic calcareous tufa derived from the channel's infilling or warping of the alluvial plain (fig. 3, nos. 3 and 4). This rapid burial of remains tied to the very particular morphological position of the site resulted in the excellent preservation of the archaeological occupation, particularly the organic and osseous remains (fig. 3, nos. 5 to 7).

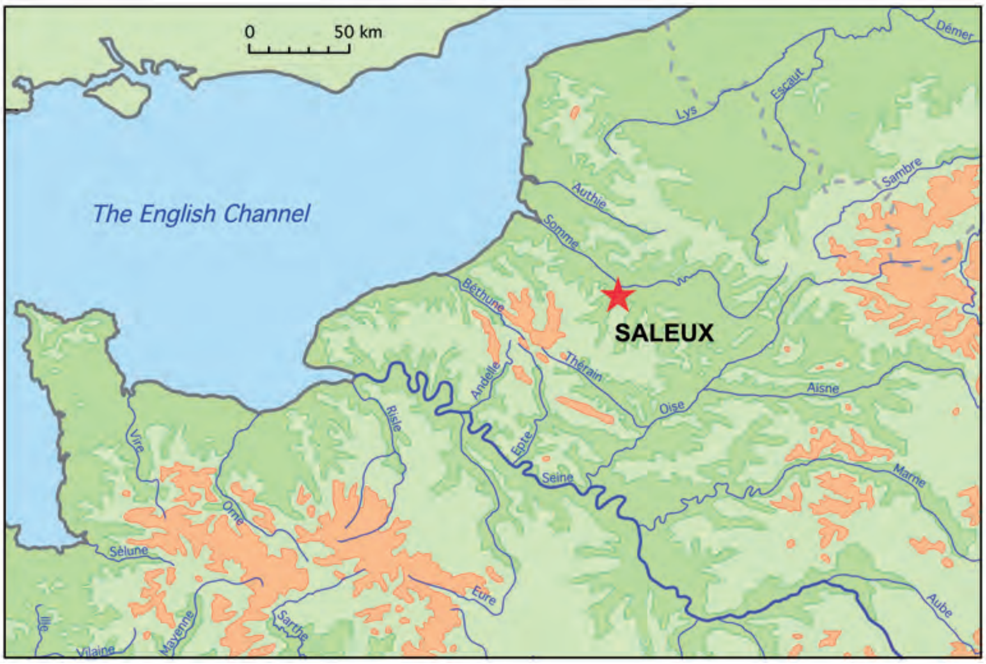

Fig. 1 – Saleux (Somme) Site location.

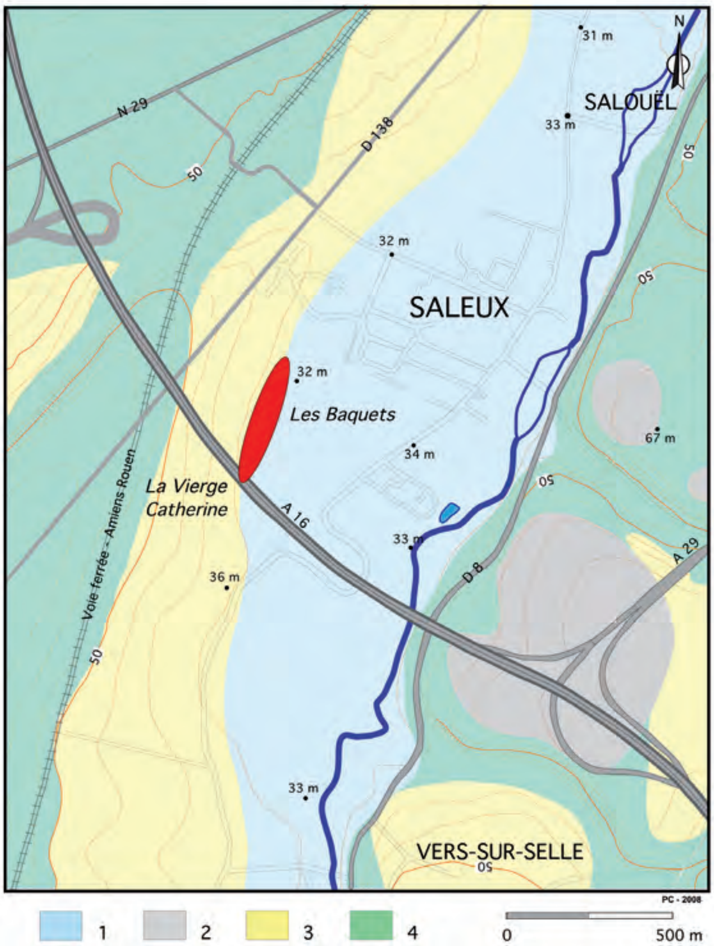

Fig. 2 – Saleux (Somme). Geomorphological and topographic context of the site. 1: floodplain; 2: alluvial gravels; 3: loess and colluvial loam; 4: chalk. In red: extent of the site over approximately 400 m bordering the river floodplain between La Vierge Catherine and Les Baquets.

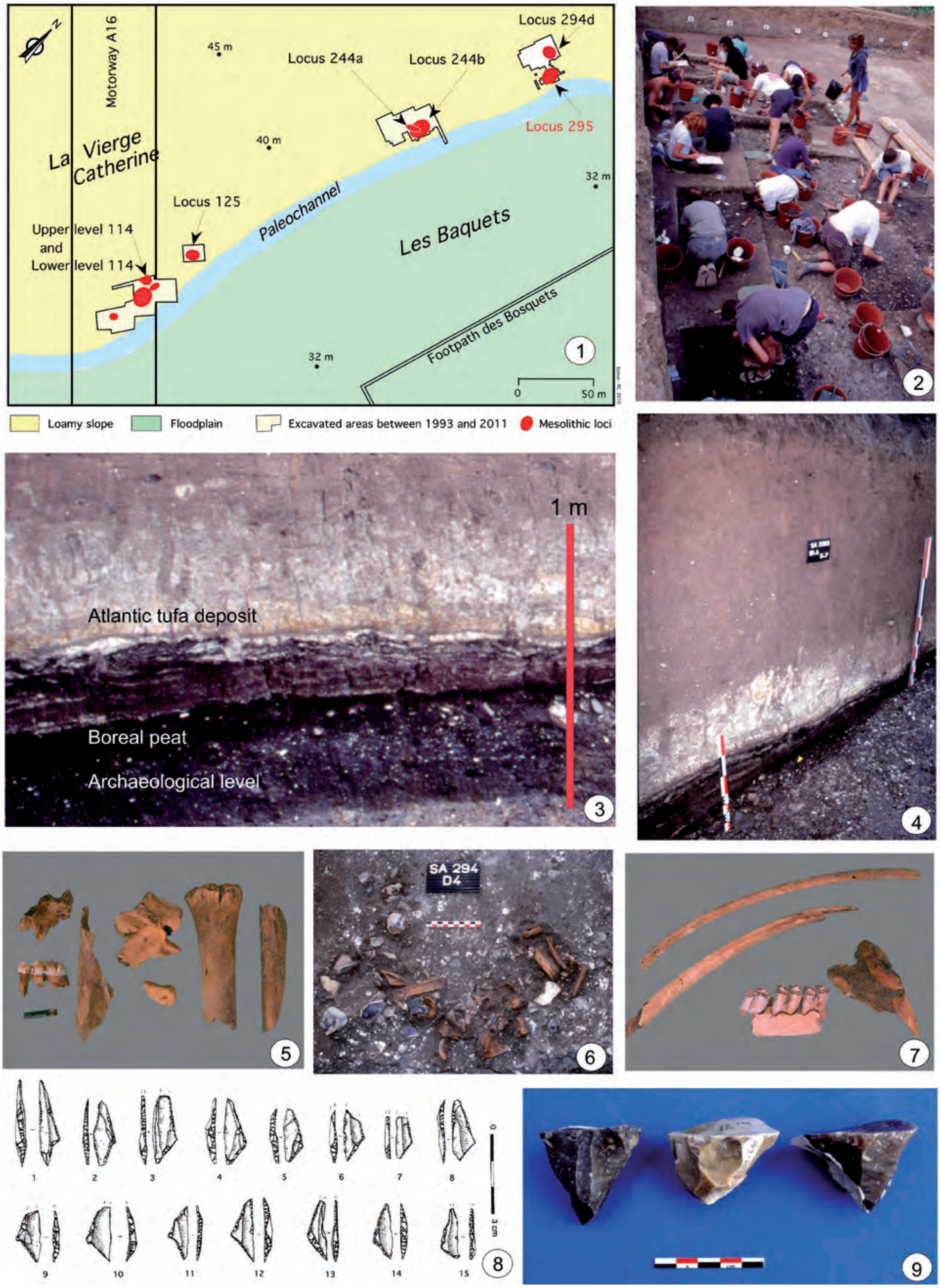

Fig. 3 – Saleux (Somme), Les Baquets. Mesolithic locus 295. 1: Location of the main Mesolithic loci; 2: partial view of the excavation of locus 295 during the 2003 field season; 3 and 4: stratigraphy of locus 295 showing the development of holocene formations overlying the archaeological occupation at the edge of a paleochannel; 5 to 7: osseous remains demonstrating the good preservation of organic material; 8: microliths (triangles); 9: unipolar bladelet cores.

CHRONOLOGICAL AND CULTURAL ATTRIBUTION OF THE INDUSTRY FROM LOCUS 295

The lithic industry, which contains around a hundred microliths, has already been the subject of a preliminary analysis (Fagnart et al., 2008). The Mesolithic assemblage is distinguished by the presence of a number of slightly elongated scalene triangles constituting 40% of the microliths (fig. 3, no. 8). Certain slightly shorter examples are typologically similar to isosceles triangles, while the remainder of the Mesolithic component is comprised of a significant number of obliquely truncated points (44% of the microliths) and, to a lesser extent, points with a transversely retouched base (16% of the microliths). Unlike the other Mesolithic occupations at Saleux, locus 295 has produced a sizeable collection of domestic tools, including 14 endscrapers and twenty or so retouched or used flakes. This composition differs radically from the other loci of the site where hunting or butchery activities seem to dominate or are the sole activities present (rarity or absence of domestic tools).

Four radiocarbon dates were produced from osseous remains; the first three on wild boar bones (Beta-170947: 8590 ± 40 BP, Beta-191693: 8510 ± 50 BP, Beta-170948: 8310 ± 40 BP) and the fourth, slighty younger, on beaver bone (Beta-191694: 8210 ± 50 BP). These dates place the Mesolithic occupation towards the middle or second half of the Boreal chronozone around 8500 BP (or 7550 calBC). According to the techno-typological character of the lithic industry, the occupation of locus 295 could be related to the Chinru group (Gob, 1981; Crombé, 1999; Crombé and Cauwe, 2001) or the 'Beuronian with triangles' of the middle phase of the Mesolithic (Ducrocq, 2009; Ducrocq, this volume). This 'triangle phase' of the Boreal falls chronologically between Mesolithic groups characterised by the presence of numerous points with a retouched base and crescents from the end of the Preboreal to the first half of the Boreal and groups set apart by the significant development of narrow backed bladelets and microliths with flat retouch from the end of the Boreal (Ducrocq, 2009).

SPATIAL ORGANISATION OF LITHIC REMAINS

Locus 295, which is particularly dense, has produced more than 7,000 lithic or osseous artefacts spread over some fifty square metres. More than 3,000 lithic artefacts have been recovered, including around a hundred microliths, thirty or so domestic tools, 69 cores, some 1,000 heated stones and a little more than 3,000 osseous remains of which 679 are identifiable. These counts do not take into account the copious number of chips. The squares with the most finds can contain as many as 500 lithic or bone artefacts. The distribution of artefacts depicts three main concentrations (fig. 4A). The two richest are situated on both sides of hearth C19 and seem to form elements of a peripheral ring around this feature which was partially destroyed by an evaluation trench in 2002. The third zone is found slightly to the northwest of the combustion feature.

The large number of thermally altered lithics constitutes one of the major characteristics of locus 295. More than a thousand small blocs or pieces of flint between 2 and 5 cm in size and 7,000 thermal chips have been recovered. As a whole, evidence of heat-altered lithics amounts to 30 kg collected from the excavation surface. Nodules or blocks of flint 10 to 15 cm in diameter were used as heating stones. Once fragmented, these stones were set aside during different restructuring phases of the C19 combustion feature, which comprises 200 heated elements and a little more than a 1,000 thermal chips alone. Two main discard zones can easily be discerned, one to the north and the other to the east of the hearth (fig. 4B).

Distribution plans of the lithic industry according to major artefacts categories are very informative and bring to light separate areas assigned to specific activities (fig. 5, 6 and 7). To the north-west of hearth C19, an important concentration of microburins spread over an area of 33 m^2 attests to the production of microliths (fig. 5A). This small well-defined zone, immediately adjacent to the combustion zone, sits at the centre of the maximal scatter zone of microliths recovered over 20 square meters. In the broadest sense, this zone to the north-west of hearth C19 represents an activity area tied to the arming or re-arming of arrows (fig. 5B). A small secondary concentration of microliths can be distinguished 5 or 6 m to the south-west of the same hearth. Future macro- and microwear analyses of these projectile points will help elucidate the manufacture and maintenance methods of projectile weapons and their respective positions in the occupation.

Domestic tools are concentrated in a marginal zone approximately 5 m to the north-west of hearth C19 and are quite sparse in the immediate surroundings of this combustion feature. Endscrapers are particularly well-represented and according to the preliminary use-wear analysis of C. Guéret can be linked to basic skin processing, probably in the course of drying, by moderate scraping over short durations. This activity more likely represents the acquisition of a raw material rather than an actual transformation of skins into leather (Guéret, 2008).

Areas assigned to flintknapping are underscored by the scattering or discard of cores to the north-west of the hearth and, to a lesser extent, on either side of the combustion feature. Refits carried out with the collaboration of G. Noens and L. Lombaert weave together short or medium length networks between varying areas of the space occupied (fig. 7B). The refitting program is still ongoing, however initial, albeit partial, results seem particularly significant and will largely contribute to the study of the Mesolithic occupation's spatial dynamics.

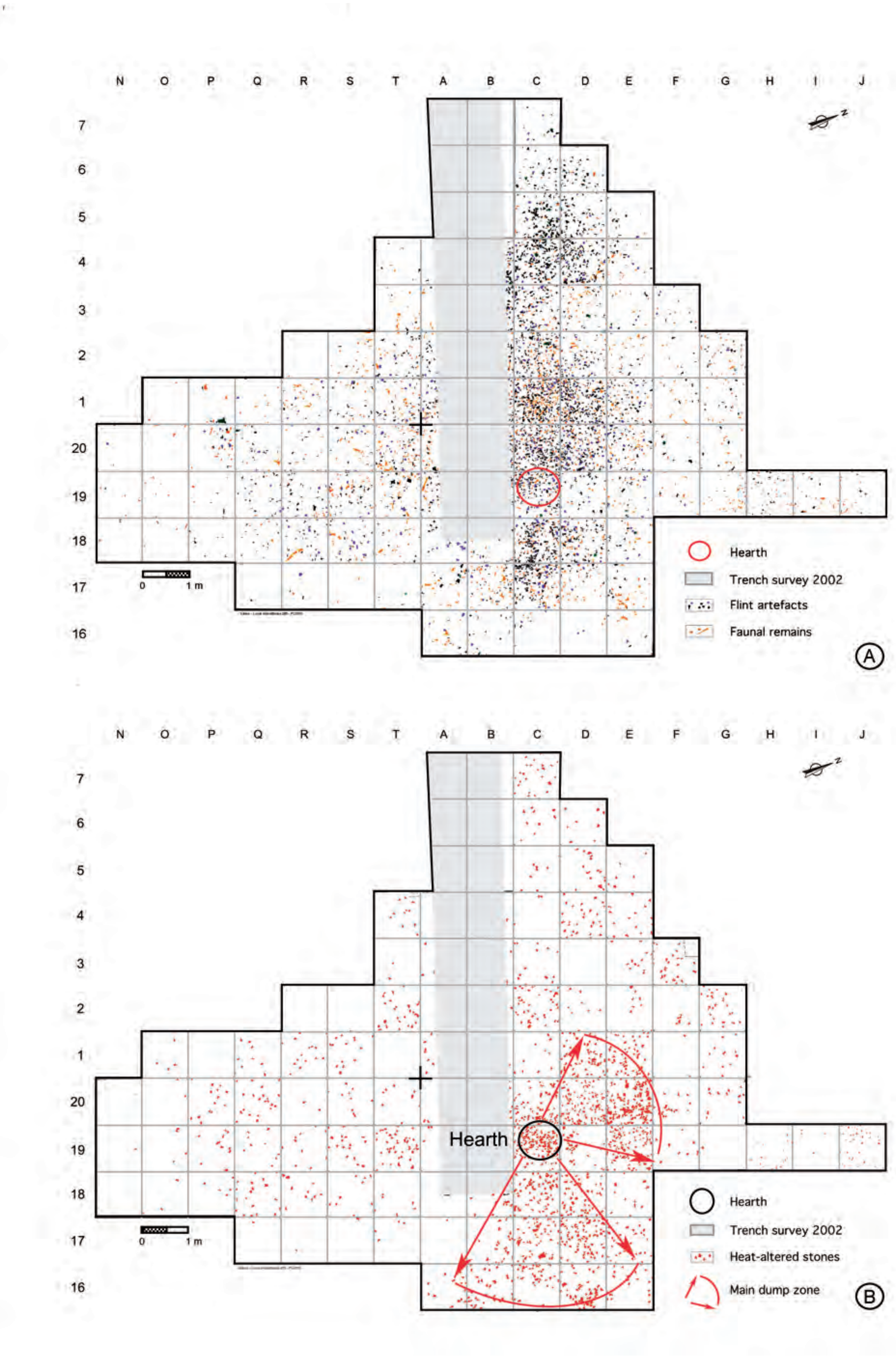

Fig. 4 – Saleux (Somme), Les Baquets. Mesolithic locus 295. A: distribution of all lithic and osseous remains; B: distribution of heated stones and the two main discard zones.

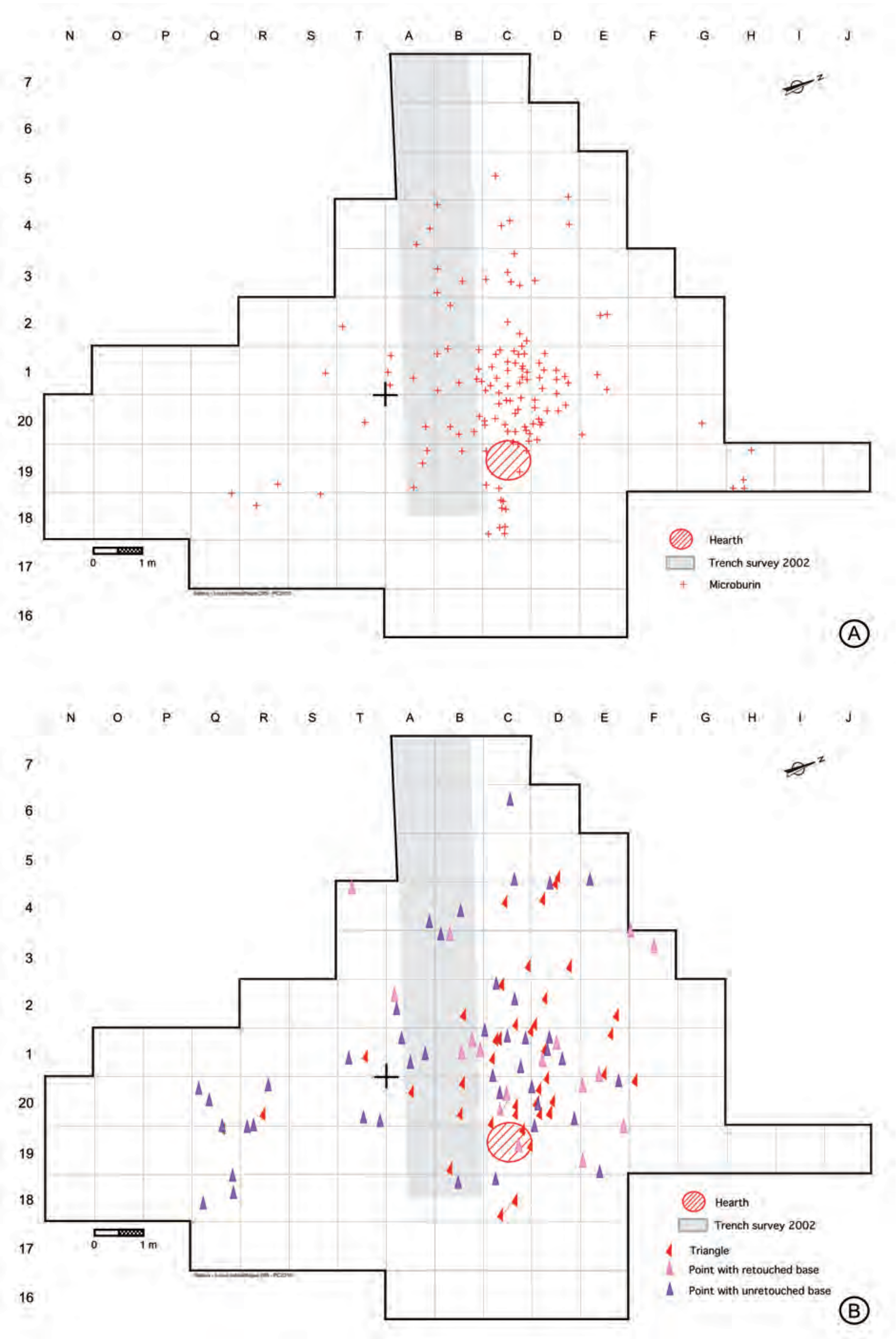

Fig. 5 – Saleux (Somme), Les Baquets. Mesolithic locus 295. A: distribution of microburins; B: distribution of microliths.

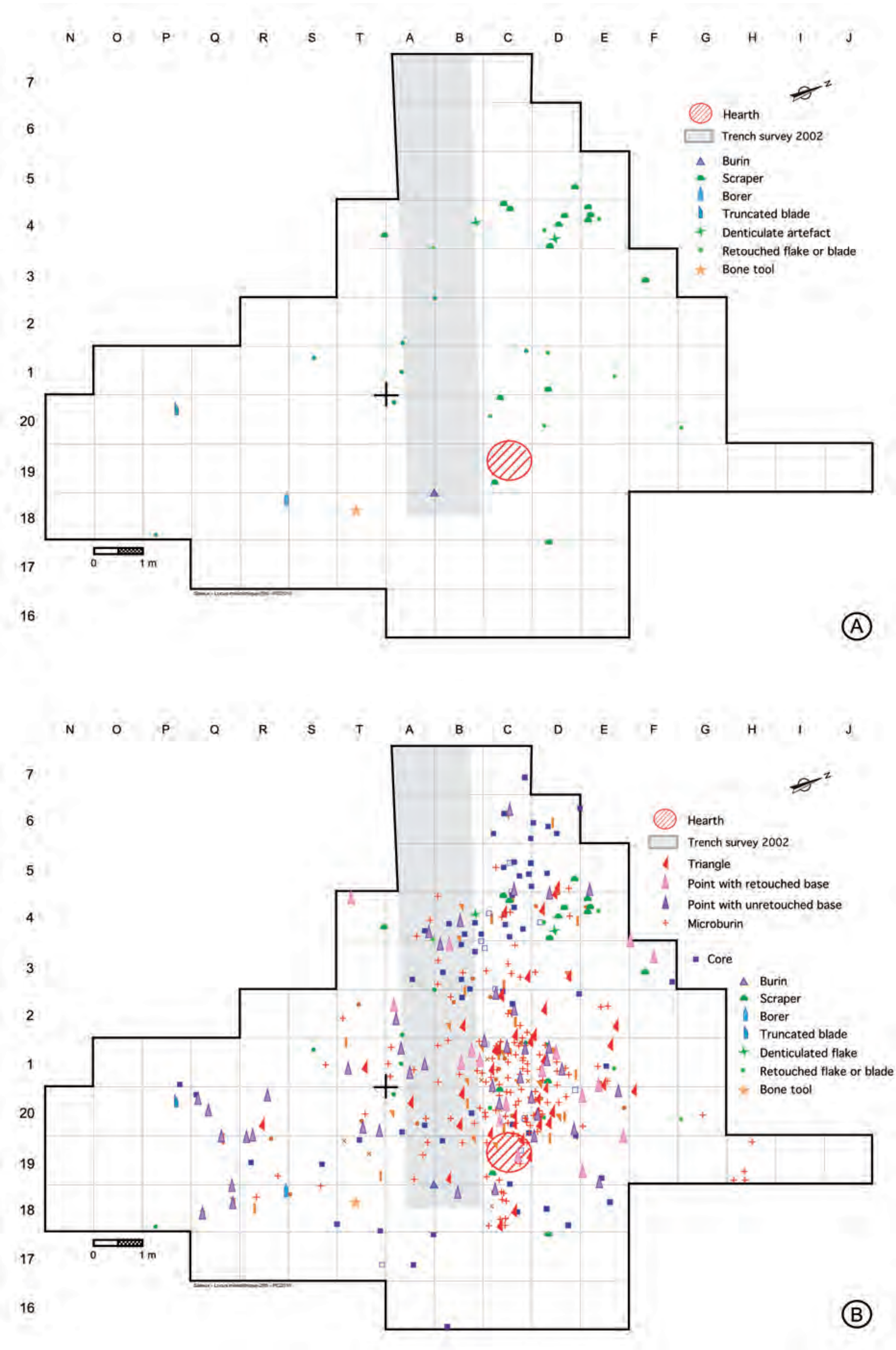

Fig. 6 – Saleux (Somme), Les Baquets. Mesolithic locus 295. A: distribution of domestic tools; B: distribution of all tools, microburins and cores.

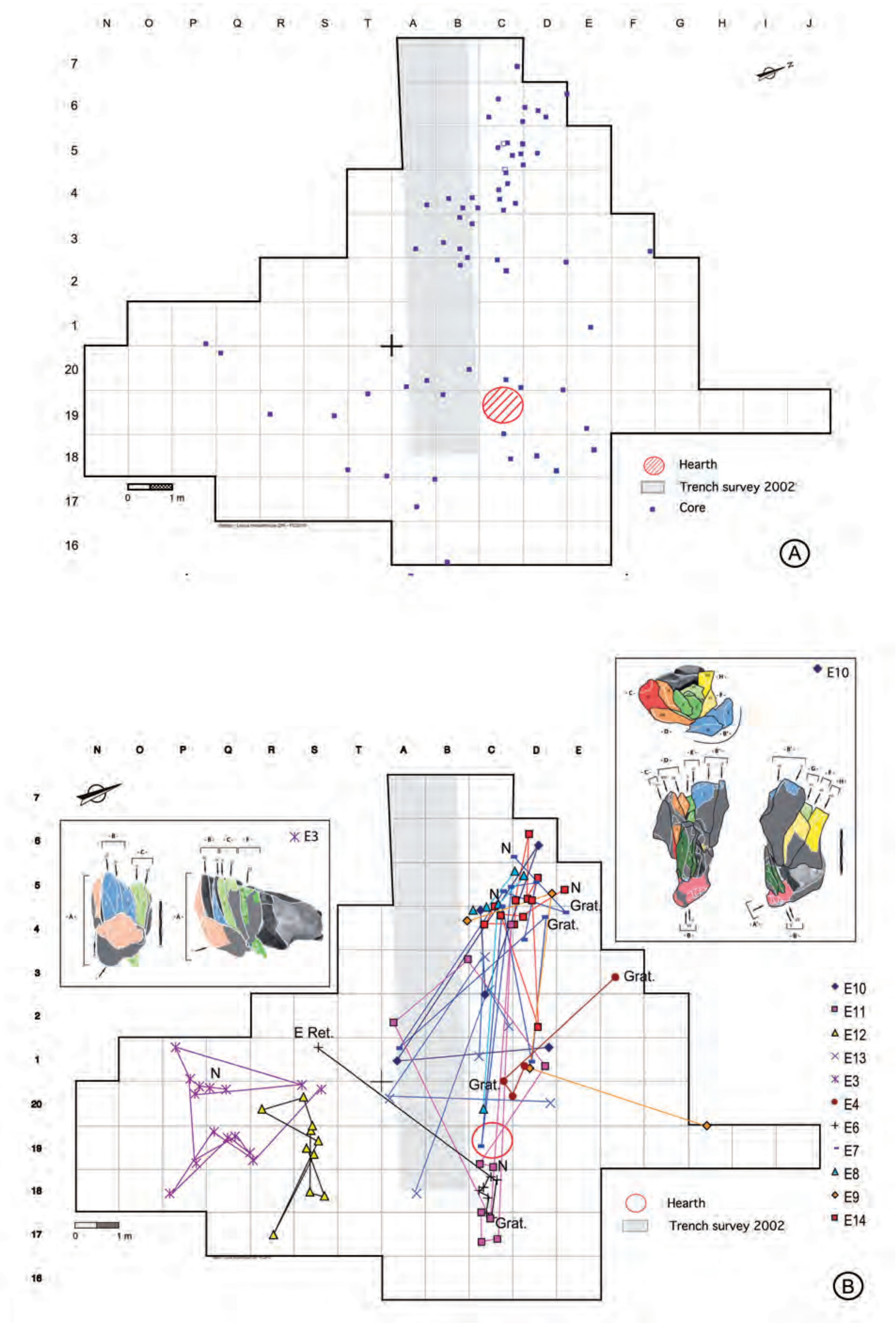

Fig. 7 – Saleux (Somme), Les Baquets. Mesolithic locus 295. A: distribution of cores; B: distribution of refits.

GENERAL FAUNAL DATA

Faunal material from locus 295 of Saleux consists of 3275 remains of variable size and is composed of animal species which are generally typical for this period (table 1 and for comparison: Bridault, 1994 and 1997; Ducrocq et al., 2008). In terms of number of remains (NR) wild boar *(Sus scrofa)*, along with red deer *(Cervus elaphus)* and aurochs *(Bos primigenius)* are especially well-represented.

Species	NR	% NR	NMIc	% NMIc
Wild boar *(Sus scrofa)*	330	*48,6*	6	31,58
Beaver *(Castor fiber cf. galliae)*	160	23,56	3	*15,79*
Aurochs *(Bos primigenius)*	83	*12,22*	2	*10,53*
Red deer *(Cervus elaphus)*	60	*8,84*	2	*10,53*
Marten *(Martes martes)*	13	*1,92*	1	*5,26*
Wildcat *(Felis sylvestris s.)*	10	*1,47*	1	*5,26*
Roe deer *(Capreolus capreolus)*	5	*0,74*	1	*5,26*
Badger *(Meles meles)*	4	*0,59*	1	*5,26*
Mistle thrush *(Turdus viscivorus)*	3	*0,44*	1	*5,26*
Anatid *(Anatidae sp.)*	1	*0,15*	1	*5,26*
Mole *(Talpa europeanus)*	3	0,44		
Fiel vole *(Arvicola terrestris)*	7	*1,03*		
Total NR determined	**679**	***100***	**19**	***100***
Cf. Bos primigenius	13			
Cf. Castor	19			
Cf. Turdus viscivorus	2			
Rodents undetermined	2			
I/II	448			
II	215			
II/III	546			
III	23			
Splinters undetermined	1328			
Total NR undetermined	2 596			
Total NR	3 275			

Table 1 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Faunal spectrum. Some undetermined remains could provide size class informations in relation with animal body size : I – birds, rodents, Beaver, Wildcat, Marten ; II – Badger, Wild boar, Rod deer ; III – Red deer, Aurochs.

However, numerous beaver bones *(Castor fiber cf. galliae)* rank this rodent second best among represented species. Scarce remains also indicate the presence of wild cat *(Felis sylvestris s.)*, badger *(Meles meles)*, roe deer *(Capreolus capreolus)*, pine marten *(Martes martes)* and two bird species: an unidentified *antatidae* and mistle thrush *(Turdus viscivorus)*. Although unrelated to hunting activities, it is important to note the presence of European water vole *(Arvicola terrestris)* and mole *(Talpa europeanus)*.

As the faunal list may already suggest it, the taphonomic context of locus 295 is generally very good, despite several minor variations between different areas (Bignon, 2008). Weathering is hardly perceptible, while localised crushing and rootlet traces are also infrequent and restricted. Bone breakage patterns indicate that they were essentially fractured while still ‘fresh’. However, a small number of faunal remains (n = 54) bear pronounced alterations unlike the large majority of the fauna from locus 295. These intrusive elements were excluded from our counts and belong either to another Mesolithic locus or a *Federmesser* occupation situated slightly upslope. Be that as it may, the preservation is excellent for an open-air site and presents ideal conditions for spatial analysis.

OBJECTIVES AND RESULTS OF THE SPATIAL ANALYSIS OF FAUNAL REMAINS

In line with the relatively high number of remains for a Mesolithic occupation, our main concern was to establish whether or not any spatial organisation of butchery activities could still be discerned. This preliminary analysis is designed to bring to light butchery operations related to carcass processing. Our observations and counts are currently only at the scale of square metres, however we plan to carry out more precise studies in the near future. Four anatomic segments were defined and comprise several different skeletal elements; the vertebral column (vertebrae and ribs), the head (skull, mandible and teeth), and the anterior and posterior members. Through the segmentation process, our spatial analysis aims to reconstruct certain dynamics linked to phases of processing and consumption of animal resources and, ultimately, allows us to deduce information about how they were acquired.

General quantitative and qualitative aspects

Much like the lithic elements, several concentrations of fauna are readily observable in close proximity to the hearth (fig. 8). The number of remains per square metre indicates that the main concentration is found to the west of this hearth (C-D/1-20), while another equally dense concentration may have existed in H19, but its extent is unknown. The main concentration C-D/1-20 is bordered by secondary concentrations at its perimeter, to the south, east, west and north. Quantitatively, these concentrations represent the abandonment of small fragments from the final phase of carcass processing, *i.e.* breaking bones to recuperate the marrow.

The differential distribution of anatomical segments by species is also instructive. Small-bodied taxa represented by a single individual are spread along the periphery of the main concentration and the hearth, exclusively in sectors 294 and 295 (fig. 9). This is the case with mistle thrush (to the south-east of the hearth), the *anatidae* (to the south-west), pine marten (to the east), wild cat (to the north) and badger (to the north and east). Larger sized animals have quite a different distribution, as seen with several roe deer posterior member fragments also at the margins of the main concentration, but to the south and south-east (fig. 9). The distribution of different anatomic segments of red deer and aurochs (fig. 10) seems to indicate that butchery activities mainly took place to the south of the hearth. The lack of spatial restrictions created ideal conditions for the processing and dismemberment of larger species. The spatial distribution of wild boar and beaver, the two best represented species in terms of the number of remains and the minimum number of individuals by combination (MNIc), is discussed below.

Distribution of wild boar remains

As with larger species, the majority of wild boar vertebral column elements are found to the south and east of the hearth in what seems to be an area reserved for processing the trunk (fig. 11). However, the vertebrae recovered from the east and north of the hearth suggest that certain dorsal portions were treated in separate areas. The distribution of head elements in various areas partially overlaps with vertebral column segments: note the high density of remains to the south and east of the hearth (fig. 12).

Anterior and posterior members have a different distribution, despite certain overlaps. The dispersion of the scapulae suggests that the anterior members could have been detached from the spine in order to be processed in different areas around the hearth (fig. 13). These elements are mainly found to the south and west of the main concentration, and to a lesser extent, to the east. Conversely, the posterior members are generally distributed further away to the south and their presence seems more important to the north-east of the hearth (fig. 14). The coxal bones demonstrate the processing of vertebral columns in several zones.

Distribution of beaver segments

Beaver is much better represented than is the norm for the Mesolithic and remains of this species are found in significant numbers in the northern half of the site, as is the case with other small species. However, the ways in which butchery was carried out is, in certain ways, reminiscent of the spatial organisation observed with larger

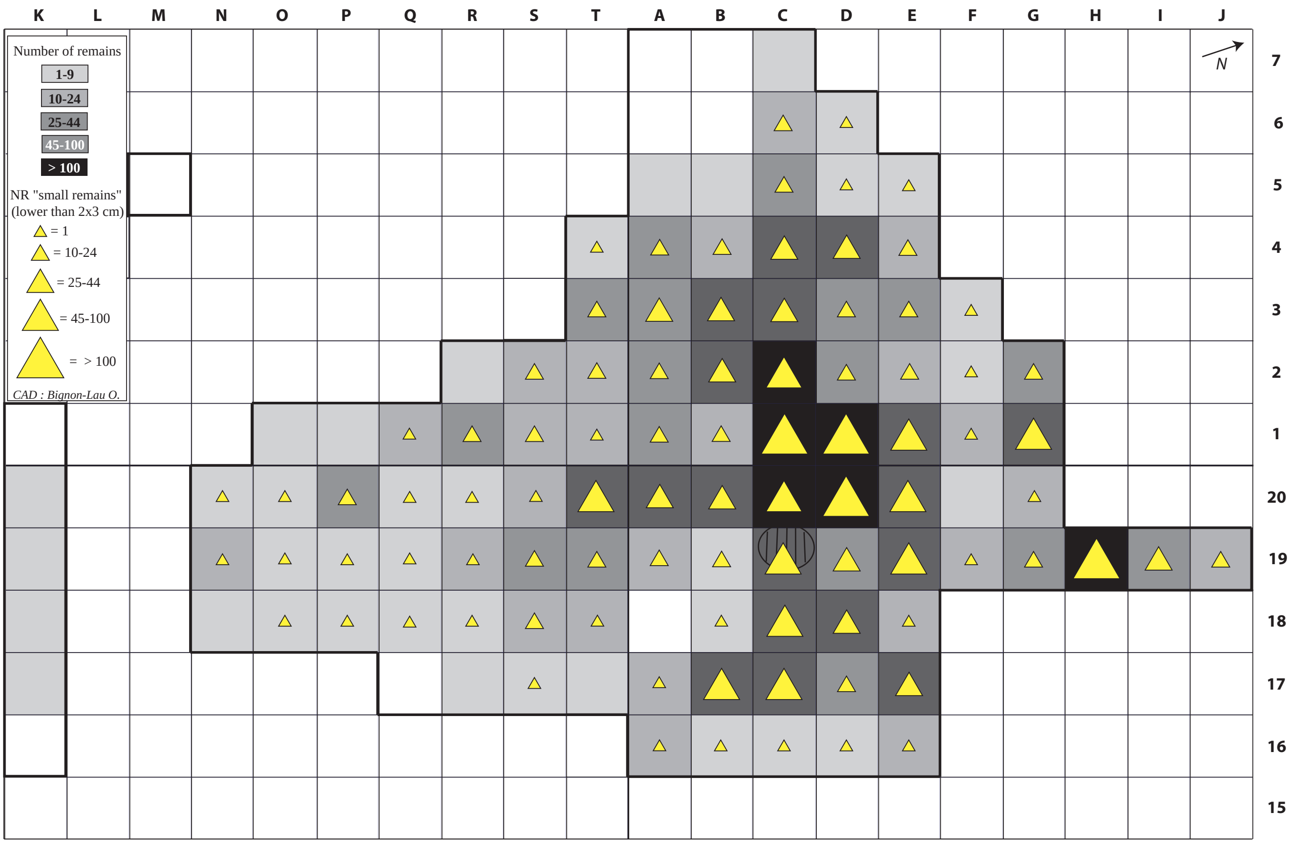

Fig. 8 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Density of faunal remains by square metre (in number of remains) and contribution by NR of small remains (less that 3 × 2 cm, yellow triangles).

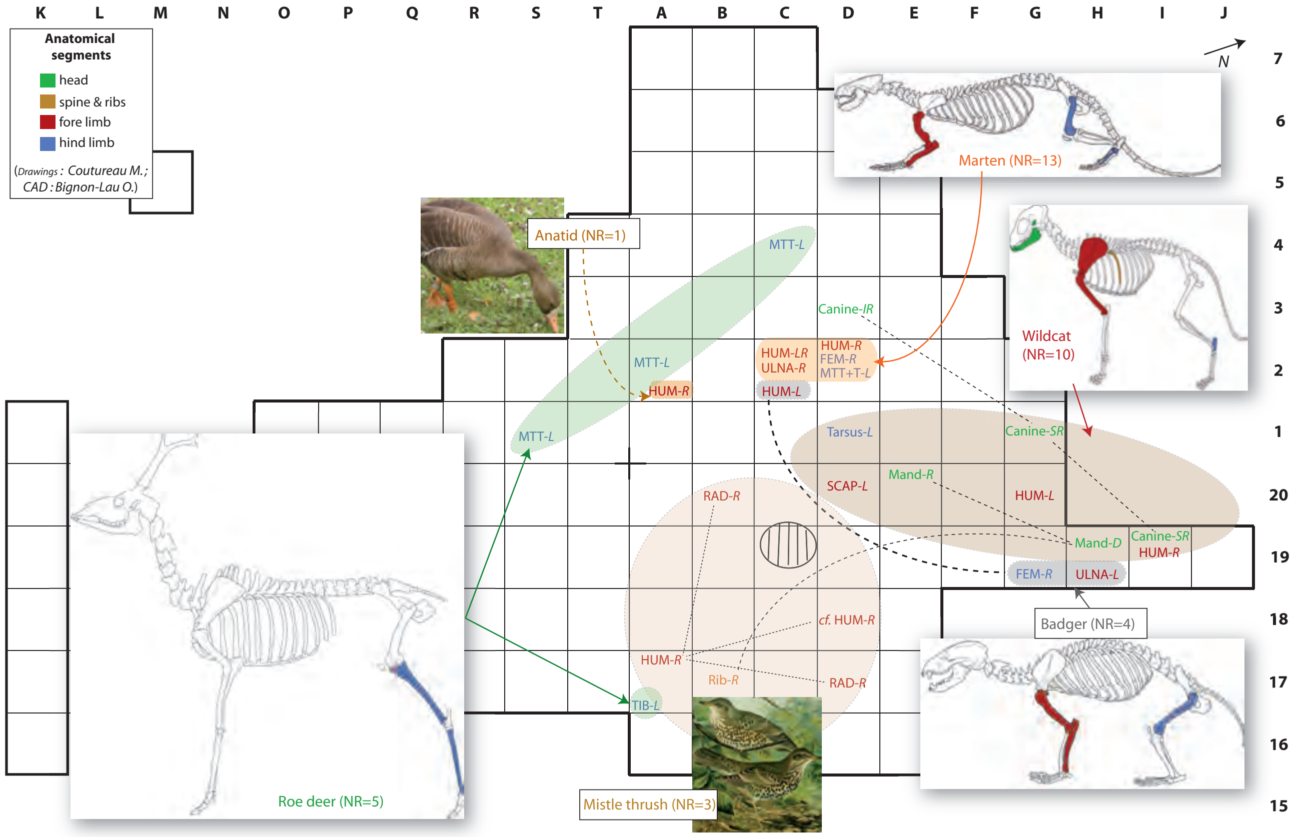

Fig. 9 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Spatial distribution of species represented by a single individual.

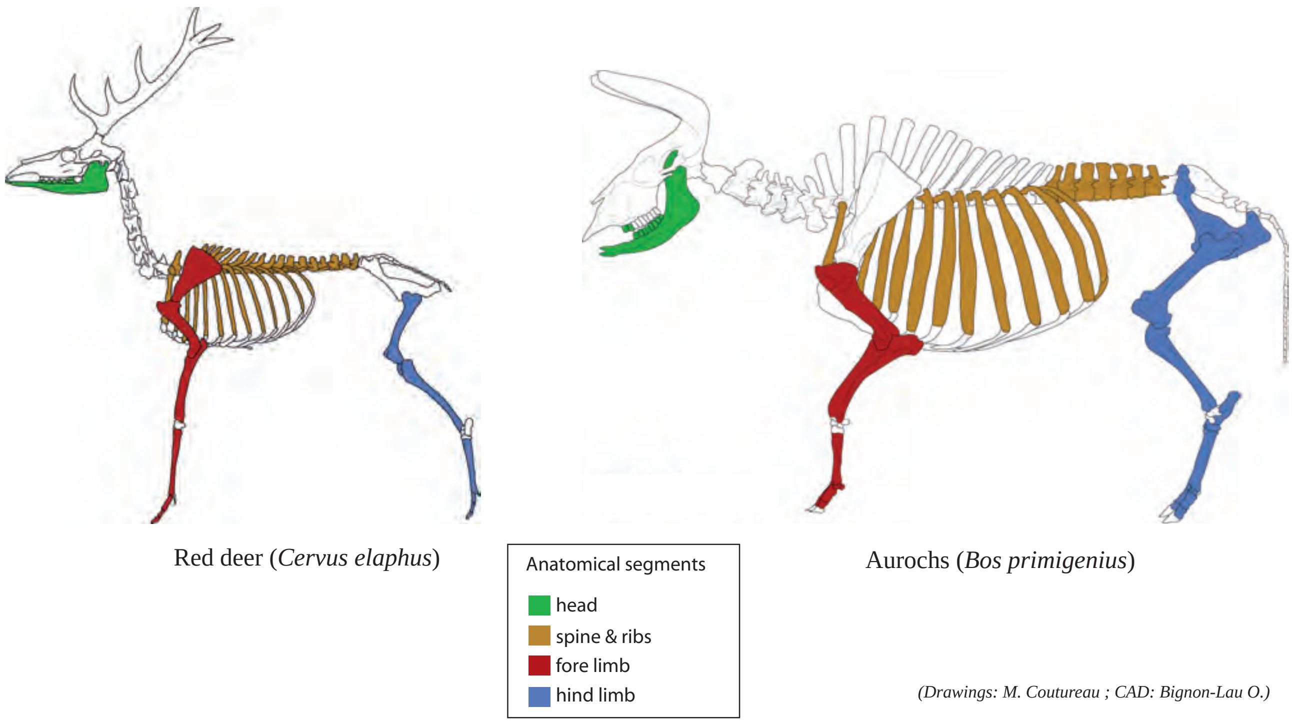

Fig. 10 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Identified skeletal parts of red deer (Cervus elaphus; NR = 60, MNIc = 2) and aurochs (*Bos primigenius*; NR = 83, MNIc = 2).

species. Discard zones of spine fragments are situated to the south-east and east of the hearth (fig. 15) and contrast with those where head fragments were discovered (fig. 16). To the west of the hearth, anterior and posterior members have an identical spatial distribution (fig. 17).

Certain incisors were recuperated from mandibles by extraction, sawing or snapped off (fig. 18). These operation were carried out at the periphery of main butchery activities in marginal zones that were less dense. It is also interesting to note an overlap in the distribution of beaver head fragments and zones relatively rich in endscrapers (fig. 6A).

Spatial organisation of faunal remains: a preliminary assessment

Of all the species represented by more than one individual, often large-bodied, the differential distribution of segments and their spatially fragmented processing suggest that these operations occurred practically simultaneously. Segmentation activities involving heads, members and trunks of carcasses seems to have taken place to the south/south-west of the hearth (fig. 19). This organisation enabled the concurrent and efficient processing of carcasses to take place in different zones around the hearth. The main and secondary concentrations correspond to areas where the final phases of butchery took place, such as breaking bones to extract marrow. A portion of the marrow was consumed *in situ* around the hearth during the final exploitation of the carcasses. The formation of discarded bone concentrations accentuates their preferential abandonment in dedicated and / or managed zones. These choices, such as the unobstructed processing area to the southwest of the hearth, convey the degree to which butchery activities were organised at locus 295.

Even if anatomic segment distribution patterns are not precisely the same for any of the species, the low dietary interest of smaller species may explain their processing to the periphery of zones richer in faunal remains. Certain areas may also have been dedicated to technical activities, as can be seen with the processing of beaver incisors (fig. 18) or the cluster of discarded burnt bones away from the hearth (fig. 20). Furthermore, remains bearing traces of fangs or gnawing are found in peripheral areas and certainly indicate the activity of a domestic dog, as a wild carnivore would have been less inclined to restrict its feast to the mere margins of such an opportunity (fig. 21).

CONCLUSIONS AND FINAL REMARKS

The Mesolithic locus 295 from the site of Saleux presents ideal preservation conditions linked to its rapid sedimentary burial by Boreal peats, followed by calcar-

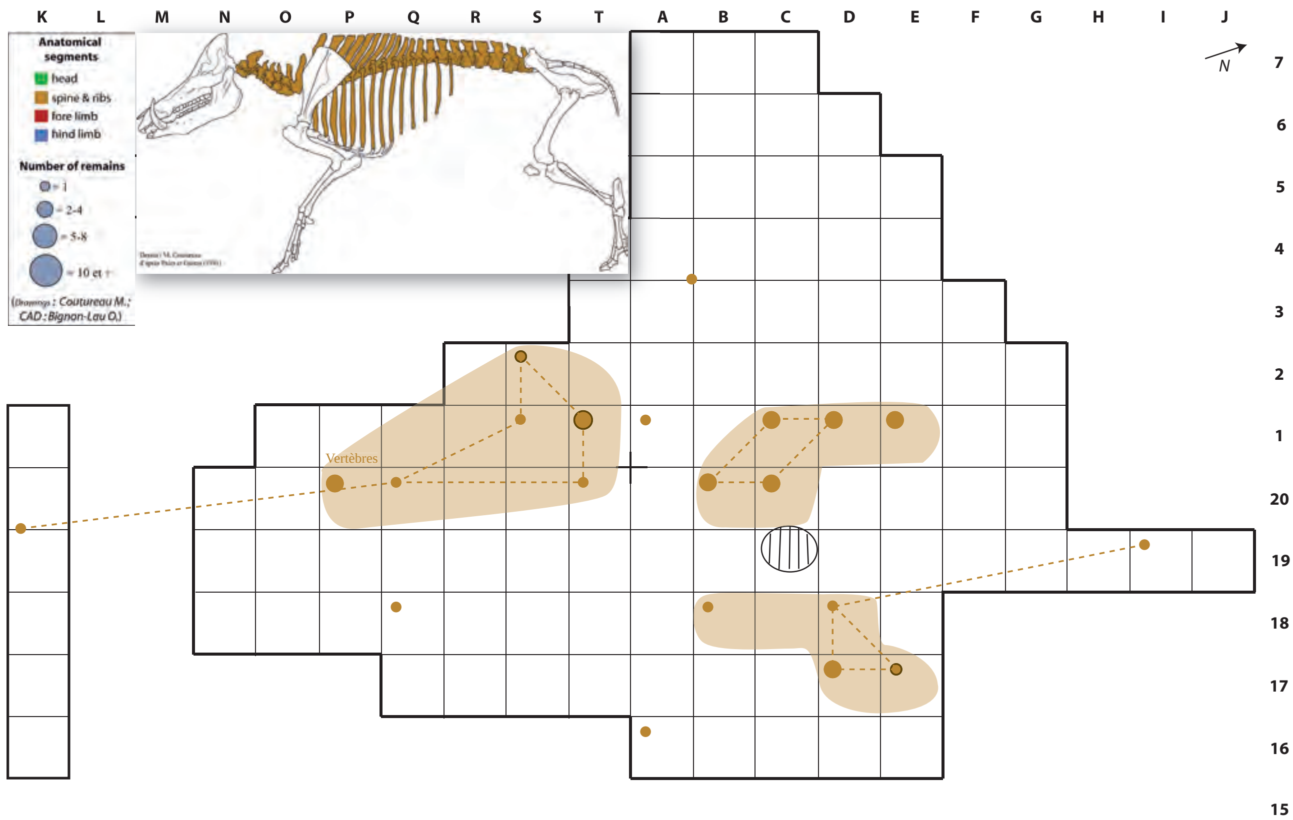

Fig. 11 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Distribution of skeletal elements of the vertebral (vertebrae and ribs) of wild boar (*Sus scrofa*; NR = 330, MNIc = 6).

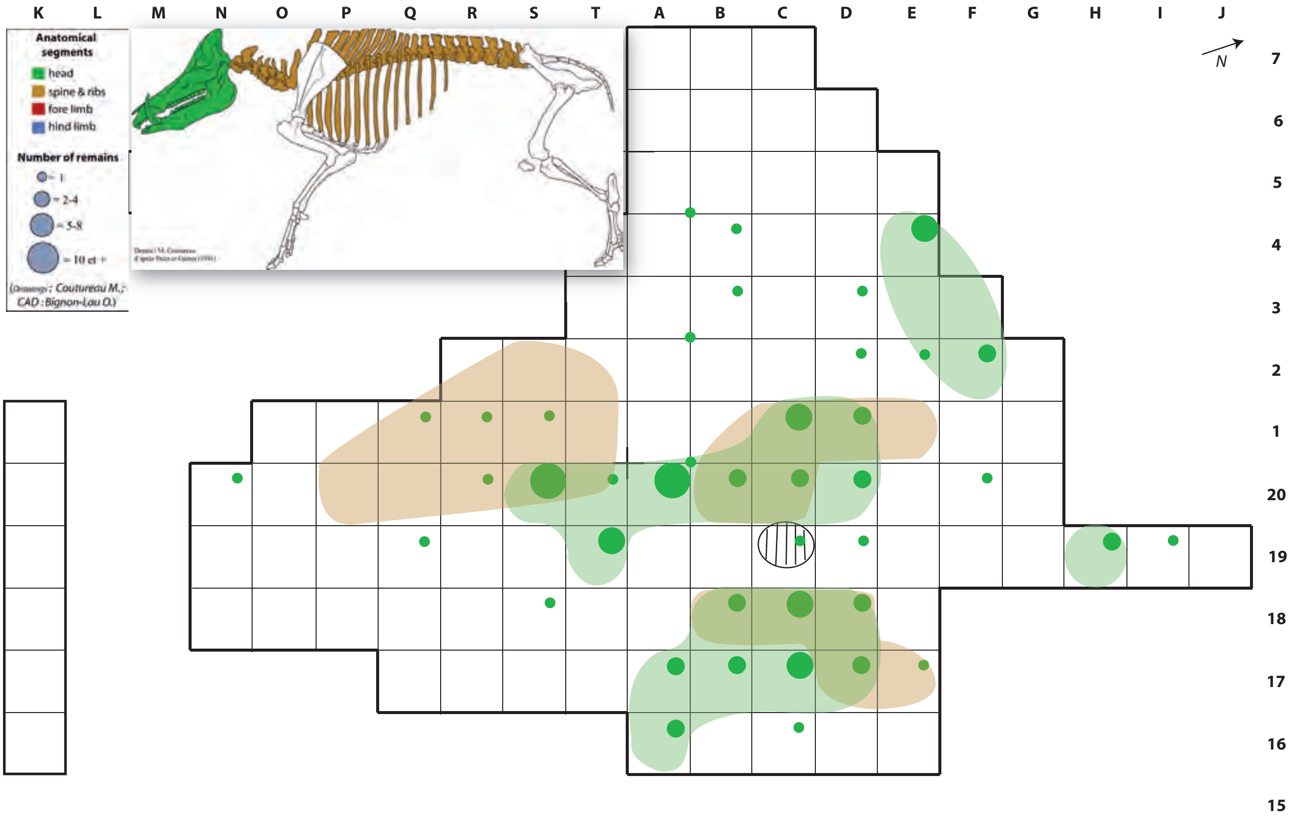

Fig. 12 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Distribution of skeletal elements of the head (skull, mandible, teeth) and vertebral column of wild boar (*Sus scrofa*; NR = 330, MNIc = 6).

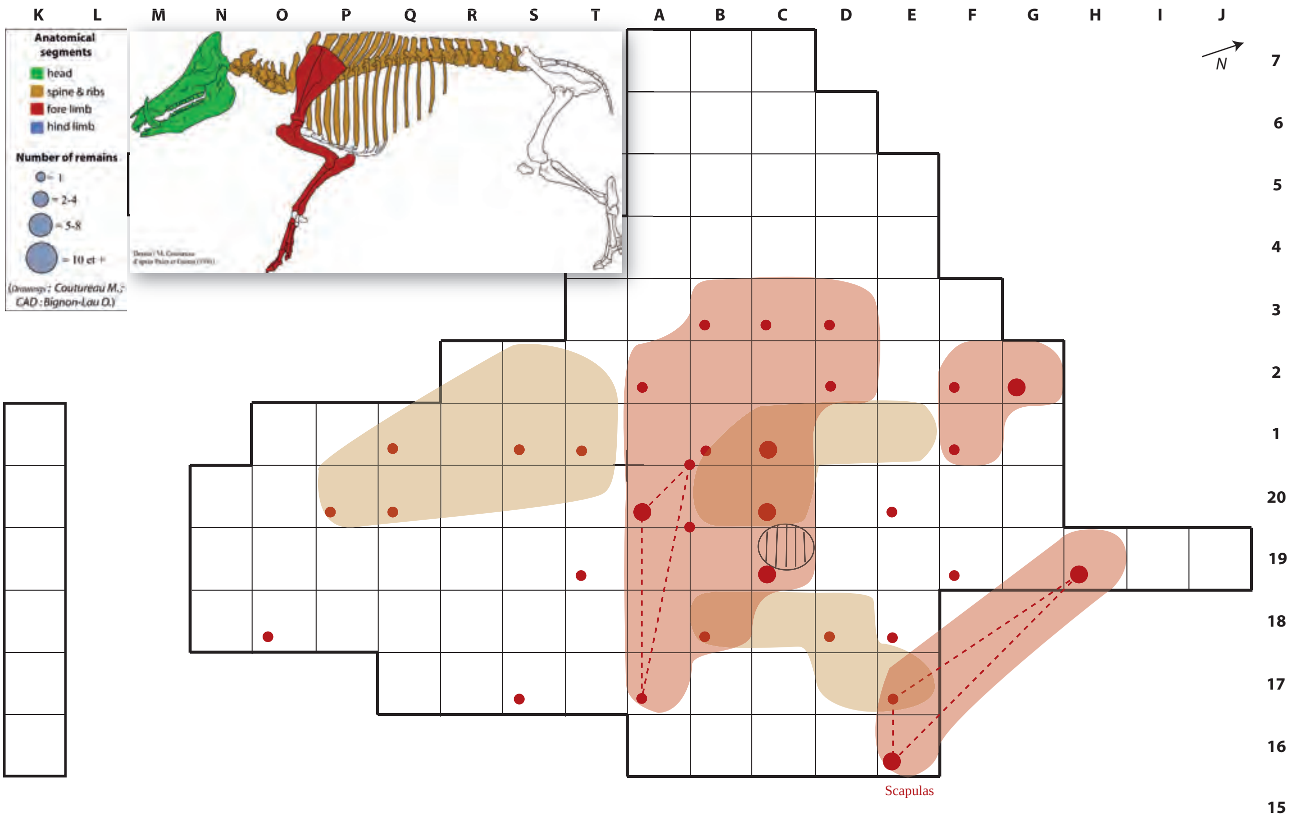

Fig. 13 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Distribution of skeletal elements of anterior members (scapula, humerus, radius, ulna) and vertebral column of wild boar (*Sus scrofa*; NR = 330, MNIc = 6).

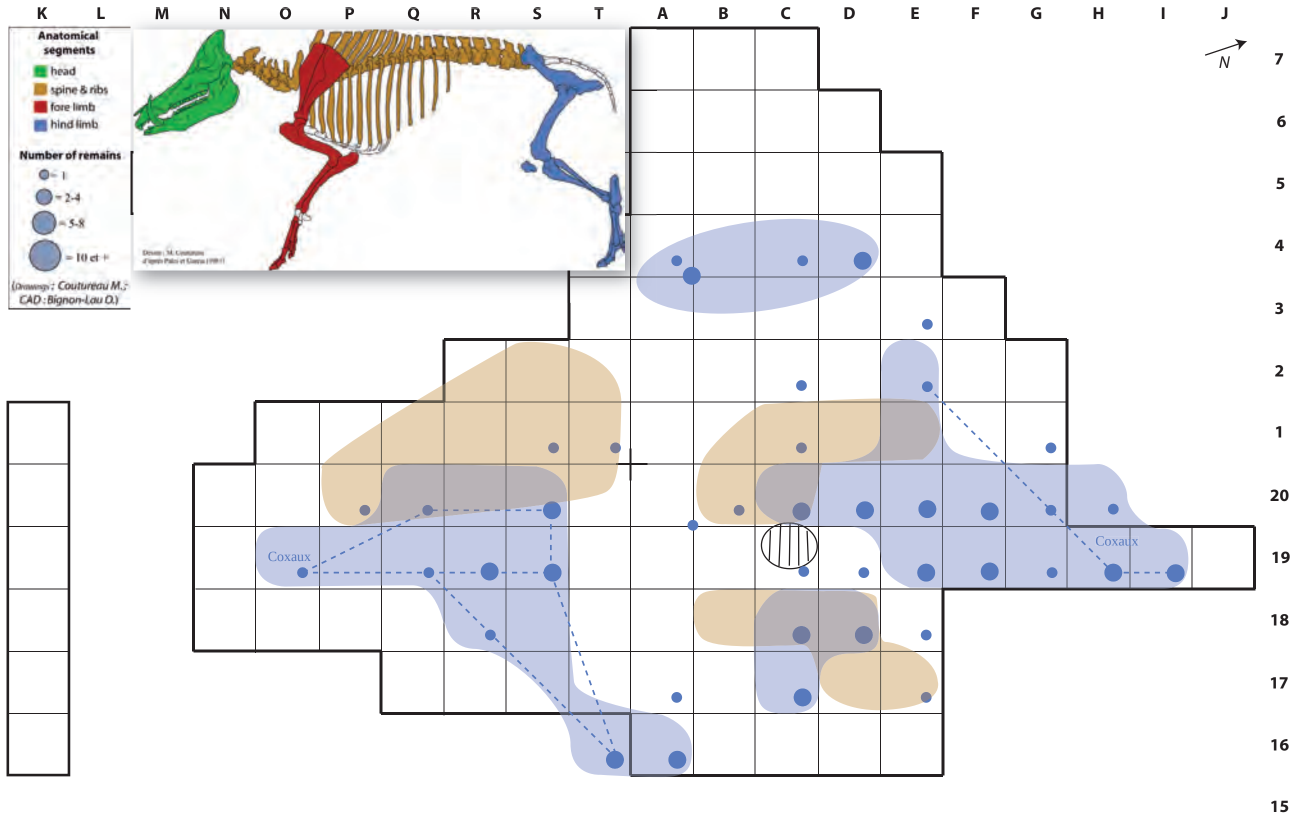

Fig. 14 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Distribution of skeletal elements of posterior members (scapula, humerus, radius, ulna) and vertebral column of wild boar (*Sus scrofa*; NR = 330, NMIc = 6).

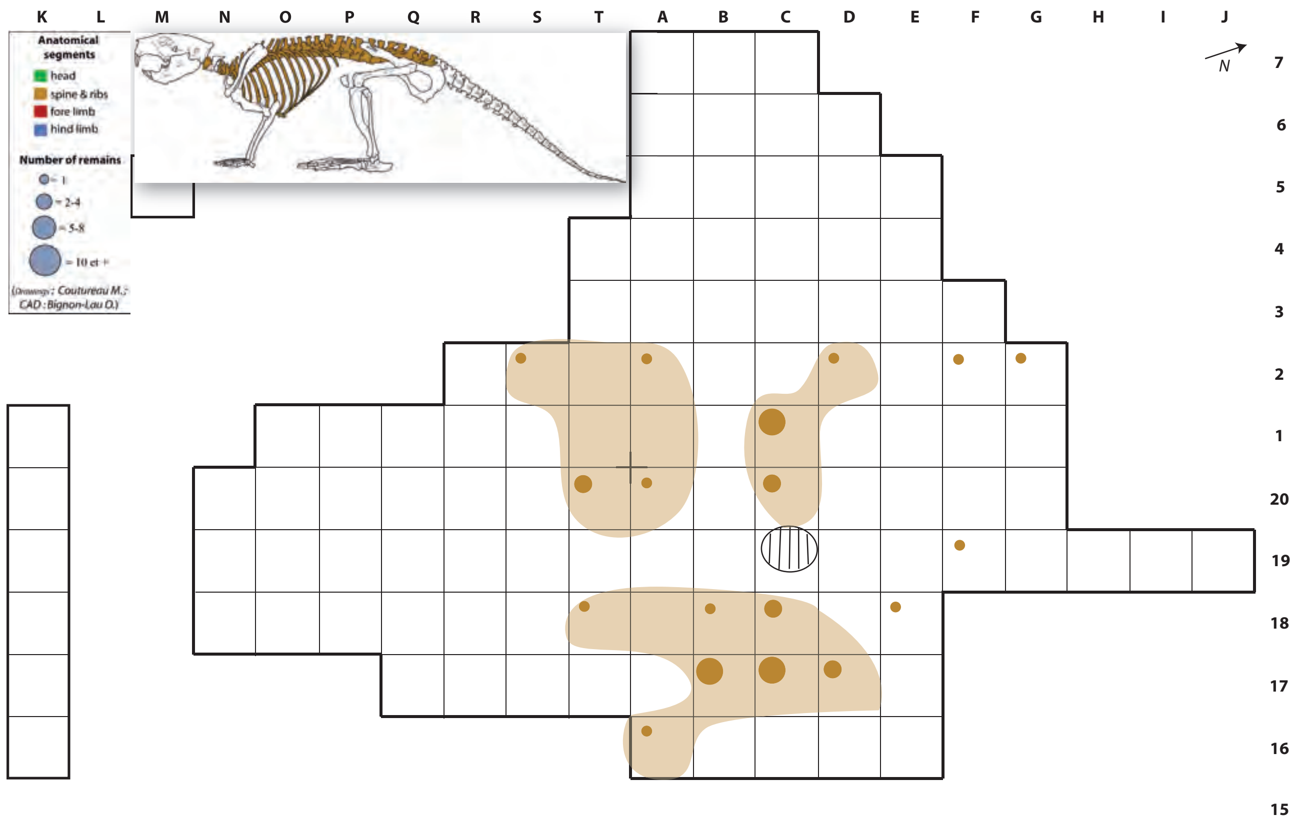

Fig. 15 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Distribution of skeletal elements of the vertebral column (vertebrae and ribs) of beaver (*Castor fiber*; NR = 160, NMIc = 3).

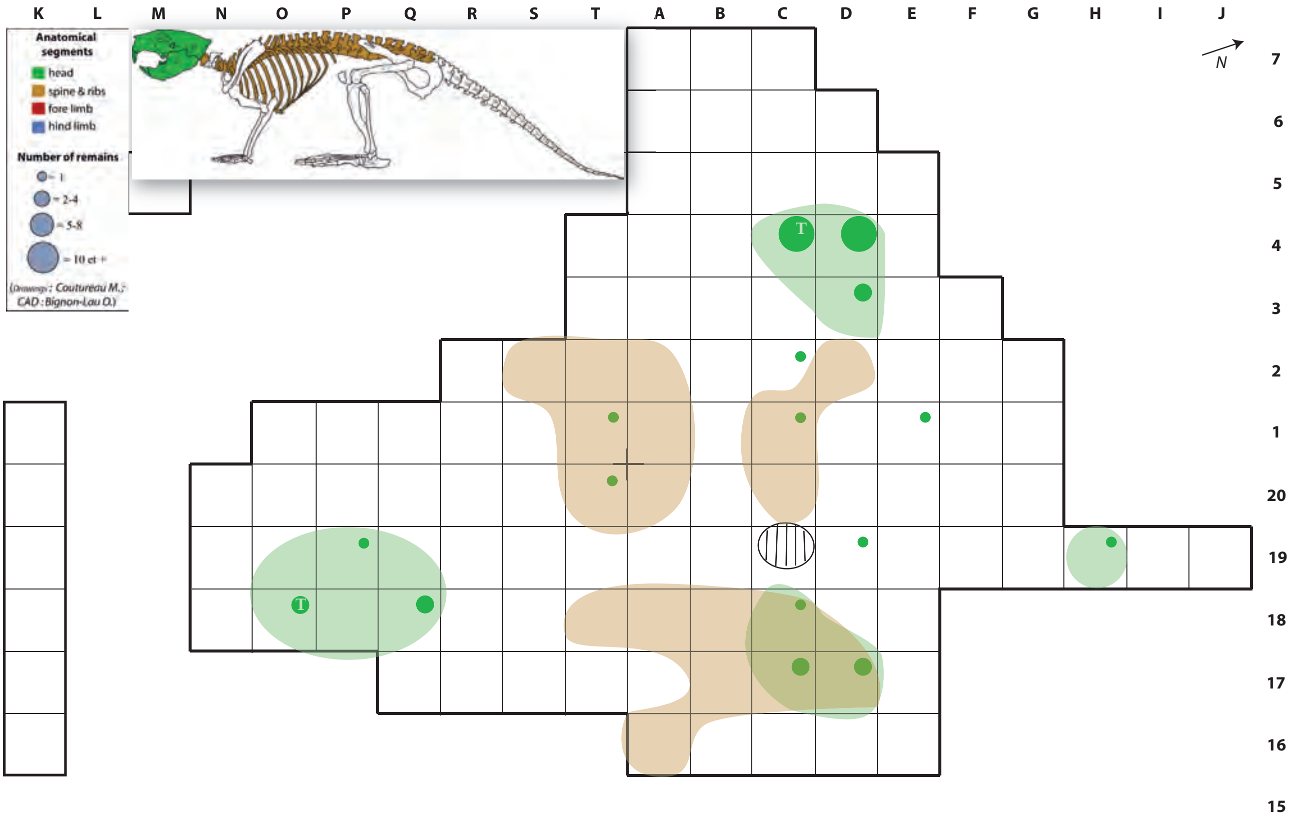

Fig. 16 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Distribution of skeletal elements from head segments (skull, mandible, teeth) and vertebral column of beaver (*Castor fiber*; NR = 160, NMIc = 3).

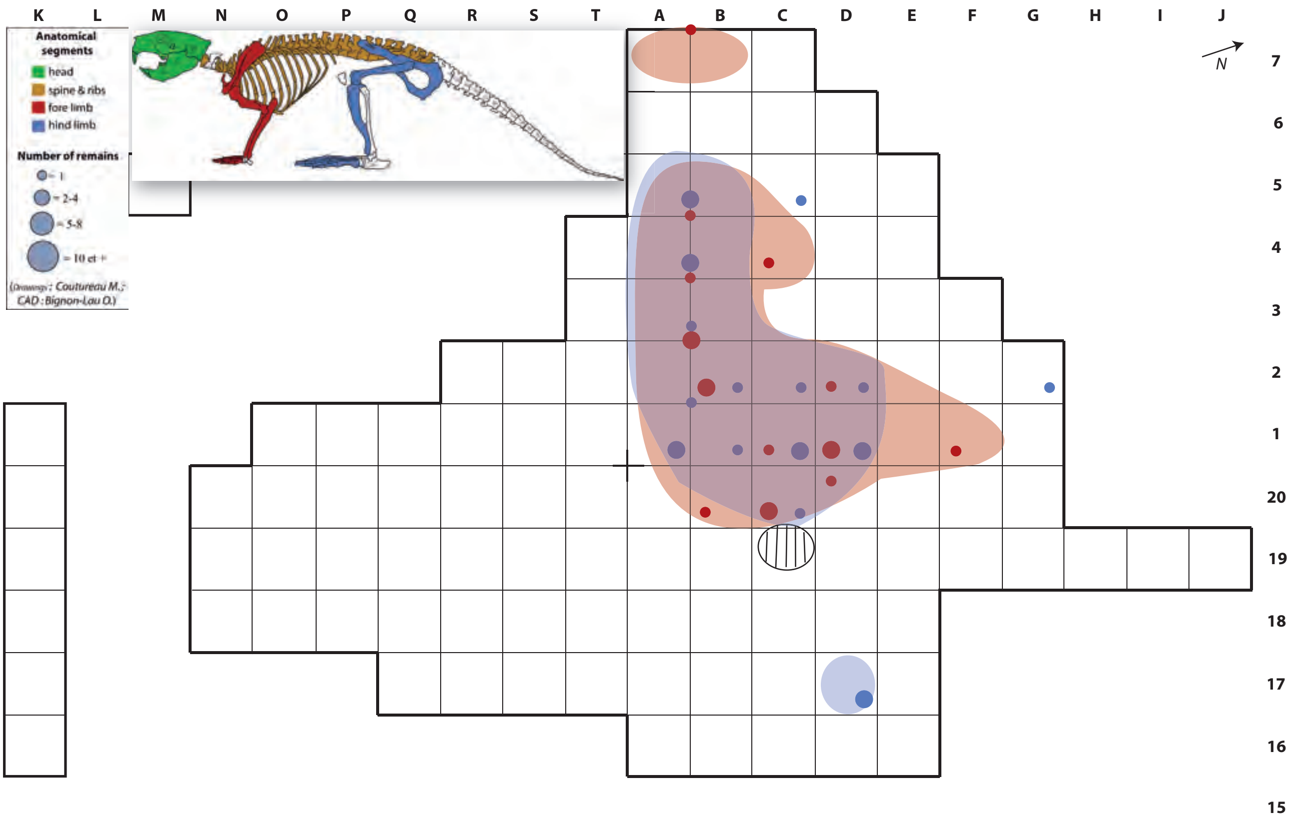

Fig. 17 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Distribution of skeletal elements from segments of anterior members (scapula, humerus, radius, ulna) and posterior members (coxal, femur, tibia, fibula) of beaver (*Castor fiber*; NR = 160, NMIc = 3).

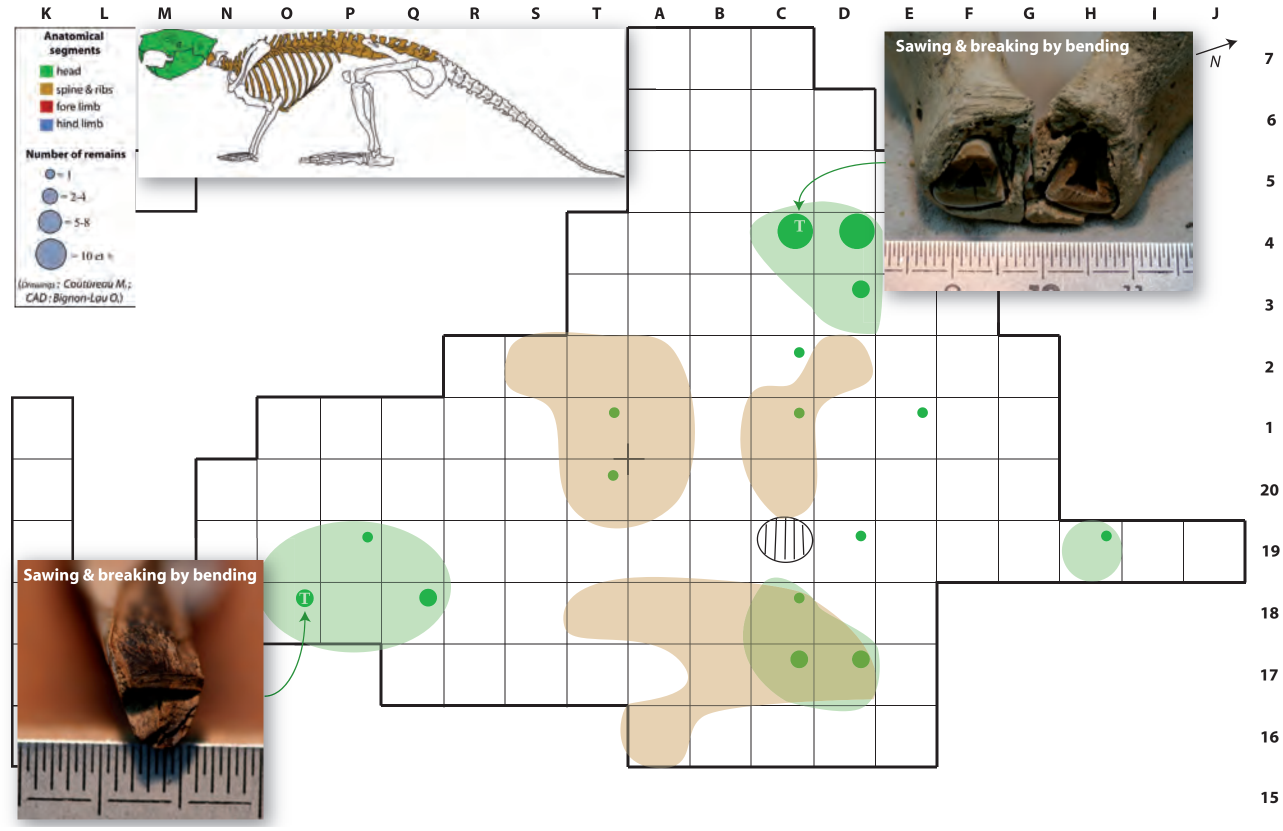

Fig. 18 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Distribution of head segments and location of worked beaver incisors (*Castor fiber*; NR = 160, NMIc = 3).

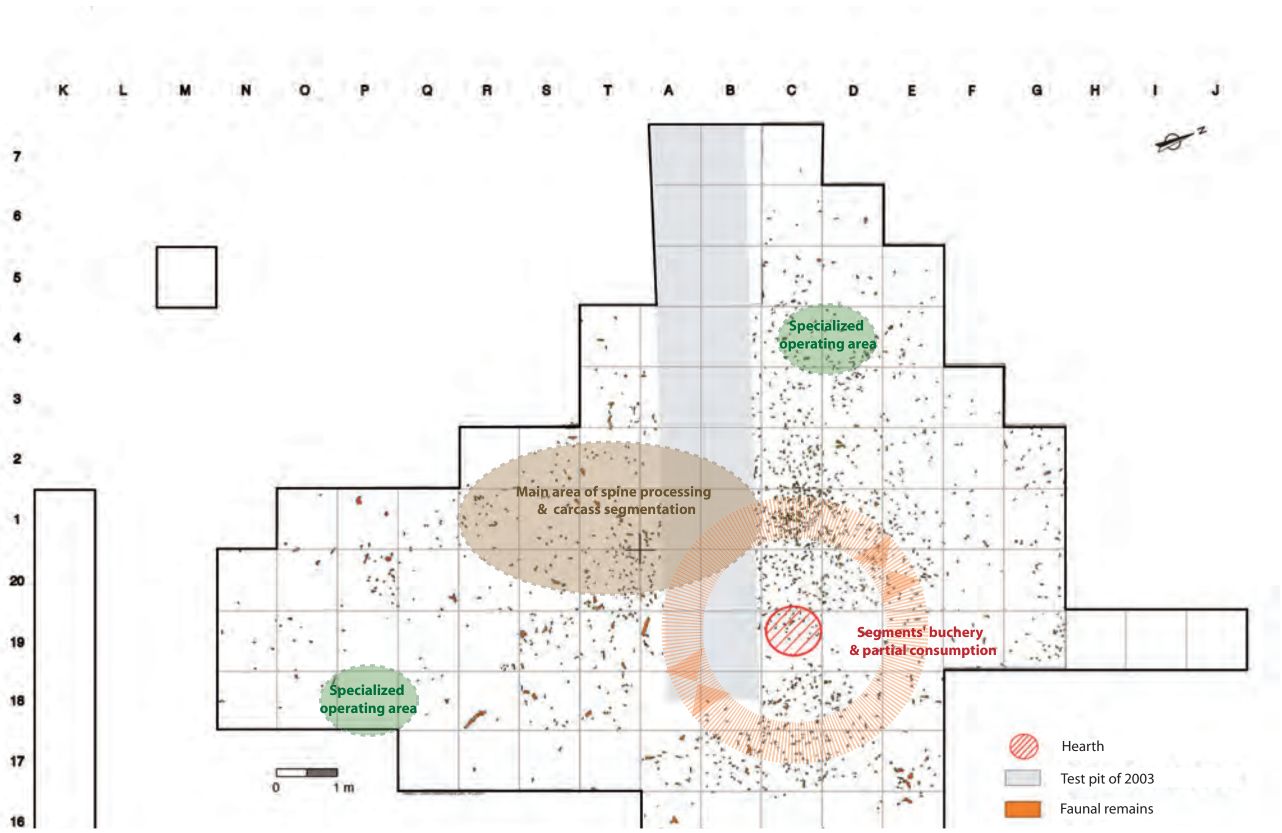

Fig. 19 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Synthesis of carcass processing based on the analysis of species distribution and their anatomic segments.

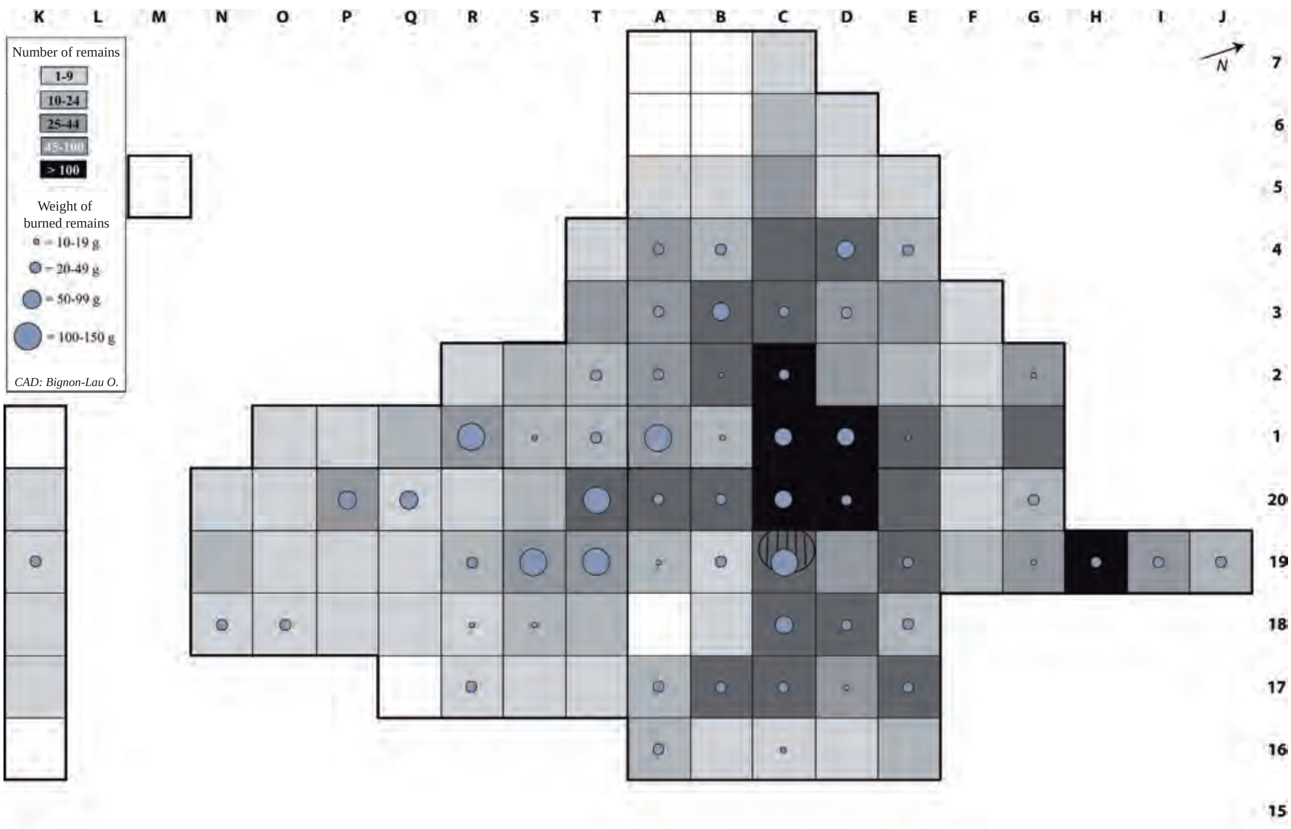

Fig. 20 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Weight density of faunal remains with traces of fire by square metre.

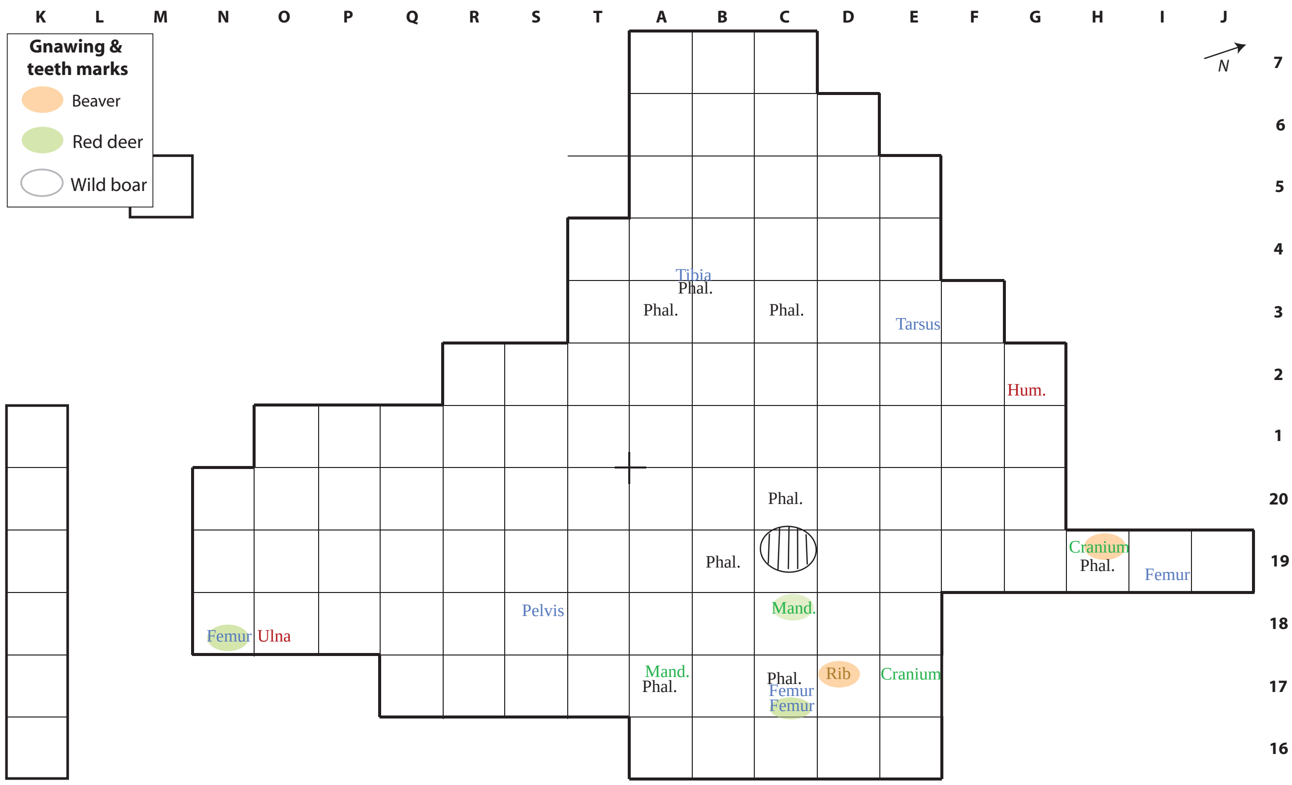

Fig. 21 – Saleux (Somme), Les Baquets. Mesolithic locus 295. Distribution of skeletal elements bearing traces of fangs or gnawing.

eous tufa. This favourable topographic position resulted in the excellent preservation of the archaeological level, as well as the original organisation of the remains. The unique typological component of the lithic industry associated with locus 295 sets it apart from other Mesolithic occupations of the site. Triangles play an important role in the range of microliths, alongside obliquely truncated points or points with a transversely retouched base. The originality of the industry is equally reflected in the presence of domestic tools which are rare or totally absent from other Mesolithic loci at Saleux. The occupation dates to the middle or second part of the Boreal, towards 8500 BP (7550 calBC).

The abundant and diversified fauna is dominated by wild boar. Due to the good preservation conditions of osseous remains, we can assert that the data related to prey is not affected by any differential preservation or a taphonomic bias. Such phenomena are however much more consequential in loci situated upslope on the alluvial apron of the lowest terrace of the Selle, which lies outside of the depositional zone of the Boreal peat. A preliminary spatial analysis of the faunal material highlights the following scenario in which hunting tactics can be even more clearly defined. The pursuit of wild boar was the major objective of this occupation and numerous individuals (including many young) were brought back to the site. Furthermore, the need to quickly process all prey during several tightly spaced stopovers explains the density of remains. In regards to the diversity of animal resources, beaver owes its unusual over-representation to specific technical intentions, namely the procurement of its incisors. Species such as aurochs and red deer may have been segmented prior to their introduction to the site. The smallest species, represented by only a single incomplete specimen, may have resulted from trapping during the occupation of the site.

Zones associated with working flint or processing fauna are well-differentiated at locus 295. The internal organisation of the occupation appears as juxtaposed zones with a multifunctional area in the vicinity of the hearth. Flintknapping occurred alongside more specific activities such as the manufacture of projectile weapons, as well as numerous butchery activities probably involving the partial consumption of animal products *in situ* during the butchery process. Carcass processing took place on a much larger scale. A space dedicated to the dismemberment and segmentation of large mammals can be found on one side, while another zone for working flint and areas for more specialised tasks, especially concerning beaver, are found in more marginal positions.

This preliminary data seems to indicate a relatively short occupation where mainly hunting and butchery activities were carried out simultaneously with more domestic activities such as skin processing. Although the working of plant and osseous materials was demonstrated by use-wear analysis, they seem to have played a secondary role. The duration of the occupation does not seem to have been long enough to disturb the original organisation of the remains or blur the structuration of space. No evidence of fishing was recovered despite the site bordering a channel and having conditions favourable to the preservation of fragile elements such as fish remains. It therefore appears that the hunting of large terrestrial mammals was the main activity at the site. Furthermore, no traces of carbonised hazelnuts were recovered, which may however be related to the period of occupation as the paleodemographic composition of wild boar suggests a warm-season frequentation of the site.

Acknowledgements: We would like to thank Yolaine Maigrot for her help and discussions concerning the identification of processing techniques on beaver incisors.

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The 'Beuronian with crescents' in Northern France: the beginnings of a palethnological approach

Thierry Ducrocq

Abstract: The establishment of a Mesolithic chrono-cultural framework reveals several successive traditions in Northern France. The most well-documented of which is the 'Beuronian with crescents' dated to around 8,000 calBC. The main sites actually seem to represent the juxtaposition of contemporaneous concentrations. The time spent at these sites seems brief and principally concerns hunting activities focused on wild boar.

FROM THE DISCOVERY OF THE MESOLITHIC IN NORTHERN FRANCE TO THE BASIS FOR A PALETHNOLOGICAL APPROACH

The small Tardenois region, which has lent its name to the Tardenoisian, has made Northern France a key area for Mesolithic research since its beginning (Rozoy, 1994a). Furthermore, information collected from north of the Loire formed the main body of J.-G. Rozoy's (1978) monumental synthesis within which can also be found the first palethnological approach to the French Mesolithic. This reconstruction of Mesolithic lifeways is principally based on discoveries from Northern European peat deposits (bows, arrows, abundant fauna, etc.). In fact, the majority of sites known from the Paris Basin are located on sandy outcrops presenting adverse conditions for the preservation of organic material. In order to fill this gap, research turned towards the peat valleys of Northern France, particularly those in the Somme (Ducrocq, 1989). The complexity of these sites quickly became apparent as the discovery of levels containing preserved fauna multiplied. As a result, comprehensive geological studies (Antoine, 1997) connected with detailed taphonomic approaches (given the frequency of palimpsests) have become instrumental (Ducrocq, 2010). The accumulation of absolute dates from sites apparently not suffering from problems connected to successive occupations traces (palimpsests) clearly demonstrates that distinct types of microlithic assemblages occupy different chronological positions (fig. 1). The initial absolute dating results also exposed the weaknesses of the chrono-typological framework employed up until this point. The primary objective became placing the Mesolithic of Northern France within a morpho-stratigraphic, environmental and cultural framework (Ducrocq, 2001). The perception of continuity between different stages of the Mesolithic was replaced by the recognition of a succession of stable typological stages separated by more complex episodes, but without any genuine transitional sites. Evidence from Southern and Western France for a single rupture between a First and Second Mesolithic (Marchand, 2008) is not easily transferred to Northern France, especially for the first two millennia given probable population displacements induced by the expansion of the North Sea. However, this would not be of relevance here if the sites had not demonstrated stark contrasts in lifeways between the different phases. For instance, several Early Maglemosian sites still contain numerous endscrapers and burins, while these tool types are almost always absent from the youngest 'Beuronian with crescents' occupations. Fishing presents a second example as it is only attested to from the beginning of the Boreal chronozone on fairly complex sites such as Noyen-sur-Seine (Mordant, 1989) or la Chaussée-Tirancourt. An inaccurate consideration of finer

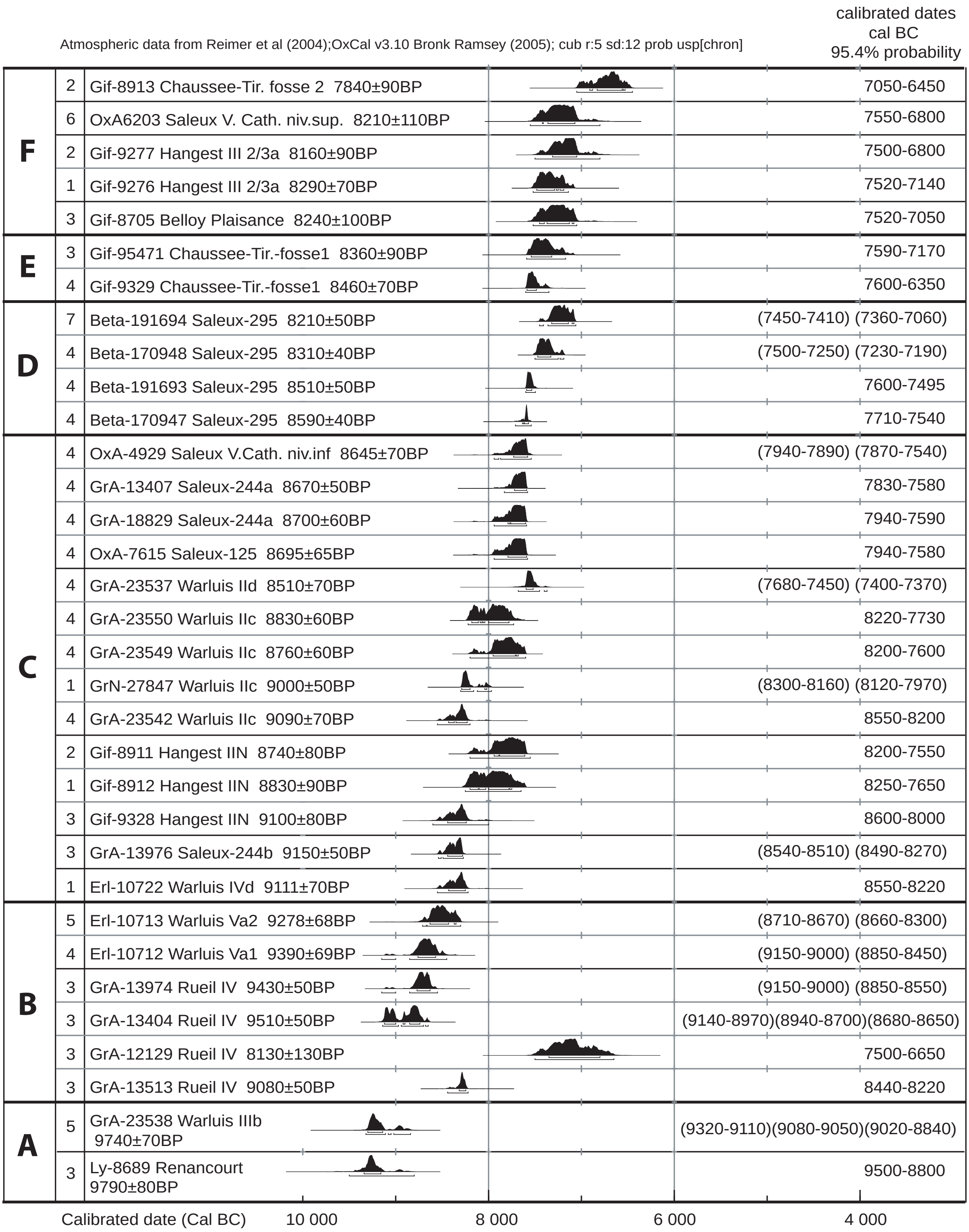


Fig. 1 – Principal absolute dates for the Early and Middle Mesolithic in the peat valleys of Picardy. A: Initial Mesolithic; B: Early Maglemosian; C: 'Beuronian with crescents'; D: 'Beuronian with scalene triangles'; E: 'Beuronian with backed bladelets'?; F: RMS A. 1: Dates on burnt hazelnuts; 2: charcoal; 3: unidentified bone; 4: *Sus scrofa*; 5: *Cervus elaphus*; 6: *Bos primigenius*; 7: *Castor fiber*.

chronological aspects could lead to a highly seductive, but ultimately incorrect analysis involving a fictitious ranking of sites and their relationships between each other (base camps, hunting camps, fishing spots, etc.).

Only the period around 8800 BP in Northern France is sufficiently well-documented from a number of different well-preserved sites to provide the basis for a robust palethnological approach. The study presented here has the simple objective of rapidly outlining the initial results concerning this Mesolithic culture.

'THE BEURONIAN WITH CRESCENTS': CHRONOLOGY, IDENTIFICATION, DISTRIBUTION, GEOGRAPHY AND TERMINOLOGY

This tradition was first recognised from surface collections in the Ercheu region (Ducrocq, 2001), followed by the recovery of artefacts from a sound sedimentary context occasioned by monitoring work on floodplains (digging reservoirs or stripping gravels) which, taken together, led to an understanding of the chronology and environmental context of the 'Beuronian with crescents' (Ailly-sur-Noye, Crouy-Saint-Pierre, Hangest-sur-Somme). New excavations were carried out on floodplains such as at Saleux (Fagnart et al., 2008), Warluis (Ducrocq et al., 2008), Conty and Amiens-Étouvie, as well as on sandy outcrops (Lihus, Attilly, Sermoise) or along plateaus as at Blangy-Tronville. Rescue diagnostics have also led to further discoveries.

In the Somme Basin, all of the lithic industries dated to between 9100 and 8700 BP contain numerous crescents associated with points with retouched bases (transverse or oblique) (figs. 2 and 3). Even if we exclude dates produced on charcoal ('old-wood' effect) and animal bone (problems with collagen preservation) and retain only those produced on carbonised hazelnuts, the results remains the same. Taking into account issues tied to calibration and the radiocarbon plateau at 8800 BP, these industries broadly date to between 8500 and 7500 calBC, in other words, several centuries on either side of 8000 calBC. Palynological analysis from several sites in the Somme (Munaut and Defgnée, 1989; Ducrocq, 2001) place them to the beginning of palynozone 7 identified by Van Zeist and Van der Spoel-Walvius (1980) which corresponds to a relatively low forested landscape dominated by hazelnut trees.

All of these sites were initially subsumed in the 'Hangest group' defined from the site of Hangest-sur-Somme 'Gravière II Nord' which was the best documented at the time (Ducrocq, 1991 and 1992; Ketterer, 1997). It then seemed appropriate to find a new term for designating this material culture given difficulties in accepting a 'culture' in the ethnological sense. The Beuronian, in a strict sense, was first defined in Southern Germany by W. Taute (1973) to describe assemblages containing both points with retouched bases and triangles. S. K. Kozłowski's (1983) broader definition of the Beuronian (Beuron-Coincy culture; fig. 4A) included assemblages that were not only very similar typologically (Gob, 1985), but were spread over a much larger territory. In my sense of the term, this more broadly defined Beuronian is comparable to a techno-complex containing points with retouched bases (fig. 4B). Distribution patterns of Western European groups who essentially employed this type of microlith during the first half of the Boreal clearly shows a separation of the Beuronian from the major Sauveterrian groups to the south and the northern Maglemose-Duvensee industries. However, the Beuronian techno-complex itself includes microlith assemblages that differ significantly according to their chronological or geographic position.

Thus the 'Beuronian with crescents' lasted for less time than the Beuronian complex in general and is characterised by the replacement of triangles by crescents. It is not restricted to the Somme, but is spread across the entire Paris Basin up to the Cher Valley in the south and all of Belgium (fig. 5). Its existence in Eastern France and Southern Great Britain, although probable, has not been clearly documented given the lack of uniform microlith assemblages genuinely comparable with those from the Somme. The possibility of different traditions coexisting in the same territory applies only to areas at the edges of this large territory, especially in Belgium (Crombé, 2002). This immense techno-complex includes smaller entities distinguishable, for example, by the use of Wommerson quartzite limited to Belgium (Noens et al., 2009), the replacement of points with transverse bases by those with oblique bases at the end of the period (towards 8700 BP) in the Somme Basin (Fagnart et al., 2008) or the use of Montmorencian prismatic tools in the Île-de-France and Centre regions (Griselin et al., this volume).

This three-tier hierarchical classification (Beuronian in a broad sense, 'Beuronian with crescents', smaller geographic or chronological entities) could provide evidence of a social territory (Beuronian with crescents) and annual territories for the lower level entities as has occasionally been proposed for the end of the Nordic Palaeolithic (Clark, 1975). This taxonomy composed of three territorial levels is reminiscent of ideas proposed by R. Newell and his team (1990) based on the study of decorative ornaments taken to reflect language families, tribes or bands, in other words, local groups. While this remains hypothetical, it is nonetheless worth noting that the lowest level entities occupy areas comparable with the cultures J.-G. Rozoy (1991) equated with tribal dialects incorporating bands of around 15 individuals (Rozoy, 1998). In this classification, the 'Beuronian with crescents' from the Somme Basin would represent the beginning of the middle stage of Rozoy's 'Somme Group' (1994b). The problem with this designation is that is presupposes a connection between the different regional and chronological phases beginning from the earliest stage. This is far from evident as major palaeogeographic changes could produce multiple population migrations.

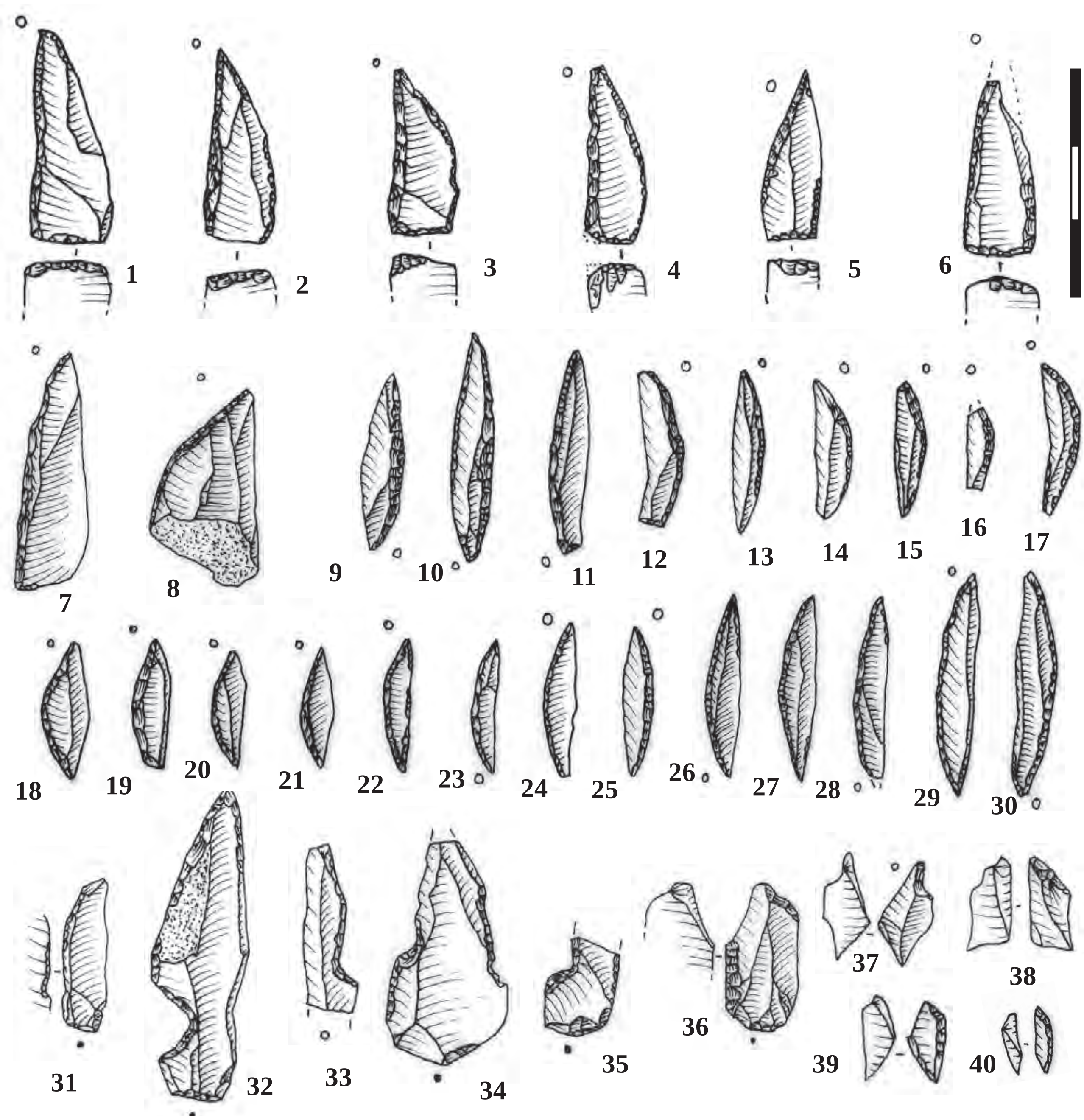


Fig. 2 – Warluis I (Oise). Microliths typical of the 'Beuronian with crescents'. 1-6: points with retouched bases; 7-8: points with un-retouched bases; 9-30: crescents; 31-35; incomplete pieces; 36-40: microburins (drawings T. Ducrocq).

WHAT IS THE NATURE OF 'BEURONIAN WITH CRESCENTS' SITES?

Apart from the site of Conty which represents a brief stopover by a lone hunter (Ducrocq, 2001), 'Beuronian with crescents' sites take the form of artefact concentrations several dozen square metres in size. The juxtaposition of several of these concentrations could be interpreted as resulting from multiple visits to the same place (Ducrocq, op. cit.). This reasoning is based on frequent palimpsests evident in Mesolithic contexts that are often responsible for the size of the largest sites (Crombé et al., 2006 and this volume).

Features are also rare: there are no traces of tents, cabins or simple shelters. Basic combustion zones are represented simply by dispersed burnt remains. Debitage clusters have been documented at the sites of Crouy 'Étang' and Hangest 'Gravière II nord' (Ducrocq, 2001).

A recent study of lithic raw materials from three sites (Ailly-sur-Noye, Crouy 'Étang' and Hangest 'Gravière II nord'; Fabre et al., 2007) documented the exploitation of all flint types available within a one kilometre radius. In each assemblage, some blocks were imported from

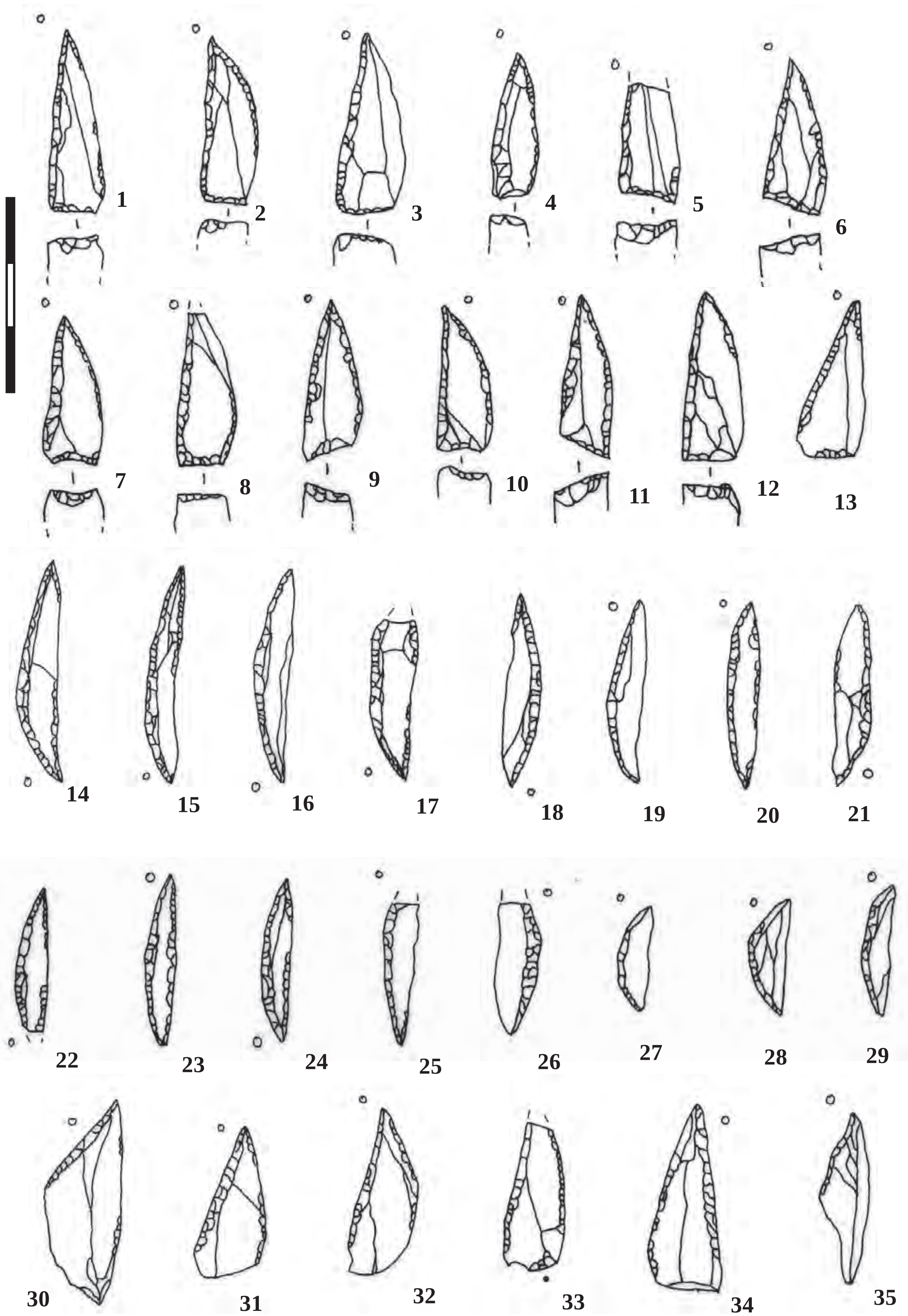


Fig. 3 – Warluis IIc (Oise). Microliths typical of the ‘Beuronian with crescents’. 1-13: points with retouched bases; 14-29: crescents; 30-35: points with un-retouched bases (drawings T. Ducrocq).

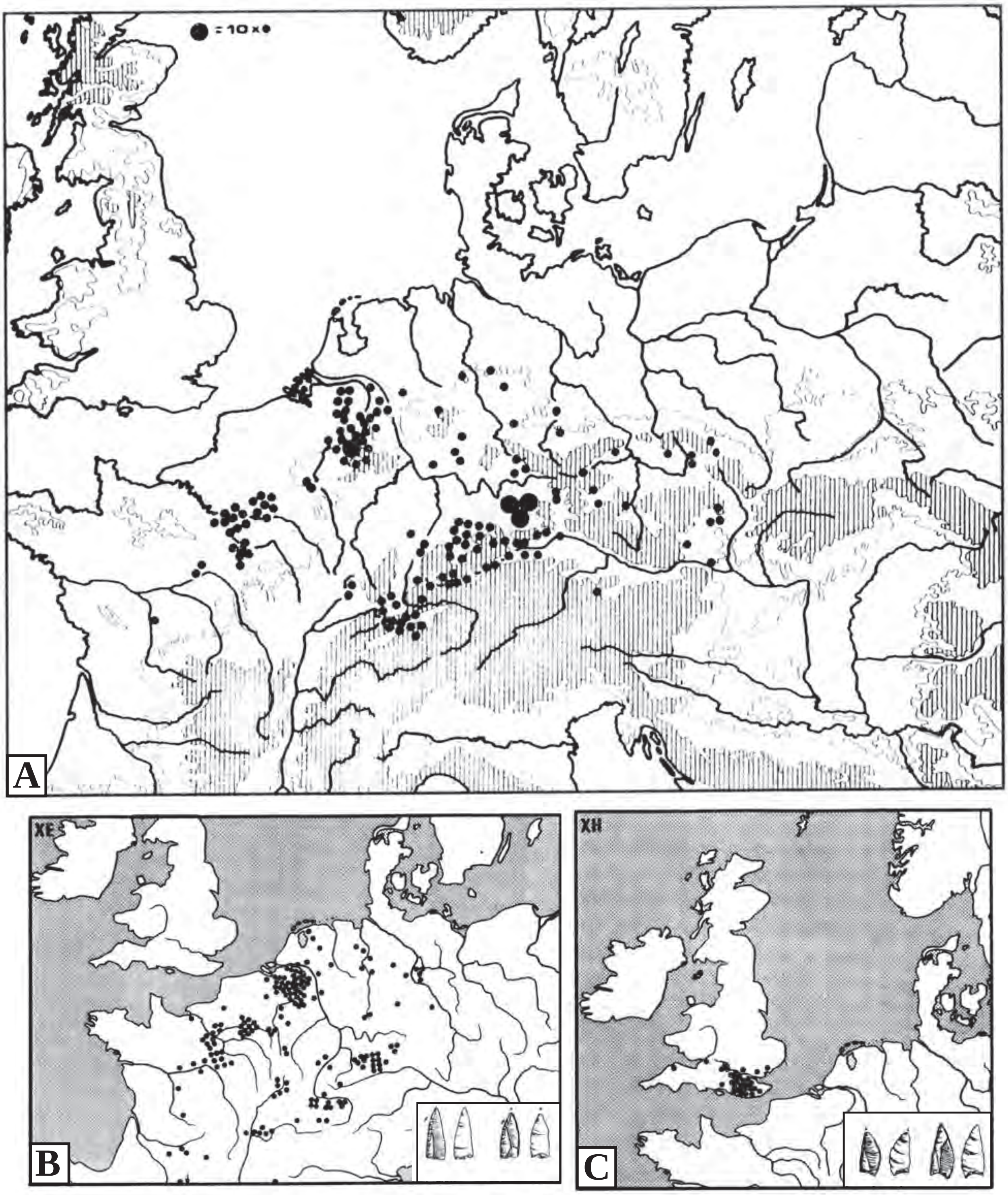


Fig. 4 – Maps after Kozłowski (2009, p. 139, 140 and 316). A: Geographic range of the Beuronian; B: Distribution of points with transverse bifacially retouched bases; C: Points with obliquely retouched bases (Horsham points). Numerous points in Northern France should be added to map C. The Horsham and Honey Hill groups from Britain could be integrated within the Beuronian (Reynier, 2005).

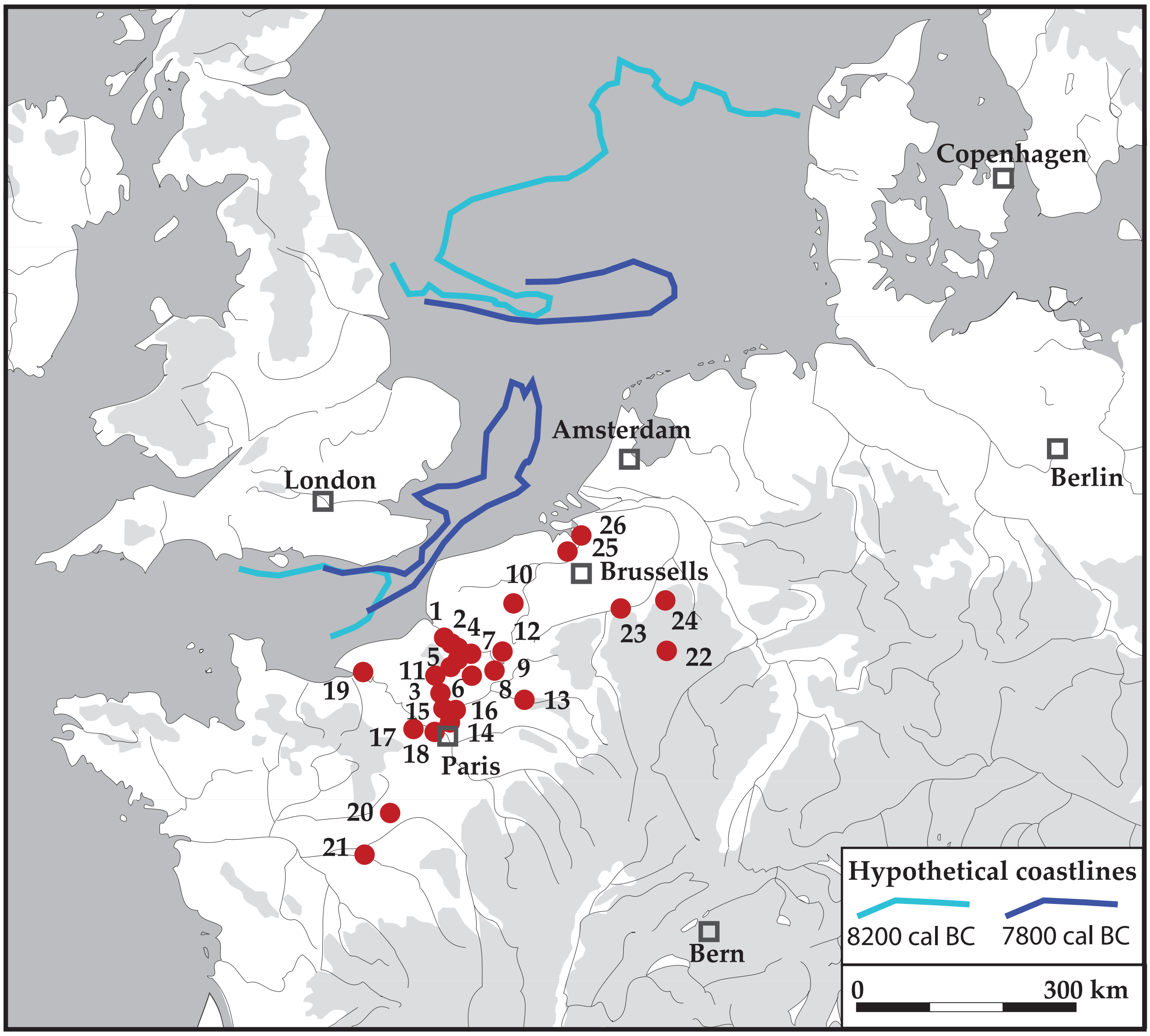


Fig. 5 – Principal sites attributed to the 'Beuronian with crescents' (towards 8800 BP). 1: Gravière II Nord at Hangest-sur-Somme; 2: L'Étang at Crouy-Saint-Pierre; 3: Warluis I, II, IV; 4: Étouvie-Chemin de la Marine and Rue Saint Maurice II at Amiens; 5: La Vierge Catherine and Les Baquets at Saleux; 6: Le Marais at Conty; 7: La Petite Tête at Blangy-Tronville; 8: Le Marais de Berny at Ailly-sur-Noye; 9: L'Abbaye-aux-Bois at Ognolles and La Haute Borne at Beaulieu-les-Fontaines; 10: Le Bois du Marais at Masny (Félix, 1968); 11: Lihus II; 12: Le Bois de la Bocquillière – MESO II at Attilly; 13: Sermoise; 14: Piscop M1 (Rozoy, 1978); 15: Hédouville (Daniel, 1934); 16: Les Prés-Saint-Laurent at Beaumont-sur-Oise (Souffi, 2001); 17: Le Dentu at Boinvillers and Haussepied at Orvilliers (Griselin, 2008); 18: Chaville I (Rozoy, 1978); 19: Saint-Wandrille-Rançon (Souffi, 2008); 20: Lorges I (Rozoy, 1978); 21: Le Chêne des Fouteaux at Saint-Romain-sur-Cher 1, 3 and 4 (Kildéa, 2008); 22: Galgebierg at Diekirch (Spier and Geiben, 1987); 23: Seilles 2 and 3 (Destexhe, 1979); 24: L'Ourlaine (Gob, 1981); 25: Verrebroeck 4 and 23 (Perdaen et al., 2008); 26: Doel Deurganckdok 3 (Noens et al., 2006). Changes in the coastline deduced from the work of Jelgersma (1979), Coles (1998), Sommé (1999) and Sommé et al. (1994).

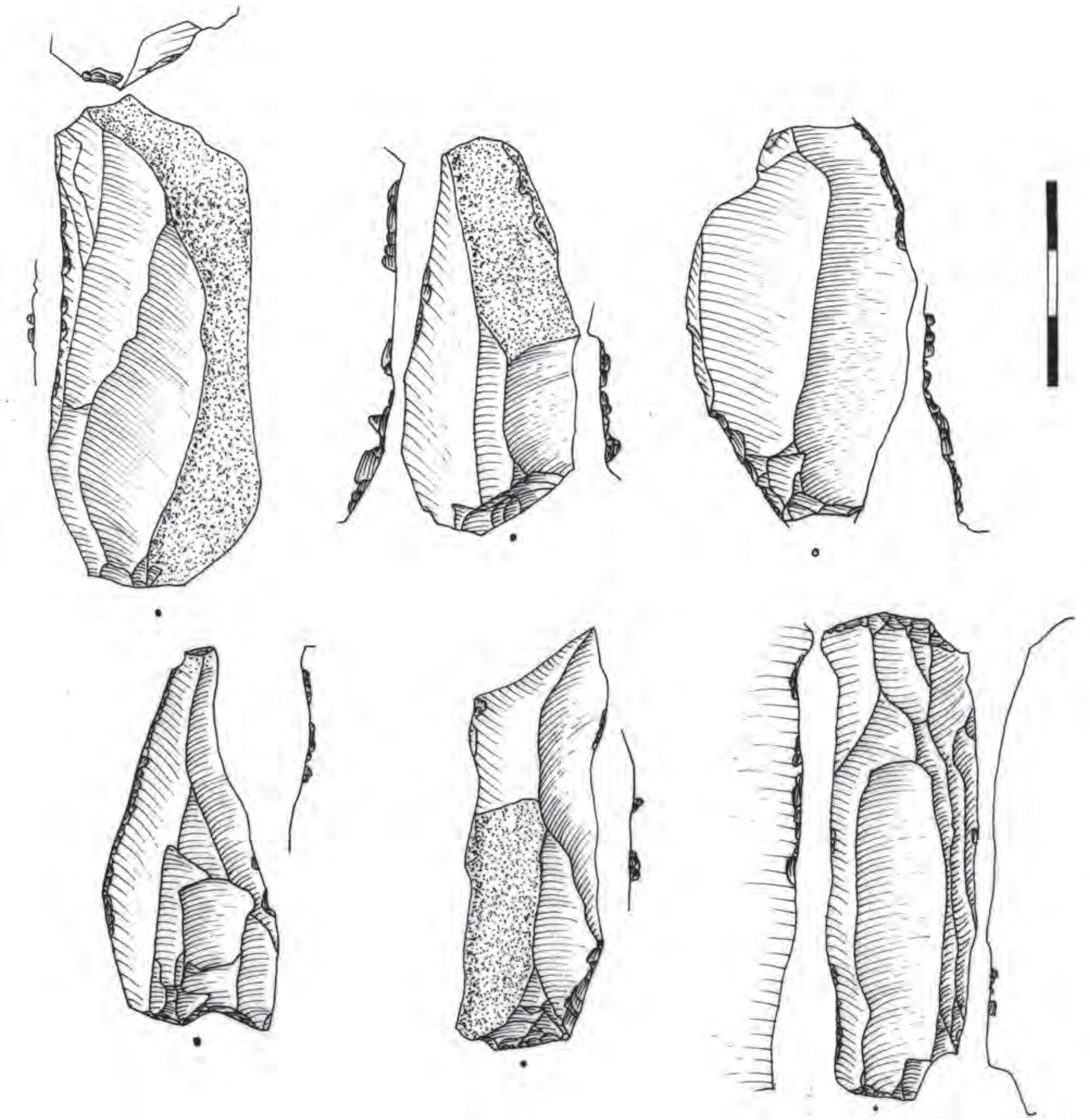


Fig. 6 – Gravière II Nord at Hangest (Somme). Artefacts with retouch produced by use (drawings T. Ducrocq).

slightly more distant sources up to 9 km from the sites or around a 2 hour walk. At other sites such as Warluis I, Mesolithic groups installed themselves directly on a source of raw material. The entirety of the *chaîne opératoire* is present from opening the block to the production of microliths. Debitage, although in the Coincy style (Ketterer, 1997), demonstrates particular nuances probably connected to the abundance, quality and morphology of the raw material. While endscrapers and burins are rare, numerous artefacts carry irregular retouch resulting from use (fig. 6). A still unpublished analysis of these pieces from Warluis I by N. Cayol (INRAP) revealed various, but moderate uses sometimes connected with the working of plant materials. Numerous microburins and unfinished pieces indicate that microliths were manufactured on-site. Several points with retouched bases bear complex breaks probably connected to their use as projectile elements and several crescents still carry traces of glue (fig. 7). This combination demonstrates that the maintenance of hunting weapons played an important role on these sites.

All of these features of the lithic industry are common on sites found on floodplains or sandy outcrops (Ducrocq, 2001). The fact that activities do not differ according to topographic position excludes considering these sites as fulfilling complementary functions.

Fig. 7 – Gravière II Nord at Hangest (Somme). Broken crescents still carrying small traces of glue near the retouch (photos S. Lancelot).

At first glance, the occupation of valley floors could be motivated by fishing practices, however no supporting evidence exists — no fish remains were recovered from Warluis, Saleux, Hangest, nor any of the sites with well-preserved fauna. The faunal spectrum is restricted to several mammals and is largely dominated by wild boar, such as at Warluis I where it is the only species present. Wild boar is often represented on sites by several, generally young, individuals (four at Warluis I). Compared to ternary age structures of natural populations, this pattern suggests non-selective hunting (Bridault, 1997). The form in which game was introduced to sites remains relatively unknown given the lack of detailed studies, limited excavations and the probable disappearance of anatomical parts in hearths or due to taphonomic processes. However, at least a portion of the animal seems to have been consumed on-site: numerous bones present traces of butchery, as well as human-induced fractures, while others are charred or carbonised. Determining the season of occupation is also difficult based solely on wild boar remains as multiple births can be spaced across the year. A. Bridault has proposed an occupation between March and August or October and January for Warluis I.

Burnt hazelnut shells are absent from certain sites such as Saleux. On other sites hazelnut shells represent rare elements susceptible to being accidentally burnt in the vicinity of combustion zones. Although their number sometimes reaches several dozen, this dietary resource appears of secondary importance.

Overall, preliminary faunal data combined with evidence for microlith production makes it possible to interpret these sites as short-term camps essentially dedicated to the hunting of large prey, especially wild boar. Patterns of raw material provisioning indicate the exploitation of an approximately 10 km area. The combination of relatively diverse activities, the on-site consumption of resources, the presence of combustion zones and all stages of the *chaîne opératoire* for microlith manufacture argue in favour of stopovers lasting several days. However, the absence of elaborate features and time invested in certain other activities (rarity of endscrapers, burins, bone tools) suggest relatively short stays. This perception of small, extremely mobile human groups moving between sites with identical functions, essentially based around the acquisition of meat resources, is very close to that of J.-G. Rozoy or the ideas formulated by S. Philibert (2004) for the Sauveterrian.

SINGLE CONCENTRATIONS OR LARGE CAMPSITES?

Large campsites elsewhere

A settlement model composed of single, non-ranked concentrations was based on the absence of more extensive or complex sites (see above). However, several studies of sites in neighbouring areas or regions have led to very different hypotheses. For example, the slightly older Beuronian from level R4 at Ruffey-sur-Seille (Séara et al., 2002) where conjoins between concentrations spread over 600 m² provide evidence of a clear contemporaneity between apparently non-complementary units and outlines an extensive campsite. The absence of certain anatomical parts of prey suggests a site mainly dedicated to hunting, probably involving the transport of portions of prey elsewhere (Séara, 2000). Faced with such discoveries (see also Kind, this volume), how can we not re-examine data concerning the ‘Beuronian with crescents’ from Northern France in an attempt to identify large campsites or long-term occupation sites?

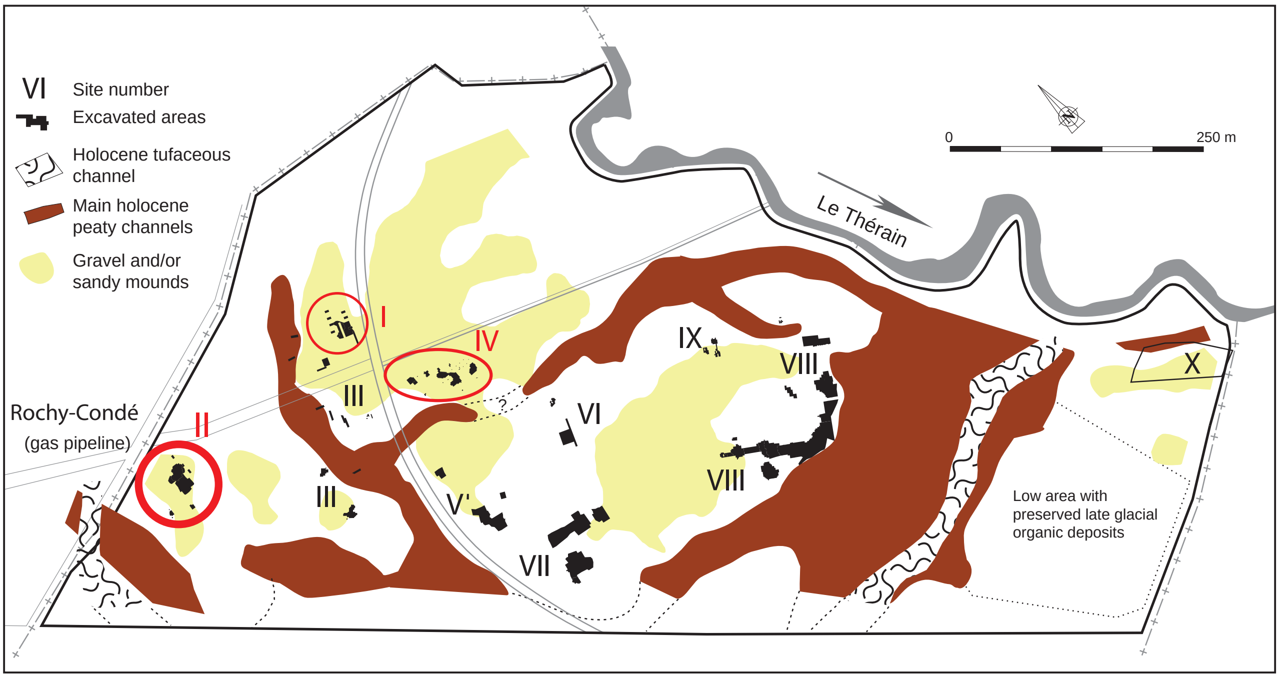


Fig. 8 – Warluis (Oise). Location of the sites and the main paleochannels across the entirety of the surface investigated (S. Coutard).

Warluis II: a large campsite

Extensive sites with multiple contemporaneous concentrations can be excavated over large areas with little or no taphonomic problems. The site of Warluis (fig. 8) has recently provided such an opportunity in the form of several Early and Middle Mesolithic loci, certain of which produced 'Beuronian with crescents' assemblages. Although different problems impeded the excavation and analysis (Ducrocq et al., 2008), one of the priorities was to excavate the Mesolithic occupations over a large area, followed by attempting refits between concentrations. This was carried out for site II which produced a typical 'Beuronian with crescents' assemblage (figs. 9, 10 and 11): crescents and points with retouched bases, numerous pieces with irregular retouch produced by use and a debitage method identical to Hangest 'Gravière II nord' (Ketterer, 1997) with all of the debitage stages once again present.

While wild boar remains (several individuals) predominate, fish is absent and hazelnut shells are present. No features were evident, however zones with heated elements or more concentrated lithic waste were noted. The 225 m² manual excavation, spread over four sectors, was complemented by a larger investigation carried out with the help of the mechanical digger. The main excavation sector (IIc; figs. 12 and 13) uncovered at least two concentrations separated by several metres, each portraying the same artefact diversity suggesting the existence of two 'activity units' (*sensu* Séara, 2000). Sector IId, separated from IIc by more than 10 m, produced a similar concentration. The more distant sectors IIa and IIb represent zones with more diffuse remains. Furthermore, a concentration detected by a trench, as well as the presence of an erosion zone and an overly restricted excavation area leaves open the possibility that other units exist. The series of ^{14}C dates, although coherent with the chrono-cultural attribution, did not allow a precise understanding of the chronological relationship between the different sectors. (fig. 1). Refits (fig. 14) and conjoins highlight the existence of two entities in sector IIc linked by numerous short-distance connections (fig. 15). The relationship between the two zones is especially well-documented by refit 9 composed of an isolated core and debitage products

Fig. 9 – Warluis II (Oise). View of sectors IIc and IId after the removal of the topsoil. The black and white areas correspond, respectively, to silts and peats covering the Mesolithic level (photo T. Ducrocq).

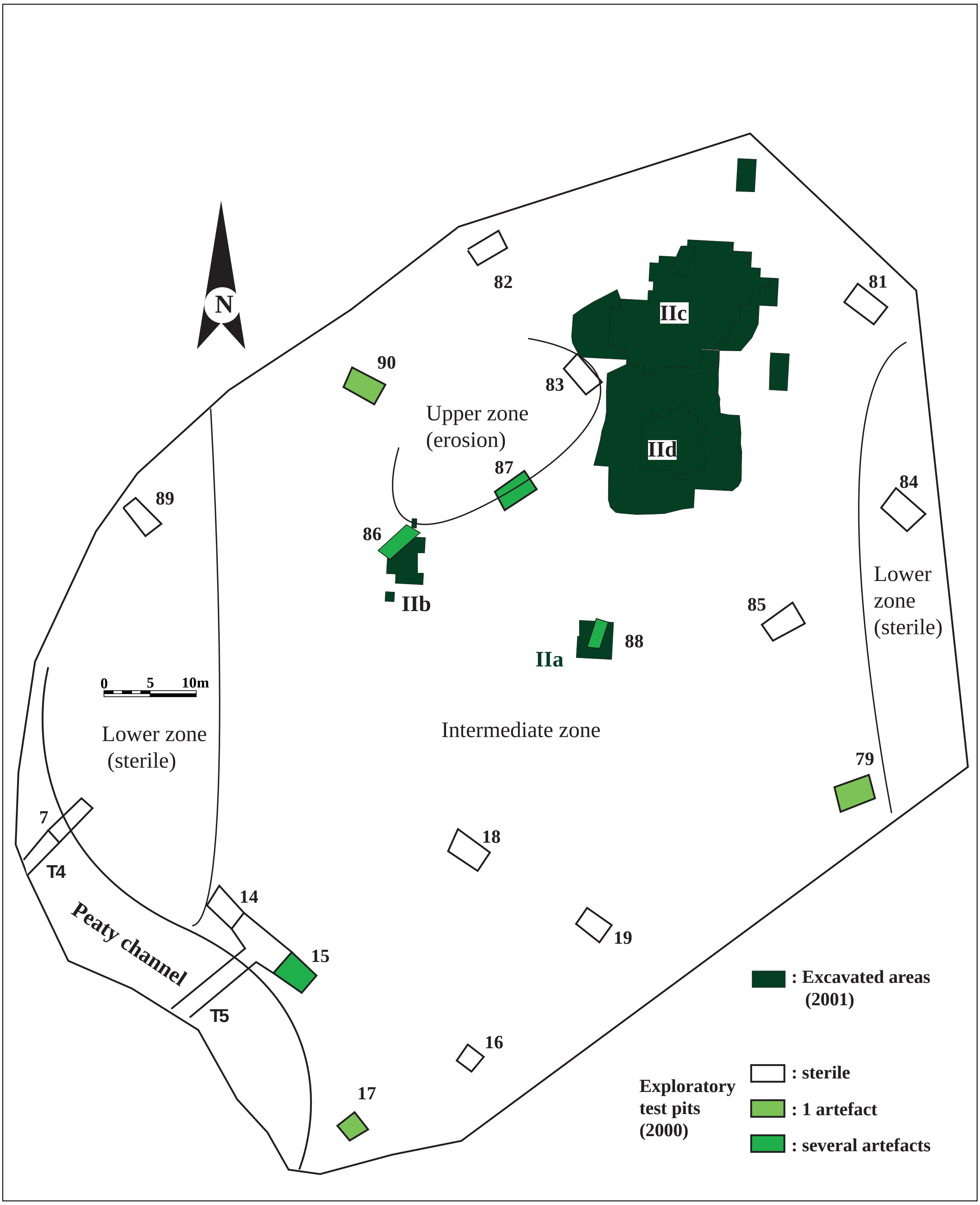


Fig. 10 – Warluis II (Oise). Overall plan of the site (T. Ducrocq).

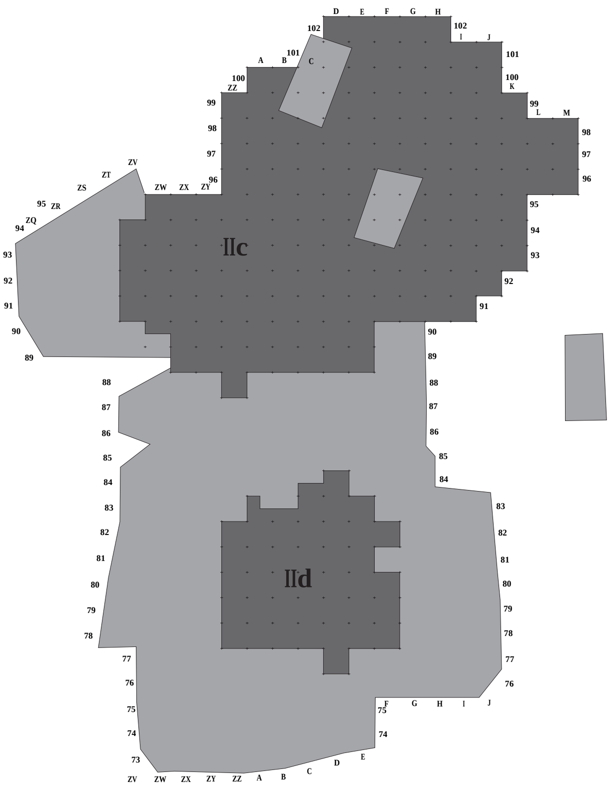


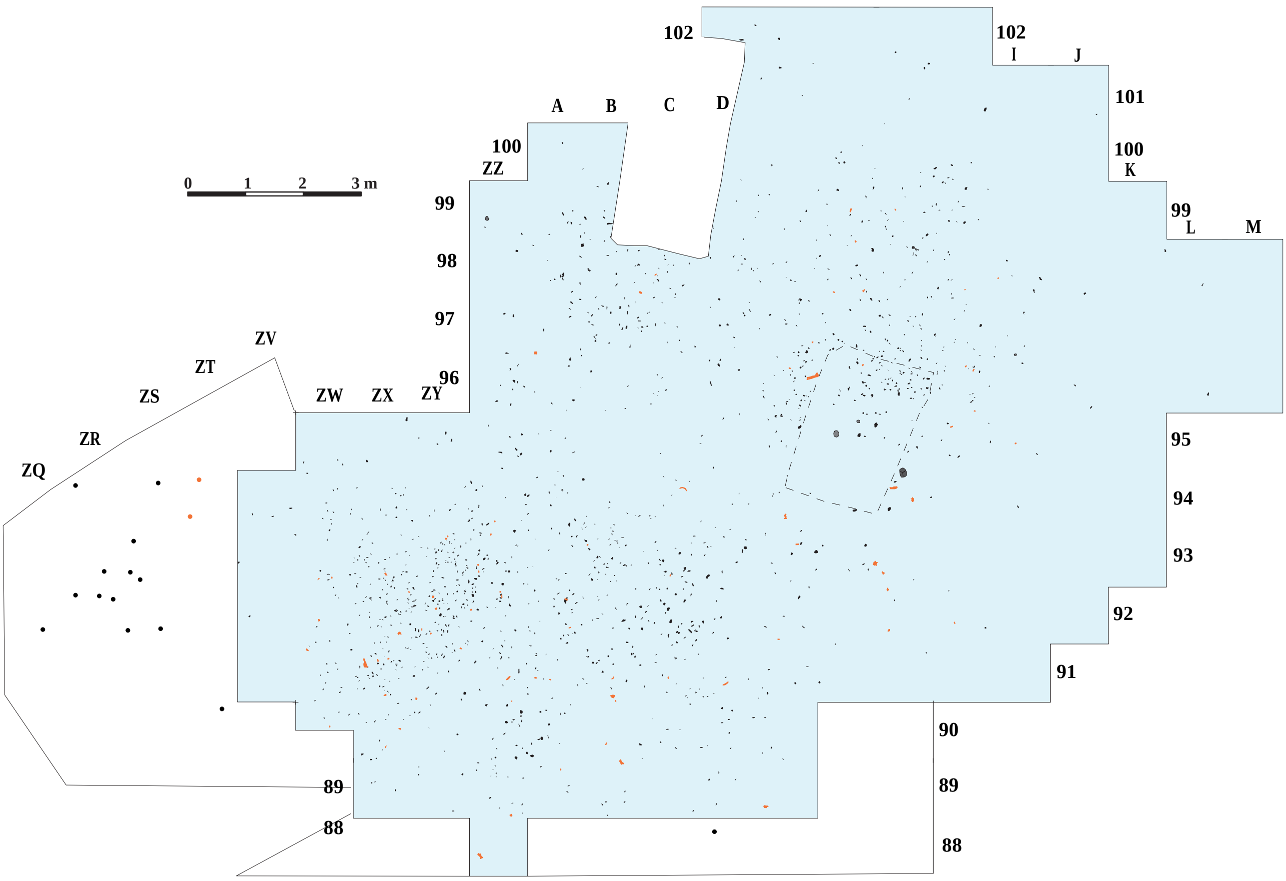
Fig. 11 – Warluis II (Oise). Detail of sectors IIc and IId including the 1 m² grid. The shaded area represents the extension of the manual excavations, lighter areas indicate the zone excavated with the mechanical digger.

dispersed across all the concentrations. Conjoins between units IIc and IId are often over a distance greater than 15 m (fig. 16) and demonstrate a clear contemporaneity between these concentrations: a core tablet found in IIc was detached in IId, while in the opposite sense, a flake from a refit sequence in IId was discarded in IIc. Cores found in IIc and IId conjoin, respectively, with flakes from IId and IIc

Another argument supporting the contemporaneity of the concentrations is the presence of an artefact type normally rare in such a context: around 10 absolutely identical perforated fossil shells (*Ampullina (Crommium) sp.*, determination P. Lozouet; fig. 17) recovered from the two units of IIc and sector IIb.

Finally, if we consider all the concentrations as contemporaneous what emerges is an campsite spread over more than 3,000 m². If we restrict it simply to sectors IIc and IId, the surface is still larger than 1,000 m². The two other main 'Beuronian with crescents' sites at Warluis are found 200 m (I) and 250 m (IV) on the other side of the paleochannel (fig. 8). Site IV also yielded a perforated shell of the same type, however nothing suggests a chronological connection with site II.

Fig. 12 – Warluis II (Oise). Sector IIc. Total artefact distribution with bone artefacts in orange. The points represent elements recovered during mechanical excavations (T. Ducrocq).



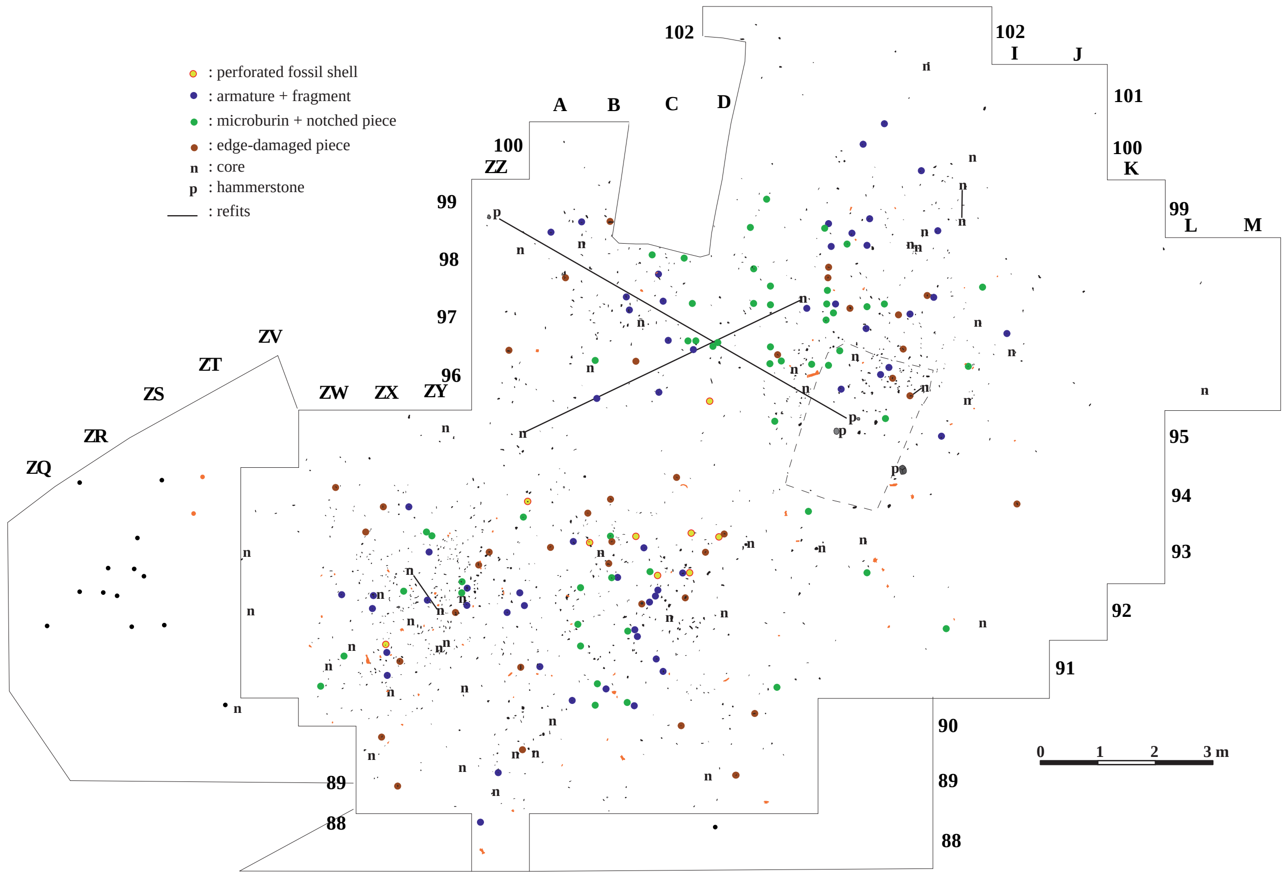


Fig. 13 – Warluis II (Oise). Sector IIc. Selective distribution of particular types of remains (T. Ducrocq).

DO SITES WITH A SINGLE ISOLATED CONCENTRATION EXIST?

Earlier documented sites in gravels, ponds, on sandy outcrops or at the base of hillsides do not provide insights into this question given the limited surface areas investigated or the erosion of adjacent large areas. The absolute dates from Saleux (Fagnart et al., 2008) allow three distinct cultural units to be distinguished (Beuronian with crescents, Beuronian with triangles, RMS). However, there are several 'Beuronian with crescents' concentrations dispersed in a 250 m corridor along the bank of a paleochannel. Conjoins have not yet been tested between more distant concentrations. On the other hand, in the 'La Vierge Catherine' sector, the lower level contains four small adjacent units connected by conjoins. The different 'Beuronian with crescents' concentrations at Saleux could provide evidence of multiple stays in the same location and/or a single occupation represented by several posts spread along a watercourse.

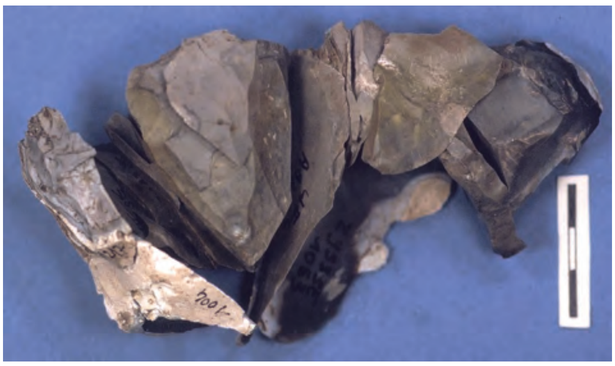


Fig. 14 – Warluis II (Oise). Sector IIc. Refit no. 10 connecting several cores to the same block. This management of large-sized raw materials is virtually indistinguishable from that observed at Hangest 'Gravière II nord' (Ketterer, 1997).

Recent diagnostics on floodplains have uncovered new 'Beuronian with crescents' sites. The investigation of large flat surfaces has led to the discovery of at least two concentrations near Amiens 'rue Saint-Maurice II' (Ducrocq, 2010), at Balagny-sur-Thérain (test pits by T. Ducrocq) and several unpublished sites near the confluence of the Oise and Aisne (work by M. Digan, T. Ducrocq, F. Joseph, C. Paris, K. Raynaud). Despite single isolated concentrations remaining impossible to demonstrate, several different units grouped together within a relatively large encampment seems in fact to be the rule. This type of camp implies a significant number of individuals capable of employing multiple hunting tactics such as battue or beating (Rozoy, 1978, p. 1405), effective for slaughtering a sounder of wild boar.

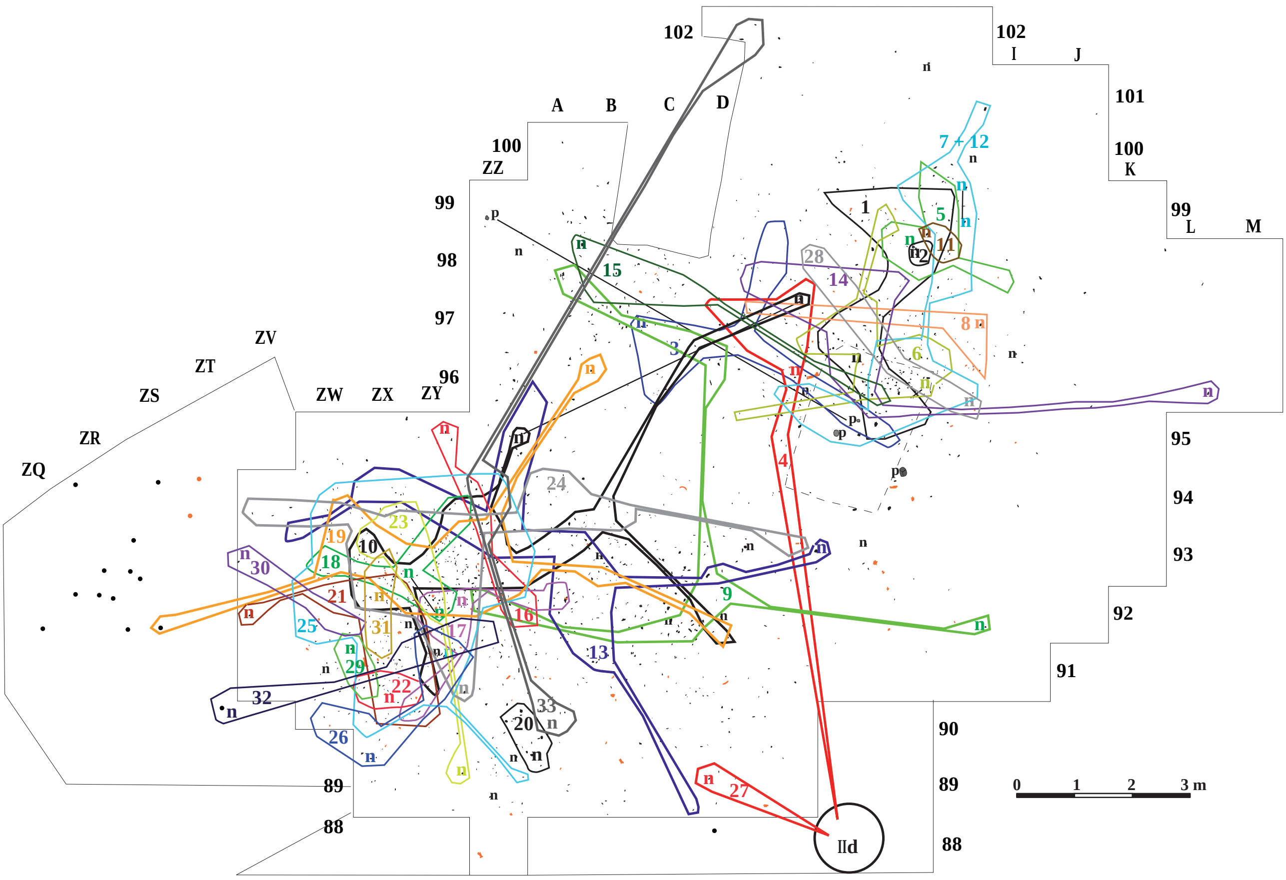


Fig. 15 – Warluis II (Oise). Sector IIc. Spaces covered by elements of the various refits (T. Ducrocq).

DIFFERENT TYPES OF SITES?

While these encampments certainly suggest residential sites occupied briefly by several families, can we be absolutely certain that they don't instead represent simple short meetings of hunters? Furthermore, how to explain the absence of endscrapers, burins and bone tools without evoking the existence of complementary specialised sites? Do locations occupied for longer intervals with features and more elaborate activities also exist? The answer to these questions can only come from new discoveries.

Unfortunately, these long-term occupation sites are likely to be found in locations that were particularly attractive throughout the Mesolithic, thus making palimpsests especially difficult to interpret.

The re-evaluation of the site of La Chaussée-Tirancourt 'Le Petit Marais', occupied throughout the Mesolithic, gives a possible indication of such a site. Located on a large silt terrace exposed to the south and directly on the banks of a small river, the attractiveness of this location is reinforced by its proximity to the confluence of the Somme and an outcrop rich in high-quality chalk flint. Peat infilling progressively pushed the dry ground up the hillside thus limiting any palimpsest effects hindering a detailed palethnological approach. The main sector produced essentially final Beuronian and 'Mesolithic with mistletoe points' occupations, however it seems that a lower level, excavated over a small surface, could correspond to the 'Beuronian with crescents'. If this attribution proves correct, this level contains a secondary burial, a combustion feature (a hearth-pit covered with heated stones and connected to small paving of heated stones), as well as numerous assorted domestic tools. It is therefore a good, although still hypothetical, candidate for a more long-term occupation that included a broader range of activities.

CONCLUSION

Clearly it is still premature to model the economic strategies of 'Beuronian with crescents' societies based on comparisons with contemporary or historic hunter-gatherer populations. This lack of data gives way to numerous contradictory hypotheses that can only be verified by new discoveries.

The main excavated sites present juxtapositions of several contemporaneous activity units that exclude the possibility of a single nuclear family. Stopovers seem

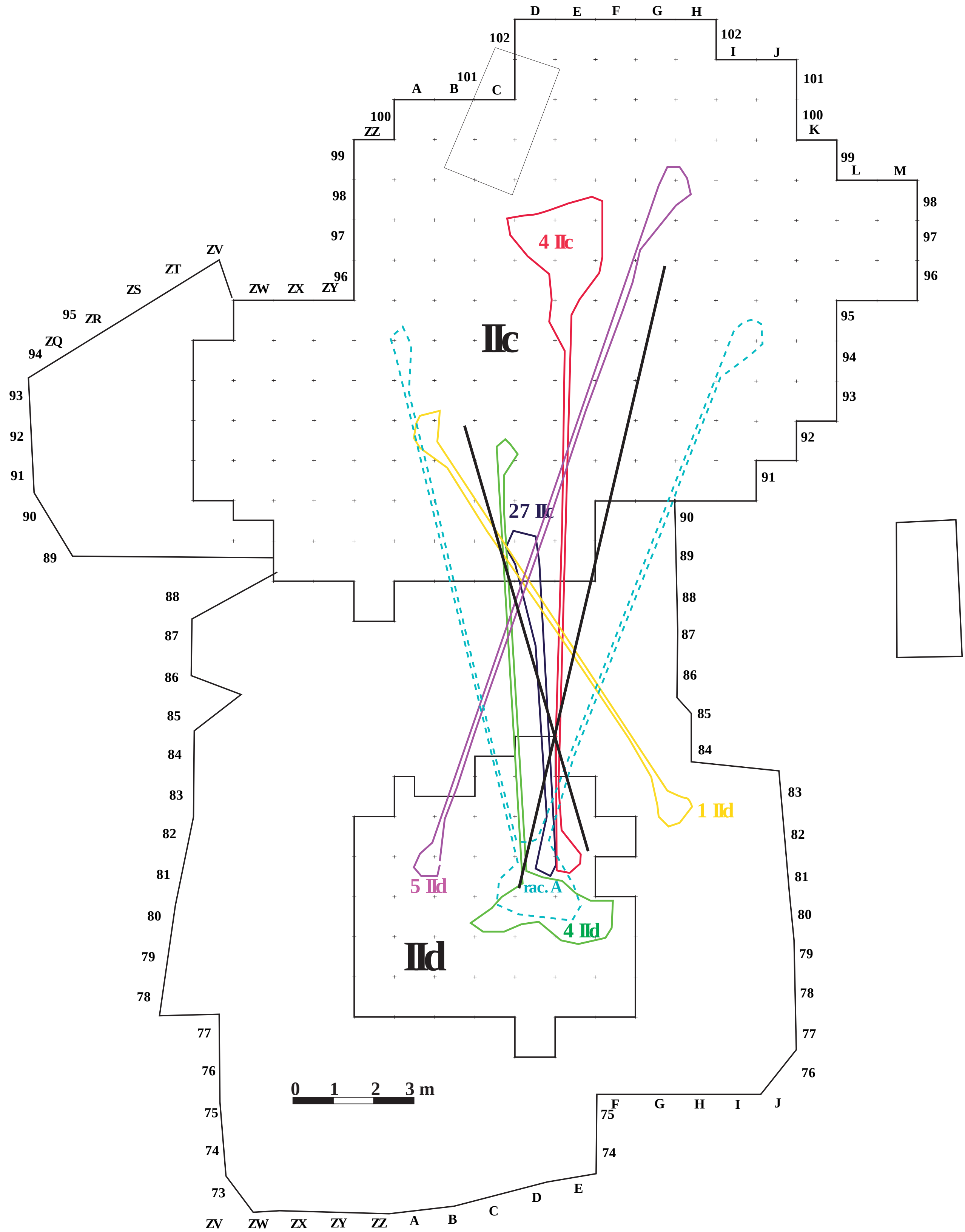


Fig. 16 – Warluis II (Oise). Sectors IIc and IId. Conjoins between the two sectors (T. Ducrocq).

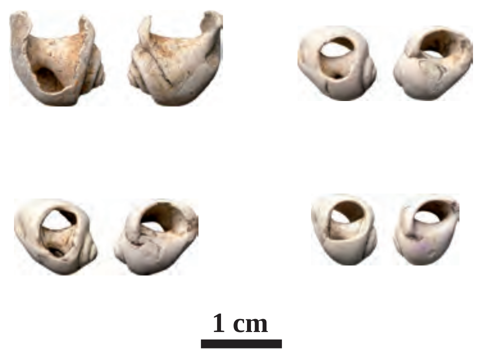


Fig. 17 – Warluis II (Oise). Perforated fossil shells of *Ampullina (Crommium) sp.* The first, top left, comes from sector IIb and the others from Sector IIc. The absence of Tertiary fossils occurring naturally in all the geological levels of the Warluis floodplain confirms their introduction by humans (photos S. Lancelot).

brief and essentially concerned hunting activities concentrated on wild boar. Seasonality studies and an investigation of which anatomical elements were exported from or introduced to the site would be instructive. A functional approach to the lithic industries is also indispensable in order to define activity zones and the relations between them.

New excavations must be both extensive and not limited to the area of just one or two artefact concentrations. Palimpsests can be studied if amongst the artefacts are objects that are rare elsewhere and could therefore possibly correspond, in some part, to specific functional occupations.

Finally, a chrono-cultural approach must continue to be pursued in order to reduce this type of variability in robust palethnological approaches.

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Mesolithic burial practices in the northern half of France: Isolated burials and their spatial organisation

Gabrielle Bosset and Frédérique Valentin

Abstract: Thirty-six Mesolithic graves, mainly primary inhumations of a single individual, were identified from 15 sites in the northern half of France. We present here a synthetic description of these graves which sheds light on the variety of funerary rites and practices. These graves are spread across the space occupied by these groups in two ways: grouped together or isolated. The chronological and spatial demarcation of 14 of these graves suggests that at least three of them represent a specific behaviour shared by certain Middle Mesolithic groups who occupied the Paris Basin.

New discoveries beyond the Loire in the northern half of France, together with associated radiocarbon dates and descriptions based on the principles and methods of field anthropology (Duday, 1990; Duday et al., 1990), renew our understanding of Mesolithic burials and their context (Duday, 1976; Rozoy, 1978; Newell et al., 1979; May, 1986; Verjux, 2007; Meikeljohn et al., 2010). Available information for 36 graves from 15 sites dated to between 9500 and 6000 BP forms the basis for a synthetic description of burial practices designed to "oversee what becomes of the corpse" (Thomas, 1980) and an examination of how these seemingly isolated graves were integrated within the space occupied by human groups. However, given the size of the data set, it is difficult to consider the Mesolithic phase by phase, even though certain phenomena would suggest they belong to its middle phase.

MESOLITHIC BURIAL PRACTICES FROM THE NORTHERN HALF OF FRANCE

The 36 graves currently known from the studied area (fig. 1), whose distribution and associated radiocarbon dates are summarised in table 1, reflect both the diversity and complexity of funerary practices and treatments of the body. This variability is evident in the different ways the corpse was treated, the inclusion of objects with the deceased and the construction of the grave itself, although the majority represent primary inhumations of a single individual within pits that were occasionally lined with stones.

Treatment of the body

The cremation of the body, followed by the gathering of the remains and their association with various objects, is evident in three structures discovered at three different sites in the studied area. At La Chaussée-Tirancourt, the remains of three cremated individuals were found deposited in a pit along with burnt perforated gastropod shells, faunal remains, a deer antler bevel and abundant stone tools (fig. 2; Ducrocq and Ketterer, 1995; Ducrocq et al., 1996; Ducrocq, 1999). At Concevreux, the remains of at least two cremated individuals were placed, along with stone artefacts and ornaments, in a pit containing a concentration of various elements including deer antler tines. At Rueil-Malmaison, an analogous practice is indicated by a concentration composed of the remains of a cremated individual mixed with ashes, heated stones and generally un-burnt animal bones, yet it is difficult to establish whether this feature represents an actual burial (Valentin et al., 2008).

Un-burnt human bones were also manipulated and transferred to the place of burial, such as those from the

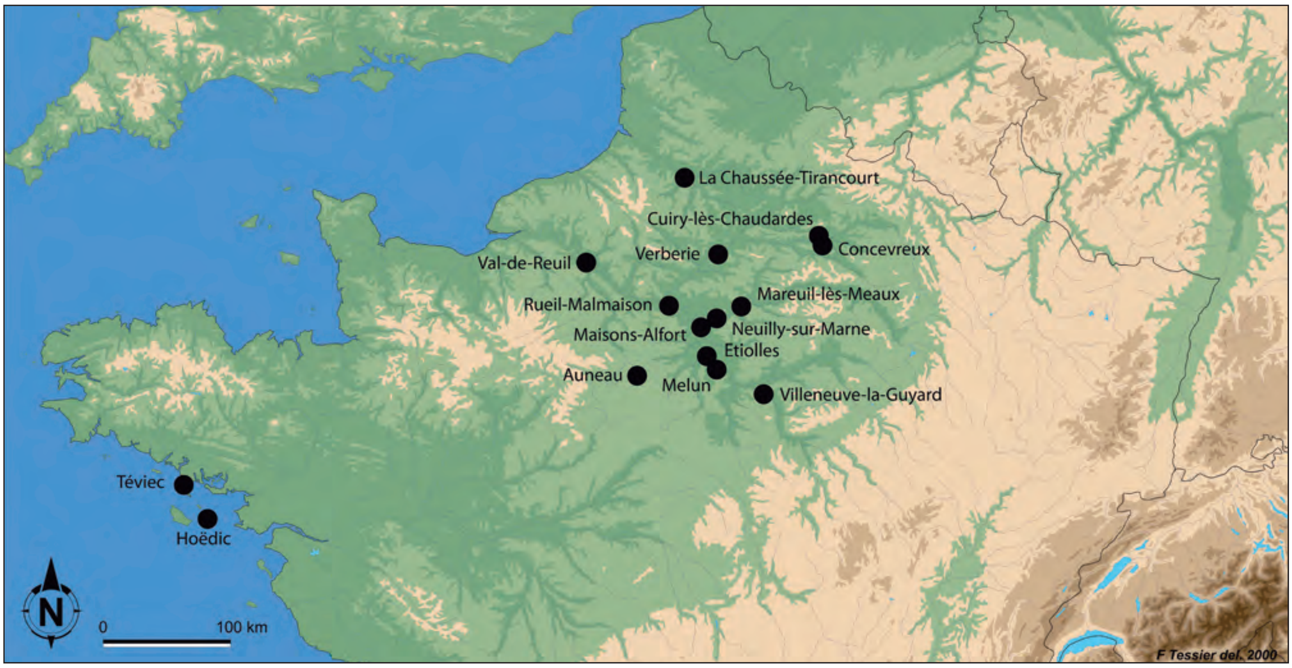

Fig. 1 – Location of Mesolithic sites with burials.

only example of a secondary Mesolithic burial discovered at the site of La Chaussée-Tirancourt in a pit containing a single animal remain and a near complete but disarticulated and rearranged male skeleton (fig. 3; Ducrocq et al., 1996; Valentin and Le Goff, 1998a). These remains suggest that a form of 'double funeral' was possibly practiced during the Mesolithic (cf. Hertz, 1907). Other treatments of bones, revealing a different type of mortuary behaviour, have been documented for several burials containing the remains of several individuals or 'plural'[1] burials at Val-de-Reuil (Billard et al., 2001), Téviec and Hoëdic (burials H and K from Téviec, C from Hoëdic; Péquart and Péquart, 1954; Péquart et al., 1937) and indicate reductions and successive phases of inhumations in the same grave.

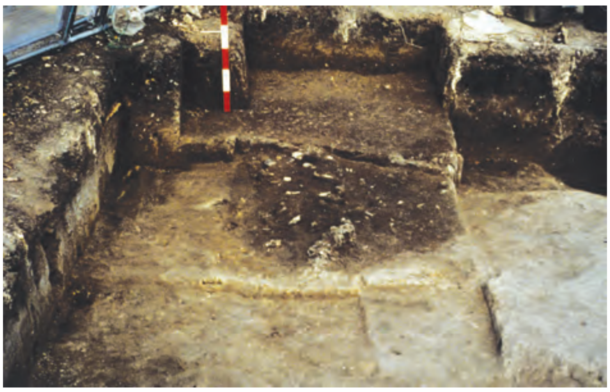

Fig. 2 – La Chaussée-Tirancourt (Somme). Example of a secondary cremation burial: pit F1 (photo T. Ducrocq).

Fig. 3 – La Chaussée-Tirancourt (Somme). Example of a secondary cremation burial: pit F4 (photo T. Ducrocq).

Fig. 4 – Mareuil-lès-Meaux (Seine-et-Marne). Example of a contracted position (photo D. Casadei).

Definitive inhumation was however the most extensive funerary practice in the northern half of France, represented by 20 individual burials and 7 multiple burials. While these multiple burials most often associate an adult and a child (burials D, E, J at Téviec, burial J at Hoëdic), they can also group two children (burial C at Hoëdic), two adults (burial A at Téviec) or three adults and a child (Villeneuve-la-Guyard; Prestreau, 1989). The bodies were generally deposited in a contracted position, except for the individual at Val-de-Reuil who was laid out with legs extended (Billard et al., 2001) and, in another particular case, the individual at Auneau placed in a sitting position, also with the legs extended (Verjux and Dubois, 1996; Verjux, 1999). Of the 40 burials for which it was possible to reconstruct the body's original position, 20 had been placed in supine positions at Téviec, Hoëdic and Cuiry-les-Chaudardes, 6 on either their right or left side at Auneau, Villeneuve-la-Guyard, Maisons-Alfort and Mareuil-lès-Meaux (fig. 4), one in a prone position at Auneau, 13 in sitting positions at Villeneuve-la-Guyard, Téviec (fig. 5), Hoëdic, Verberie, Rueil-Malmaison and Neuilly-sur-Marne and 2 on their knees or in a crouching position at Melun and Étiolles, with elbows, hips and knees tightly flexed (Péquart and Péquart, 1954; Péquart et al., 1937; Ilett, 1998; Verjux, 1999; Prestreau, 1992; Valentin et al., 2008; Audouze et al., 2009; Bosset, 2010).

Artefacts and ornaments

Artefacts and ornaments are rare or absent in the majority of burials from the northern half of France. Nonetheless, we are able to draw up the following inventory: a pike vertebrae necklace from Cuiry-les-Chaudardes (Ilett, 1998), two bone awl fragments, pieces of mother-of-pearl derived from a single shell, and flint blades from Auneau (Verjux and Dubois, 1997), a few flint flakes and a pebble from Rueil-Malmaison, a blade fragment and two laminar flakes from Maisons-Alfort (Valentin et al., 2008) and nine worked flints from Val-de-Reuil (Billard et al., 2001). This apparent dearth of grave goods contrasts with the richness of several other graves. The burial at Concevreux, for example, produced some fifty perforated red deer canines, flint microliths, six *suidae* tusks, of which one was shaped, and antler tools (Robert and Naze, 2006). At Téviec and Hoëdic, tools made in flint or hard animal materials, ornamental elements in the form of perforated shells and bone awls (interpreted as toggles for clothing or a funerary shroud) were identified in several different burials (Péquart et al., 1937; Péquart and Péquart, 1954).

Moreover, the inclusion of ochre in graves now seems to be a variable practice in northern France. Although this practice is well-known from western sites, frequently occurring at Téviec and Hoëdic (Péquart and Péquart, 1954; Péquart et al., 1937) and present at Val-de-Reuil (Billard et al., 2001) or Étiolles (Le Grand and Brunet, 1994), it has not been identified from eastern sites.

Fig. 5 – Téviec (Morbihan). Example of a sitting position: burial D (photo archives of the Carnac Museum of Prehistory).

Burial pits and their construction

The deceased, whether buried or cremated, were placed in oval or circular burial pits of limited size. The largest ones are the multiple burials at Val-de-Reuil and Villeneuve-la-Guyard which measure 0.80 m by 2 m and 1.80 m by 2.30 m respectively (Billard et al., 2001; Prestreau, 1992). Certain examples had a stone arrangement around their edge and/or at their base. At Téviec and Hoëdic, they were bordered by stones, while at Maisons-Alfort stones were placed at the bottom of the pit (Valentin et al., 2008). The individual from burial 3 at Auneau was placed on a rectangular pavement (Verjux, 1999) in the same way as the individual from burial K at Téviec (Péquart et al., 1937).

The infilling of the pit seems to have occurred soon after the deposition of the body at Rueil-Malmaison (Valentin et al., 2008), Étiolles (Bosset, 2010), Verberie (Audouze et al., 2009), Val-de-Reuil (Billard et al., 2001) and in the three burials at Auneau (Verjux, 1999), since decomposition took place within a filled space (cf. Duday, 1990). Conversely, the infilling of the grave at Neuilly-sur-Marne does not seem contemporaneous with the placing of the body (Valentin et al., 2008). In certain cases, such as Rueil-Malmaison, Maisons-Alfort, Mareuil-lès-Meaux, Neuilly-sur-Marne and Auneau (burial 7), the burials seemed to have been backfilled with sediment extracted from the pit (Valentin et al., 2008; Verjux, 1999). In other cases, different sediment was used like at Melun and Auneau (burial 6). In the latter, the body was covered by waste from a hearth and 300 kg of stone (Verjux and Dubois, 1996). The skeletons at Hoëdic were also found in contact with remarkably large stones, as well as smaller slabs (burials B, C, J and K; Péquart and Péquart, 1954).

These stone could have had multiple functions; at Auneau, they did not form a visible above-ground feature (Verjux and Dubois, 1997; Verjux, 1999), whereas stone or cervid rack surface structures overlying the graves of Téviec and Hoëdic may have served as surface markers (Péquart and Péquart, 1954; Péquart et al., 1937). A similar surface structure composed of burnt red deer, roe deer and bovid skulls was also associated with the grave at Val-de-Reuil (Billard et al., 2001), located, like the aforementioned cases, in the western part of the region under consideration. The easternmost graves do not show traces of similar features. Furthermore, hearths were associated with all but one of the ten graves at Téviec and two of

Place name	Site	Department	Number of burials	Type of treatment	Dates ^{14}C		Bibliography
					Age BP	Age cal. BC.*	
Port-Nehue	Hoëdic	Morbihan	9	inhumations	7165±60 (sép. A) to 5750±35 (sép. B)	6123-5769 (sép. A) to 4662-4370 (sép. B)	Schulting et Richard, 2001 Schulting, 2005 Marchand *et al.*, 2007
Saint-Pierre-Quiberon	Téviec	Morbihan	10	inhumations	6740 ± 60 (sép. M) to 6322 ± 40 (sép. B)	5704-5475 (sép. M) to 5336-5076 (sép. B)	
Le Petit-Marais	Chaussée-Tirancourt	Somme	2	inhumation and cremation	9020 ± 100 (F4) to 8460 ± 70 (F1)	8533-7833 (F4) to 7597-7355(F1)	Ducrocq *et al.*, 1996
Le Parc du Château	Auneau	Eure	3	inhumations	8350 ± 105 (sép.6) to 6655 ± 90 (sép. 3)	7582-7090 (sép.6) to 5730-5471 (sép. 3)	Verjux et Dubois, 1996
Les Fontinettes	Cuiry-lès-Chaudardes	Aisne	1	inhumation	Unpublished		
Les Jombras	Concevreux	Aisne	1	cremation	6440 ± 30	5479-5343	Robert, 2008
Les Falaises de Prépoux	Villeneuve-la-Guyard	Yonne	1	inhumation	6070 ± 110	5293-4725	Prestreau, 1992
179 du Quai Voltaire	Melun	Seine-et-Marne	1	inhumation	8540 ± 100	7935-7346	Valentin *et al.*, 2008
Les Varennes	Val-de-Reuil	Eure	1	inhumation	8715 ± 310	8635-7066	Billard *et al.*, 2001
Les Vignolles	Mareuil-lès-Meaux	Seine-et-Marne	1	inhumation	8320 ± 90	7547-7084	Valentin *et al.*, 2008
La Zac d'Alfort	Maisons-Alfort	Val-de- Marne	1	inhumation	8030 ± 50	7121-6708	Valentin *et al.*, 2008
La Haute-Île	Neuilly-sur-Marne	Seine-Saint-Denis	1	inhumation	8540 ± 100	7935-7346	Valentin *et al.*, 2008
Les Closeaux	Rueil-Malmaison	Hauts-de-Seine	2	inhumation and cremation	8870 ± 130	8282-7613	Valentin *et al.*, 2008
Les Coudray	Etiolles	Essonnes	1	inhumation	8990 ± 50	8293-7974	Bosset, 2010
Le Buisson-Campin	Verberie	Oise	1	inhumation	8740 ± 50	7954-7606	Audouze *et al.*, 2009

*Calibration values of all sites are from IntCal 09 du logiciel OxCal 4.1, except calibration values of Hoëdic and Téviec using the reservoir correction values (Marchand et al., 2007)

Tabl. 1 – Number of burials and dates.

the nine graves at Hoëdic (Péquart and Péquart, 1954; Péquart et al., 1937), whereas this combination is rare in eastern sites. Only Villeneuve-la-Guyard produced possible evidence of such a feature: a depression containing ashes and small charcoal fragments in the centre of the burial pit (Prestreau, 1992).

Number of burials per site and their distribution

Finally, two aspects related to the spatial organisation of graves and the funerary area equally draw our attention: the number of burials per site and their spatial distribution in the area excavated. The number of mortuary deposits by site is ten times less in the Paris Basin than in Brittany. The sites of Téviec and Hoëdic have yielded 10 and 9 burials respectively, while 10 sites from the Paris Basin have produced only one Mesolithic burial each (table 1). Furthermore, while graves are grouped together at both sites in Brittany, 14 from the Paris Basin are apparently isolated within their respective sites. Does this 'isolation' constitute part of Mesolithic funerary behaviour?

ISOLATED BURIALS

J.-G. Rozoy (1978, p. 1115) in *Les derniers chasseurs* was the first to discuss isolated burials "generally found in caves", that he contrasted with the famous 'cemeteries' of Hoëdic and Téviec, as well as isolated human remains. This term has also been used to describe burials that are not grouped together (Duday, 1976; Verjux, 2007; Valentin and Le Goff, 1998b; Valentin et al., 2008). Moreover, certain researchers considered these graves to be "related to the living space" (in southern France: Valentin and Le Goff, 1998b, p. 183) while for others they represent individuals who were "buried away from living spaces" (Ghesquière and Marchand, 2010, p. 144). Consequently, several parameters mediate the evaluation of a grave's isolation: the physical distance between two contemporaneous graves, the temporal separation between two neighbouring graves and the relationship between graves and living spaces.

Questions of distance and temporal separation: isolated burials *versus* grouped burials

To guarantee the singular nature of a grave, both its spatial and chronological isolation from another grave must be established. In order for this to be achieved, theoretically, the maximal distance (allowed) between two contemporaneous graves (i.e. with overlapping calibrated dates at two standard deviations) from a group of graves must be known. In the present case, this reference distance has been estimated from four French Mesolithic sites with more than three burials: Téviec, Hoëdic, La Vergne and Auneau. Available data indicates that the maximal distance is on the order of 10 m. Indeed, the ten Mesolithic burials at Téviec are grouped together over a surface of around 36 m^2 (Péquart et al., 1937), separated by distances ranging from 0.5 m (burials H-J and K-L) to more than 6 m (burials H-M and C-E). At Hoëdic (fig. 6), the graves are generally set apart by approximately 1 to 2 metres, while others (burials A and B) appear removed from the other graves found in the western part of the site, roughly 10 metres from burial L (Péquart and Péquart, 1954). At La Vergne (Charente-Maritime), burials are very close to one another; graves 7 and 10 are separated by 0.25 m, while graves 7 and 3 have around 2.5 metres between them (Duday and Courtaud, 1998). Finally, approximately 9 metres separate burials 3 and 7 at Auneau (Verjux and Dubois, 1997).

Chronological isolation may be considered established if two dates (calibrated at two standard deviations) from two neighbouring graves do not overlap. However, the possibility of long-term use of the funerary area complicates the matter. At La Vergne, burials 7, 10 and 3 are dated respectively to 9070 ± 70 BP (8536-7990 cal. BC), 9215 ± 65 BP (8607-8293 cal. BC) and 9075 ± 65 BP (8536-8011 cal. BC), indicating that their deposition took place over a very short period, if not concurrently (Schulting et al., 2008). Tombs 3 and 7 at Auneau, dated to 6655 ± 90 BP (5730-5471 cal. BC) and 6825 ± 90 BP (5968-5562 cal. BC) also have overlapping calibrated radiocarbon dates (at two standard deviations). On the other hand, at Téviec and Hoëdic, use of the funerary area was spread over a long duration of 700 and 2,000 years respectively (Schulting and Richards, 2001; Schulting, 2005; Marchand et al., 2007). Five of the ten graves at Téviec were dated and present overlapping dates at two standard deviations. However, it appears that graves B and M were constructed, respectively, before and after the deposition of K and H. At Hoëdic, the six dated burials present a maximal chronological range of 2,000 years, while deposits B and K, on the one hand, and deposits H and C, on the other, may be contemporaneous.

Data set and biases

As of 2010, ten sites in the Paris Basin have produced lone Mesolithic burials (fig.1): Neuilly-sur-Marne, Mareuil-lès-Meaux, Maisons-Alfort, Melun, Verberie, Val-de-Reuil, Étiolles, Concevreux, Cuiry-lès-Chaudardes and Villeneuve-la-Guyard. Rueil-Malmaison, which has produced two structures containing Mesolithic human remains, constitutes a particular case in the sense that the funerary nature of the deposition of burnt remains has yet to be demonstrated (Valentin et al., 2008). To this collection of sites can be added the two secondary deposits at La Chaussée-Tirancourt (Ducrocq et al., 1996), whose associated radiocarbon dates (calibrated at two standard deviations) do not overlap and burial 6 at Auneau dated to the Middle Mesolithic, whereas burials 3 and 7 at the same site have been attributed to Late Mesolithic (Verjux and Dubois, 1996).

Fig. 6 – Hoëdic (Morbihan). General view of grouped burials (photo archives of the National Museum of Natural History).

However, several biases impede the verification of the actual isolation of these burials. The lack of published information precludes us from knowing if the graves excavated at Maisons-Alfort, Melun, Cuiry-lès-Chaudardes and Concevreux are indeed isolated. Additionally, the location of the graves in the excavated area complicates discussions concerning the spatial isolation of three other graves — Mareuil-lès-Meaux, Neuilly-sur-Marne and Villeneuve-la-Guyard. In these three cases, the burials are found respectively at the limits of the excavated area (Valentin et al., 2008), 2 metres (Lanchon and Le Jeune, 2004) or six metres from it (Prestreau, 1992). They therefore fall within the maximum theoretical distance allowed between two contemporaneous graves, estimated here at 10 metres. The spatial 'isolation' of these three burials is thus unclear. Finally, temporal intervals between grouped graves at Auneau (1,300 to 2,000 years) and La Chaussée-Tirancourt (200 to 1,200 years) are problematic as they are similar to those at Téviec and Hoëdic. These graves which, at first glance, appear chronologically isolated within the site, could in fact belong to a long-term funerary group — perhaps spanning different cultural stages — whose intermediate components may be missing.

Based on the criteria defined here, only four of the fourteen burials surveyed can ultimately be considered as absolutely isolated — those at Rueil-Malmaison, Étiolles, Verberie and Val-de-Reuil. The burial at Rueil-Malmaison is found to the south-west of the excavated zone (approximately 1.5 hectares), some 10 metres from the eastern limits and more than 20 metres from the southern, western and northern limits (Lang, 1977). In the case of Étiolles, extensive exposure of the area surrounding the grave (> 10 m) did not result in the identification of any similar feature in the 6.7 hectares excavated (Le Grand and Brunet, 1994). Similarly at Verberie, the excavation of a considerable area around the burial did not reveal other nearby Mesolithic graves (Audouze, pers. comm.) and at Val-de-Reuil only one Mesolithic grave was discovered in the 4 hectares excavated (Billard et al., 2001).

Isolated burials and living spaces

A grave's isolation also depends on its relation with living spaces as evidenced by hearths, pavements, pit features and/or lithic and faunal concentrations. At Val-de-Reuil, identification of the reopening of the grave and the presence of a surface marker suggest the site was used at different times however, based on available information, it is impossible to confirm or invalidate the possibility that the burial was linked to a living space. Conversely, at Rueil-Malmaison, there exists no evidence of a strict association between the burial and domestic remains: the

Fig. 7 – Étiolles (Essonne). General view of the burial: feature 11 (photo Y. Le Grand and P. Brunet).

test excavation in sector VIII, over 20 m away and attributed to the Middle Mesolithic, has yielded the nearest evidence of a living space while other concentrations of contemporaneous material are over 80 m away. Étiolles presents a similar case; a relatively large zone exposed (approximately 1,200 m^2) around the burial produced no evidence of nearby domestic features (Le Grand and Brunet, 1994). A concentration of material initially attributed to the Mesolithic was identified around 300 metres from this grave, however a recent re-evaluation of this material reassigned it to the Final Palaeolithic (Olive and Valentin, 2007). The situation is the same at Verberie, where no Mesolithic artefacts have been recovered (Audouze, pers. comm.)

Ultimately, only the three burials at Rueil-Malmaison, Étiolles and Verberie, all dated to the Middle Mesolithic (table 1) appear totally isolated within the site. No overlap of these funerary features with a living space was noted. On the contrary, these graves do indeed seem to be separated from occupied living areas.

Fig. 8 – Rueil-Malmaison (Hauts-de-Seine). The burial in sector 3 (photo L. Lang).

Isolating graves: a funerary choice?

Does the spatial exclusion of burials at Rueil-Malmaison (fig. 8), Étiolles (fig. 9) and Verberie (fig. 10) express a funerary choice? In terms of funerary practices, we note that the three burials are all primary inhumations of a single individual (table 2). The bodies were placed in extremely contracted positions, without any non-perishable grave goods, and immediately covered with sediment. Differences exist in the degree of limb flexion and could correspond to accommodating the body to the dimensions of the pit. These very narrow, simple pits lack any stone

Fig. 9 – Étiolles (Essonne). The burial: feature 11 (photo: Y. Le Grand and P. Brunet).

Fig. 10 – Verberie (Oise). The burial (photo F. Audouze).

arrangement and never exceed 1 metre in diameter. Such characteristics suggest an economy of actions interpretable in different ways. Does it indicate a period of high group mobility as proposed by several researchers (Ghesquière and Marchand, 2010)? Could it relate to certain 'duties[2]' specific to a particular cultural group? Does it mark the social status of the buried individuals? These questions remain open, however it seems, at least for the moment, that this funerary practice is proper to the Paris Basin, compared to the rest of the studied region, and may have been reserved for particular individuals: a child of 1 or 2 years at Verberie (Audouze et al., 2009), a gracile woman at Rueil-Malmaison (Valentin, 1997) and a very gracile adult at Étiolles (Bosset, 2010). We may include the burial at Melun to this set, provided its isolation is confirmed, which contains a female individual buried with the same low level of investment (Valentin et al., 2008).

CONCLUSION

The 36 graves surveyed from 15 sites in the northern half of France supply evidence for Mesolithic funerary practices that are both complex and diverse. This is especially evident in the various ways the body was treated, ranging from simple individual primary inhumations to more complex procedures indicating the transfer of dry and cremated remains occasionally involving several individuals. We also observe variability in the original burial positions, often bent or sitting, and the inconsistent inclusion of grave goods. This diversity can also be extended to the arrangement of the grave which may be simple to particularly elaborate, sometimes including the construction of surface structures.

Mesolithic graves in the northern half of France articulate with the space occupied by groups according to two modes: grouped together or isolated. The critical evaluation of the 14 apparently isolated graves confirms that only three, dated to the Middle Mesolithic, are genuinely isolated: Rueil-Malmaison, Verberie and Étiolles, to which we can add the burial at Melun. These four burials, excluded from domestic zones, reflect similar funerary behaviours and practices, revealing the same low level of funerary investment. The desire to isolate certain social groups seems to have existed during the Mesolithic. Does this behaviour represent a particular conception of funerary space during this period?

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Site	Type of inhumation	Number of individual	Decay modalities of the corpse (cf. Duday, 1990)	Size of the pit (in meter)		Artefacts associated to the burial	Sex detemination	Age-at-death estimation
				Length	Width			
Rueil-Malmaison	primary burial	1	filling space	0,65	0,65	none	female slender	adult
Etiolles	primary burial	1	filling space	0,7	0,55	none	unknown very slender	adult
Verberie	primary burial	1	filling space	0,6	0,4	none	-	subadult 1-2 years old
Melun	primary burial	1	filling space	0,8	0,8	none	female	Adult

Tabl. 2 –Synthetic description of isolated burials.

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NOTES

(1) Graves containing the remains of several individuals are, according to J. Leclerc, 'plural'. This supra-category comprises 'multiple' burials resulting from the simultaneous deposition of several bodies in the same place, 'collective' burials resulting from the successive deposition of several bodies in the same place and burials containing several individuals whose depositional chronology cannot be established.

(2) This notion "groups all obligations and prohibitions constituting the elementary structure in which funerary practices must take place" (Bocquentin et al., 2010, p. 3).

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Intrasite analysis of Early Mesolithic sites in Sandy Flanders: The case of Doel-'Deurganckdok J/L', C3

Gunther Noens

Abstract: Lithic open-air sites situated in unstratified coversand deposits are our most important source of information for the study of the Early Mesolithic in the sandy lowlands of Northern Belgium. Their poor resolution in terms of both stratigraphic and organic preservations requires the development of adapted research designs in order to make reliable inferences regarding their complex formation processes. In this article, it is argued that an accurate reconstruction of these processes is possible by including systematic refitting into our intra- and intersite research programs. Some preliminary results of such an integrated intrasite approach, including radiometric and lithic analyses (i.e. morphotypology, attribute analysis, refitting, microwear) from the Early Mesolithic site of Doel-'Deurganckdok J/L' (C3) are presented to explore both the technological aspects of this lithic assemblage as well as the formation processes of this site.

More than four decades of excavations in the sandy area of Flanders (lowland Belgium) has revealed around twenty five sites at which remains of Early Mesolithic occupation (ca. 9500-8700/8500 BP–ca. 9000-7700/7500 cal. BC: Crombé and Cauwe, 2001) were identified, based on the typological composition of the microlithic toolkit and/or by radiocarbon dating (fig. 1). Recently, large-scale archaeological and palaeo-environmental investigations have shown the large potential of the wetland areas within these lowlands for the study of the Mesolithic (i.e. Crombé, 1998b and 2005a; Crombé et al., 2009). These projects not only resulted in the discovery, mapping, evaluation and detailed reconstruction of a variety of extensive palaeolandscapes covered by Late Glacial and/or Holocene deposits (i.e. dry coversand ridges; small, sandy elevations in low lying areas; river dunes; alluvial contexts; etc.), but also included extensive and detailed rescue excavations of several (mainly Early) Mesolithic sites associated with these sealed palaeolandscapes (Crombé, 2005a; Sergant and Wuyts, 2006; Sergant et al., 2007).

Despite a number of post-excavation projects on the artefact assemblages of the wetland sites in Sandy Flanders (NW-Belgium), including radiometric (Crombé, 2005a; Crombé et al., 2009), morphotypological (Crombé, 1998b; Sergant, 2004), spatial (Crombé, 1998b; Crombé et al., 2003; Sergant, 2004; Sergant et al., 2006), functional (Beugnier, 2007; Beugnier and Crombé, 2005; Crombé et al., 2001) and/or technological approaches (Noens et al., 2006 and 2009; Perdaen, 2004; Perdaen et al., 2008a and 2008b), our general understanding of the formation processes and the variation in assemblage composition in terms of prehistoric human behaviour still remains problematic (Van Gils et al., 2010). Due to a lack of financial means in the context of these rescue excavations the inadequate understanding of this Early Mesolithic record is partly attributable to the virtual absence of detailed and extensive intrasite analyses characterised by an integration of the aforementioned analytical approaches.

In this article some preliminary results of such an integrated intrasite approach are presented, focusing on one of the two Early Mesolithic assemblages (C3) found at the site of Doel-'Deurganckdok J/L' (Bats et al., 2003; Crombé, 2005a; Jacops et al., 2007; Noens et al., 2005 and 2006). The C3 lithic assemblage, which was radiocarbon dated to the second part of the Boreal, is currently being subjected to a systematic refitting program, in combination with morphotypological attributes and microwear analyses in order to improve understanding of

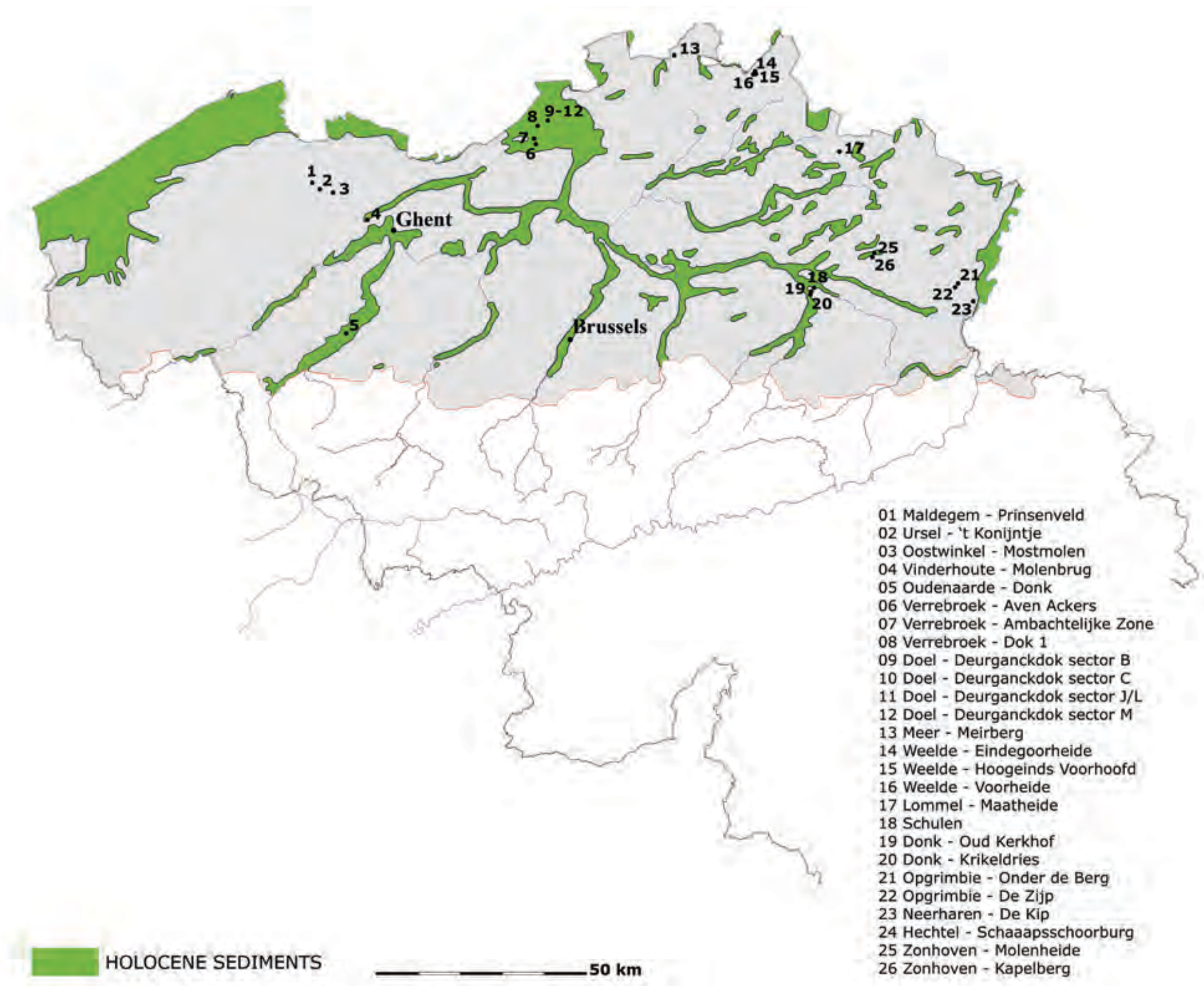

Fig. 1 – Location of the excavated Early Mesolithic sites in Flanders (lowland Belgium), with an indication of the wetland areas.

technological and functional aspects of the assemblage, and to allow a more adequate evaluation of the formation processes on an intrasite level.

LITHIC SITES IN SANDY FLANDERS

Regarding the general state of preservation and the presence of recent disturbances of prehistoric sites in the sandy areas of lowland Belgium, a distinction can be made between the intensively disturbed coversand dryland, generally characterized by very poor preservation conditions (Crombé, 2006; Vermeersch, 1999; Vermeersch and Bubel, 1997) and, on the other hand, the potentially better preserved wetland areas, like polders, river floodplains, paleolakes and paleodepressions (Crombé, 2006). In addition to the sporadic preservation of unburnt organic remains, the currently known and excavated Early Mesolithic record of both dry- and wetland areas is characterized by the presence of one or more distinctive cluster(s) of lithic artefacts, often in spatial association with charred/burnt organic remains (i.e. hazelnut shells, charcoal, bone fragments) and anthropogenic and/or biogenic soil features. Other characteristics of these sites include the non-stratified, vertical dispersion of the artefacts up to 0,5 meter and the general absence of anthropogenic structural features ('structures évidentes', i.e. structured hearths). Thus, at present most of our knowledge about the Early Mesolithic in this region is derived from lithic open-air sites situated in unstratified coversand deposits, which are characterized by their poor resolution in terms of both stratigraphic and organic preservation. Given the problematic character of absolute dating of these sites (Crombé et al., 1999; Van Strydonck et al., 1995), an extensive radiocarbon dating project was initiated in 1998 (Crombé et al., 2009; Van Strydonck and Crombé, 2005; Van Strydonck et al., 2001), focusing on single entity dating of short-lived organic materials preferably from reconstructed (latent) surface hearths (Sergant et al., 2006) as well as on charcoal from hearth-pits. In addition to the construction of a reliable regional typochronological framework for the Early Mesolithic (Crombé et al., 2009), this ongoing project provides us with a better understanding of the chronological relationships of the artefact assemblages on an inter-site as well as an intra-site level (Crombé, this volume; Crombé et al., 2006). These radiocarbon dating results indicate the

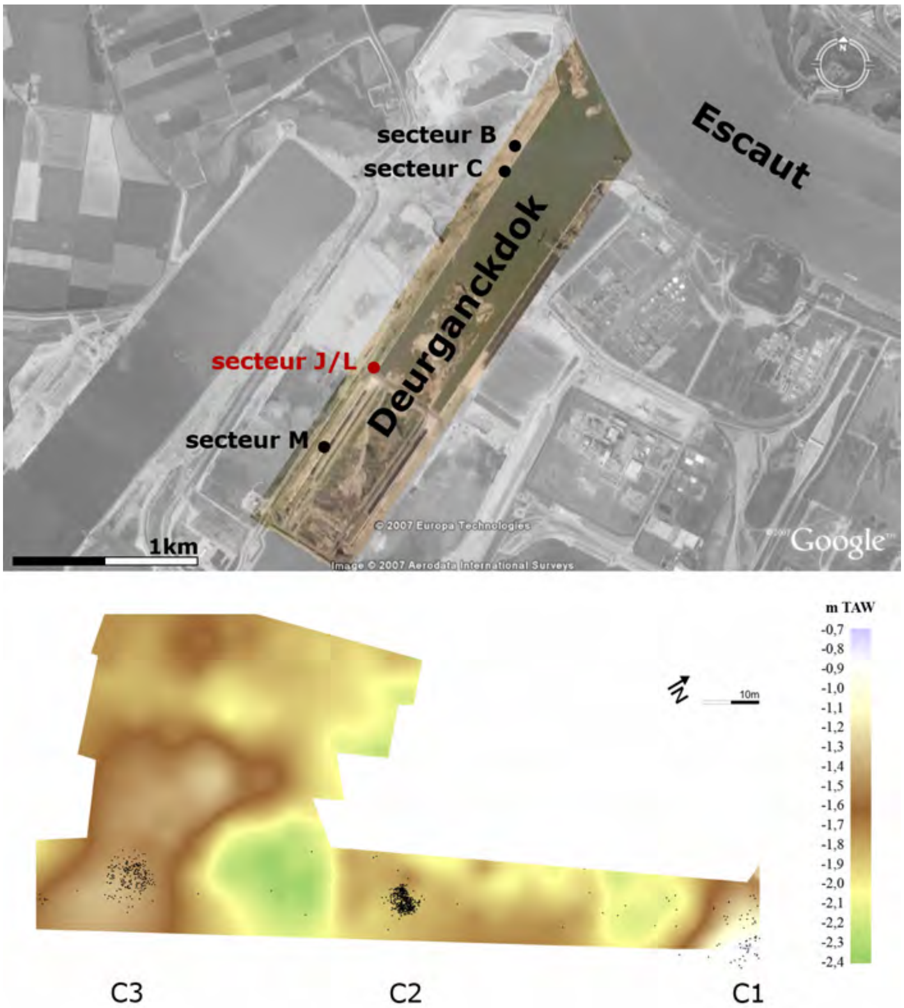

Fig. 2 – Doel-Deurganckdok. Upper: location of the site (see also fig. 1). Below: location of the three small and individual artefact concentrations within sector J/L.

omnipresence of complex palimpsest situations (*sensu* Bailey, 2007), implying severe problems of homogeneity and integrity of the larger and/or more dense artefact assemblages. Unless proven otherwise, this observation forces us to assume a potential palimpsest character for the smaller and/or less dense artefact assemblages as well (i.e. Crombé, 2002; Shott, 2010; Vermeersch, 1996 and 1999; Vermeersch and Bubel, 1997).

INTRASITE ANALYSES

An accurate reconstruction of the formation processes of lithic sites, in order to understand prehistoric human behaviour, is possible using detailed intra- and intersite research programs. However, despite recent major methodological advances, the Mesolithic in North-West Europe is still lagging behind in this respect; such detailed studies are rather exceptional and often concern a limited set of these approaches, executed on a restricted segment of the record, i.e. small, individual concentrations which are often *a priori* presumed to reflect well-preserved, single occupation sites (Crombé, 1998a). Furthermore the few Early Mesolithic intrasite studies from the lowland sandy areas of Belgium published so far *(supra)*, focus primarily on the integration of radiocarbon dating, spatial analyses based on clustering of morphotypological groups and attribute and/or microwear analyses. Detailed intra- and intersite approaches including systematic refitting to explore both the technological aspects of the lithic assemblages and the formation processes of the site as a whole, are hitherto missing. Interestingly, this lacuna relates to the fact that the entire lithic assemblage, including the unmodified (so-called 'waste') products of lithic production as an analytical unit has hardly been explored in detail, despite its good preservation condition and great abundance in the archaeological record which make it one of the primary sources of information for inferring formation processes and prehistoric human behaviour on different spatial and temporal scales (i.e. Andrefsky, 2001 and 2008; Hall and Larson, 2004; Holdaway and Stern, 2004; Rasic, 2004; Shott, 2010). Only a combination of several approaches of lithic analysis on different scales, thus reasoning along different lines of evidence, allow us to make reliable inferences on the complex formation

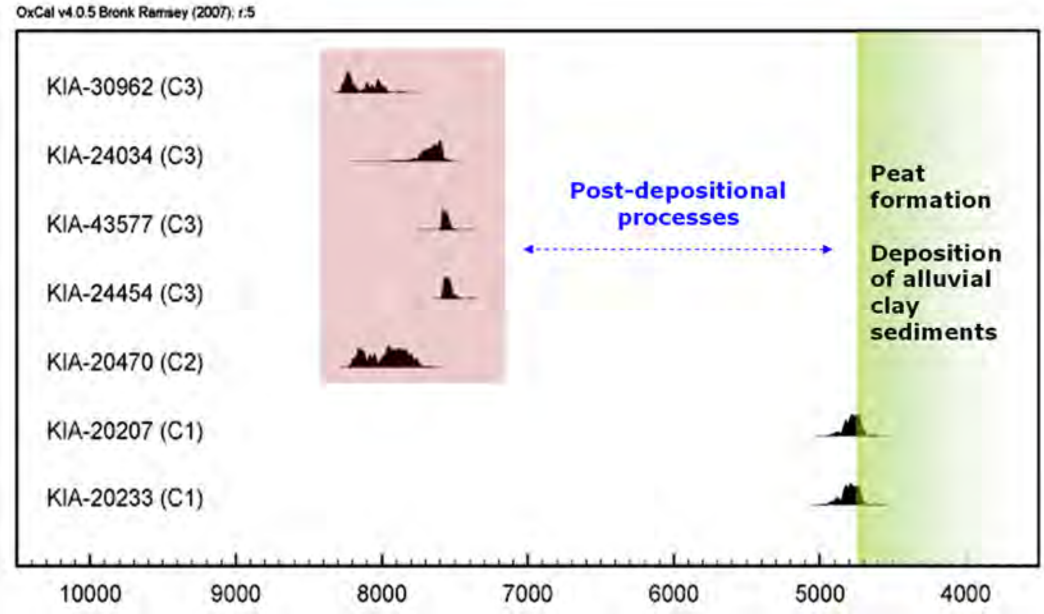

Fig. 3 – Doel-Deurganckdok. Simplified diagram showing the calibrated radiocarbon dates of sector J/L and the beginning of the peat formation and clay deposition in this region.

processes of our Early Mesolithic record. Lithic refitting holds a privileged position in this, since it is the only analytical tool providing a dynamic reconstruction by direct observation of the relative chronological and spatial links between the individual artefacts (Cziesla et al., 1990; Hofman and Enloe, 1992; Schurmans and De Bie, 2007). Furthermore, each artefact within an assemblage possesses a constellation of attributes carrying potential information about its production, use, and life history. Concentrating on (macroscopic) observable and univocal measurable characteristics, attribute analysis of artefacts in an assemblage thus allows to a large extent a reconstruction of the life cycle of each artefact. Only within the context of a combined intra- and intersite approach, both methodologies, together with lithic functional analyses, form a powerful means to study our complex Early Mesolithic record, despite their often time consuming nature.

DOEL-'DEURGANCKDOK J/L', C3

The construction of the Deurganckdock in the Antwerp harbour area resulted in a number of rescue excavations between 2000 and 2003. Sealed by clay and peat deposits of several metres thickness, a number of sites dating from the Final Palaeolithic to the Middle Neolithic were discovered on three separate asand dunes (Bats et al. 2003; Crombé et al., 2000 and 2004). Sector J/L, excavated during two short campaigns in 2003 (Bats et al. 2003), consisted of three small and individual artefact concentrations (fig. 2). A small depression, characterized by the presence of several tree windthrows, separated two of these concentrations (C2 and C3). Morphotypological and radiometric data attribute these two concentrations to the Early Mesolithic, in particular to the second part of the Boreal. They are considered as potentially contemporaneous. Adversely, the third concentration (C1), situated on top of the dune, forms the periphery of a partly destroyed Final Mesolithic occupation (Swifterbant Culture).

Paleoenvironmental data (Crombé, 2005a) indicates that the peat formation in this region started between 4750 and 3680 cal. BC and was interrupted by the deposition of alluvial clay sediments (fig. 3). This relative late chro-

Fig. 4 – Doel-Deurganckdok. Excavation strategies of C2 (upper) and C3 (lower). Courtesy Department of Archaeology, University of Ghent.

nology for the inundation of the landscape could explain the absence of organic material on the Early Mesolithic sites. Furthermore, it contributes to the potential palimpsest character and the complex formation processes of the sites situated in a very active and dynamic pedological system. On the other hand, both peat and clay formation are responsible for the protection of this palaeoenvironmental and archaeological record from recent disturbances, making it a prehistoric heritage of great value for this region (Crombé, 2006).

Due to lack of time C2, which was partly disturbed by a tree windthrow, was excavated by manual shovelling (fig. 4). C3 on the other hand (ca. 50m²) was excavated in a more detailed fashion, using grid cells of 50 × 50 cm with an artificial thickness of 5 cm. These excavation units were wet sieved over 2 mm meshes. This excavation strategy permitted the recovery of a lithic assemblage (around 14.500 individual pieces of which 81% smaller than one centimeter) and a small assemblage of carbonized hazelnut shells (table 1). Furthermore, a soil feature of biogenic origin was recorded (fig. 5). The presence of roots associated with this feature indicates an origin just before or contemporaneous with the start of the peat formation, thus post-dating the Early Mesolithic occupation.

The systematic refitting programs of both concentrations (Noens et al., 2006; Jacops et al., 2007) did not result in a physical link between the two clusters. The low numbers of refits within C2 is partly attributable to the unfavourable excavation conditions (table 1). Adversely, the presence of 270 refitting units, comprising around 1,200 individual pieces (i.e. 41% of the artefacts larger than 1 cm), indicates the success of the refitting program of C3. The number of artefacts within the compositions varies between 2 and 39 (fig. 6). The current state of this refitting program does not only give us an opportunity to study the refitted sequences in detail, it also allows us to make reliable inferences about the formation processes and prehistoric activities based on the non-refitted component of the lithic assemblage.

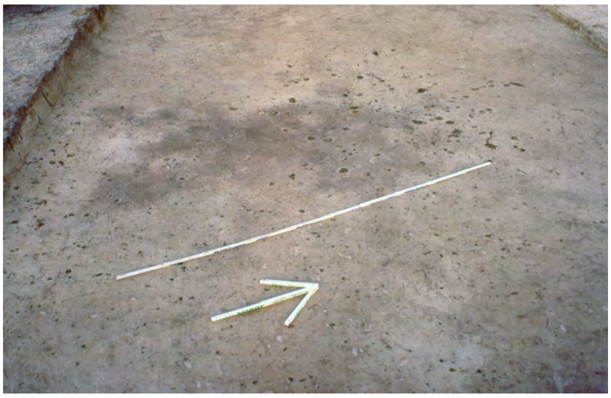

Fig. 5 – Doel-Deurganckdok. Soil feature spatially associated with C3. Courtesy Department of Archaeology, University of Ghent.

	CONCENTRATION 2 (ca. 25m²)	CONCENTRATION 3 (ca. 30m²)
POST-EXCAVATION ANALYSES	(*cf.* Crombé 2005 for palaeoenvironmental and chronological context)	
¹⁴C-dating on individual hazelnut shells	8830±45 BP	8965±45 BP 8630±60 BP 8525±40 BP 8485±40 BP
spatial analysis *morphotypological analysis* *attribute analysis*	Jacops 2007 Jacops et al. 2007	Noens et al. 2006 G. Noens, in prep.
refitting	J. Jacops & G. Noens (+ C. Guéret) 17 refitting sets N=53 artefacts 12% of assemblage > 1cm	G. Noens 270 refitting sets N=1196 artefacts 41% of assemblage > 1cm
microwear	C. Guéret, in prep.	V. Beugnier (75 artefacts) + V. Beugnier, in prep.
SITE CHARACTERISTICS		
stratigraphic position	sand dune, sealed by peat and clay deposits	
lithic assemblage	671 artefacts	ca. 14500 artefacts
charred hazelnut shells	present (a few fragments)	ca. 72 gr.
charcoal	present (a few fragments)	present – not yet analysed
soil features	1 – tree windthrow	1 - vegetation (decay *in situ*)

Table 1 – Doel-Deurganckdok. Overview of the general site characteristics of C2 and C3.

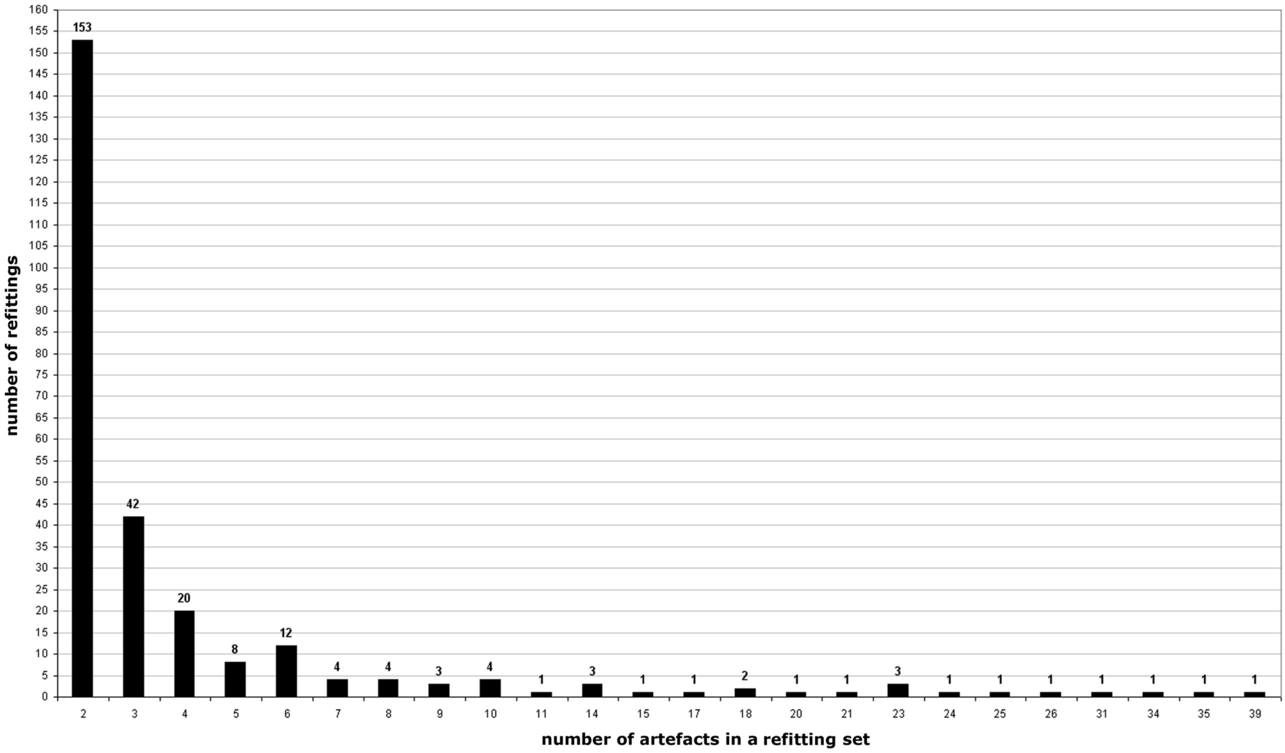

Fig. 6 – Doel-Deurganckdok. Number of refits and number of artefacts in refits.

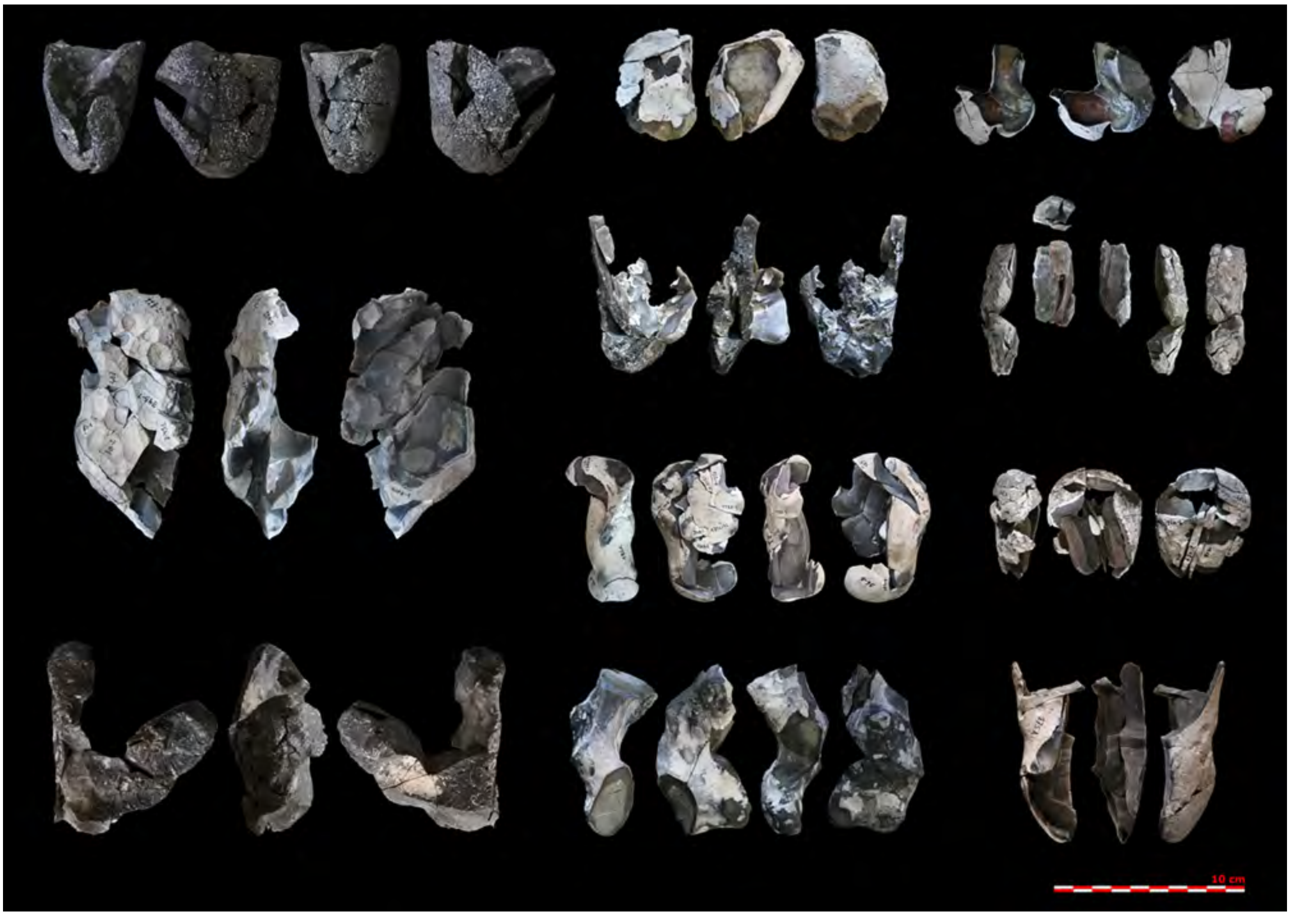

Fig. 7 – Doel-Deurganckdok. Some of the refits that give an idea of the irregular morphology and limited dimensions (i.e. 10-15 cm) of the original nodules.

THE ARTEFACT ASSEMBLAGES, SOME GENERAL CHARACTERISTICS

With a few exceptions, the assemblage consists almost uniquely of flint artefacts, characterized by a large variation in morphology, dimensions, colours and quality (i.e. texture, inclusions, etc.). A number of refits gives us an idea of the irregular morphology and limited dimensions (i.e. 10-15 cm) of the original nodules (fig. 7). The presence of distinct spatial clusters is evident in the cases where different raw material variants can be attributed to individual nodules. Furthermore, the overlap between the small cluster of carbonized hazelnut shells and a cluster of (heavily) burnt lithic artefacts in the centre of the locus indicates the presence of a (latent) surface hearth (fig. 8). The considerable number of artefacts in the assemblage can partly be attributed to the meticulous excavation techniques, but to a certain extent also reflects the high degree of fragmentation. This is exemplified by two refitting units (fig. 9), one of a fragment of a burnt burin (with burin spall) consisting of 20 refitted pieces, the other of a fragment of a small nucleus. Another characteristic of the assemblage is the small dimension of the artefacts (fig. 10), which might also relate to the degree of fragmentation. However, refitting of these fragments confirms their small original dimensions. In addition, a recurrent element is the presence of two or more cores in the same flint variants. Refitting demonstrates that a number of nodules were fractured in the initial stages of production, often along existing frost fissures (fig. 11). The resulting fragments were then further reduced creating multiple cores in the same flint variants. Elements of the entire production and use sequences are present (i.e. tested nodules, exhausted cores, products of preparation and rejuvenation, secondarily modified and unmodified products with or without microscopic use wear, knapping accidents, microburins, esquilles, bulbar flakes, etc.). A microwear analysis by V. Beugnier (Beugnier, 2006 and 2007) on 75 pieces indicates a mediocre state

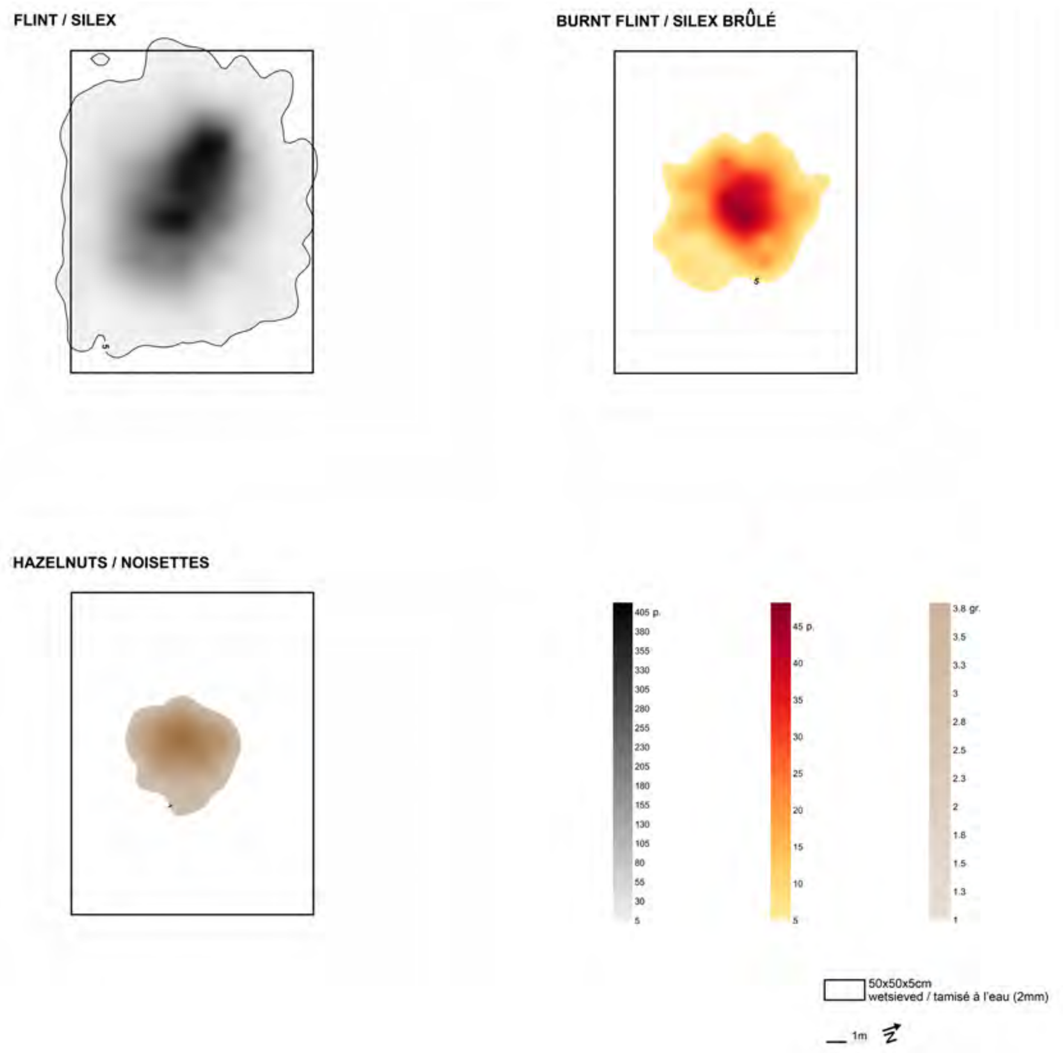

Fig. 8 – Doel-Deurganckdok. Horizontal distribution of all the lithic artefacts (in numbers; lower boundary = 1 artefact), the burnt lithic artefacts (in numbers; lower boundary = 5 artefacts) and the carbonized hazelnut shells (in grams; lower boundary = 1 gram). A clear spatial overlap between burnt lithics and hazelnut shells indicates the presence of a (latent) surface hearth.

Fig. 9 – Doel-Deurganckdok. Illustration of the high degree of fragmentation of the lithic artefacts caused by heat alteration. Left: fragment of a burin (with fragment of the burin spall) which consists of 20 individual fragments. Right: fragment of a core (in orange), together with a number of products; the core fragment itself consists of 12 individual fragments.

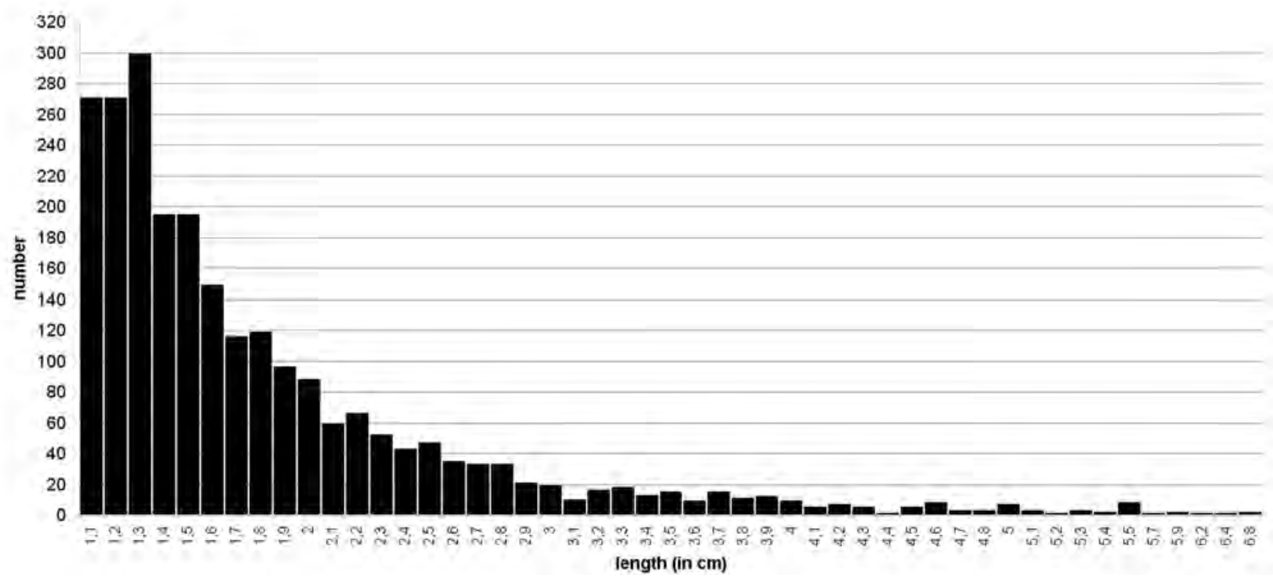

Fig. 10 – Doel-Deurganckdok. Graph showing the maximum length of the artefacts > 1 cm.

Fig. 11 – Doel-Deurganckdok. Fragmentation of a nodule during the early stages of the production process, and the subsequent reduction of each of the fragments, resulting in (at least) two different cores (in orange and yellow) in the same flint variant.

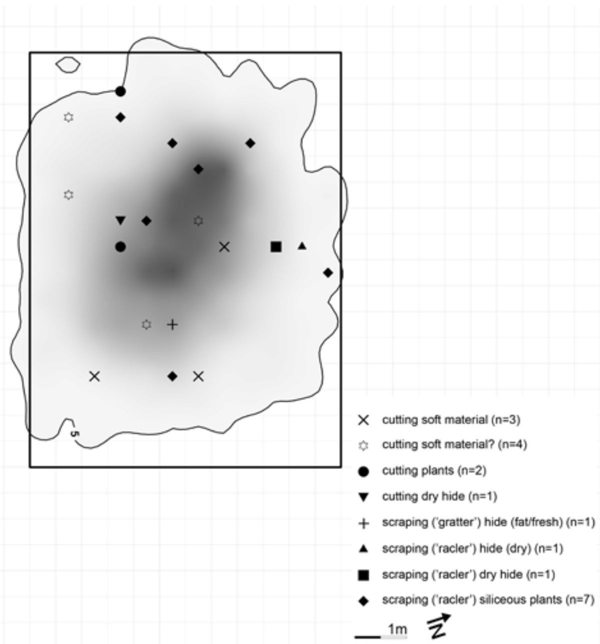

Fig. 12 – Doel-Deurganckdok. Horizontal distribution of the lithic artefacts showing microscopic traces of use, with indications of the material worked (microwear analysis by V. Beugnier).

of preservation. A number of taphonomic traces might have obliterated some of the traces of use, notably the most discrete of them. Traces of use were observed on 33 pieces, with a dominance of plant working, followed by hide working. The restricted number of this sample does not yet allow a reliable understanding of the spatial distribution of activities (fig. 12). However, it seems that the majority of artefacts without observable traces are situated in the north-western -part of the locus.

In general, the production processes often seem to have a non-standardised, *ad hoc* character, and are primarily directed towards the production of small irregular bladelets. However, and despite the reduced dimensions of the nodules, several elements indicates a more elaborate preparation of the cores (fig. 13). The most striking examples of this are different decortication sequences, superimposed core tablets and (unilateral) crested bladelets. Other indications of elaborate preparation are the regular occurrence of products with negatives of knapping accidents on their dorsal surfaces, as well as some presumably intentional *outrepassages*. It is remarkable that none of the refitted sequences contains all the elements of the *chaîne opératoire* (fig. 14). In cases where cores are incorporated into a sequence, large parts of the reduction sequences are absent; in other cases the cores themselves are missing. For an interpretation of these

Fig. 13 – Doel-Deurganckdok. Examples of some elaborate preparation and reduction of the cores: multiple superimposed tablets, a decortication sequence, (unilateral) crested bladelets, and (presumably intentional) 'outrepassées' bladelets.

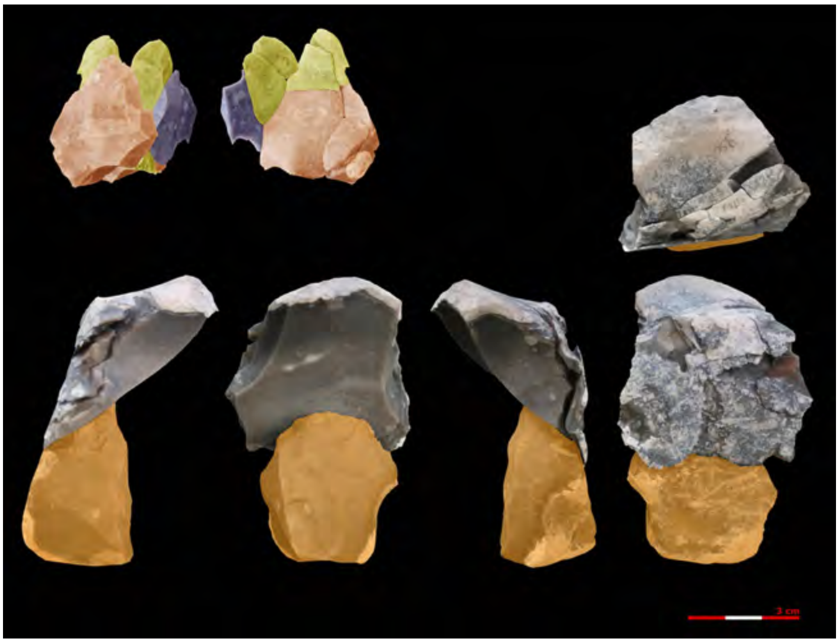

Fig. 14 – Doel-Deurganckdok. Illustration of the presence of partial reduction sequences; either the core (above, left), or a large part of the reduction sequence (below) are missing. Both observations suggest a highly complex and mobile pattern of technological organization.

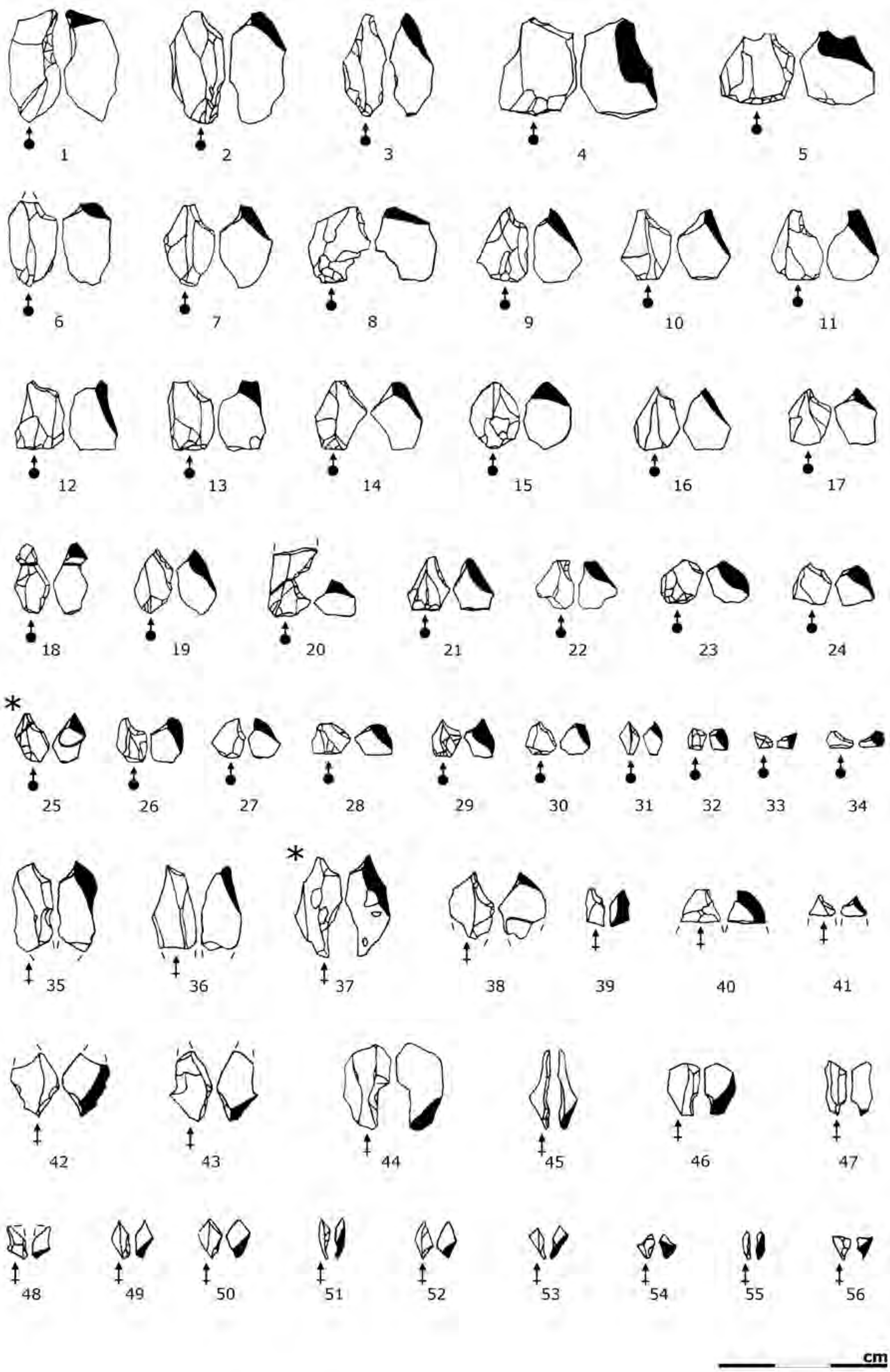

Fig. 15 – Doel-Deurganckdok. Selection of microburins. No. 20 was the only one that could be refitted onto a retouched fragment (star indicates burning).

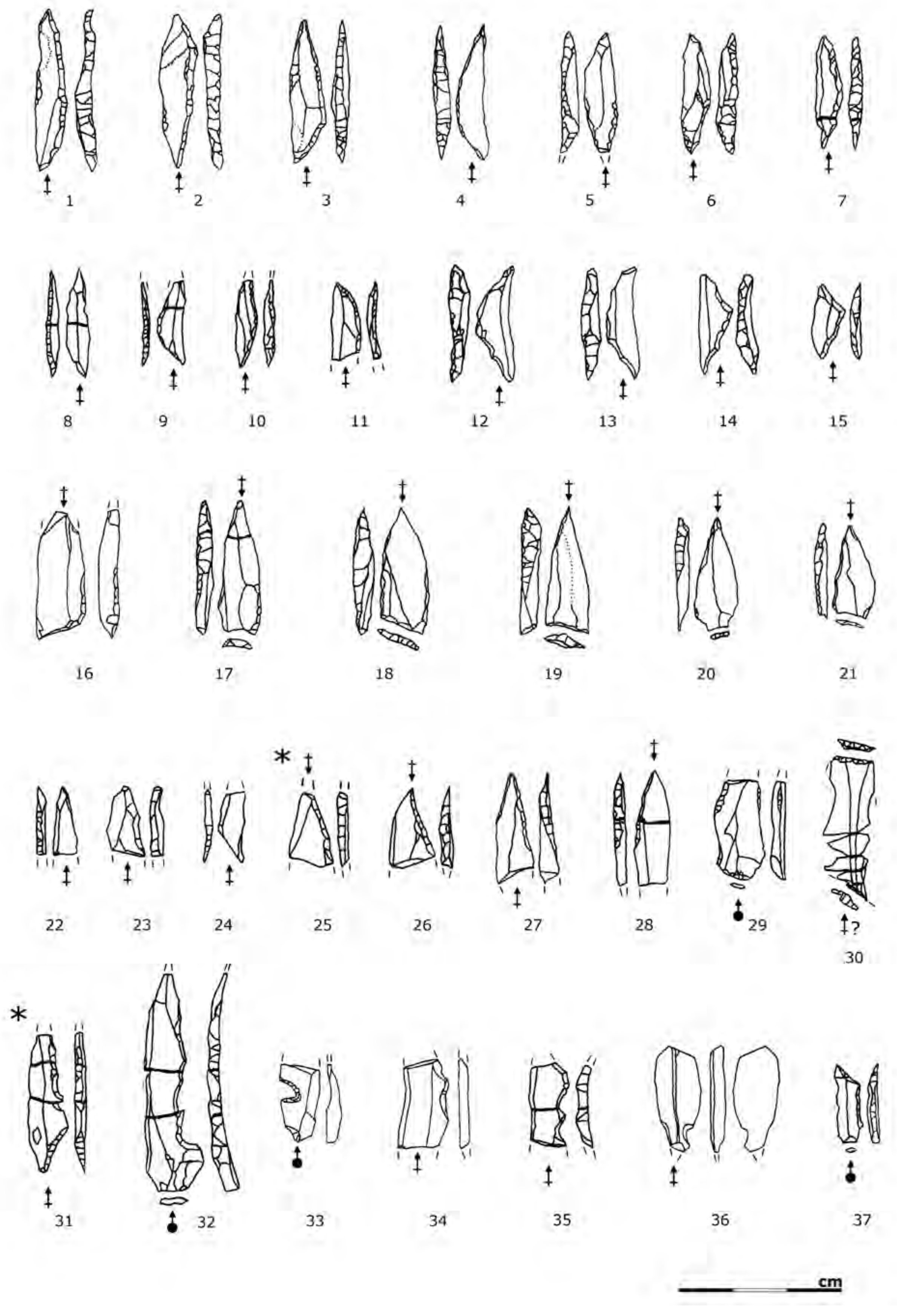

Fig. 16 – Doel-Deurganckdok. Selection of microliths (and 'technical pieces'), including refitted fragments. No. 16 was refitted into a reduction sequence; the refitted fragment of no. 30 was made from Wommersom Quartzite (star indicates burning).

partial sequences the limited extent of the excavation has, however, to be taken into account. Nevertheless, the recurrent nature of this observation suggests that this factor provides only a partial and limited explanation. It seems therefore that the presence of these partial sequences not only indicates a temporal and spatial fragmentation of the lithic *chaînes opératoires*, but also reflects a highly complex and dynamic mobile pattern of the technological organization.

With more than 100 pieces, microburins constitute an important element (fig. 15). The majority of these are made from well represented flint variants; some of them could be refitted into reduction sequences. With one exception, they cannot be related to the microliths within the assemblage, although several *piquant trièdres* were observed on the microliths. Only one microlith (fig. 16) was refitted in a reduction sequence, although several others are made from well represented flint variants as well. On the other hand, some of the microliths were made from variants that were otherwise totally absent in the assemblage. The majority of the microburins cluster in the south-eastern part of the concentration, together with fragments of microliths for which the complementary fragments are missing (fig. 17). Furthermore, complete and refitted fragments of microliths concentrate in the south-western sector, clearly separated from the microburins and non-refitted microliths fragments. Together, these observations suggest that the production and reparation of arrowheads occurred on this site, presumably in the southern sector of the excavated area. The dominance of microburins, together with the microliths, as well as the limited number of other retouched artefacts (i.e. endscrapers, burins, etc.) and the small dimension of the lithic concentration all suggested that this assemblage represents the remains of a small, presumably single occupation hunting camp (Crombé, 2005b).

In the majority of the cases where cores or artefacts with traces of use wear are incorporated into refitted sequences, these artefacts are predominantly situated in the immediate vicinity of the other elements of the sequence. This is indicative of production, (re)use and discard 'on the spot'. On the other hand, a number of artefacts, mostly larger bladelets, do not fit into any sequence, and they seem to be imported to this site. Furthermore, refits suggest that a number of artefacts for which typological determination was problematic and which were often made from very small nodules, appear to be burins (fig. 18). In order to confirm this hypothesis an additional microwear analysis is currently being undertaken on these (and other) artefacts.

Beyond any doubt, the elements presented so far reflect (spatial) regularities linked to human activities. However, an interpretation of this site is far from straightforward. These difficulties relate primarily to the dating of the site. At present, it is unclear whether this small concentration represents one or more visit(s). The morphological variability of the microliths (i.e. a dominance of segments associated with points with retouched base and some triangles) does not univocally fit in the regional typochronological framework (Crombé et al., 2009). This might indicate a palimpsest situation. Conversely, it might also suggest a larger typochronological variability of microlith assemblages than currently recognized. The microlith assemblage of C3 matches the Group of Hangest-sur-Somme which is currently recognized in northern France (Ducrocq, 2009) and could also be interpreted as a late development within the regional Group of Ourlaine (Crombé et al., 2009) where points with retouched base become more important. Radiocarbon dating poses further problems, as the four available radiocarbon dates for C3 (fig. 3), all obtained from individual fragments of carbonized hazelnut shells from the centre of the reconstructed surface hearth (fig. 8), indicate at least two distinct burning episodes in the second half

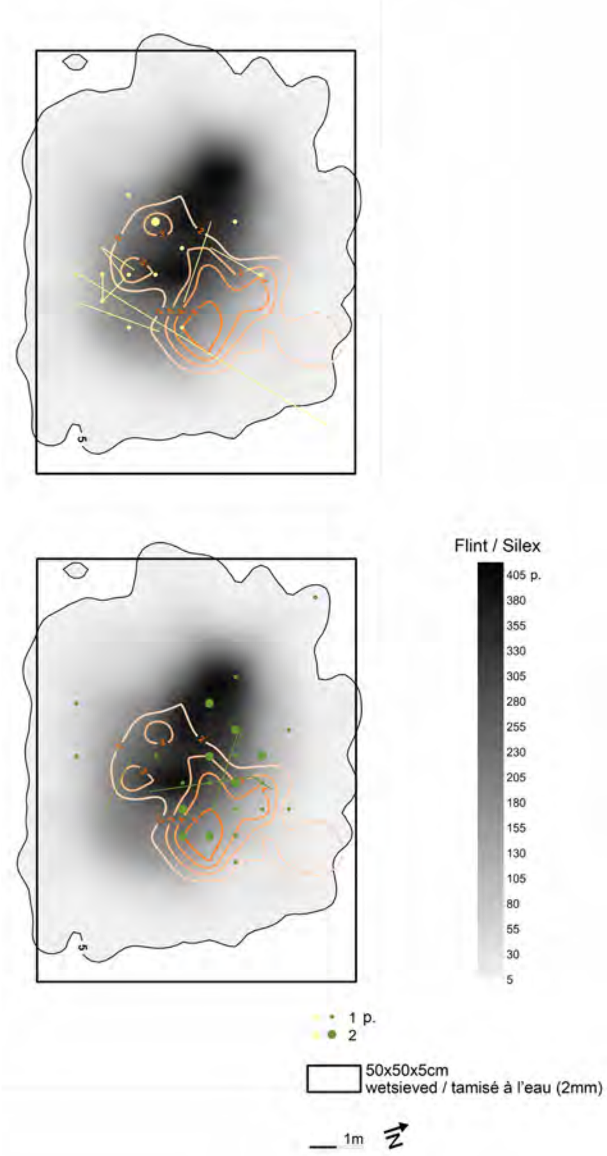

Fig. 17 – Doel-Deurganckdok. Horizontal distribution of microburins (orange contour lines), complete and refitted fragments of microliths (yellow dots with refitting lines) and fragments of microliths for which the complementary fragments are missing (green dots with refitting lines).

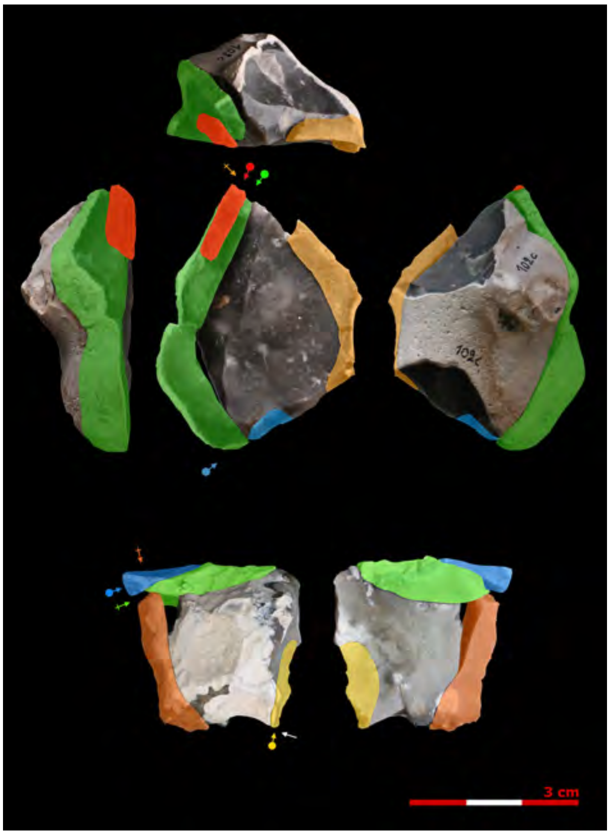

Fig. 18 – Doel-Deurganckdok. Two refitting units including artefacts for which the typological determination was problematic (burins?) and which were often made from very small nodules.

of the Boreal. There is no reason to doubt the reliability of these dates. Neither the vertical dispersion of the artefacts, up to 45 cm, nor the patination observed on different artefacts confirm the presence of multiple phases of occupation. The confrontation of the refit results and the raw material analyses with the vertical distribution of the artefacts does support the post-depositional character of the artefact displacement. Numerous refits of patinated with non-patinated fragments, as well as the frequent inclusion of patinated pieces within non-patinated sequences (fig. 19), suggest that patination does not form a chronological indicator for multiple occupation phases.

DISCUSSION AND CONCLUSIONS

Given the complex formation processes of the lithic sites in Sandy Flanders, the importance of developing adapted research designs (i.e. Holdaway and Stern, 2004, p. 93) should deserve our primary attention. Taking

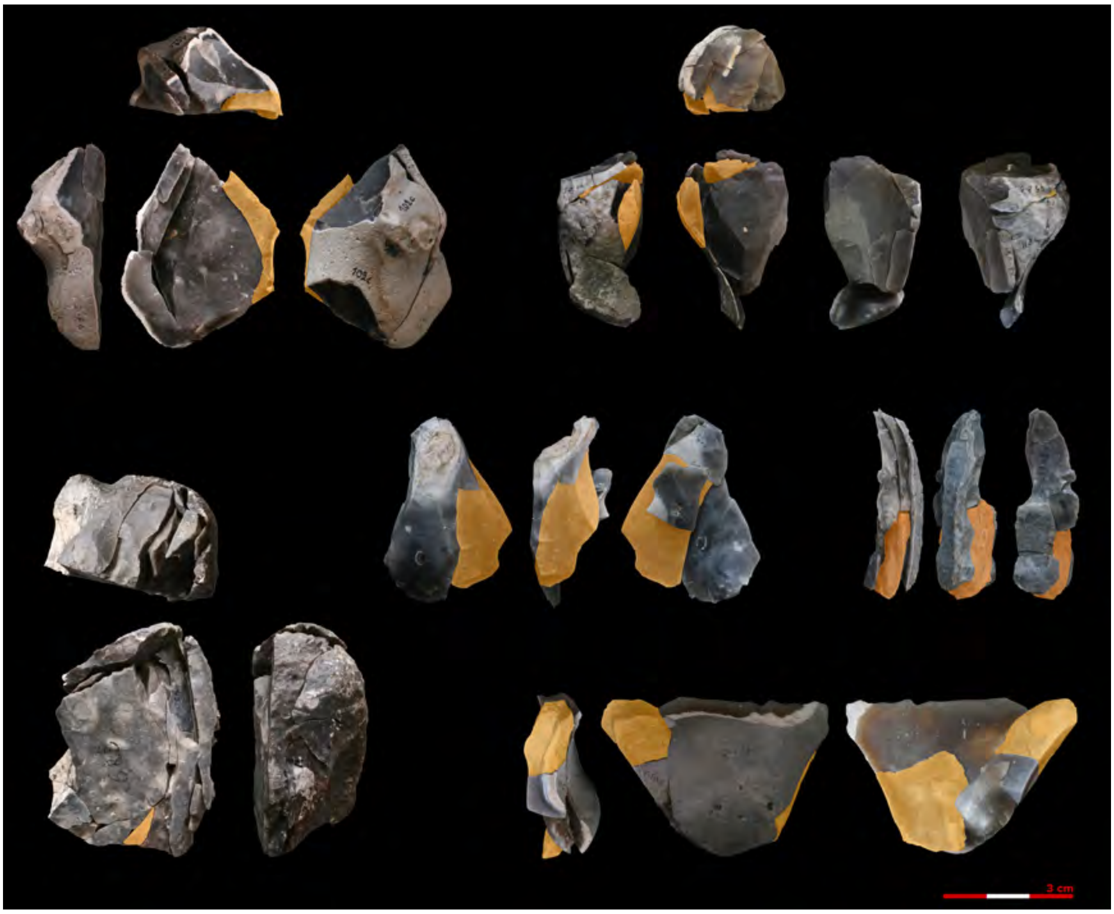

Fig. 19 – Doel-Deurganckdok. Refitting of patinated with non-patinated fragments, as well as the frequent inclusion of patinated pieces within non-patinated sequences. Patinated artefacts are indicated in orange.

into account our current state of knowledge, an integrated intra- and intersite approach, including detailed technological studies of entire artefact assemblages, still seems to be our best option for an adequate understanding of this record. Such an approach, for which detailed, consistent and large-scale excavations (beyond the boundaries of individual artefact clusters) are an absolute prerequisite, is not only characterised by the application of a wide variety of lithic analytical approaches, but also demands extensive and well-considered radiometric analyses of associated organic remains (Crombé, this volume). Given the potential palimpsest nature of the assemblages, lithic analyses within these research frameworks should take into account different scales: that of specimen attributes, individual artefacts as well as incomplete or entire assemblages with a specific focus on technological, functional, spatial and contextual characteristics of the remains. Furthermore, the spatial and temporal relationships between separate artefact clusters, as well as 'empty' zones or low density areas (i.e. off-site phenomena), have too often been neglected and should be included in our research programs. Given the partial destruction of Doel-'Deurganckdok J/L', this site offers only limited potential in this regard.

Currently, active expertise on lithic technology as well as a general framework for the study of Early Mesolithic technology is largely missing in Flanders. Despite a few technological studies (table 2), many aspects of Early Mesolithic lithic technology have not been explored in detail. For the development of a reliable technological framework, systematic refitting, which has been practised on a number of Early Mesolithic sites in lowland Belgium (table 2), seems to be an essential tool. Unfortunately, none of these studies have been published so far. On the other hand, most of the published technological studies used a quantitative analysis of various technological attributes of individual artefacts on the level of whole assemblages or samples thereof and have focused on a Late-Glacial/Early Holocene diachronic perspective rather than a synchronic Early Mesolithic perspective. However, a quantitative analysis of technological attributes remains a haphazard enterprise, due to the potential palimpsest character of the assemblages and the difficulties in the selection, measuring and interpretation of (technological) attributes. In this regard, constant evaluation of the usefulness of selected attributes by confronting these with the detailed information gained from refitting, can result in a significant contribution of technological research to our understanding of the archaeological record in this region. Not only will it provide a better characterization of Early Mesolithic technological organization, it will also give us a more solid base for inter-assemblage comparisons on a broader

SITE	METHODOLOGY	REF. ([...]= unpublished)
Meer – *Meirberg* (IV)	refitting	[Vreysen-Van Durme 1984] [Nijs 1986: 33-39]
Verrebroek - *Ambachtelijke Zone*	attribute analysis	[Van Roeyen 1990]
Schulen	attribute analysis	De Bie 1999
Neerharen - *De Kip*	refitting (limited?) attribute analysis	Lauwers & Vermeersch 1982 De Bie 1999
Verrebroek - *Dok 1* (C6, C16, C23, C70)	attribute analysis (+ limited refitting)	[Perdaen 2004] Perdaen, Crombé & Sergant 2004 Perdaen, Crombé & Sergant 2008a Perdaen, Crombé & Sergant 2008b Noens, Perdaen & Ryssaert 2009
Doel - *Deurganckdok sector J/L* (C3)	attribute analysis refitting	Noens *et al* 2005 Noens *et al* 2006 Noens, Perdaen & Ryssaert 2009 [Noens, in prep.]
Doel - *Deurganckdok sector J/L* (C2)	attribute analysis refitting	[Jacops 2007] Jacops, Noens & Crombé 2007
Oudenaarde – *Donk* (C1, C2, C3)	attribute analysis refitting	[Lombaert 2007] Lombaert, Noens & Ameels 2007 Lombaert 2009
Weelde – *Eindegoorheide* (loci 12 & 13)	attribute analysis	[De Wilde 2007] De Wilde, Verbeek & De Bie 2007 De Wilde 2009
Zonhoven - *Kapelberg*	refitting	unpublished, see Vermeersch 2008
(Zonhoven – *Molenheide*)	refitting	unpublished, see Vermeersch 2008

Table 2 – Doel-Deurganckdok. Overview of the most important technological studies on Early Mesolithic lithic assemblages in lowland Belgium.

geographical scale and in a syn- and diachronic perspective. Furthermore, it can contribute to a refinement of our typochronological frameworks and to more detailed insights into the formation history of our archaeological record. The examples mentioned in this article are only a first, discrete step in this direction, and our lithic technological approaches are in urgent need of further refinements, constant evaluation and a better integration in our research frameworks. In this respect, it is worth noting that lowland Belgium, and more particularly the wetland areas, still offer a huge unexplored potential. The sites of Verrebroek-'Dok 1' and Verrebroek-'Aven Ackers', where large surfaces were excavated in more favourable conditions than was the case in Doel, are a good example of this. In particular Verrebroek-'Dok 1', where different aspects of the intrasite approach already have advanced considerably, is a major case in point. Furthermore, a focus on other regions where the archaeological record is less problematic and/or technological frameworks already well established might result in a fruitful confrontation of methods and results.

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The use of radiocarbon dates in unraveling Mesolithic palimpsests:

Examples from the coversand area of North-West Belgium

Philippe Crombé, Joris Sergant and Jeroen De Reu

Abstract: Extensive radiocarbon dating at several sealed sites in North-West Belgium has enabled investigation of the formation processes of spatial and cumulative palimpsests dating to different stages of the Mesolithic. A clear spatio-temporal difference could be observed in the occupation of large *versus* small sand dunes. The former are characterized by continuous occupation on a seasonal basis over many hundreds of years, mainly during the Early and Final Mesolithic, leading to either extensive spatial palimpsests (Early Mesolithic) or dense cumulative palimpsests (Final Mesolithic). The occupation of smaller sand dunes on the other hand seems more discontinuous but covering the entire Mesolithic and even the Early Neolithic. Furthermore a difference in the relative duration of each occupation stay is likely, with relatively longer stays on larger dunes and more ephemeral visits on smaller dunes.

Mesolithic sites in North-West Europe often consist of several spatially delimited scatters of lithic artifacts of various sizes and densities, situated unstratified in the top of coversand deposits. In absence of any interstratification, the exact formation process of these 'multiple scatter' sites generally poses major difficulties. Yet, most archaeologists interpret these sites as palimpsests, resulting from repeated visits to the same location. Depending on the mode of re-use, a distinction is made between spatial palimpsests and cumulative palimpsests, as defined by Bailey (2007). The latter result from repeated occupation of exactly the same location within a site, leading to an often irrevocable mixture of settlement remains from different occupation events. Spatial palimpsests on the other hand are formed when re-occupation occurs within separate areas of a site, so that there is no or only minor overlap between the remains of different occupation events, i.e. the artifact clusters.

Refitting is usually considered the best tool to improve understanding of the formation process(es) of palimpsests. Indeed, refits between different artifact loci are often used to demonstrate real contemporaneity. However, refitting is a very time-consuming and hence expensive analysis. As a consequence in Flanders refit analyses are, in particular in salvage, developer-led excavation projects, seldom or only limitedly financed.

In the present paper we would like to demonstrate that ^{14}C-dating can offer a good alternative to get a general grip on the intrasite chronology and hence the formation of Mesolithic open-air sites in particular in cases where refitting is difficult or cannot be done. Even if refitting is financed, a preliminary dating program is useful as it may facilitate organization of subsequent refitting in a more adequate way certainly if one is dealing with sites with numerous artifact loci.

THE STUDY-AREA

The paper will focus on the wetland area of the lower Scheldt river in North-West Belgium. Expansion of the Antwerp harbor during the last 20 years has allowed Ghent University to excavate almost 2 hectares of sealed Mesolithic settlement surface (tabl. 1; Crombé, 1998 and 2005). The Pleistocene landscape in the study area

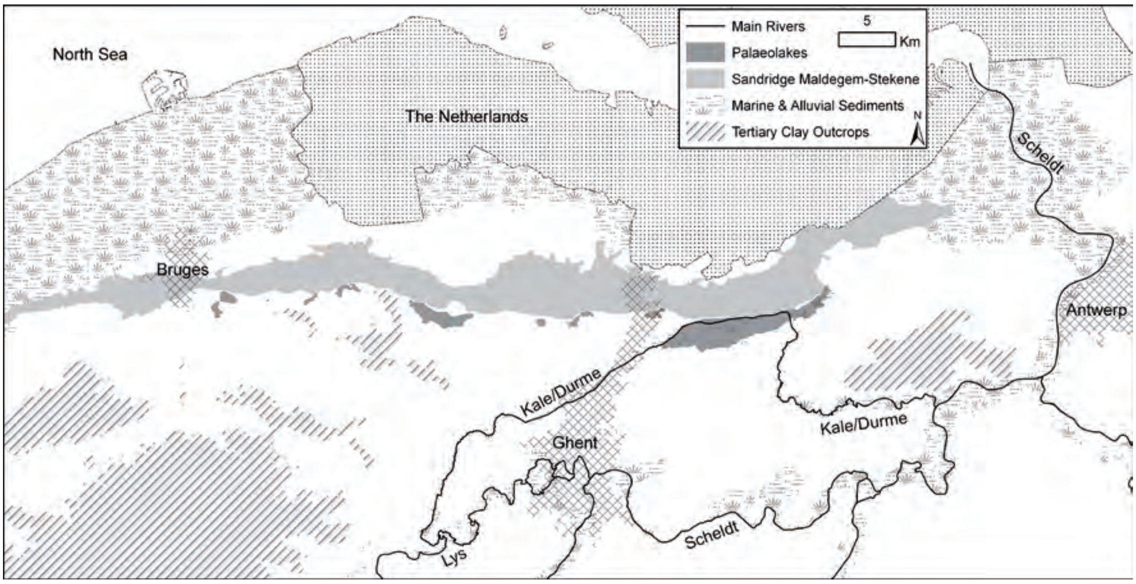


Fig. 1 – Map showing the extent of the Great Ridge 'Maldegem-Stekene', which is the largest sand dune within North-West Belgium. To the west and east this massive dune 'disappears' underneath Holocene sediments of respectively the coastal polders and Scheldt polders.

consists of numerous sand ridges formed during the end of the Pleniglacial and the Late Glacial (Heyse, 1979). Due to subsequent rising of the sea-level, these ridges got gradually buried below Holocene peat and (peri)marine clay. Geo-morphologically two types of sand ridges can be discerned:

– large and extensive sand dunes running over several hundred of meters or even several kilometers. The largest sand ridge, called the Great Ridge 'Maldegem-Stekene' (Crombé and Verbruggen, 2002), runs from east to west over ca. 80 km, is locally 1.5 to 3 km wide, and is built up of a series of parallel partly overlapping and intersecting ridges separated by low lying depressions (fig. 1);

– small and low sandy outcrops with a limited occupation surface of ± 2,000 to 3,000 m^2 (fig. 2).

Numerous palimpsest sites have been excavated on both types of sand dunes. However, the present paper will just focus on the most extensively dated sites, i.e. Verrebroek 'Dok 1', Doel 'Deurganckdok' sector B and sector M, all situated on large sand dunes, and the sites of Verrebroek 'Aven Ackers', lying on small sandy outcrops (table 1).

Site		Excavated surface (m²)	Chronology	References
Verrebroek 'Dok 1'	1992-2000	6210	Early Mesolithic	Crombé, 1998 and 2005; Crombé et al., 2003 and 2006
Verrebroek 'Dok 2'	1999	1034	Final Palaeolithic	Crombé 2005; Crombé et al., 1999; Perdaen et al., 2004
Doel 'Deurganckdok' sector B	2000	3500	Final Palaeolithic Early Mesolithic Final Mesolithic	Crombé, 2005; Crombé et al., 2000
Doel 'Deurganckdok' sector J/L	2003	3300	Early Mesolithic Final Mesolithic	Bats et al., 2003; Noens, this volume
Doel 'Deurganckdok' sector M	2003	800	Early Mesolithic Final Mesolithic	Crombé et al., 2004
Verrebroek 'Aven Ackers'	2006-2007	3000	Early Mesolithic Middle Mesolithic Late Mesolithic Neolithic	Sergant and Wuyts, 2006; Sergant et al., 2007
TOTAL		17844		

Table 1 – Overview of excavated Mesolithic sites and surfaces in the lower Scheldt polder area.

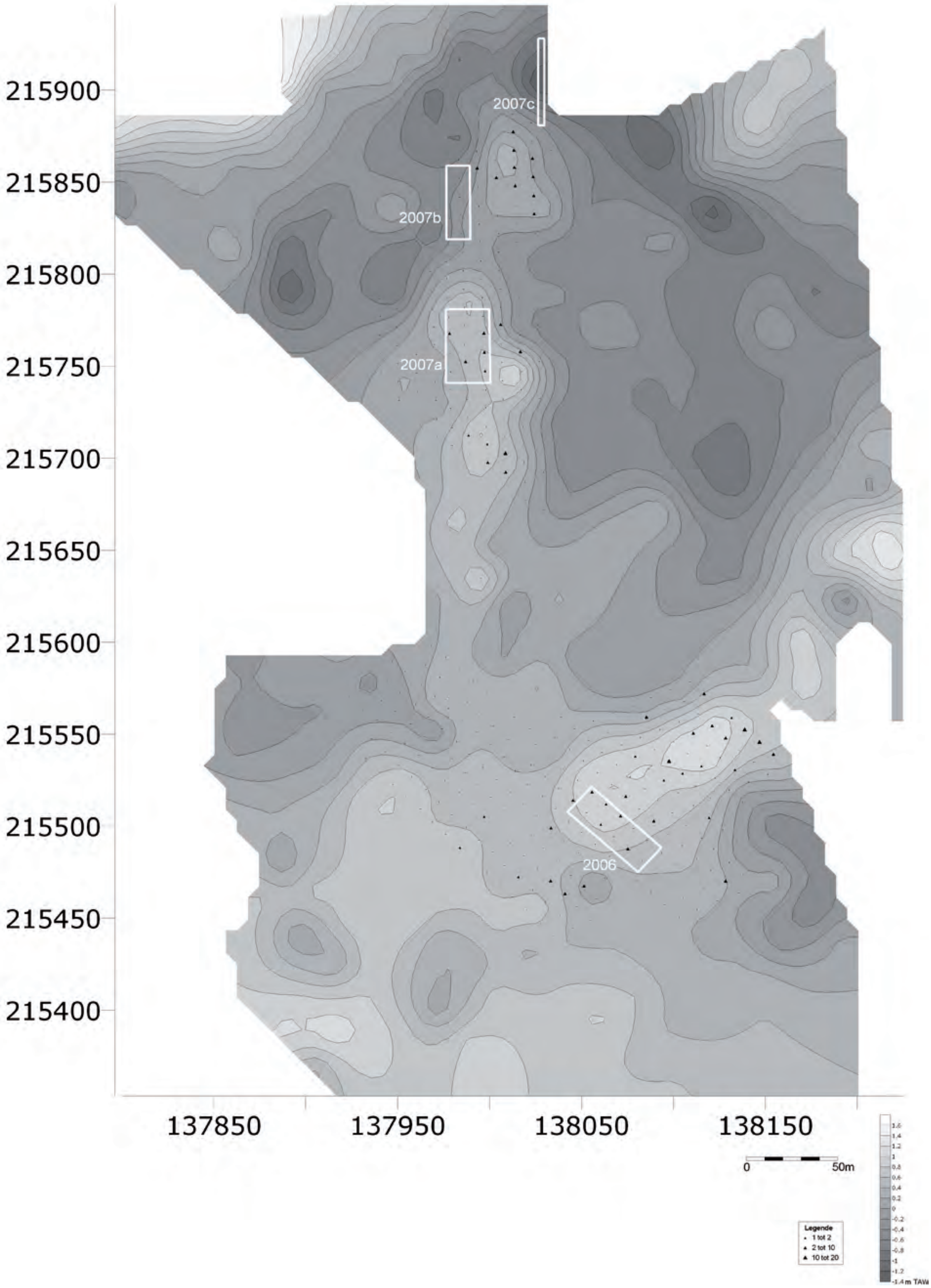


Fig. 2 – Verrebroek 'Aven Ackers'. Palaeotopographical map of the sealed coversand relief. The palaeolandscape consists of several small sandy outcrops, all yielding remains of Mesolithic occupation. Indicated are the location of the borings which yielded lithic artifacts (black triangles) and the excavations trenches from 2006 and 2007.

DATING STRATEGY AND RESULTS

All four sites have been dated extensively following the same sampling strategy. Dating was done exclusively on single entity samples with a clear connection to human activity. Dating focused on carbonized food residues, mainly burnt hazelnut shells and, to a lesser extent, carbonized seeds and pips, collected from humanly made features such as latent surface-hearths (Sergant et al., 2006). Charcoal dates, although available for these sites, have been omitted from the analysis because of supposed contamination problems (Crombé et al., 2009a and 2012).

Comparison of the dating results reveals a different pattern between the sites situated on large and small sand dunes. The sum probability curves of the dates obtained for the sites situated on large sand dunes show a clustered pattern (fig. 3). More than 80% to 90% of all dates concentrate within a specific time period of the Mesolithic. The large-scale excavated site of Verrebroek “Dok 1”(fig. 3a), which has been dated on 57 hazelnut dates, was almost exclusively occupied during the Boreal, between ca. 8740 and 7560 cal BC — 95% probability range — or 8405 to 7890 cal BC — interquartile range — (Van Strydonck and Crombé, 2005). Judging by the presence of only three younger ^{14}C dates, prehistoric man only incidentally visited the site afterwards. This occupation pattern obtained by ^{14}C is in full agreement with the settlement remains found on the site, which typologically mainly refer to the Early Mesolithic (Crombé et al., 2009a).[1] Besides a handful of trapezes, no artefacts belonging to the Late Mesolithic or Neolithic have been attested, indicating that in later times activities were very restricted and ephemeral, even though the sand ridge was still dry enough for occupation. Radiocarbon dating of the peat base, which covered the sand dune, indicates that the wettening of the dune slopes did not start before the middle of the 4th millennium cal BC (Van Strydonck, 2005).

Although less dated (10 to 11 dates), a similar pattern is observed at both Doel sites, also situated on large sand dunes (fig. 3b and 3c; Van Strydonck and Crombé, 2005; Boudin et al., 2009). Clearly both sites were occupied during specific stages of the Mesolithic. A first occupation phase dates back to the late 9th and early 8th millennium and is partly contemporaneous with the main occupation of Verrebroek ‘Dok 1’ (Early Mesolithic).[2] However, the main occupation took place during the second half of the 5th millennium cal BC, when hunter-gatherers belonging

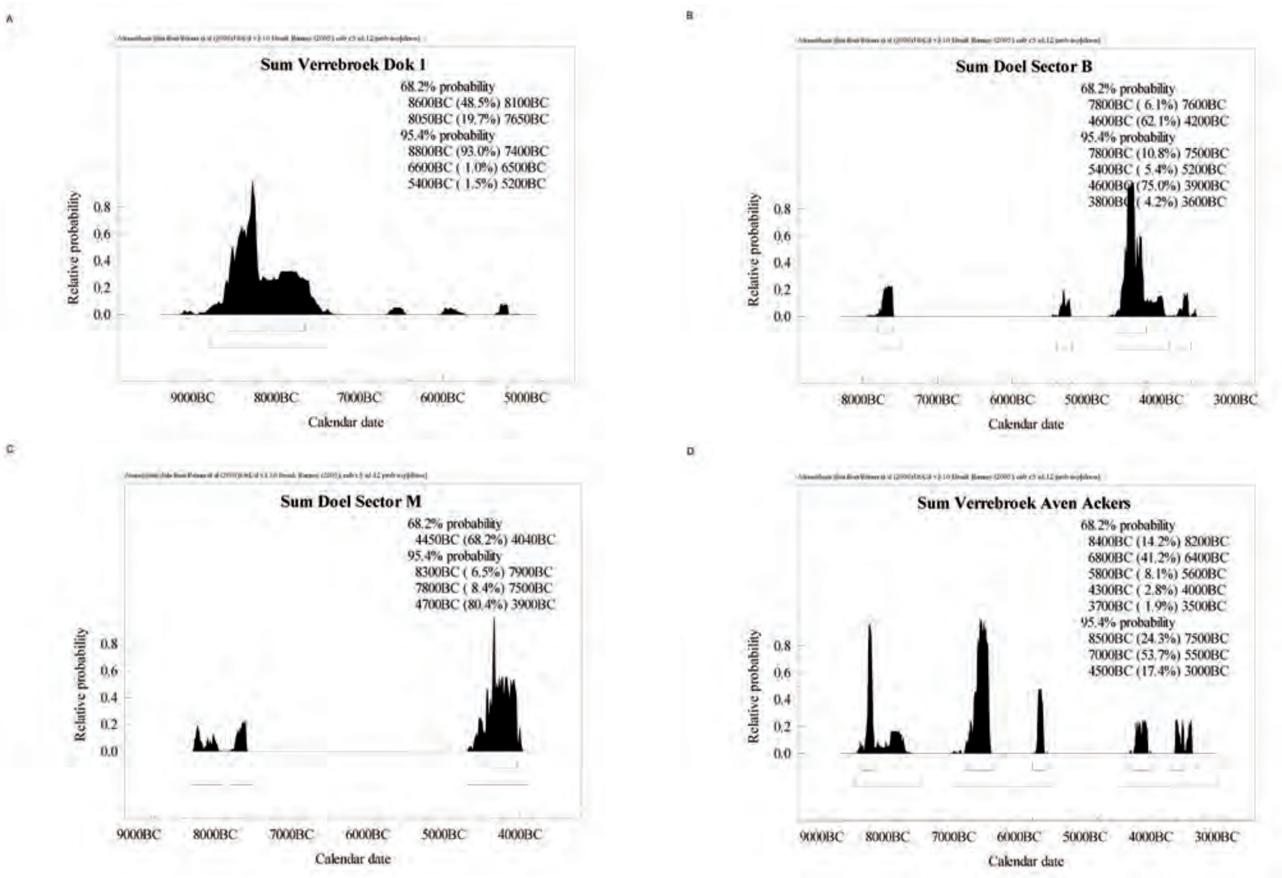


Fig. 3 – A: Verrebroek ‘Dok 1’, Sum probability of 57 hazelnut dates from different artifact loci (Reimer et al. 2009; Bronk Ramsey, 2005); B: Doel ‘Deurganckdok’ sector B, sum probability of 10 hazelnut dates from different artifact loci; C: Doel ‘Deurganckdok’ sector M, sum probability of 11 hazelnut dates from different artifact loci; D: Verrebroek ‘Aven Ackers’, sum probability of 11 hazelnut dates from different artifact loci.

to the Swifterbant Culture settled on these sand dunes (Boudin et al., 2009). The total lack of radiocarbon dates in between these two events, except for one single date around 5300 cal BC at Doel B, strongly suggests that both sand ridges remained largely unoccupied during almost three millennia, which is also confirmed by the total absence of material remains belonging to the Middle and Late Mesolithic.

The dating results from the site of Verrebroek 'Aven Ackers' (fig. 3d), situated on a few small sandy outcrops, is totally different from these three sites. The dates from the most extensively excavated and dated sandy outcrop (trench 2007a; fig. 2) shows no clear clustering at all (Crombé et al., 2009b). Rather, there is a spread of isolated dates over a time-period of more than five millennia, starting from the middle of the 9th till the 4th millennium cal BC. Apparently this small outcrop of hardly 1,500 m² has been used repeatedly during the Early, Middle and Late Mesolithic as well as during the Early Neolithic, as also testified by the presence of a broad variety of microlith types and pottery fragments.

DISCUSSION

Clearly the observed intersite difference in the distribution of radiocarbon dates reflects differences in occupation dynamics throughout the Mesolithic.

The clustered pattern on the large sand dunes most likely matches with what we could call a continuous reoccupation on a seasonal basis over a relatively extended period of several centuries to possibly even a millennium. These massive sand dunes clearly functioned as persistent places (Barton et al., 1995; Crombé et al., 2011) during specific stages of the Mesolithic, in particular during the Early (Boreal) Mesolithic and the Final Mesolithic (Swifterbant Culture). Apparently people kept using these locations on a seasonal basis probably yearly over many generations. In situations where the available occupation surface was large enough, Mesolithic populations could avoid settling on the remains of a former visit by choosing an area a little further on for each new camp. This process ultimately led to the formation of extensive

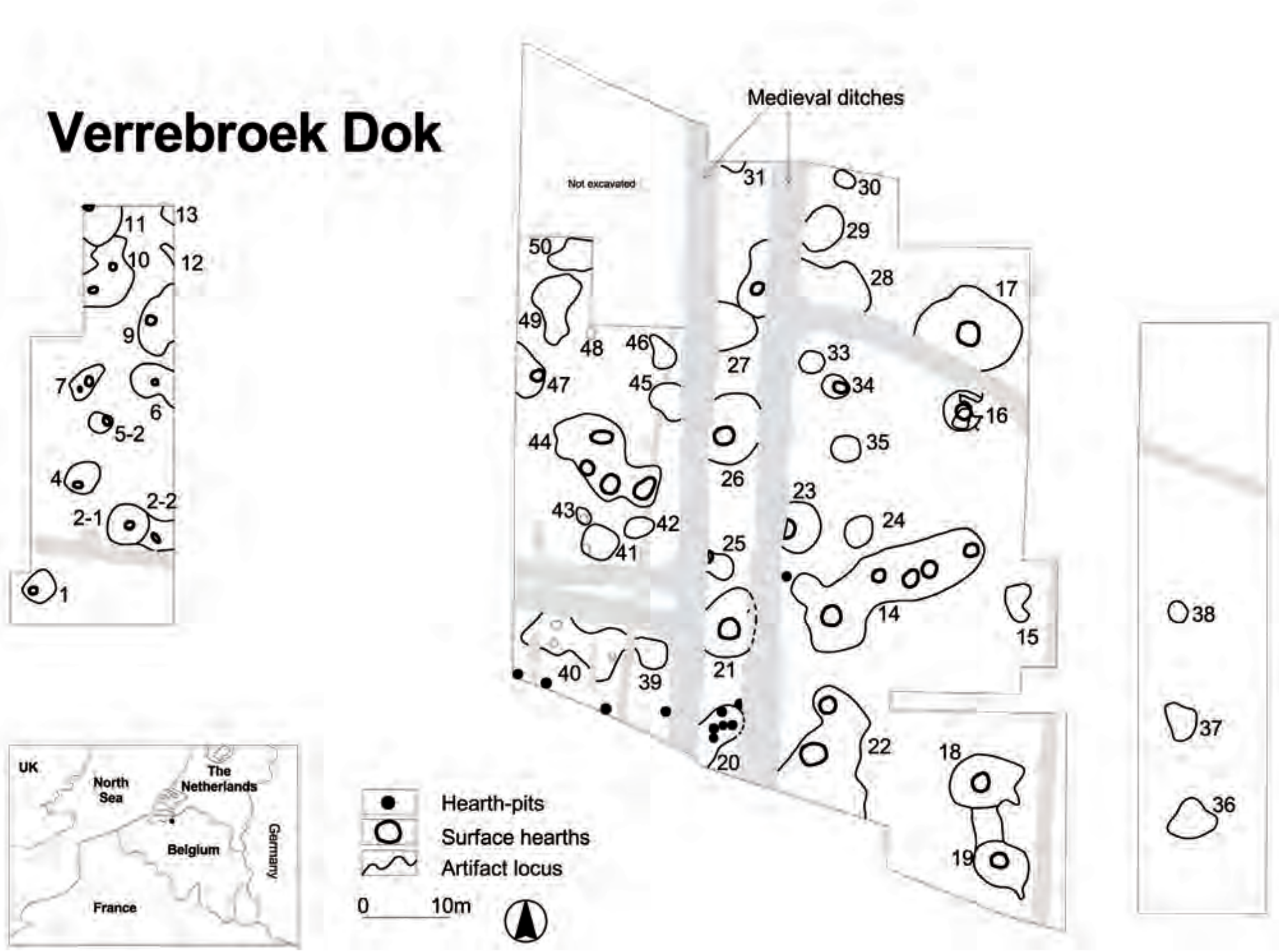


Fig. 4 – Verrebroek 'Dok 1'. Schematic distribution map of the artifact loci excavated.

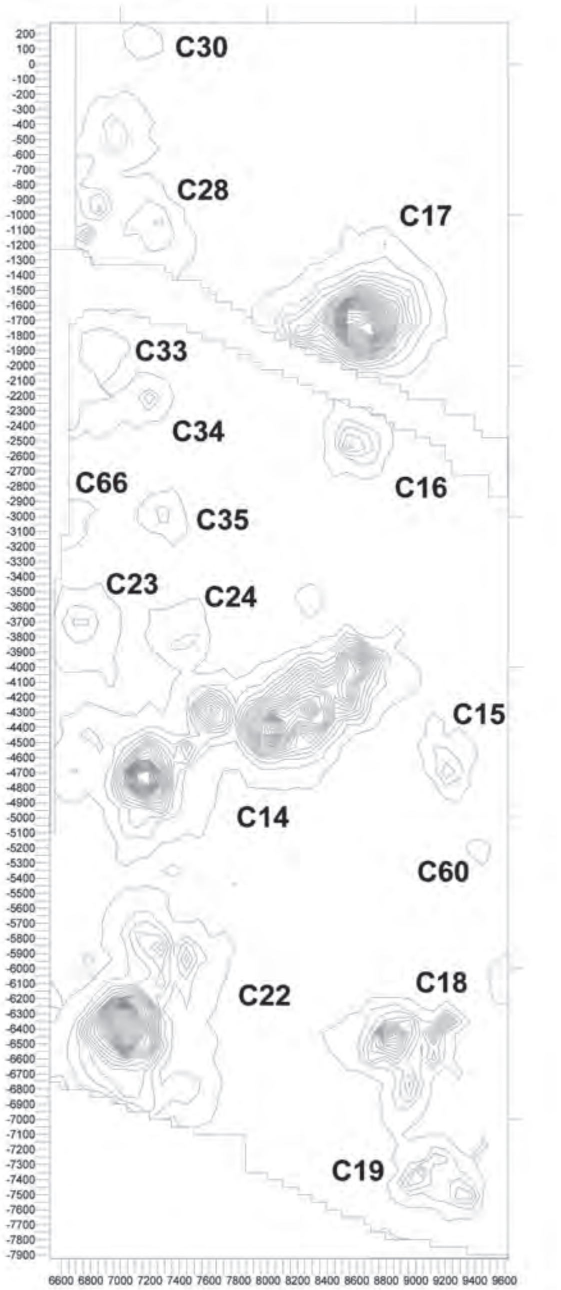


Fig. 5 – Verrebroek 'Dok 1'. Detailed distribution map of the artifact loci excavated in the eastern section.

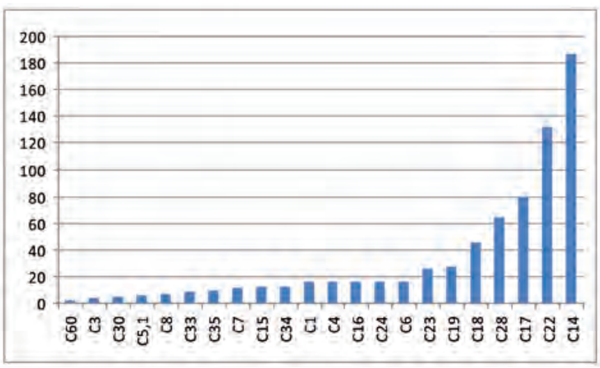


Fig. 6– Verrebroek 'Dok 1'. Diagram showing the difference in size (m²) of different artifact loci.

spatial palimpsests, comprising numerous artifact units which in most cases are spatially separated or slightly overlapping.

A good example of this process is found at the Early Mesolithic site of Verrebroek 'Dok 1', situated on the easternmost end of the massive Great Ridge. Excavations over a surface of ca. 6,200 m² revealed a very dense pattern of artifact loci of various sizes and densities (figs. 4, 5 and 6), each dated by means of ^{14}C. Spatial modeling of all these dates demonstrates clearly how these loci were used diachronically while the occupation of the sand dune gradually shifted from the south to the north (fig. 7 a-g). The radiocarbon dates (fig. 8) furthermore indicate that the smallest units (< 25-30 m²), which are most prevalent on the site, are chronologically homogeneous and might thus represent single occupation events, while the formation of the larger units (40-186 m²) is much more difficult to explain (Sergant, 2004; Crombé et al., 2006). The available ^{14}C dates (fig. 9a, c) at first sight suggest that the latter are cumulative palimpsests resulting from at least two to three occupation events. However, by combining different types of analyses (typology, raw materials, spatial analysis) and series of radiocarbon dates it could be argued that most of these larger loci (e.g. C14, C22, C28,) can be split up into smaller subclusters (with mostly one or two surface-hearths). Each subcluster possibly represents a separate occupation event, the remains of which spatially only slightly overlap or border with remains of former occupations (Crombé et al., 2006). Most subclusters (table 2; figs. 10 and 11) are of the same size as the smallest individual loci (< 25-30 m²), but larger subclusters of ca. 46 m² to 87 m² (C67, C14, C70 and C22) do also occur. Yet most of these larger subclusters yielded compatible radiocarbon dates (fig. 9a, 9c), suggesting that these too might reflect single occupation events, although diachronic use within a limited time-span cannot be fully ruled out (Crombé et al., 2006). Real cumulative palimpsests, showing an irreversible mixture of remains from different occupation events and no internal sub-clusters, are rather exceptional on the site (e.g. unit 17; figs. 9b and 12).

On a larger scale the site of Verrebroek 'Dok 1', or what has been excavated of it, represents just a small portion of a larger site-complex. Systematic augering (Bats and Cordemans, 2005) revealed that the Early Mesolithic site extends over a surface of at least 12 hectares and is connected to a series of surface sites running along the southern edge of the same massive sand dune over approximatively 8 km distance (Crombé et al., 2011; fig. 13). What we observe here is a large 'lithic landscape' probably resulting from an intense, seasonal occupation of an extensive dune side specifically during the Boreal.

Contrary to the Early Mesolithic repeated seasonal re-occupation of large dunes during the Final Mesolithic did not result in extensive spatial palimpsests. Due to a gradual wettening of the environment as an indirect result of rising sea level the coversand dunes, even the largest and highest ones, got gradually covered by peat and brackish water sediments (Crombé, 2005).

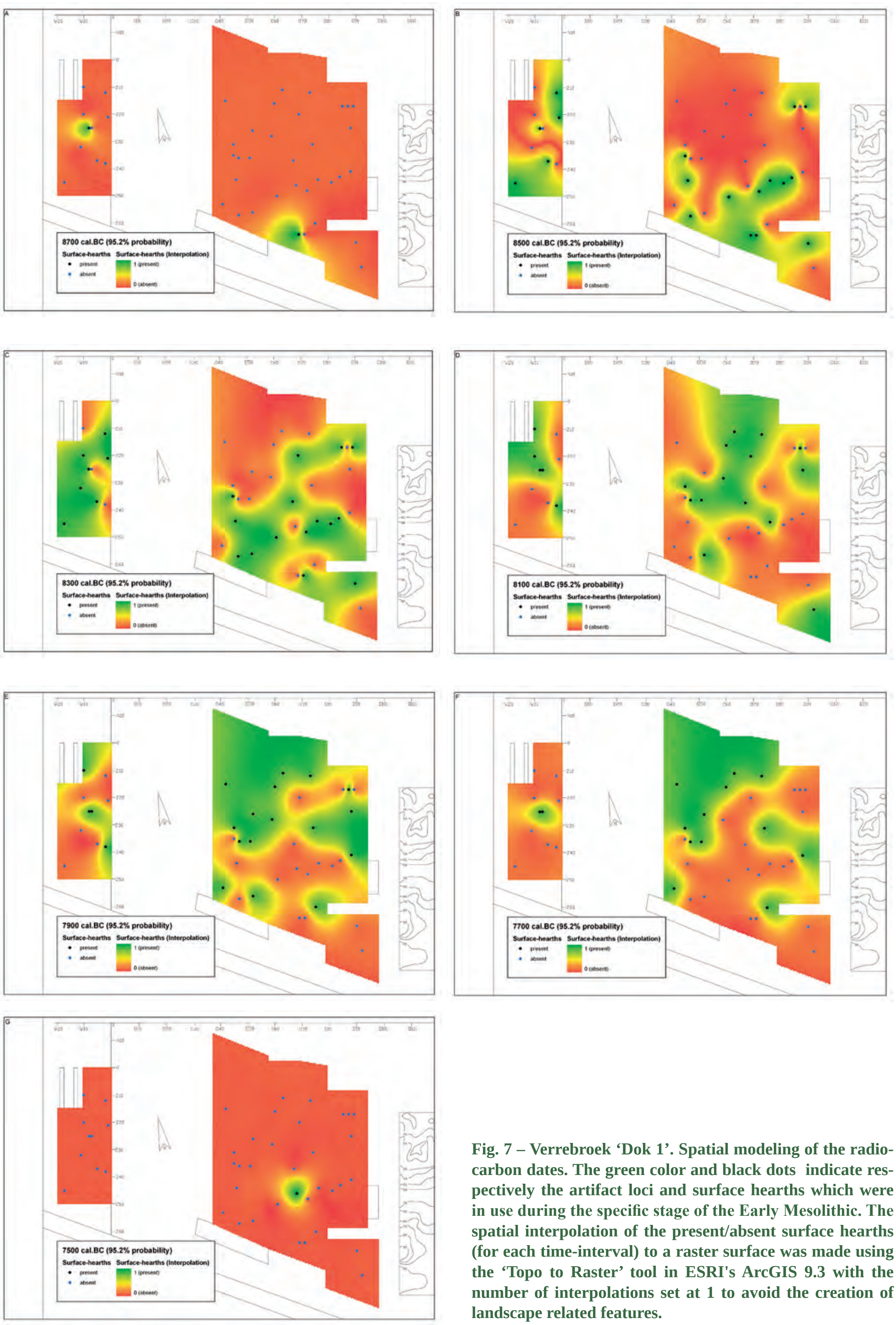


Fig. 7 – Verrebroek 'Dok 1'. Spatial modeling of the radiocarbon dates. The green color and black dots indicate respectively the artifact loci and surface hearths which were in use during the specific stage of the Early Mesolithic. The spatial interpolation of the present/absent surface hearths (for each time-interval) to a raster surface was made using the 'Topo to Raster' tool in ESRI's ArcGIS 9.3 with the number of interpolations set at 1 to avoid the creation of landscape related features.

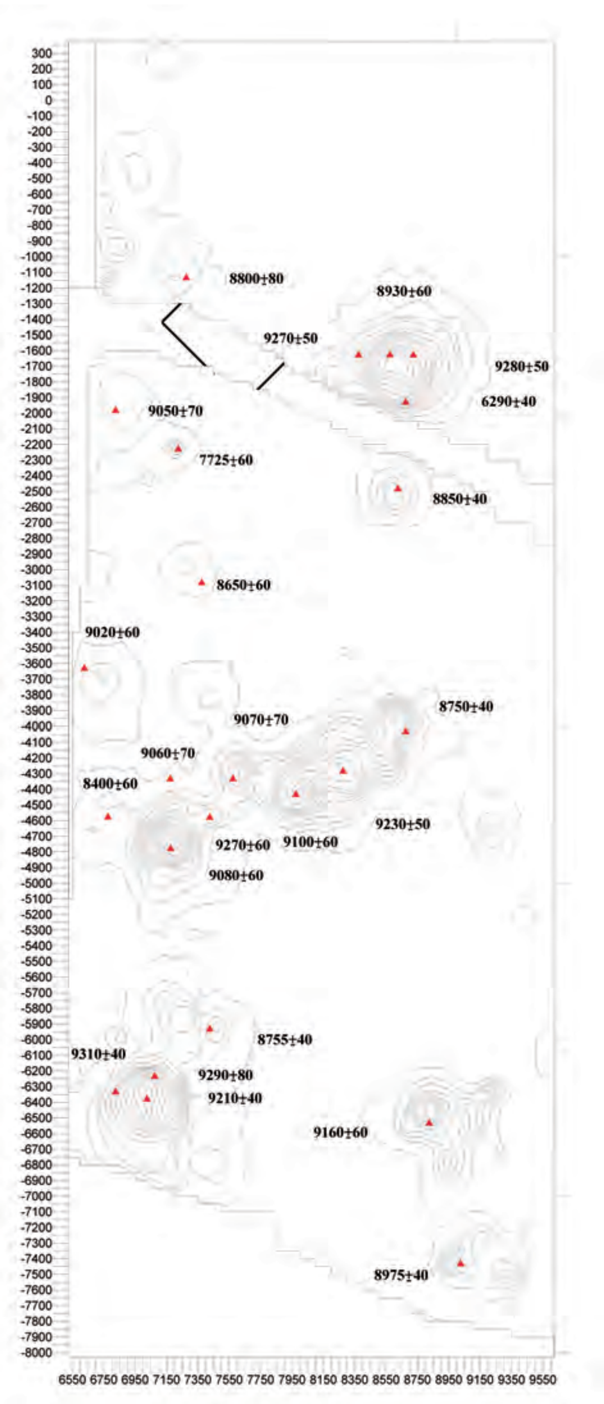


Fig. 8 – Verrebroek 'Dok 1'. Distribution of the radiocarbon dates related to different artifact loci.

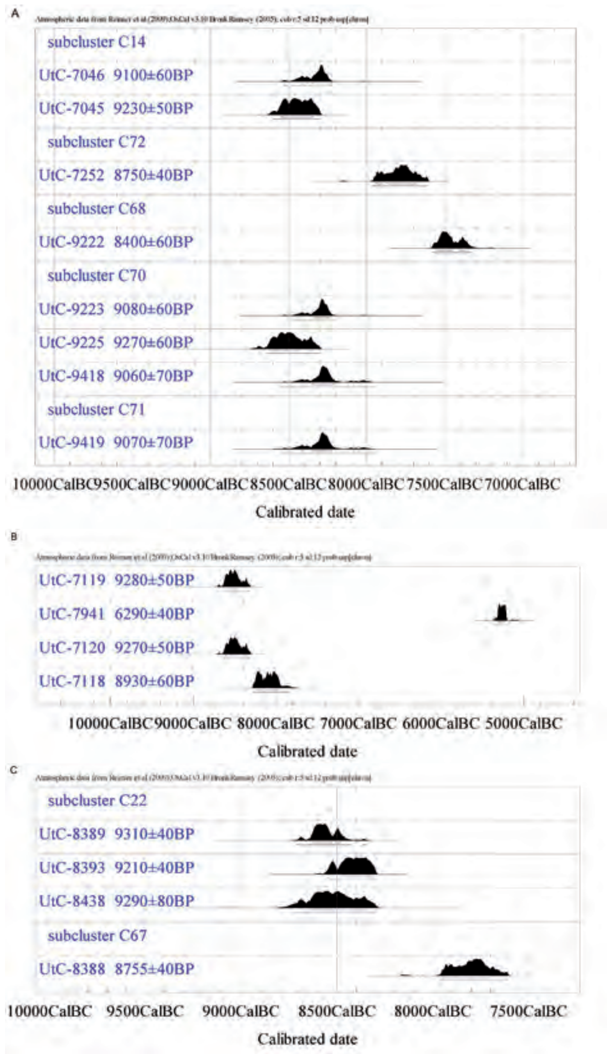
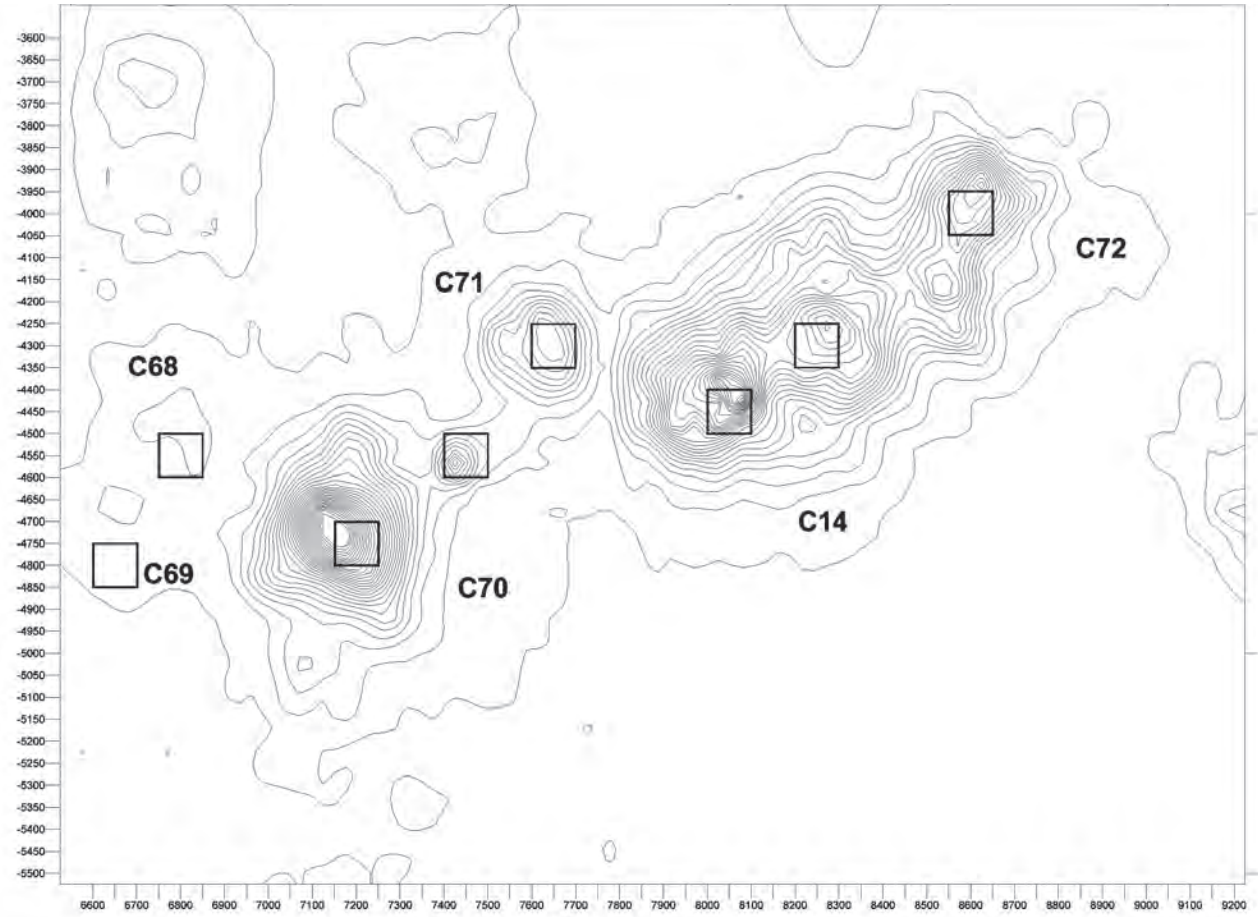


Fig. 9– Verrebroek 'Dok 1'. Calibrated radiocarbon dates from the largest artifact loci. A: locus 14; B: locus 17; C: locus 22.

Table 2 – Verrebroek 'Dok 1'. List of subclusters within the largest artifact loci.

Main clusters	Subclusters	surface (m²)
C14	C14	57
	C68	14
	C69	6/25
	C70	62.5
	C71	18
	C72	28.75
	Total	**186.5**
C22	C22	86.5
	C67	45.5
	Total	**132**
C28	C28	27.75
	C29	19.25
	C61	5
	C62	8.25
	C63	3.75
	Total	64



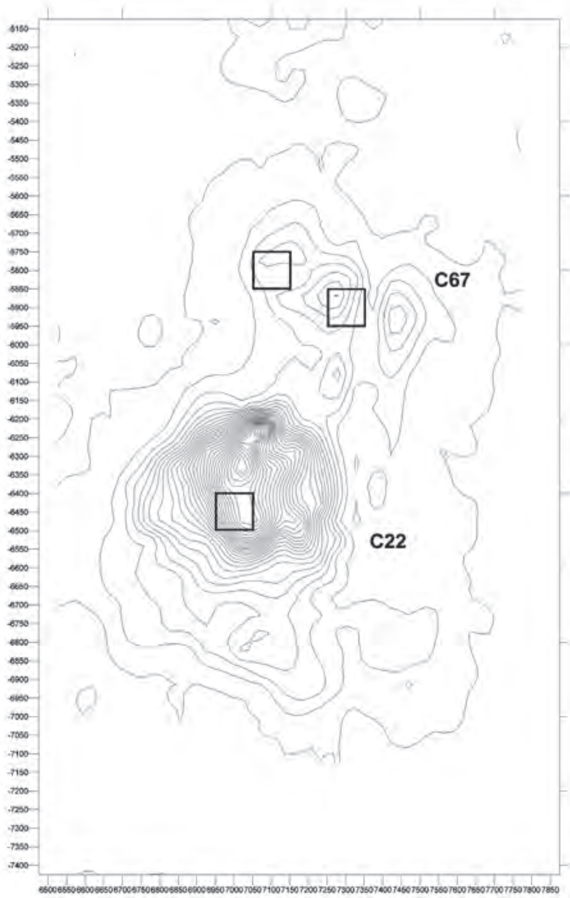


Fig. 10 – Verrebroek 'Dok 1'. Detailed density map of the main artifact locus C14, which can be split up into different subclusters. Indicated is the presumed position of latent surface-hearths (boxes).

Fig. 11 – Verrebroek 'Dok 1'. Detailed density map of the main artifact locus C22, which can be split up into different subclusters. Indicated is the presumed position of latent surface-hearths (boxes).

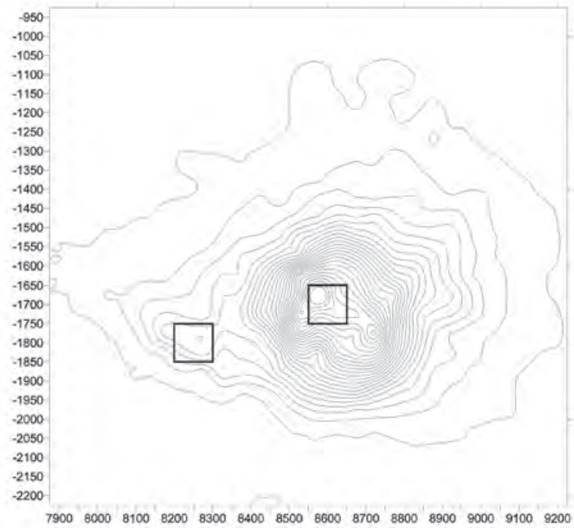


Fig. 12 – Verrebroek 'Dok 1'. Detailed density map of the main artifact locus C17. Indicated is the presumed position of latent surface-hearths (boxes).

As a consequence in the 5th millennium only the top part of the dunes were dry enough to be suited for human occupation. This reduction of the available occupation surface forced man to re-use the same locations, leading to the formation of cumulative palimpsests.

Compared to the large dunes, occupation of small sandy outcrops, e.g. at Verrebroek 'Aven Ackers' situated immediately south of the extensive site-complex mentioned above, clearly is more discontinuous and incidental. Due to the much more restricted available land surface, re-use more rapidly led to the formation of large 'multiperiod' cumulative palimpsests. On the top of one of the outcrops at Verrebroek 'Aven Ackers' (trench 2007a) a cluster of ca. 225 m² (C1) was excavated (fig. 14). Eight hazelnut samples were radiocarbon dated, yielding evidence of at least three different episodes of occupation over a period of four millennia (Crombé et al., 2009b; fig. 14). This is also corroborated by the presence of typically Early (e.g. crescents) and Middle Mesolithic microliths (e.g. points with surface retouch) and pottery fragments.

This difference in the spatio-temporal use of these two types of sand dunes within the study-area is also reflected in other aspects of these sites. For instance there is a marked difference in the mean find-density between

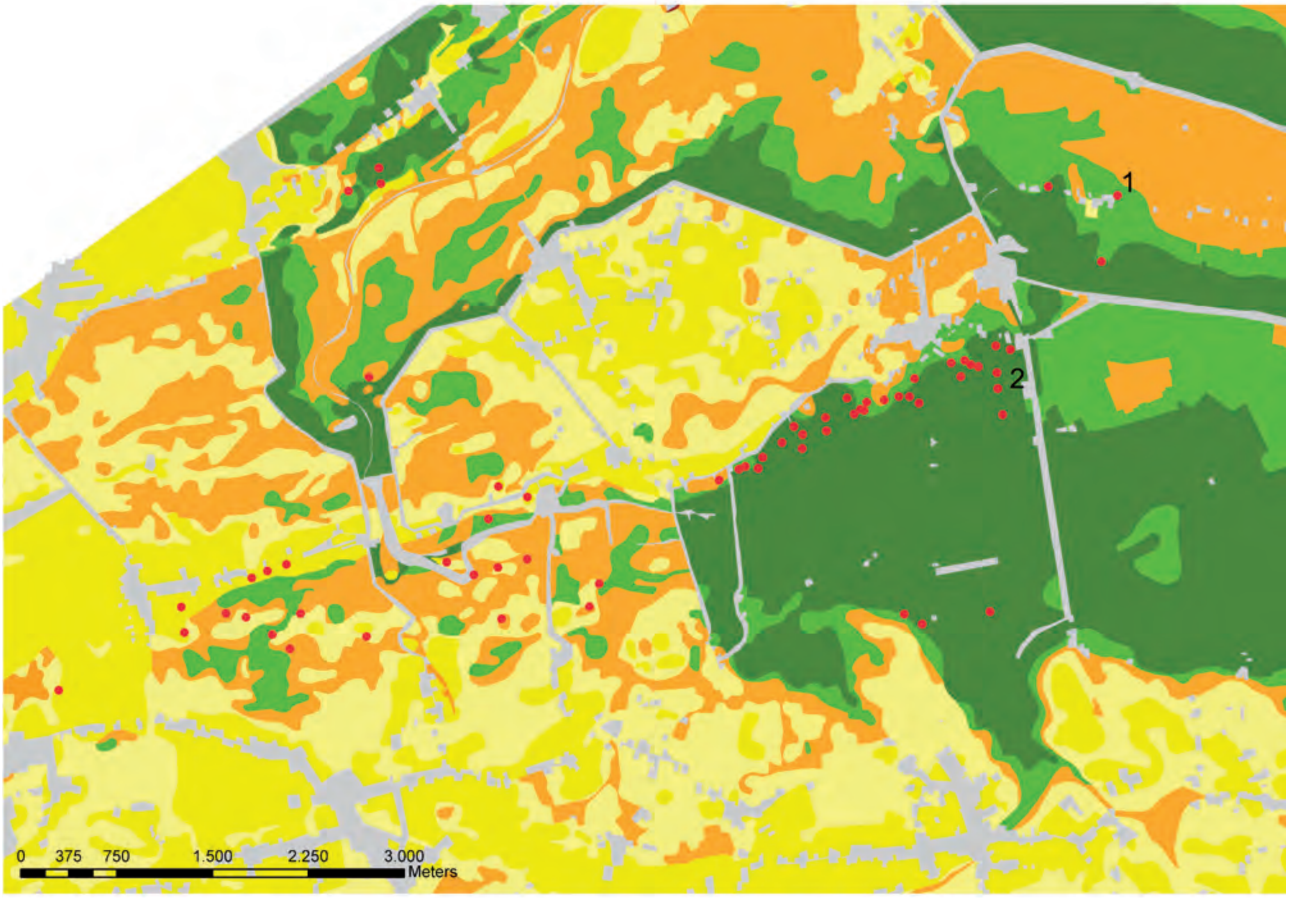
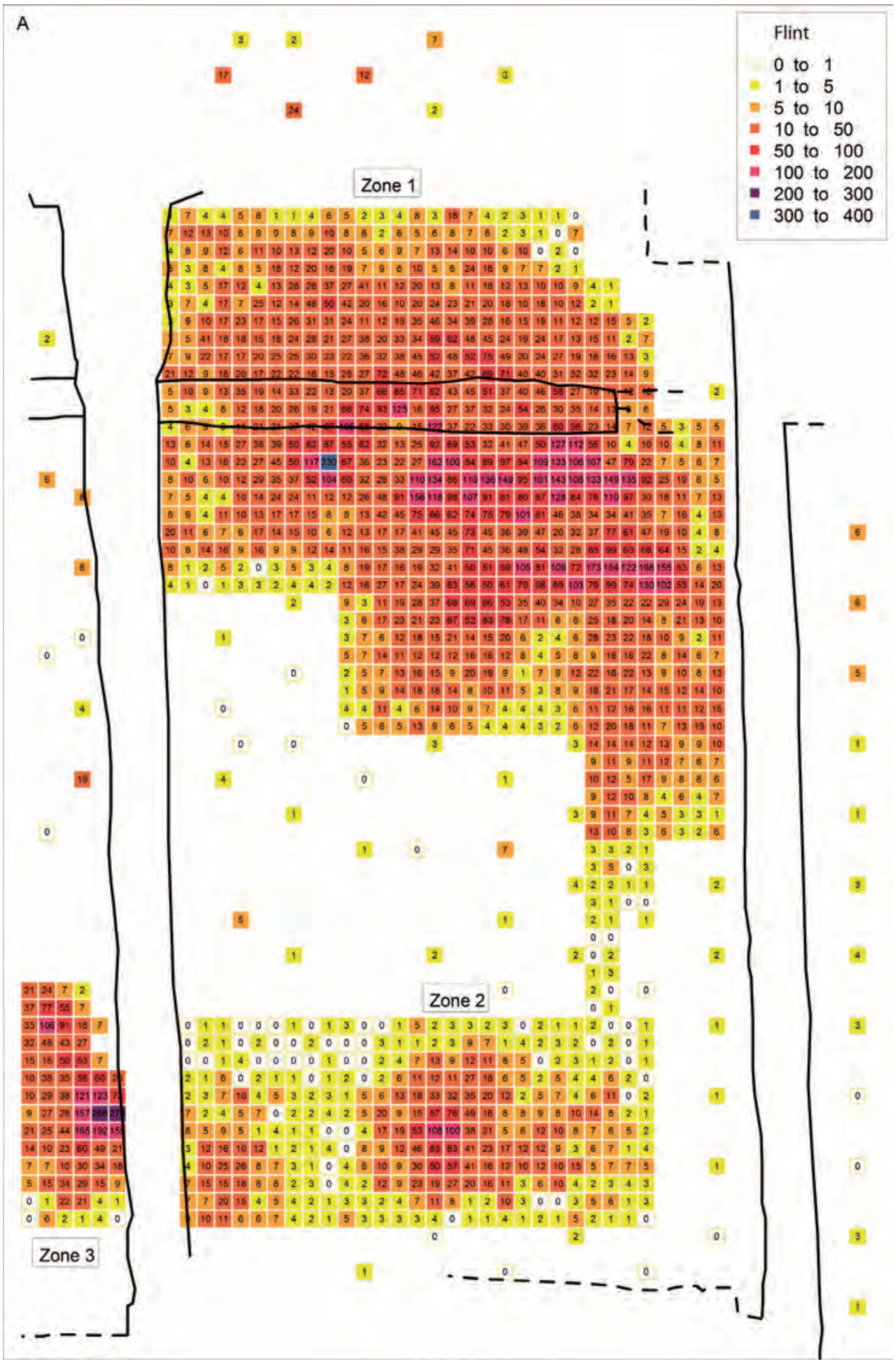


Fig. 13 – Distribution map of Mesolithic sites along the southern edge of the Great Ridge. 1: Verrebroek 'Dok 1'; 2: Verrebroek 'Aven Ackers'.



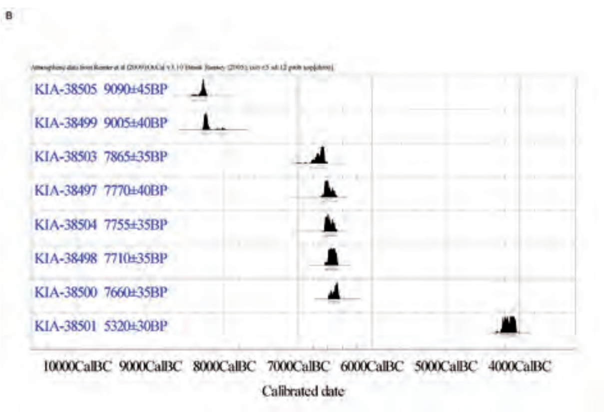


Fig. 14 – Verrebroek 'Aven Ackers'. A: Distribution of the excavated artifact loci; B: the list of calibrated radiocarbon dates relates to the largest locus, C1.

both (figs. 15 and 16). On large dunes the complete range from low-density (sub)clusters (< 20 artifacts per ¼ m²) over medium (20-60 artifacts) to really high density (sub) clusters, the latter yielding between 70 an 160 artifacts per ¼ m², is present (fig. 15a). Apparently there is no linear relationship between the size of the unit and its find density (fig. 15b). Although all larger (sub)clusters have a high to very high densities, some smaller units also yielded substantial numbers of artifacts per ¼ m². On the smaller dunes high density (sub)clusters are completely lacking (fig. 16a); density is nearly always below 20-25 artifacts per ¼ m² even within the big cumulative palimpsest C1. This intersite difference might indicate that occupation generally lasted shorter and were more ephemeral on small sand dune.

Another intersite difference is related to the frequency of burnt artifacts, as a possible indication of fire places (Sergant et al., 2006). On large dunes their frequency ranges between ca. 10% and 60-75% (fig. 15c); apparently there is no direct relationship with the size of the units, nor with the find-density, although all larger units are characterized by a very high frequency of overheated artifacts. On small dunes (fig. 16b) the data are still restricted, but nevertheless tend to point to generally low percentages (10-30%) of burnt artifacts. This might reflect shorter burning episodes compared to most loci on the large dunes, and combined with the generally lower find density, suggest shorter duration of occupation.

CONCLUSION

There is obviously an important spatio-temporal difference in the use of large *versus* small sand dunes in the coversand area of North-West Belgium. Camp sites situated on large sand dunes are on average seasonally occupied in a continuous way while the use of smaller sand dunes is more discontinuous and ephemeral. Possibly these differences reflect functional (e.g. base camps *versus* temporary special activity camps) and/or seasonal variations in the use of both types of sand ridges. For the Early Mesolithic, nevertheless, no obvious differences in the tool-composition can be seen between both types, which might suggest no or only limited functional differences. However, detailed microwear analyses are needed in order to get a clearer view on the activities which were really performed on these sites. Unfortunately, microwear analyses thus far have been limited to sites situated

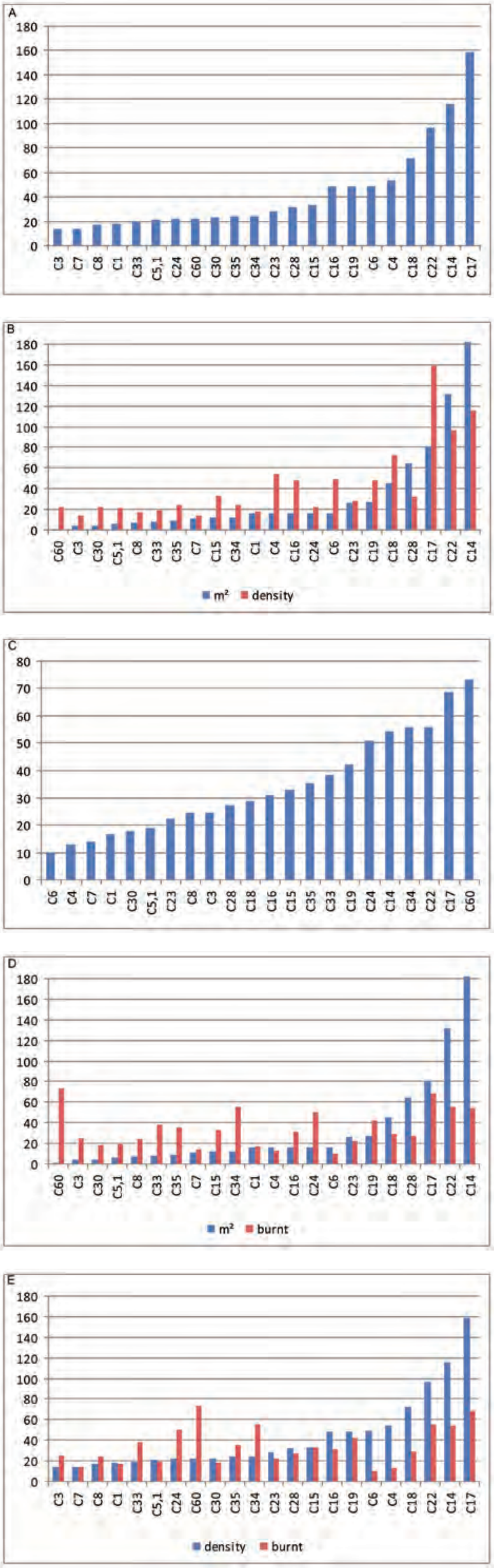


Fig. 15– Verrebroek 'Dok 1'. A: artifact density per ¼ m² within several loci; B: relation between artifact density and size within several loci; C: frequency of burnt artifacts within several loci; D: comparison between the surface and frequency of burnt artifact in several loci; E: comparison between the artifact density and frequency of burnt artifact in several loci.

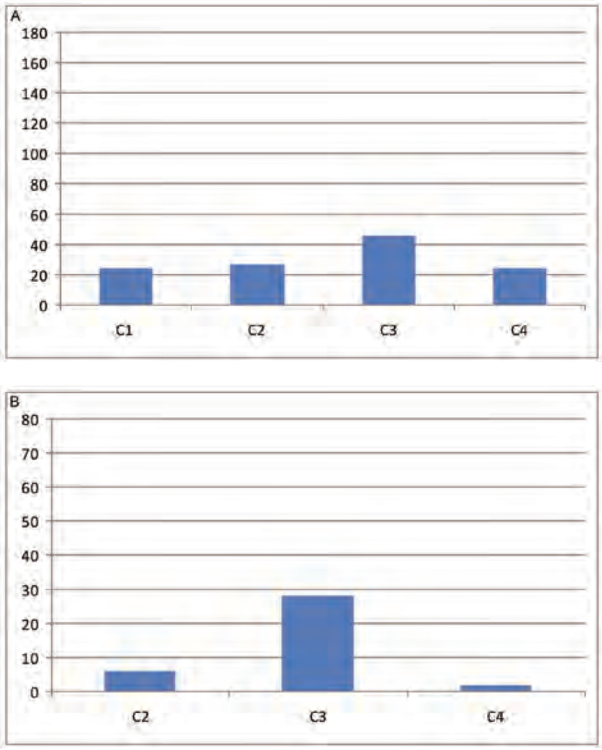


Fig. 16– A: Verrebroek 'Aven Ackers', artifact density per ¼ m² within several loci; B: Verrebroek 'Aven Ackers', frequency of burnt artifacts within several loci.

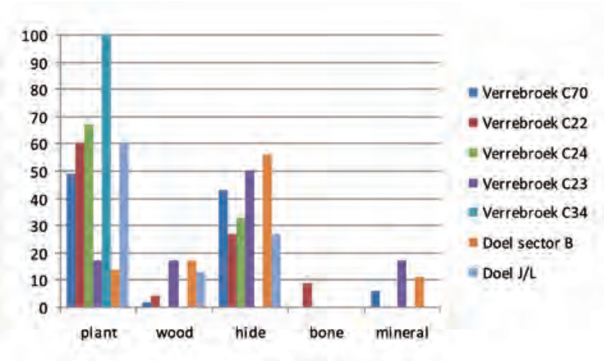


Fig. 17– Doel and Verrebroek 'Dok 1', results from microwear analyses on different artifact.

on larger sand dunes, e.g. Verrebroek 'Dok 1' (Crombé et al., 2001; Beugnier and Crombé, 2005; C. Guéret, this volume) and Doel (Beugnier, 2007; C. Guéret, rthis volume). The results point to a very limited activity range on these sites, comprised of two main activities: (dry) hide working and the processing (mainly scraping) of non-siliceous plants probably for making small craftwork (fig. 17). Future microwear analyses are planned to investigate also some low-density clusters from small dunes. Furthermore the complete lack of faunal remains on all sites, does not allow us to test whether there are differences in the seasonal occupation of sites on large versus small sand ridges.

Another important conclusion of the above analysis is that continuous re-occupation of large ridges, leading to the formation of extensive spatial palimpsests (e.g. Verrebroek-region), seems to occur only during specific stages of the Mesolithic, especially during the Early Mesolithic.[3] Apparently these large site-complexes are bound to important open-water systems, such as the Kale-Durme river and a fossil river gully south of the Great Ridge nearby Verrebroek (Crombé et al., 2008 and 2011). For the Middle, Late and Final Mesolithic these large site-complexes so far seem to be missing from the study-area (Crombé et al., 2008 and 2011), albeit large dunes continue to be used intensively on a seasonal basis, certainly during the Final Mesolithic. This change in settlement system might be related to an increased focus on wetland (peat marshes) exploitation which seems to characterize the later stages of the Mesolithic (Crombé et al., 2011). As illustrated by the excavations at Doel 'Deurganckdok' the available land surface in these wetlands was limited due to a gradual rising of the water table and inundations. Prehistoric man was forced to install his camp-sites on the highest parts of the dunes, which in the long run led to the formation of large cumulative palimpsests.

FOOTNOTES

(1) Based on series of radiocarbon dates, the chronological boundaries of the Mesolithic stages for the Belgian coversand region are: Early Mesolithic (ca. 8750-7400 cal BC), Middle Mesolithic (ca. 7400-6500 cal BC), Late Mesolithic (ca. 6500-4500 cal BC) and Final Mesolithic (ca. 4500-4000 cal BC): Crombé et al., 2009a and 2009b.

(2) At Doel-sector B remains of a *Federmesser* occupation were also found, which is not revealed by ^{14}C dating as no hazelnuts were available for dating.

(3) A similar pattern has been observed for the *Federmesser* Culture (Crombé and Verbruggen, 2002; Crombé et al., 2011).

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Tiny stones in the mud.

The Mesolithic sites of Siebenlinden (Rottenburg, Baden-Württemberg, South West Germany)

Claus Joachim Kind

Abstract: The Mesolithic sites of Siebenlinden were excavated between 1990 and 2004. Several areas were investigated which belong to a large Mesolithic landscape. The site of Siebenlinden 3-5 covers an area of about 480 m². Three Mesolithic layers were identified. The uppermost layer belongs to the Late Mesolithic while the two lower ones can be assigned to the Beuronian. The three different layers show different aspects. The uppermost layer II is the product of a residential camp which was occupied for a medium length of time of about one or two weeks. Layer III also clearly shows features of a residential camp site which seems to have been occupied for a longer period of several weeks. The internal organization of layer III differs remarkably from the organization of layer II. This may be due to a change in social behaviour. Finally, the smaller find concentrations in layer IV seem to represent brief field camps which were occupied during the acquisition of resources such as game and hazelnuts.

GENERAL CONTEXT

During the last two decades several excavation campaigns were conducted on Mesolithic open-air sites at Siebenlinden on the outskirts of Rottenburg. The town of Rottenburg is situated on the banks of the Neckar River in the southwestern part of Germany in Baden-Württemberg, some 50 km from Stuttgart and about 10 km southwest of Tübingen (fig. 1).

All activities at Siebenlinden have been rescue excavations which were organized and carried out by the Office for the Protection of Monuments in Baden-Württemberg. The fieldwork started in 1990 at the site of Siebenlinden 1 (Hahn et al., 1993). It was continued in 1991 at Siebenlinden 2 (Kieselbach et al., 2000) and from 1993 to 1995 at Siebenlinden 3 (Kind, 2003 and 2006). Between 2001 and 2004, Siebenlinden 4 and 5 were discovered and excavated (Kind, 2011). In total, an area of nearly 580 m² was investigated (fig. 2). The different sites at Siebenlinden can no longer be interpreted as isolated find spots. They form one large Mesolithic landscape on the banks of the Neckar River.

All the sites were situated on a small peninsula along the Neckar River which remained dry during a high flood. This geographical situation on a peninsula is very similar to Mesolithic sites on the shores of small lakes in South-west Germany (Jochim, 1998) and Switzerland (Nielsen, 2009).

STRATIGRAPHIC SETTING

The sites of Siebenlinden 3, 4 and 5 together cover an area of about 480 m². The finds were deposited in loamy alluvial sediments and were relatively quickly covered in a low energy environment (fig. 3). These alluvial sediments overlay Lateglacial gravels, their sedimentation started during the Preboreal and continued during the Boreal and Atlantic periods. Three Mesolithic layers could be distinguished. The uppermost layer II can be dated to the Late Mesolithic, while the deeper layers III and IV both can be assigned to the Middle Mesolithic (Beuronian B and C; Taute, 1973-1974). This is confirmed by the typology of the microliths (fig. 4). Finally, layer I is a mixture of material from the Neolithic and the La Tène period.

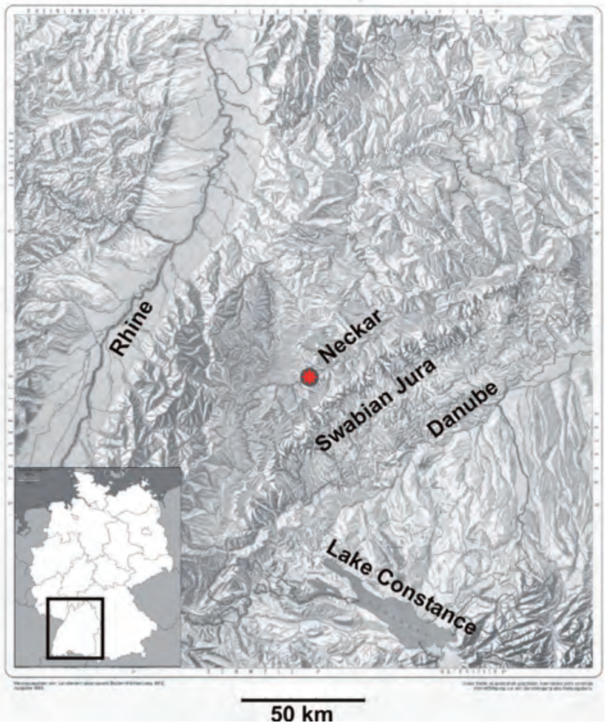

Fig. 1 – Siebenlinden. Geographical Position in Southwest Germany.

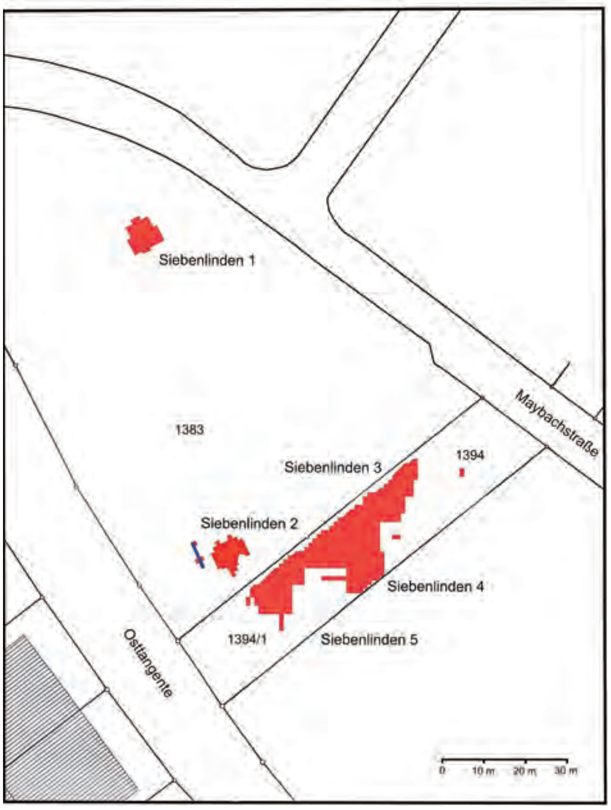

Fig. 2 – Siebenlinden. Excavated areas.

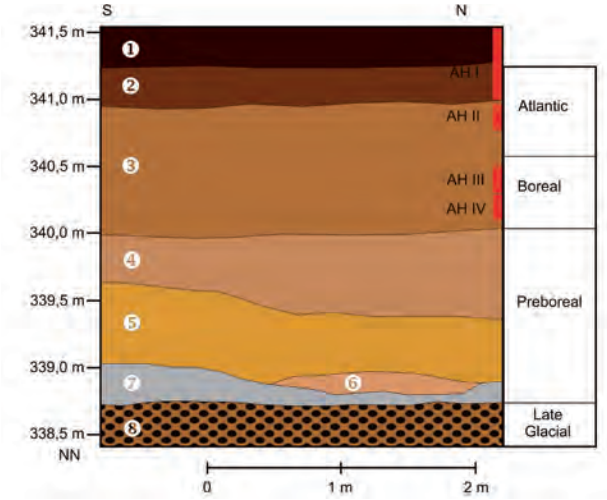

Fig. 3 – Siebenlinden. Stratigraphy.

SIEBENLINDEN 3-5, LAYER II

The uppermost Layer II belongs to the Late Mesolithic. Several radiocarbon dates put the occupation to a period between 6100 and 6500 cal. BC during the Atlantic period. Typologically, the lithic artefacts are characterized by very regular bladelets and rectangular microliths like trapezes. This is diagnostic for the southwest German Late Mesolithic. The faunal material is dominated by roe deer, followed by red deer and wild boar. One antler axe is also present (fig. 5).

Layer II yielded several hundred chipped lithic artefacts. The principal *chaîne opératoire* is complete with artefacts from the primary decortification and preparation well represented. The raw material was imported as whole nodules. Some of the lithics were retouched into endscrapers and truncations; microliths are also common. The faunal elements are numerous with bones representing complete carcasses of roe deer, red deer and wild boar. Some of the bones are pieces of debitage connected to the production of bone artefacts while the end products (chisels and points) are missing. The assemblage shows several different activities and domestic ones are very common. Layer II seems to be the product of a more or less intense occupation which in any case lasted longer than a few days, possibly for one or two weeks (table 1).

Horizontal artefact distribution is sometimes more or less random, but occasionally objects were found in clearly limited accumulations (fig. 6). Five could be identified.

For example, Locus II/1 shows a concentration of lithic artefacts in the vicinity of three hearths. At the periphery of this concentration, bone fragments and burnt stones were found.

The unit is quite large and covers an area of about 150 m². It seems to be an area where different activities such as the production of lithic artefacts, hafting and retooling microliths (Keeley, 1982), the use of scrapers

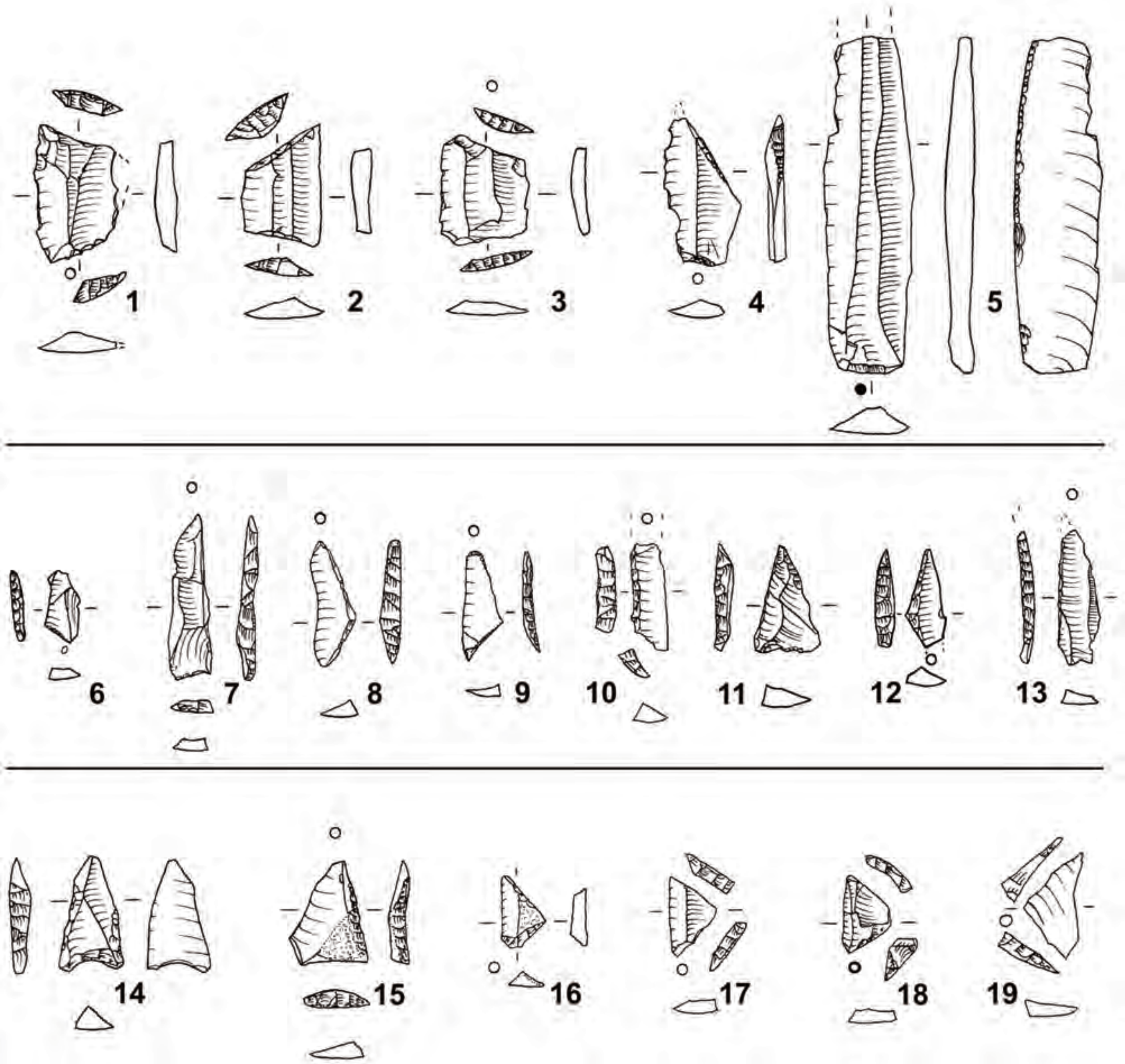

Fig. 4 – Siebenlinden. Lithic artefacts. 1-5: layer II, Late Mesolithic; 6-13: layer III, Beuronien C; 14-19: layer IV, Beuronien B.

Fig. 5 – Siebenlinden. Layer II, Late Mesolithic: antler axe.

- Numerous lithic artefacts
  - complete *chaîne opératoire*
  - import of complete nodules
  - tools of the fonds commun
  - microliths
- Numerous bone fragments
  - complete carcasses (*sus*, *capreolus* and *cervus*)
  - bone/antler tools and waste of production
- several different activities
- medium duration of occupation

Table 1 – Siebenlinden. Layer II, Late Mesolithic: general characterization.

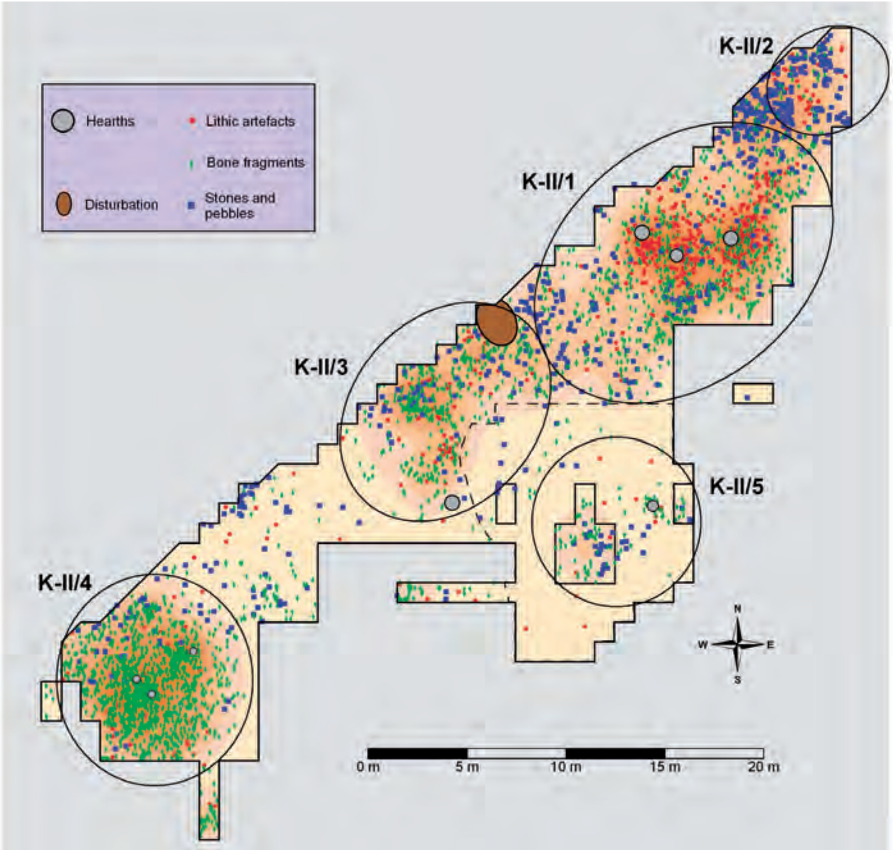

Fig. 6 – Siebenlinden. Layer II, Late Mesolithic: horizontal distribution of finds.

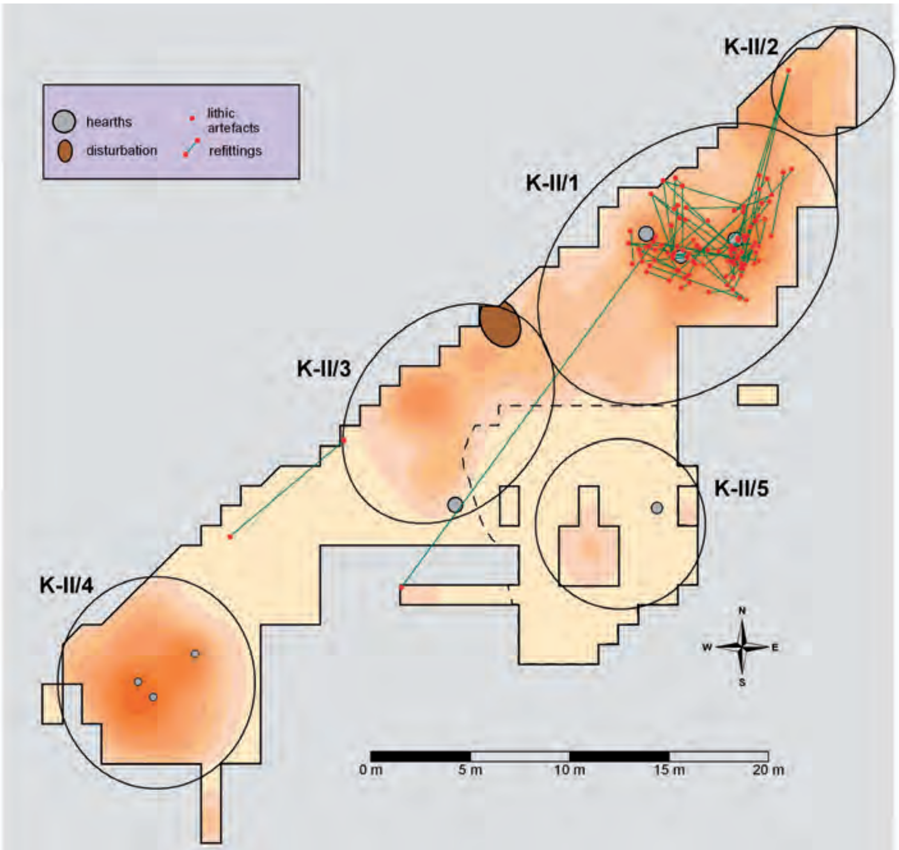

Fig. 7 – Siebenlinden. Layer II, Late Mesolithic: horizontal distribution of refitted lithic artefacts.

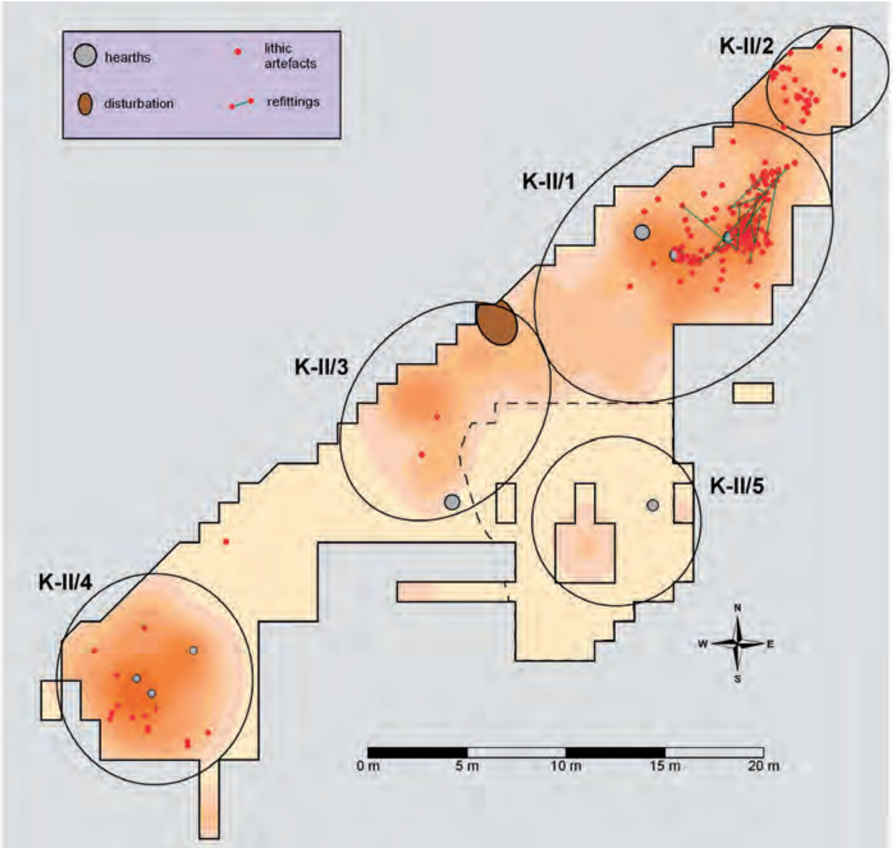

Fig. 8 – Siebenlinden. Layer II, Late Mesolithic: horizontal distribution of lithic artefacts, nodule KN 1.

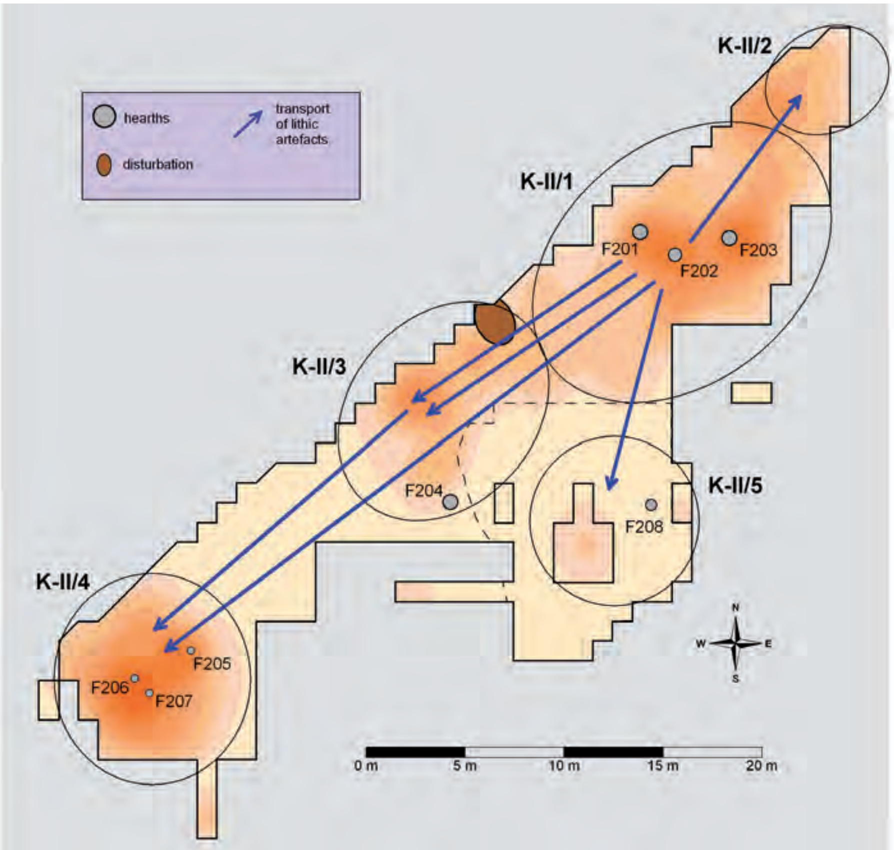

Fig. 9 – Siebenlinden. Layer II, Late Mesolithic: general transport of lithic artefacts.

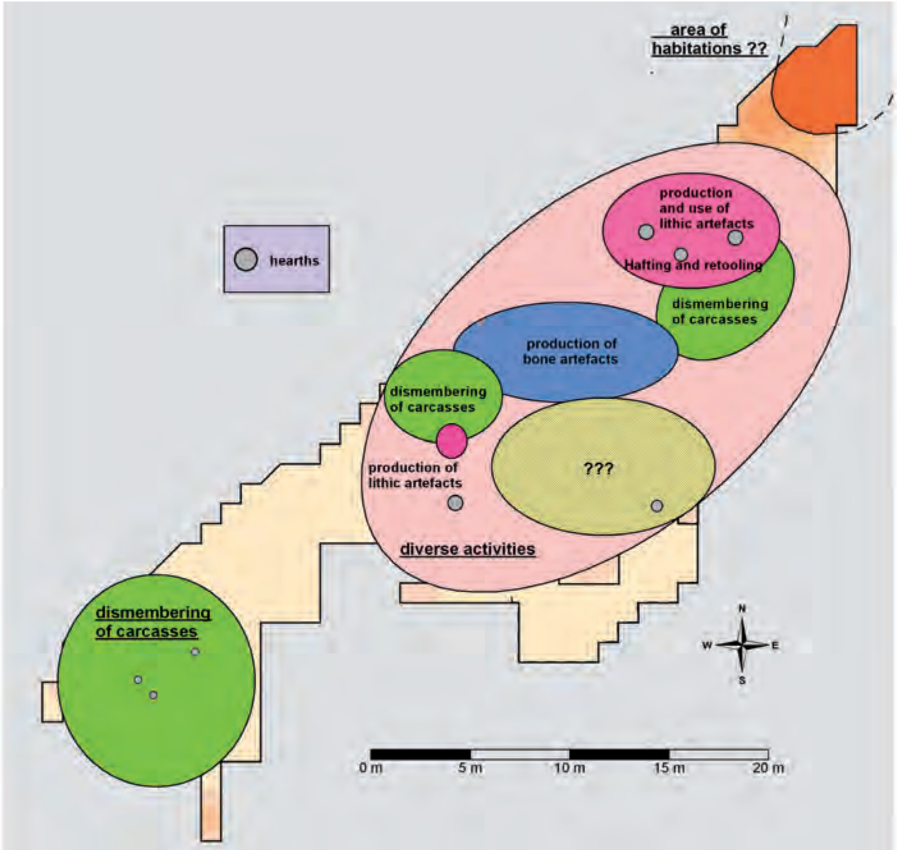

Fig. 10 – Siebenlinden. Layer II, Late Mesolithic: localisation of activities.

and knives and the production of bone tools all took place. As another example, Locus II/4 is characterized by a significant quantity of bone fragments. They were again found in the vicinity of three small hearths. Lithic artefacts are very rare. The unit again covers a large area of 90 m² and seems to be the product of butchering game.

The distribution of refitted lithic artefacts clearly shows that all of the three hearths in locus II/1 were used contemporaneously (fig. 7). However, there are also connections between the units II/1 and II/2, as well as between II/1 and the periphery of II/3.

A special kind of analysis is the attempt to assign artefacts to individual nodules on the basis of raw material specificities. Artefacts from one nodule are seen as belonging to one worked piece. Twelve nodules belonging to layer II were identified. The distribution of artefacts coming from these nodules gives further information about the use of space. Some examples show that artefacts which were produced in locus II/1 were afterwards transported to units II/2, II/3 and II/4 (fig. 8).

If all connections on the basis of refits *and* raw material specificities are drawn on one map it becomes clear that the whole site is covered by a network of transport activities (fig. 9). This demonstrates a dynamic system of occupation and proves that all units belong to one large settlement.

It is possible to characterize the different units of this settlement (fig. 10). Loci II/1, II/3 and II/5 belong to one large area with different activities. These include the production of lithic artefacts, use of tools, hafting and retooling of arrowheads as well as the dismembering of carcasses and the production of bone artefacts. In contrast, locus II/4 can be seen as a large area where animals were butchered. Finally, unit II/2 possibly belongs to a habitation area. If the assumption is right that large areas of activity are used by a large number of individuals it becomes clear that all the members of the group were doing the same things, but at the same places.

SIEBENLINDEN 3-5, LAYER III

In Layer III several thousand chipped lithic artefacts were found. Among the microliths there are extremely scalene triangular pieces. These are typical of the late Middle Mesolithic which is called Beuronian C. More than 30 radiocarbon dates put the occupation of layer III in the late Boreal period between 7100 and 7400 cal. BC. Additionally, artefacts made on pebbles (hammer and grinding stones, fig. 11) and bone artefacts (points and chisels, fig. 12) were found as well as waste from the production of these bone artefacts (fig. 13). The fauna again is dominated by roe deer, red deer and wild boar.

The principal *chaîne opératoire* of the production of lithic artefacts is once again complete. Artefacts from decortification and primary preparation are well represented. Raw material was imported mainly as complete

Fig. 11 – Siebenlinden. Layer III, Beuronien C: hammer stone.

Fig. 12 – Siebenlinden. Layer III, Beuronien C. Left: bone point. Right: bone chisel.

Fig. 13 – Siebenlinden. Layer III, Beuronien C: waste of production of bone tools (design E. David).

nodules. Among the lithic artefacts there are several end-scrapers, truncations and burins; microliths and microburins are also represented. Complete carcasses of roe deer and wild boar were imported, while the bones of red deer mainly represent meat-rich parts of the bodies. Significant numbers of bone fragments — mainly from metapodiums — show traces of the production of bone artefacts. Several bone points and bone chisels were also found. In sum the assemblage again demonstrates several different activities and again domestic activities are very common. Layer III also clearly seems to be the product of an intense occupation which possibly lasted for several weeks (table 2).

Horizontal artefact distribution in layer III define 18 find units which often are accompanied by hearths (fig. 14). In several aspects this distribution resembles the situation in Mesolithic settlements like Choisey and Ruffey-sur-Seille (Séara et al., 2002).

- Numerous lithic artefacts
  - complete *chaîne opératoire*
  - import of complete nodules
  - tools of the fonds commun
  - microliths and microburins
- Numerous bone fragments
  - complete carcasses *(sus* and *capreolus)*
  - partial carcasses *(cervus)*
  - bone/antler tools and waste of production
- Artefacts made of pebbles and stone slabs
- Numerous different activities
- Long duration of occupation

Table 2 – Siebenlinden. Layer III, Beuronien C: general characterization.

There seem to be different types of concentrations. Units III/1, III/3, III/6, III/13 and III/14 are areas where numerous burnt pebbles and stones were found. With the exception of unit III/3, lithic artefacts and bone fragments are rare. Paved hearths are very common inside these concentrations. Most of these units show a clear border effect (Stapert, 1989) and it seems possible that they represent sheltered structures like habitations. The paved hearths are mostly associated with shallow pits (fig. 15). They are similar to features in several other Mesolithic sites (Gob and Jaques, 1985, p. 169; Rozoy, 1978, p. 1096; Paulet-Locard, 1989; Rozoy and Slachmuylder, 1990; Spier, 1994, p. 89; Foucher et al., 2000; Svoboda et al., 2000, p. 293; Svoboda, 2003, p.169, 209, 245; Séara et al., 2002; Ghesquière and Marchand, 2010, p. 103, 115). Possibly they were used as cooking pits (Fretheim, 2009) or as constructions for roasting meat.

Loci III/4, III/7 and III/10 belong to another type of concentration. They are dominated by lithic artefacts and bone fragments; waste from producing bone artefacts is also sometimes present. Only simple hearths were found inside these units.

Finally loci III/2, III/8, III/12, III/16, III/17 and III/18 are small concentrations with variable content. Sometimes there are some lithic artefacts inside, sometimes some bone fragments. The hearths in these units are only simple ones.

A couple of pebbles and stones were refitted (fig. 16). The refitted fragments were usually found close together but sometimes they show connections between different units.

A similar interpretation can be drawn by the refitting of lithic artefacts (fig. 17). Usually the pieces involved were found close together but again some refitted objects were found further away in different units.

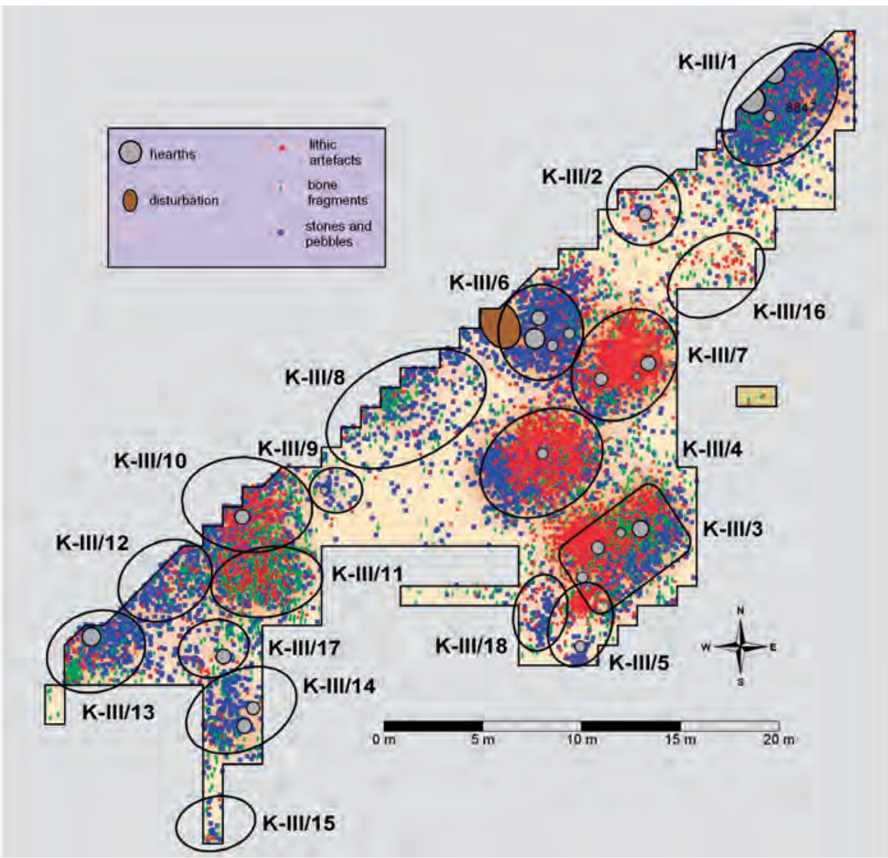

Fig. 14 – Siebenlinden. Layer III, Beuronien C: horizontal distribution of finds.

Fig. 15 – Siebenlinden. Layer III, Beuronien C: paved hearth.

Most of the artefacts can be assigned to worked nodules on the basis of raw material specificities. About 80 nodules belonging to layer III were identified. Some of them demonstrate that artefacts were transported from one unit to another (fig. 18).

If all the indications for transports of lithic artefacts are combined — in this case the transport of cores — a complex network of movements becomes visible (fig. 19). This again demonstrates a dynamic system of occupation and proves that most of the units in layer III may belong to one large settlement.

Usually units with different activities are linked together (fig. 20). In three cases transports originate in units which are dominated by lithic artefacts and bone fragments. Those units can be seen as areas where a number of different activities took place. From these primary activity units, artefacts were brought to areas which were dominated by burnt pebbles and stones and because of the border effect possibly represent dwelling areas. From the primary activity areas artefacts also were transported to the small units with variable content. These can be seen as areas for diverse activities which were sometimes accompanied by satellite hearths. Sometimes lithics were exchanged between different primary activity units.

This interpretation demonstrates that a primary activity unit, a dwelling unit and several satellite units define a housing area. It gives us an initial idea how such a Mesolithic domestic area was organized (fig. 21). It seems to be divided into places of working, of habitation and of special activities. The single units are smaller than the large units in layer II. Therefore a smaller group of inhab-

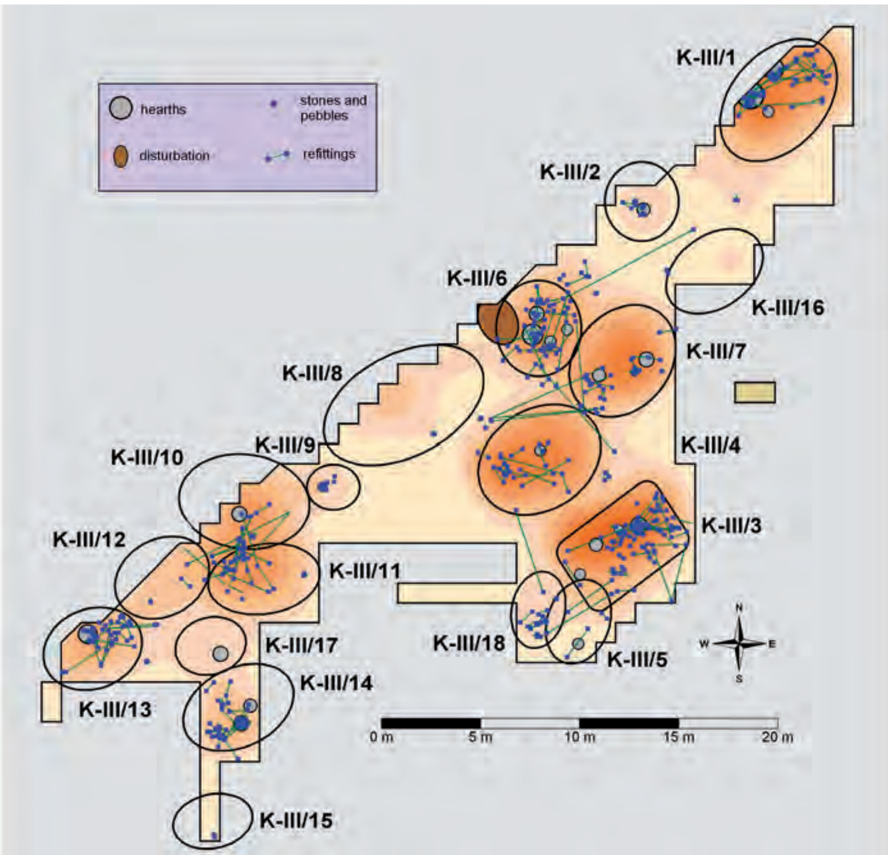

Fig. 16 – Siebenlinden. Layer III, Beuronien C: horizontal distribution of refitted stones and pebbles.

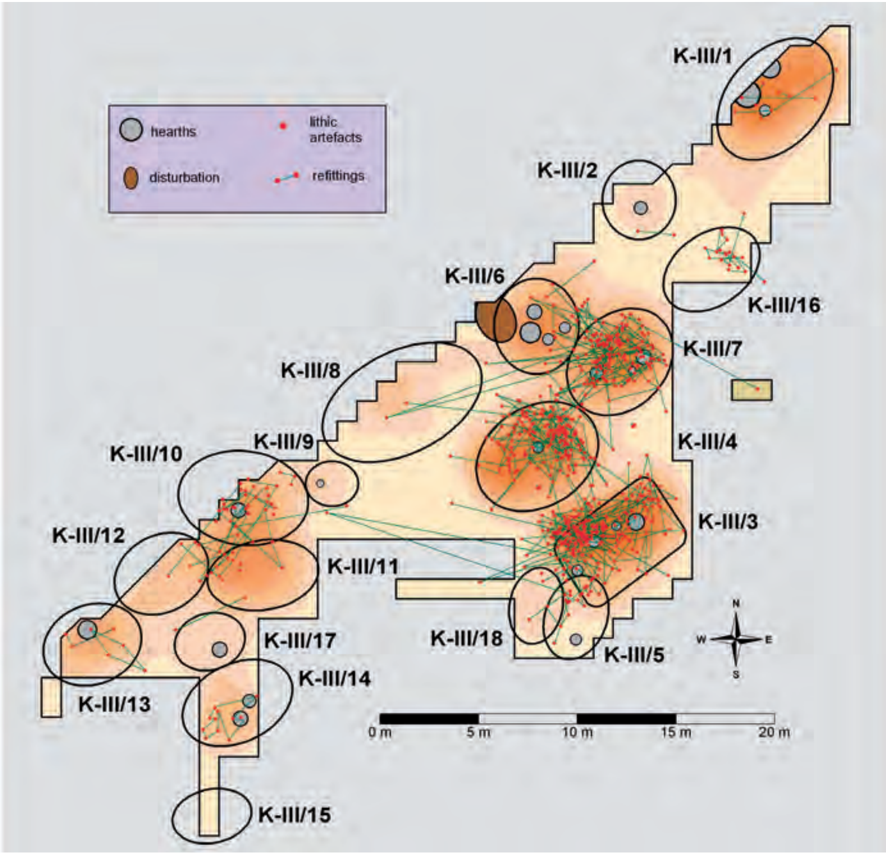

Fig. 17 – Siebenlinden. Layer III Beuronien C: horizontal distribution of refitted lithic artefacts.

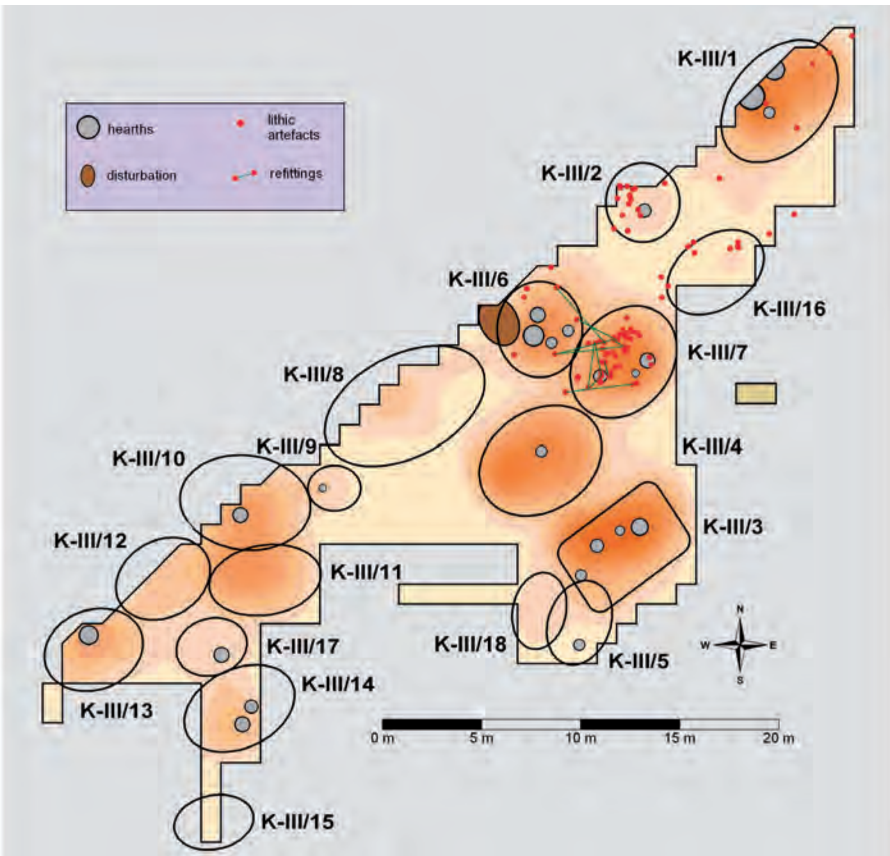

Fig. 18 – Siebenlinden. Layer III, Beuronien C: horizontal distribution of lithic artefacts, nodule J 7.

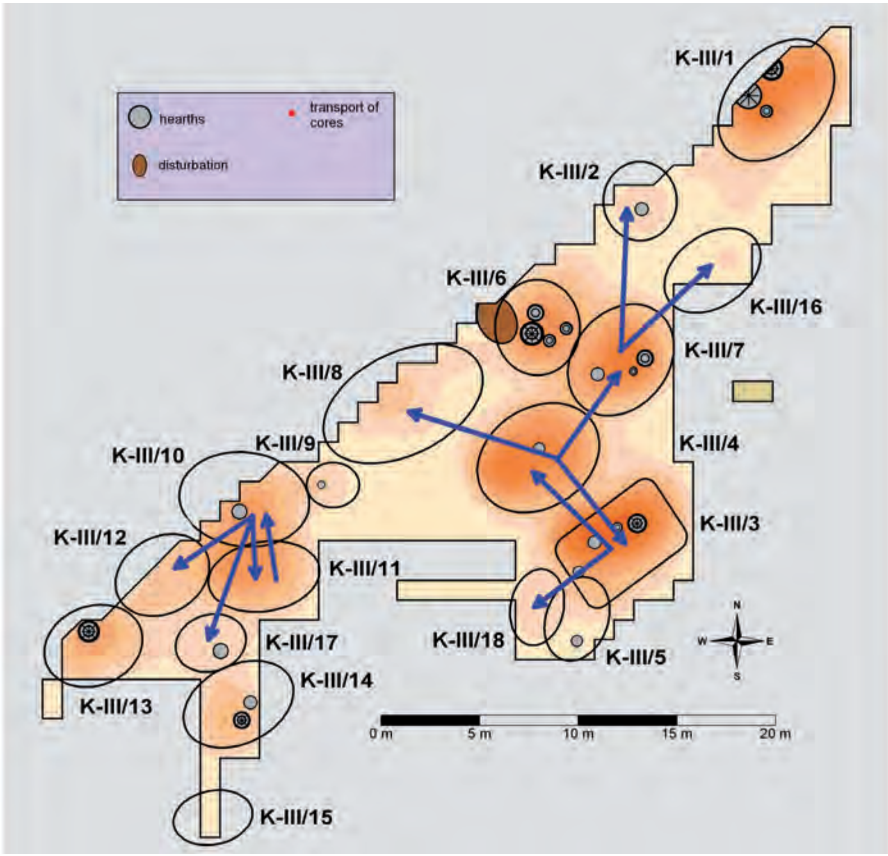

Fig. 19 – Siebenlinden. Layer III, Beuronien C: general transport of lithic artefacts.

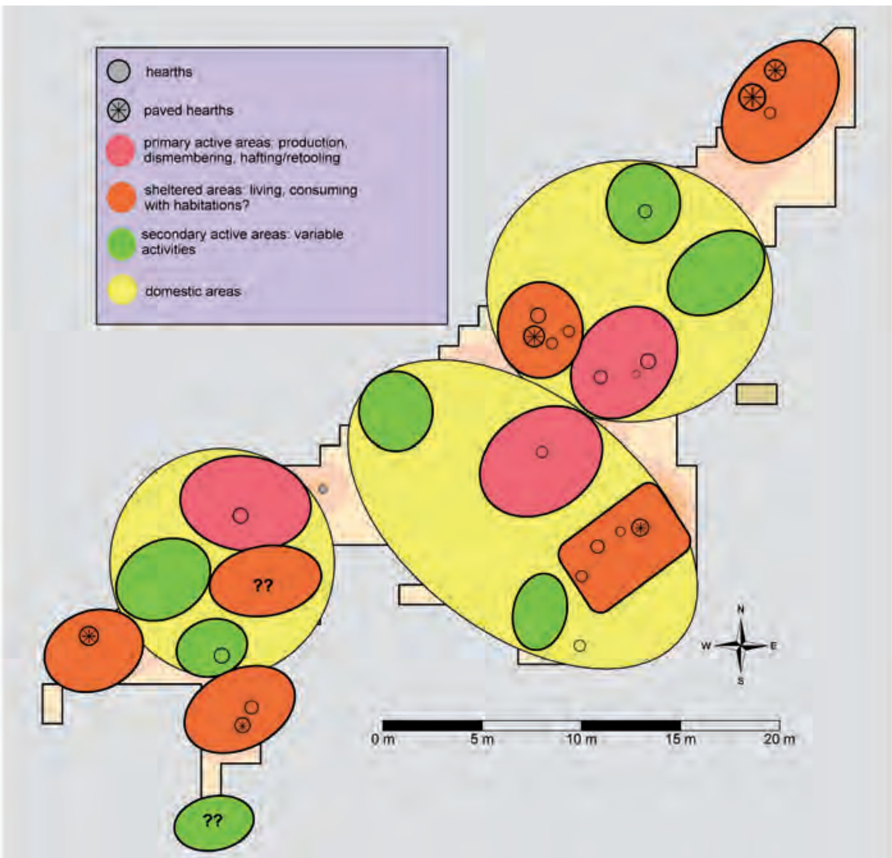

Fig. 20 – Siebenlinden. Layer III, Beuronien C: localisation of activities and domestic units.

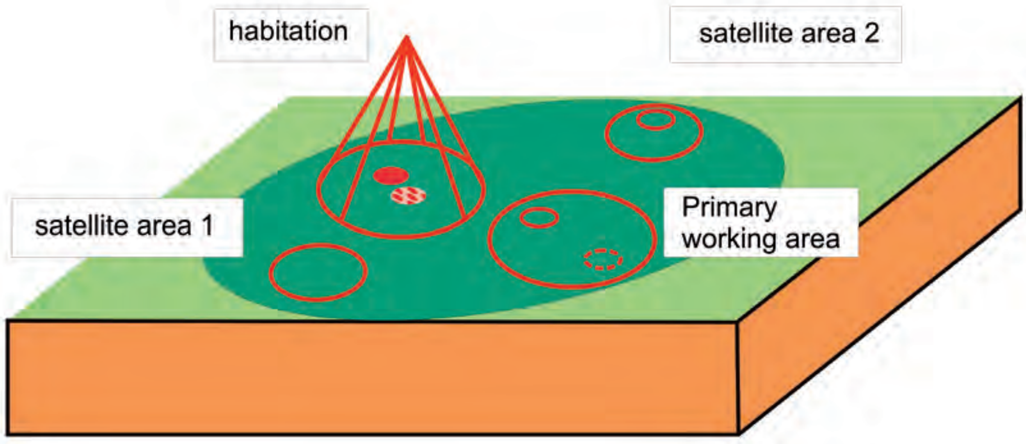

Fig. 21 – Siebenlinden. Layer III, Beuronien C: model of a Mesolithic domestic unit.

itants—possibly a family—lived inside these domestic areas. It was assumed that in layer II all inhabitants did the same things in the same places. In layer III, each of these smaller family groups was self-sufficient and carried out their activities in their own housing area. However, the different housing areas of the different families were connected by transported items.

SIEBENLINDEN 3-5, LAYER IV

Layer IV is dated to between 7700 and 8100 cal. BC in the early Boreal period. Among the microliths there are larger isosceles triangles and triangular points with bifacially retouched bases. These are diagnostic of the Middle Mesolithic which is called Beuronian B. The faunal remains are dominated by bones from aurochs and beaver. Also hundreds of burnt hazelnut shells were found.

The number of lithic artefacts is limited. The *chaîne opératoire* of the lithics is incomplete and artefacts from primary preparation and decortification are very rare. Raw material seems to be imported as active cores from which the artefacts found on the site were knapped. Endscrapers are missing. Microliths and microburins are present, but not very numerous. The bone fragments are sometimes very small and do not represent complete carcasses. Bones from meat-rich parts are often missing. Hundreds of burnt shells around a burning pit indicate the roasting of hazelnuts. Hazelnuts were an important part of the diet during Mesolithic times (Holst, 2010).

The layer seems to be the product of quite short occupations mainly connected to the acquisition of food resources (table 3).

The horizontal distribution of artefacts in layer IV shows six distinct small concentrations (fig. 22). Three of them (units IV/1, IV/3 and IV/4) yielded some lithic artefacts and some bone fragments in the vicinity of a simple hearth. A pit for roasting hazelnuts was also discovered in unit IV/3. Two other units (IV/2 and IV/6) are dominated

- Several lithic artefacts
  - incomplete *chaîne opératoire*
  - import of active cores
  - no tools of the fonds commun
  - few microliths and microburins
- Several bone fragments
  - incomplete carcasses
  - no bone/antler tools
  - few waste of production
- Numerous burnt hazelnut shells
- Few different activities
- Acquisition of food ressources
- Short duration of occupation

Table 3 – Siebenlinden. Layer IV, Beuronien B: general characterization.

by bone fragments while lithic artefacts are very rare or even missing.

Lithic refits, as well as the analysis of the worked nodules demonstrate that units IV/3 and IV/4, as well as units IV/1 and IV/2, are linked together (fig. 23). Stratigraphic observations, as well as available radiocarbon dates seem to indicate that the northern occupations in IV/1 and IV/2 are possibly slightly younger than the southern occupations in IV/3 and IV/4. This shows that layer IV is a palimpsest, the product of different occupations.

The network of connections demonstrates the transport of lithics between the contemporaneous units (fig. 24). It also becomes clear that a wider space outside the primary units was used during the occupations and therefore areas for off-site activities may be identified.

In sum, it can be demonstrated that the main find spots in layer IV only cover a limited area and were quite small (fig. 25). Sometimes two units are contemporaneous. The range of activities is also clearly limited. This fits with the interpretation of these units as being products of short occupations in several quite small camp sites.

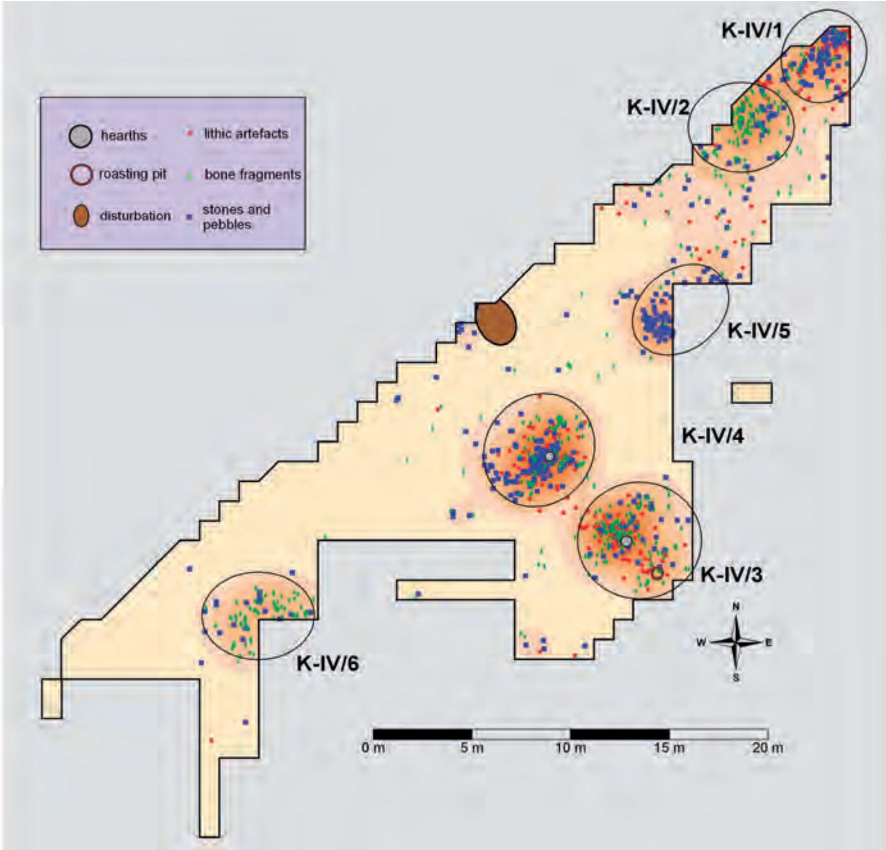

Fig. 22 – Siebenlinden. Layer IV, Beuronien B: horizontal distribution of finds.

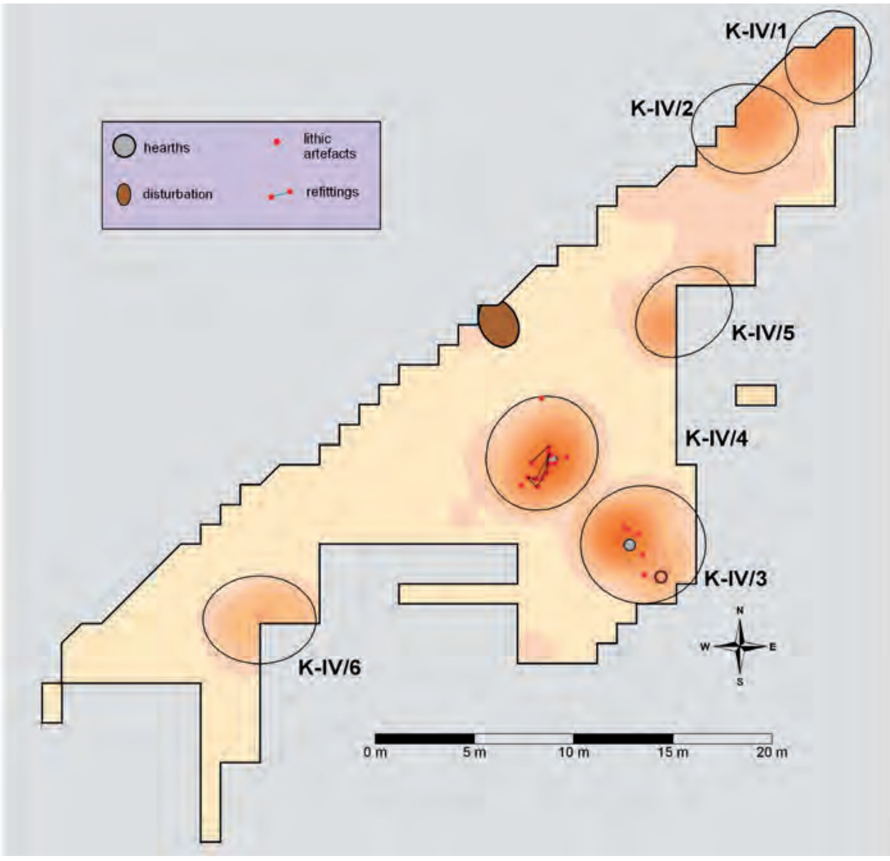

Fig. 23 – Siebenlinden. Layer IV, Beuronien B: horizontal distribution of lithic artefacts, nodule GH 1.

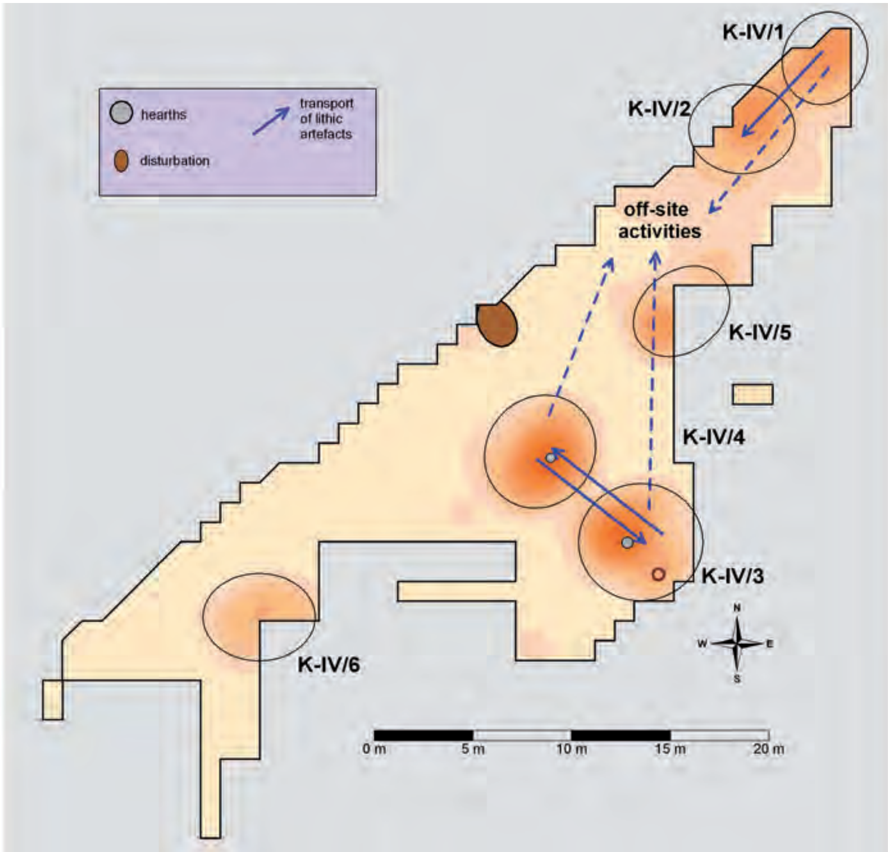

Fig. 24 – Siebenlinden. Layer IV, Beuronien B: general transport of lithic artefacts.

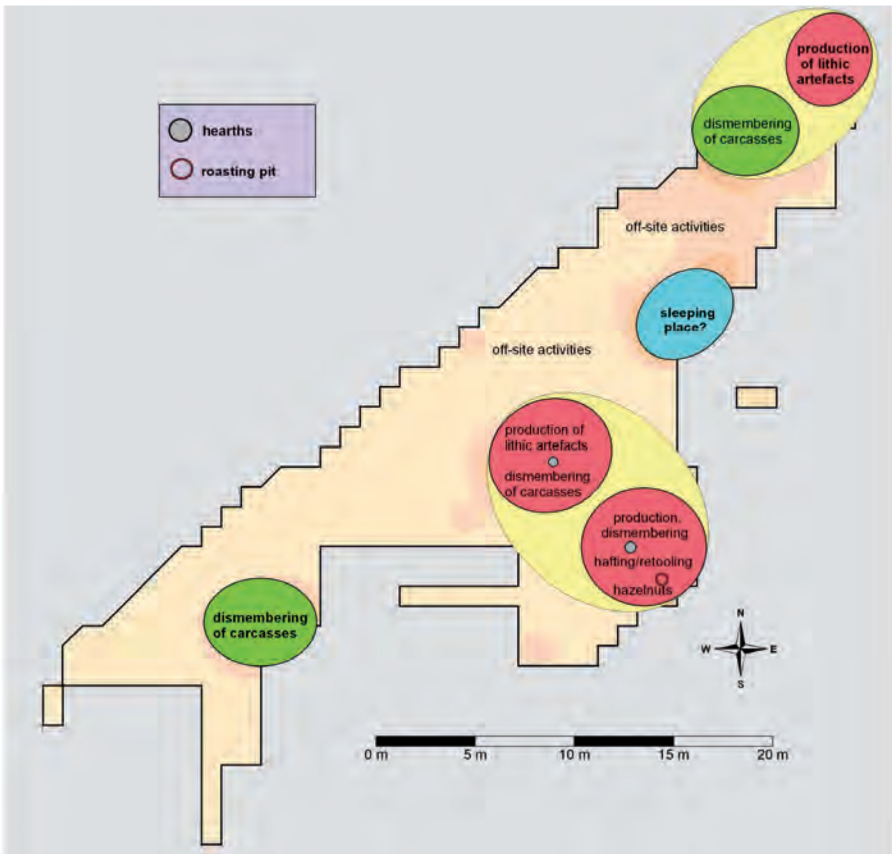

Fig. 25 – Siebenlinden. Layer IV, Beuronien B: localisation of activities.

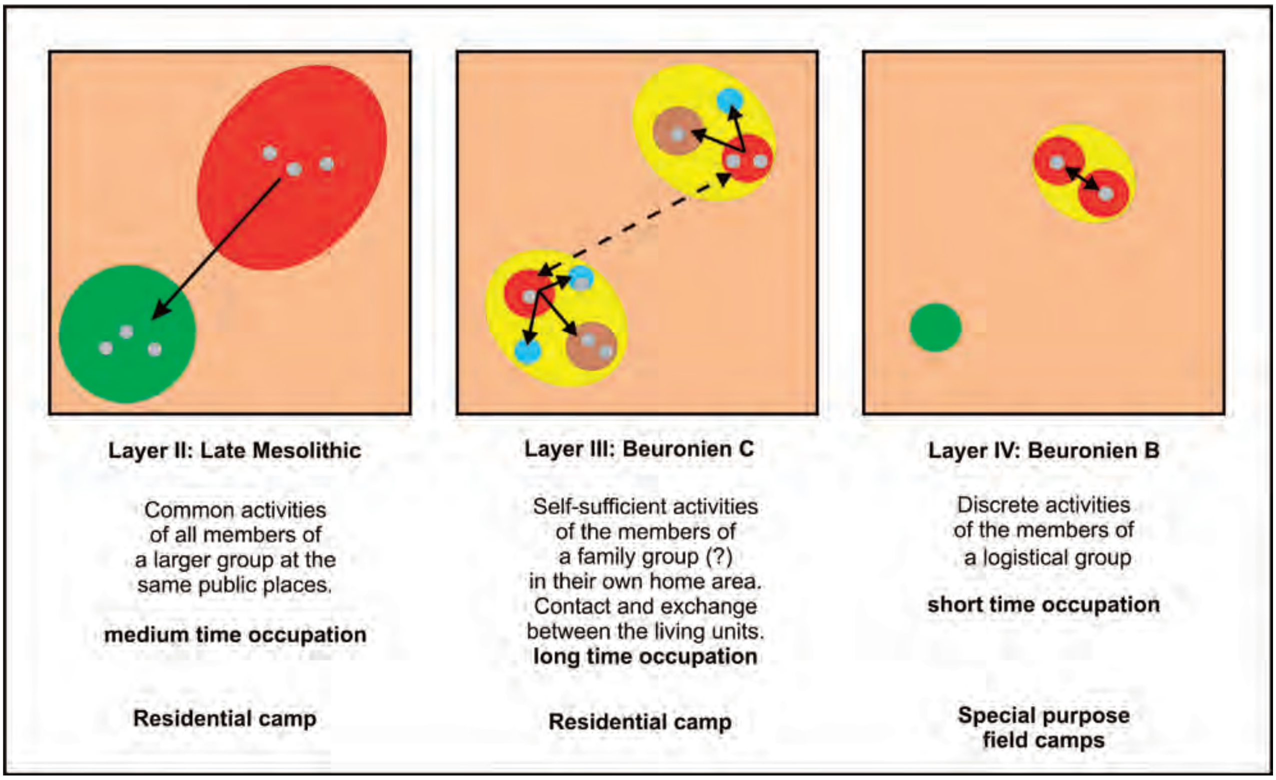

Fig. 26 – Siebenlinden. Organization of camp sites.

FINAL INTERPRETATION

In all three layers at Siebenlinden there are several indications of the season of occupation. All layers are the product of warm season occupations. Layer II and layer IV may be dated to occupations at the transition between summer and autumn while layer III is the product of a summer camp.

Finally, there are three different organizations of camp sites in three different layers (fig. 26). Layer II shows a limited number of quite large find concentrations with a quite large number of objects. One shows evidence of a range of different activities, while another one is mainly characterized by butchery activities and the dismembering of carcasses. Both concentrations are linked by the transport of lithic artefacts. Members of a larger group were obviously living together in a large camp site. All individuals of the group worked together at the same areas, thus these areas functioned as public places. The duration of the stay seems to be of a medium length.

Layer III shows a different organization. It is characterized by smaller concentrations, again with a large number of objects. Units having evidence for the production of lithic artefacts and dismembering carcasses are linked to possible dwelling units, as well as to satellite units. These three types of units define domestic structures which are connected to each other by transport activities. It seems that once again the members of a larger group were living together in a large camp site. However, the different families had a mostly self-sufficient supply of resources and were living and working in separate domestic structures. The duration of the stay seems to be long.

Finally, layer IV is characterized by smaller concentrations with a small number of objects. Units are sometimes connected by the transport of items. It seems that members of small groups of people were living in the different areas at different times. They carried out limited and discrete activities which can be defined as provisioning with food. The duration of these stays seems to be quite short.

The differences between layer IV on one hand and layers II and III on the other seem to relate to different statuses within the subsistence-settlement-system. The small units of layer IV may mostly represent what has been called a 'field camp' (Binford 1980)—a small task camp in a logistical system for the acquisition of resources.

On the other hand, layer II and III both represent larger camp sites which can be interpreted as base or residential camps (Binford, 1980; Newell, 2009, p. 59). They clearly show different organizations. Both camps were occupied in a similar season and in a similar environment with differences not connected to a different status in the subsistence-settlement-system. They therefore must be the product of a change in social behaviour between the Middle and Late Mesolithic.

Thus, a detailed analysis of archaeological layers allows us to not only answer typological or technological questions, but also helps us to identify different kinds of camp sites and even social systems.

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