Halbrucker E., Messiaen L. Denis S., Meylemans E., Crombé P. (2022) – Faceted tools within indigenous hunter-gatherer assemblages of NW Belgium: evidence of forager-farmer contact during the 5th millennium cal BC, *Bulletin de la Société préhistorique française*, 119, 4, p. 605-633.

Faceted tools within indigenous hunter-gatherer assemblages of NW Belgium: evidence of forager-farmer contact during the 5th millennium cal BC

Éva Halbrucker, Liesbeth Messiaen, Solène Denis, Erwin Meylemans, Philippe Crombé

Abstract: A recent exhaustive analysis of lithic assemblages from four wetland sites belonging to the 5th and early 4th millennium cal BC, all situated in the Lower-Scheldt basin of NW Belgium (East Flanders), has revealed the presence of numerous faceted tools. Unknown prior to the 5th millennium, these tools constitute a totally new type of tool within hunter-gatherer contexts of the Scheldt basin. Typologically, they seem to resemble similar tools found within Early Neolithic contexts in northern France and Belgium, suggesting some kind of connection between the last hunter-gatherers from the sandy lowlands and the first farmer-herders from the loess area. Within this paper, faceted tools from both communities will be presented and discussed in the light of the neolithization process of the Scheldt basin. For the first time, a large scale use-wear analysis was conducted on these artefacts.

Keywords: faceted tool, NW Belgium, forager-farmer contact, microwear analysis, lithic industry.

Résumé : Une étude exhaustive a été récemment conduite sur quatre assemblages lithiques provenant de sites découvertes dans les zones humides du bassin inférieur de l'Escaut, localisé dans le Nord-Ouest de la Belgique (Flandre orientale). Ces quatre sites datent du 5e et du début du 4e millénaire avant notre ère. L'étude a révélé la présence de nombreux outils facettés, complètement inconnus jusqu'alors. Ils constituent donc un type d'outil nouveau chez ces communautés de chasseurs-cueilleurs du bassin de l'Escaut. Or, ces outils sont connus chez les premières populations agro-pastorales du Bassin parisien et de Moyenne Belgique. Ils pourraient alors se révéler cruciaux pour mieux comprendre les rapports entretenus entre les derniers chasseurs-cueilleurs des basses terres sablonneuses des Flandres et les premiers agro-pasteurs néolithiques des régions lœssiques plus au sud.

Cet article propose une étude inédite de ces pièces facettées qui inclut, pour la première fois, une analyse tracéologique de grande ampleur. Celle-ci repose sur la constitution d'un premier référentiel expérimental. Ce référentiel rassemble 337 minutes d'utilisation concernant 13 outils facettés. Ils ont principalement été utilisés pour écraser et broyer. Ces outils expérimentaux ont été testés sur des céramiques, du grès, du poisson, des os frais et brûlés (vache et cerf), et des carcasses de canards colverts. Les céramiques ont été concassées sur une dalle de grès afin de produire du dégraissant de différentes granulométries. La surface de la même dalle de grès a ensuite été piquetée pour la raviver. Les outils expérimentaux ont également été utilisés pour retirer les nageoires et les têtes de plusieurs carpes. De plus, ils ont été employés pour extraire la moelle d'os frais. Une autre expérimentation a permis la production de dégraissant d'os brûlés. Enfin, deux outils ont été utilisés pour désarticuler les carcasses de deux colverts et écraser les os creux pour en extraire la moelle. La sélection des matériaux des enclumes constitue une autre variable prise en compte lors des expérimentations.

Sur cette base, 69 outils facettés archéologiques ont ensuite été analysés. 48 proviennent des sites mésolithiques du bassin inférieur de l'Escaut et 21 proviennent du site Blicquy/Villeneuve-Saint-Germain de Vaux-et-Borset localisé dans l'Est de la Belgique. Cela permet alors une comparaison directe entre les outils des communautés d'agro-pasteurs et des chasseurs-cueilleurs. Notre analyse s'est déclinée en deux volets : l'analyse typo-technologique basée sur des études antérieures a été enrichie de l'analyse tracéologique inédite.

Nos résultats montrent que ces outils facettés, innovation en contexte Swifterbant, représentent environ 10 % de la panoplie des outils chez ces communautés. Cette proportion est tout à fait comparable à celle des sites blicquiens du Hainaut et de Vaux-et-Borset. Les outils facettés apparaissent en très petites quantités à la fin du Rubané mais c'est durant la culture Blicquy/Villeneuve-Sait-Germain qu'ils se multiplient dans certaines régions, notamment le Bassin parisien et la Belgique où ils peuvent constituer jusqu'à 20 % des assemblages. Par ailleurs, les différentes catégories typo-technologiques distinguées dans les contextes BQY/VSG semblent également présentes dans le bassin de l'Escaut.

Article reçu le 23 mai 2022, accepté le 3 octobre 2022, publié le 31 décembre 2022.

Leurs proportions respectives sont difficilement comparables, car les catégories typo-technologiques doivent être précisées par les données fonctionnelles (résultats de l'analyse tracéologique). Mais quoiqu'il en soit, les formes et les dimensions semblent comparables entre les sites néolithiques et mésolithiques. Ainsi, il ressort de la présente étude que les outils facettés du bassin de l'Escaut présentent des similitudes morphométriques avec ceux découverts dans des contextes du Néolithique ancien dans la zone lœssique de la Belgique moyenne et du Nord de la France. Plus intéressante encore est l'analyse tracéologique menée sur ces artefacts. Ils semblent utilisés selon un mouvement caractérisé par une action dynamique rapide et assez puissante, comme l'écrasage, le martèlement, le piquetage ou le broyage. Les matériaux travaillés correspondraient essentiellement à de la matière dure animale. Le spectre des modalités d'utilisation de ces outils pourrait être un peu plus varié à Vaux-et-Borset que sur les sites mésolithiques.
Il s'agit ici d'une étude qu'il faudra bien évidemment poursuivre et enrichir à l'avenir afin de mieux comprendre le mode d'utilisation de ces outils et affiner alors les comparaisons entre les différentes communautés qui utilisent cet outillage nouveau. Cependant, on peut incontestablement lier cette innovation en contexte Swifterbant aux contacts entretenus avec les populations néolithiques de Moyenne Belgique. Ces dynamiques sont discutées à la lumière des récents résultats obtenus sur les processus de néolithisation du bassin de l'Escaut en Flandres orientales.

Mots-clés : outil facetté, nord-ouest Belgique, contact Mésolithique/Néolithique, tracéologie, industrie lithique.

INTRODUCTION: FACETED TOOLS AS A WITNESS OF CONTACTS BETWEEN HUNTER-GATHERERS AND AGRO-PASTORAL COMMUNITIES?

Recent studies conducted on hunter-gatherer wetland sites located in the Lower-Scheldt basin of NW Belgium (fig. 1) have all demonstrated contacts between these communities and the first farmers who settled on the loess area of Middle Belgium (Meylemans *et al.*, 2018 ; Crombé *et al.*, 2020 ; Messiaen, 2020 ; Teetaert, 2020 ; Halbrucker, 2021 ; Crombé *et al.*, 2022). In this paper, we will focus on one very peculiar element: lithic faceted tools. Their presence on sites belonging to the 5th and early 4th millennium cal BC marks an important break in the lithic record of the Scheldt basin (Messiaen, 2020 ; Messiaen *et al.*, 2022). Indeed, they constitute a totally new type of tool within hunter-gatherer contexts. This raises questions about the origin of this local innovation.

One hypothesis is related to contacts with the first agro-pastoral communities of the loess area in Middle Belgium (Messiaen, 2020). A production of faceted tools has indeed been documented in the Paris Basin and Middle Belgium, especially within the Blicquy/Villeneuve-Saint-Germain culture (Cahen, Van Berg, 1979 ; Cahen *et al.*, 1986 ; Allard, 1999 ; Denis, 2017 ; 2019). Although, the status of these tools and production is still discussed among researchers (Denis, 2019), the identification of this kind of tools within hunter-gatherer communities in the Lower-Scheldt basin reopens the debate about these artefacts.

Most archaeologists working on the Blicquy group (BQY hereinafter, post-LBK in Middle Belgium) consider these pieces as tools (Cahen, Van Berg, 1979 ; Constantin, 1985 ; Cahen *et al.*, 1986 ; Caspar, Burnez-Lanotte, 1994 ; 2008). "Polyhedrons" are then defined as "small blocks sculpted by short removals in all directions whose shape tends towards the sphere. [...] They cannot be exhausted cores because the removals they carry clearly respond to an intention of shaping and not to a will of flake production" (Cahen *et al.*, 1986). But research on the Villeneuve-Saint-Germain lithic industry (VSG hereinafter, post-LBK in the northern half of France) did not initially lead to the same diagnosis, considering this type of artefact as cores (Bostyn, 1994 ; Augereau, 2004), until the work of Pierre Allard on Bucy-le-Long sites (Allard, 1999). Metric analysis of the flake tools and the negatives of removals on the cores/faceted pieces helps to distinguish artefacts whose removal negatives are incompatible with the modulus of the tool blanks objectives. Consequently, these faceted pieces may not be interpreted as cores but as tools (Allard, 1999 ; Denis, 2019). Furthermore, specific characteristics are identified on these faceted pieces: fine retouching of the edges; concentration of impact points, sometimes very far from the edges, whose concentration creates sometimes hammered surfaces; crushing of the edges; hammered/pecked surfaces (fig. 2). These traces could be related to their use which is also supporting the idea that they are tools. Different types have been distinguished on a typo-technological perspective: polyhedrons, faceted denticulated pieces, faceted flakes, and faceted debris (Allard, 1999 ; Denis, 2019). A comparison at the scale of the BQY/VSG cultural entities demonstrates an important variability of the simple productions (Denis, 2019) and the absence of these faceted tools in certain geographical area, e.g. Normandy (Devaux, 2016 ; Biard, Riche, 2017) and probably Northern France (Praud *et al.*, 2018). Finally, the lack of systematic use-wear analysis on these pieces has been underlined as an important gap to better understand these tools and to support their individualization in the archaeological series.

Indeed, very limited use-wear analyses have been conducted so far. Observations on BQY/VSG faceted tools were essentially conducted by Jean-Paul Caspar on the site of Vaux-et-Borset (Hesbaye), but no specific publication was dedicated to a detailed presentation of this study. Some hints can be found in Caspar and

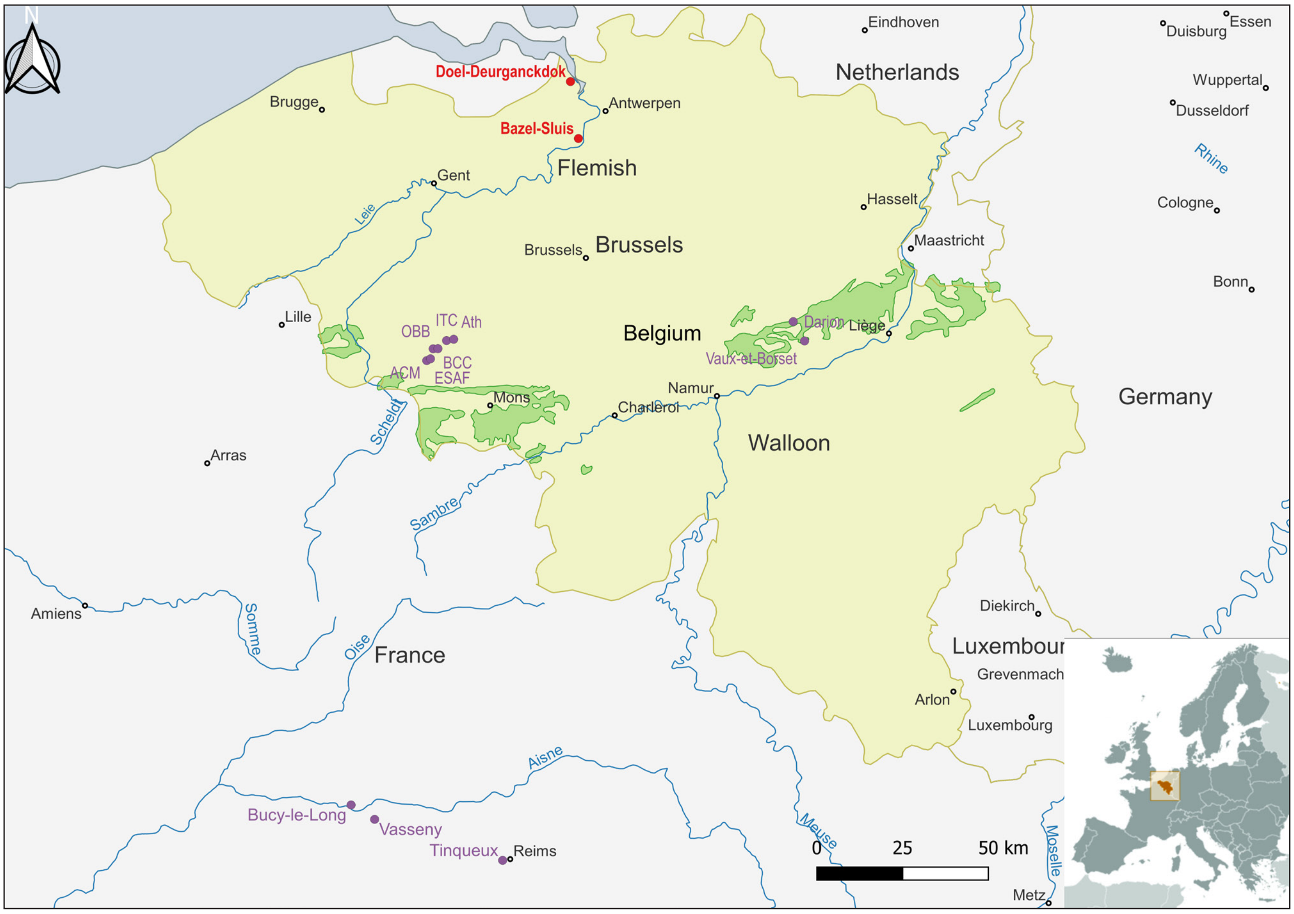

Fig. 1 – Map of research area : Swifterbant sites with red, Blicquy/Villeneuve-Saint-Germain sites mentioned in this study with purple.

***Fig. 1** – Carte de la zone d'étude : en rouge, les sites Swifterbant et en violet, les sites Blicquy/Villeneuve-Saint-Germain mentionnés dans le texte.*

Burnez-Lanotte, 1994 and 2008. The results suggest that these polyhedrons would have been used as strike-a-lights (Caspar, Burnez-Lanotte, 2008). Nevertheless, the authors also mention that 30 % of these tools also show traces of crushing, which would indicate that they were used by direct percussion on soft (shale or marcasite) or hard (flint), or medium hard material (sandstone). Another study mentions that some denticulated pieces, which have a core shape ("denticulé nucléiforme", Cahen *et al.*, 1986) and could probably be compared to faceted denticulated pieces, were used to work wood essentially by transversal actions (Cahen *et al.*, 1986).

Thus, no consensus is existing yet whether it be from a typo-technological or functional perspective. The discovery of similar faceted tools in the Lower-Scheldt area reopens these issues, especially thanks to the necessity of a better understanding of the relationships between Mesolithic and Neolithic communities. Due to the non-predetermined *chaîne opératoire* of faceted tool production, fine typo-technological comparisons are not easy. In that regard, our study is relying on a unique use-wear analysis conducted on artefacts coming from both cultural contexts.

MATERIAL AND METHOD

Site and sample selection

Sandy lowland (Lower-Scheldt basin)

The four studied sites are situated in the floodplain of the Lower-Scheldt river and are well-preserved thanks to their sealing with peat and (peri)-marine clay (fig. 1). Three sites were discovered on inland coversand ridges during the construction of a large dock in the harbor of Antwerp, called the Deurganckdok. Site B and M in the Deurganckdok yielded archaeological remains (burned bones, lithics, pottery, ...) belonging to the Swifterbant Culture, with minor admixture with respectively Final Palaeolithic (*Federmesser* Culture) and Early Mesolithic artefacts (Crombé *et al.*, 2002 ; Crombé, 2010). Site B consists of six individual artefact loci/sectors (B-1 to B-6), most of which could only be partially excavated due to the harbor works. The radiocarbon dates cover the entire second half of the 5th millennium cal BC, from ca. 4500 till 3990 cal BC. Site M yielded two artefact clusters, also partially destroyed by the construction works, dated between ca. 4575 and 4040 cal BC. Although the occupation duration is similar for both sites, the main

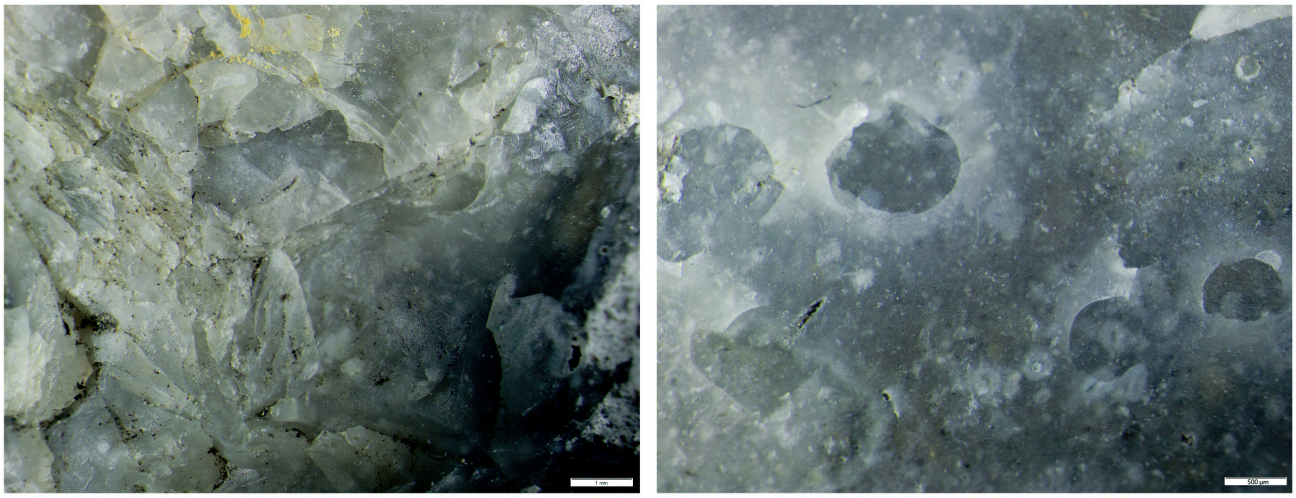

Fig. 2 – Close-up of macroscopically visible damage on faceted tools from Doel B-1: crushing (left, 20x magnification) and impact points (right, 50x magnification).

***Fig. 2 –** Détails des traces macroscopiques visibles sur les outils facettés de Doel B-1 : écrasements (à gauche) et points d'impact (à droite).*

Typology	Doel B	Doel M	Doel C	Bazel
Chips	11584	1096	176	41301
Tools	341	153	30	1167
Artefacts with use traces	93	56	8	456
Flakes	1166	416	67	6518
Blade(let)s	318	120	25	2957
Undetermined artefacts	247	57	4	2584
Cores	9	0	0	52
Preparation/Rejuvenation	21	6	2	187
Microburins	2	0	0	138
Knapping accidents	7	0	1	58
Debris	274	102	8	832
Chips with retouches	32	0	1	38
Miscellaneous	9	2	1	4
Total	**14103**	**2008**	**323**	**56292**
Older Mesolithic tools	2	8	0	69

Table 1 – General typological composition of the lithic assemblages at Doel-Deurganckdok and Bazel-Sluis.

***Tabl. 1 –** Classement typo-technologique des assemblages lithiques de Doel-Deurganckdok et Bazel-Sluis.*

occupation in site B situates in the third quarter of the 5th millennium, contrary to site M which centers around the fourth quarter. Finally, site C in the Deurganckdok yielded a small lithic assemblage (Table 1) dated to 4193/3952 cal BC and 3973/3721 cal BC, and culturally linked to the Michelsberg Culture/Spiere group (Crombé *et al.*, 2002).

The fourth site, Bazel-Sluis, situates on a levee or scroll-bar bordering a paleochannel of the Scheldt river (Deforce *et al.*, 2014 ; Crombé *et al.*, 2015 ; Meylemans *et al.*, 2016). Contrary to the Deurganckdok-sites, the site of Bazel has been discontinuously occupied over a very long time-period, from the Early Mesolithic till the Middle Neolithic. A total of 115 radiocarbon dates (fig. 3) situates these occupations from the 8th until the mid-4th millennium cal BC, with a hiatus in the 7th and most of the 6th millennium cal BC (Crombé *et al.*, 2019). Clearly, the main occupations took place between the late 6th and mid-4th millennium cal BC, corresponding to the Late Mesolithic, Swifterbant and Michelsberg cultures (Crombé *et al.*, 2015). In addition, and contrary to the Doel-sites the successive occupations at Bazel occurred on the same spot, i.e. on the top of the levee/scroll-bar. Due to severe and long-term bioturbation (Crombé *et al.*,

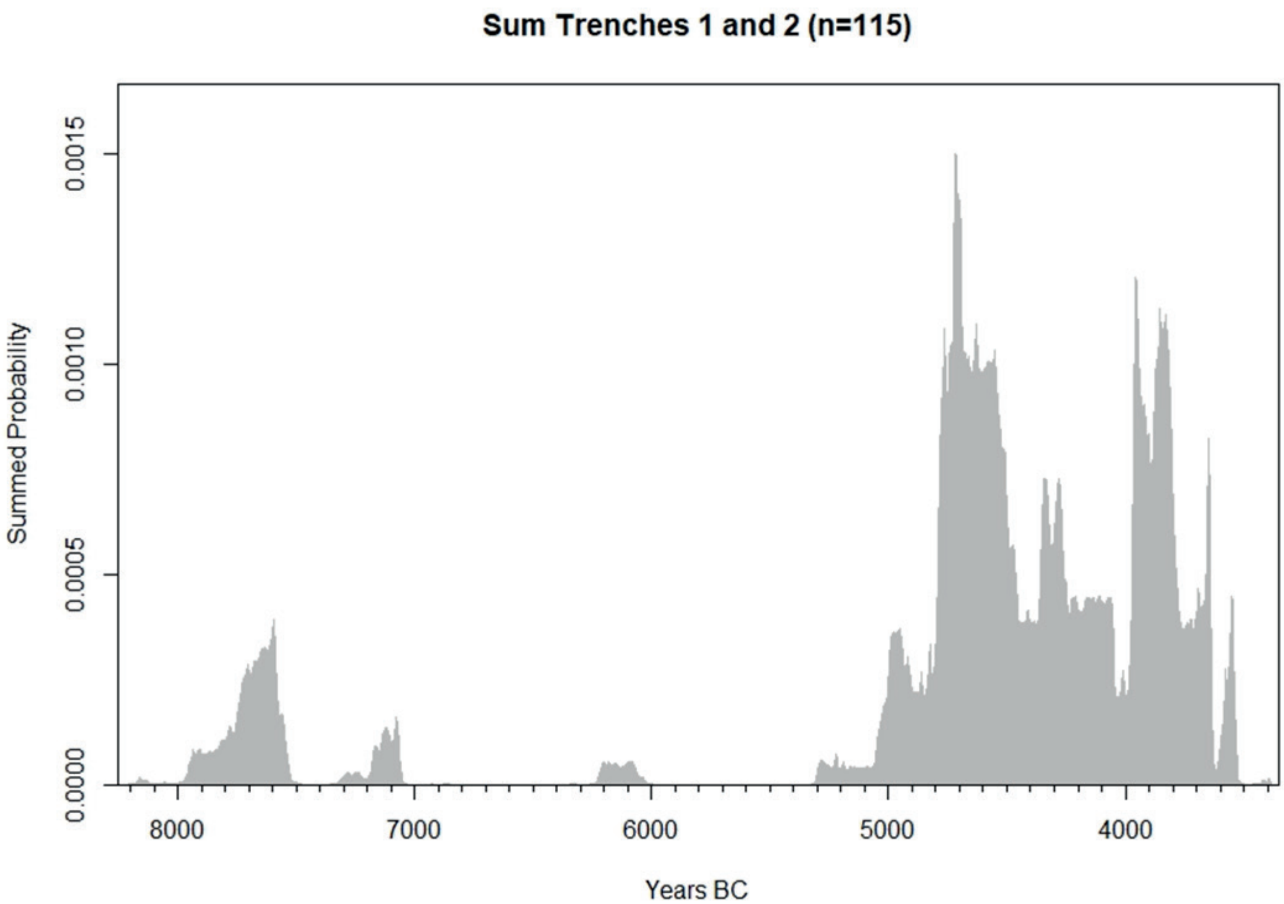

Fig. 3 – Sum plot of the radiocarbon dates from Bazel-Sluis. Prepared in OxCal v. 4.3 using the IntCal13 calibration curve date (Bronk Ramsey, 2009 ; Reimer *et al.*, 2013). Plot by E. Van Maldegem (Ghent University).

***Fig. 3 –** Graphique cumulé des dates radiocarbone de Bazel-Sluis. Préparé dans OxCal v. 4.3 en utilisant la courbe IntCal13 (Bronk Ramsey, 2009 ; Reimer* et al.*, 2013). Graphique par E. Van Maldegem (Université de Gand).*

2019) the settlement remains of these different occupation events, comprising over 56,200 lithic artefacts (Table 1), got mixed up, leading to the formation of a huge cumulative palimpsests. Despite the presence of a phantom/latent stratigraphy it has turned out to be impossible to separate these remains according to the different occupation events.

There are animal remains recovered from all sites, in different stages of conservation. From Bazel, the most important wild species are hare (*Lepus capensis*), beaver (*Castor fiber*), red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), aurochs (*Bos primigenius*) and (probably) wild boar (*Sus scrofa*) (Meylemans *et al.*, 2016). In addition there are a few remains of domesticated animals, such as sheep/goat, and possibly also cattle and pig (Crombé *et al.*, 2020). At the Doel sites, only burnt animal remains have been preserved (Van Neer *et al.*, 2013). These consist of a high amount of fish bones, e.g. roach (*Rutilus rutilus*), bream (*Abramis brama*), rudd (*Rutilus erythrophtalmus*), sturgeon (*Acipenser spp.*), shad (*Alosa sp.*) and some highly fragmented mammal bones. The identified species are red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), marten (*Martens sp.*), wild boar (*Sus scrofa*), and polecat.

Loess area of Northern France and Middle Belgium

For comparison, we will use data from some sites of the first farmer-herders of the Paris Basin and Middle Belgium (fig. 1), where faceted tools have been studied: Bucy-le-Long (Allard, 1999), Vasseny (Denis, 2019), and Tinqueux (Hachem *et al.*, 2021) in the Paris Basin, and the BQY sites from Hainaut, and Vaux-et-Borset (Denis, 2017). The BQY/VSG follows the initial LBK neolithization in North-Western Europe, and constitutes the final stage of Neolithic colonization in Northern France. Radiocarbon dates place it between 4950 and 4650 cal BC (Dubouloz, 2003). In Middle Belgium, two occupation areas can be distinguished: the Dendre sources (Hainaut), where around 20 sites from LBK and BQY/VSG have been discovered (Constantin, 1985; Deramaix *et al.*, 2018) and the Hesbaye, densely occupied during the LBK (Jadin, 2003; Meylemans *et al.*, 2018) and much less occupied during the BQY/VSG (2 sites, Jadin, 2003 ; Caspar, Burnez-Lanotte, 2008). The Early Neolithic settlements consist of villages whose extension varies according to the number of house plans identified. The waste material, generally coming from the side dwelling pits of houses, is rich. In Belgium, more than 100,000 lithic artefacts have been identified for the BQY groups.

N° Piece	Inventory number	Pit	Quadrant	Depth	Raw material	Lenght	Width	Thickness	Weight
1	76	VBT90.2	B	50-80	Campanian	47	37	31	72
2	24	VBT90.2	A	30-40	Campanian	49	42	27	71
3	31	VBT90.2	D	50-60	Campanian?	68	43	34	135
4	93	VBT90.2	D	60-80	Campanian	43	35	23	38
5	2428	VBT90.2	A	80-90	Campanian	45	44	37	89
6	2429	VBT90.2	C	30-40	Campanian	44	30	25	47
7	2430	VBT90.2	D	40-50	Campanian	36	31	22	33
8	2431	VBT90.2	D	20-30	Campanian	31	46	28	59
9	2432	VBT90.2	B	20-30	Campanian	37	31	27	27
10	2433	VBT90.2	C	50-60	Campanian	47	36	33	63
11	2434	VBT90.2	A	20-Oct	Campanian	41	30	24	25
12	2435	VBT90.2	indet	60-70	Campanian	36	33	27	29
13	2436	VBT90.2	A	20-30	Campanian	55	45	39	102
14	2437	VBT90.2	D	50-60	Campanian	42	35	28	41
15	2438	VBT90.2	A	20-30	Campanian	51	50	38	116
16	2439	VBT90.2	A	20-30	Campanian	40	35	19	31
17	2440	VBT90.2	C	30-40	Campanian	39	35	30	40
18	156	VBT90.2	A	20-30	Campanian	27	27	23	22
19	156	VBT90.2	A	50-60	Campanian	33	32	37	47
20	156	VBT90.2	B	40-60	Campanian	34	29	22	25
21	156	VBT90.2	D	60-80	Campanian	36	33	25	35

Table 2 – Inventory of the 21 artefacts from Vaux-et-Borset selected for this study.

***Tabl. 2 –** Inventaire des 21 artefacts de Vaux-et-Borset sélectionnés pour cette étude.*

The two areas of occupation are almost at equal distance from the hunter-gatherer sites of the Lower-Scheldt basin, and the raw material procurement on the latter demonstrates their incursion on both territories, with silicites from the Mons Basin on the Hainaut and Wommersom quartzite for the Hesbaye site (Messiaen, 2020 ; Messiaen *et al.*, 2022). To achieve direct comparisons between faceted tools from Mesolithic and Neolithic communities, 21 artefacts from the BQY site of Vaux-et-Borset (Hesbaye) were studied for this paper (Table 2).

There are only minimal to no bones preserved at LBK and BQY sites in Belgium due to the acidity of the soil. At Vaux-et-Borset, only small pieces of burnt bones were recovered, from which 69 could be determined and 49 were identified as cattle (*Bos sp* and *Bos taurus*) (Hachem, 2001).

Typo-technological approach

The typo-technological approach has been described elsewhere (Allard, 1999; Denis, 2019). To summarize, the most important element to identify these faceted tools is the inconsistency of the dimensions of their removal negatives with the dimensions of flake blanks in case of the coexistence of flake production in the same assemblages. The presence of macro-traces (retouch and scarring marks, concentration of impact points far from the edges, crushed and pecked surfaces) which do not seem to be associated with the debitage is also one of the arguments. It seems that the more exhausted are the pieces, the more these macro-traces are developed (Hachem *et al.*, 2021). Indeed, when the blocks/cores reached dimensions that are not (anymore) in line with the dimensions of the flake tools, they more frequently display these macro-traces. The analysis of diacritical sketches suggests a slightly higher frequency of bidirectional and multidirectional patterns for tools than for cores (Denis, 2019). To build the diacritical sketches and to understand the shaping of these tools, we are trying to consider only the intentionally chipped removals and not the ones obtained during the use of the tools. Those removals are mainly characterized by split fractures. Furthermore, very small retouches or scars are excluded from the sketches.

For the sites situated in the Lower-Scheldt basin, four kinds of faceted tools have been distinguished according to the blanks used and the organization of the faceting (intensity, direction): polyhedrons, faceted denticulated pieces, faceted flakes, and faceted debris (fig. 4, and fig. 5).

At Vaux-et-Borset, we distinguish six different typo-technological categories. The first one consists of small pieces, often faceted by bifacial removals with high intensity of macro-traces, especially impact points (fig. 6, no 1). Their shape tends toward spheres, and the edges present macro-traces. The second one includes pieces without macro-traces and with negatives that have a

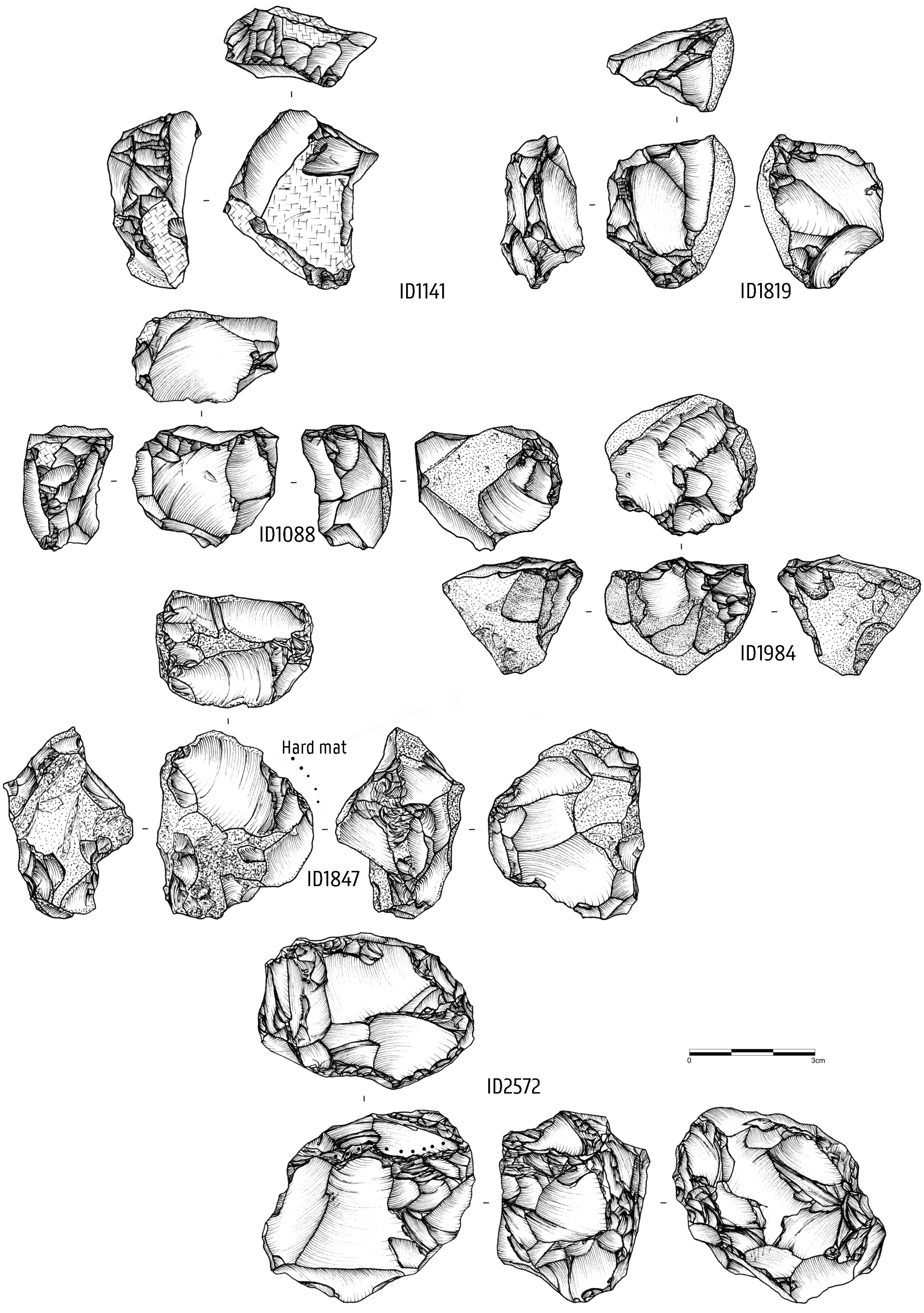

Fig. 4 – Faceted tools from Doel M-2: ID2572 probable discarded core of Campanian Hesbaye flint, used to crush bone; and Doel B-1: ID1141, ID1819, ID1088, ID1984, ID1847 used on hard material (drawings: G. Noens).

Fig. 4 – *Outils facettés de Doel M-2 : ID2572, probable reprise d'un nucléus arrivé à exhaustion, silex Campanien de Hesbaye, utilisé pour écraser de l'os; et de Doel B-1 : ID1141, ID1819, ID1088, ID1984, ID1847 sont utilisés sur des matières dures (dessins : G. Noens).*

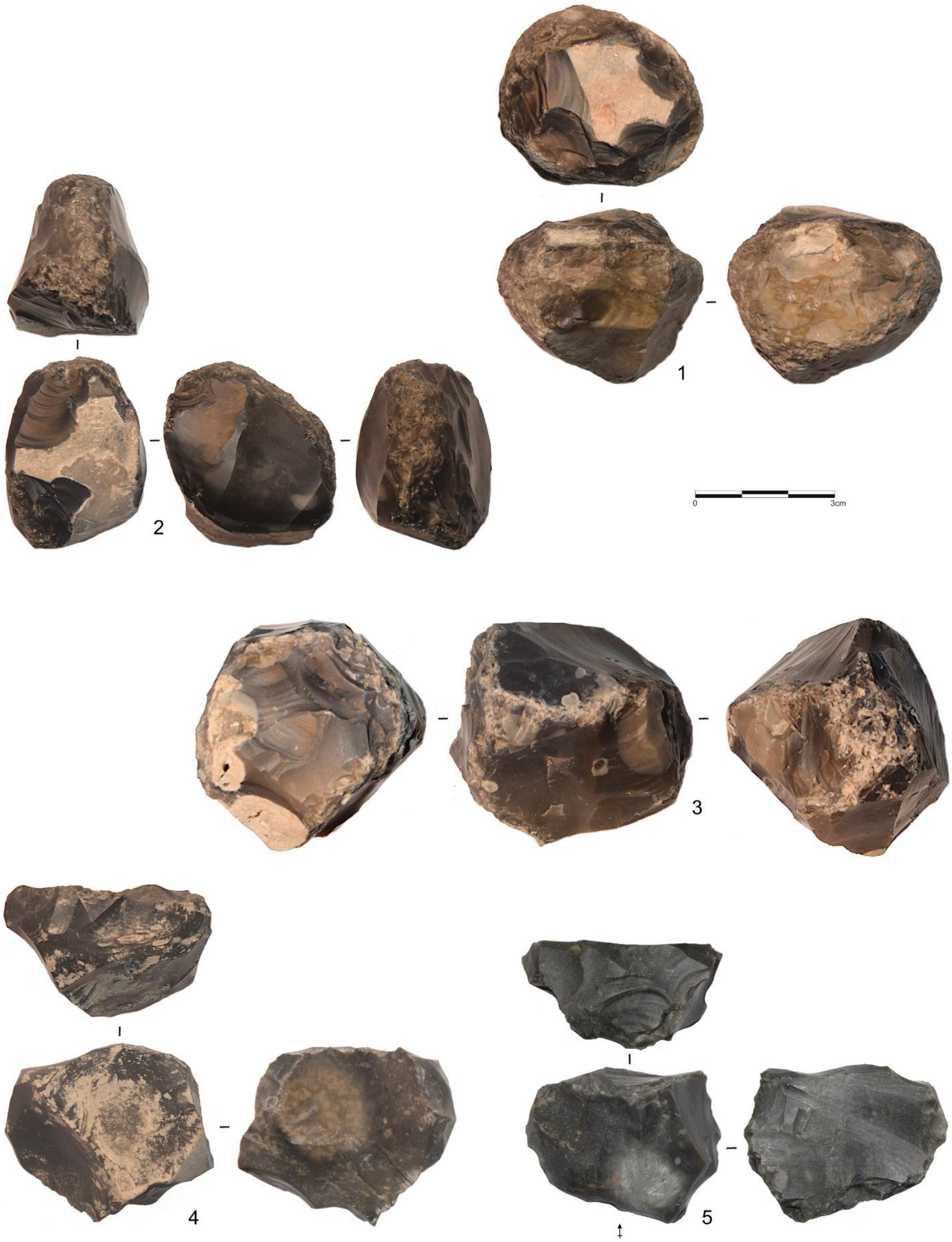

Fig. 5 – Bazel-2: Selection of flint faceted tools: **1**-**3**, polyhedrons with visible use-wear, **4**, faceted debris and **5**, faceted flake.

Fig. 5 – *Bazel-2, sélection d’outils facettés en silex :* ***1****-****3****, polyèdres avec traces d’utilisation,* ***4****, débris facetté et* ***5****, éclat facetté.*

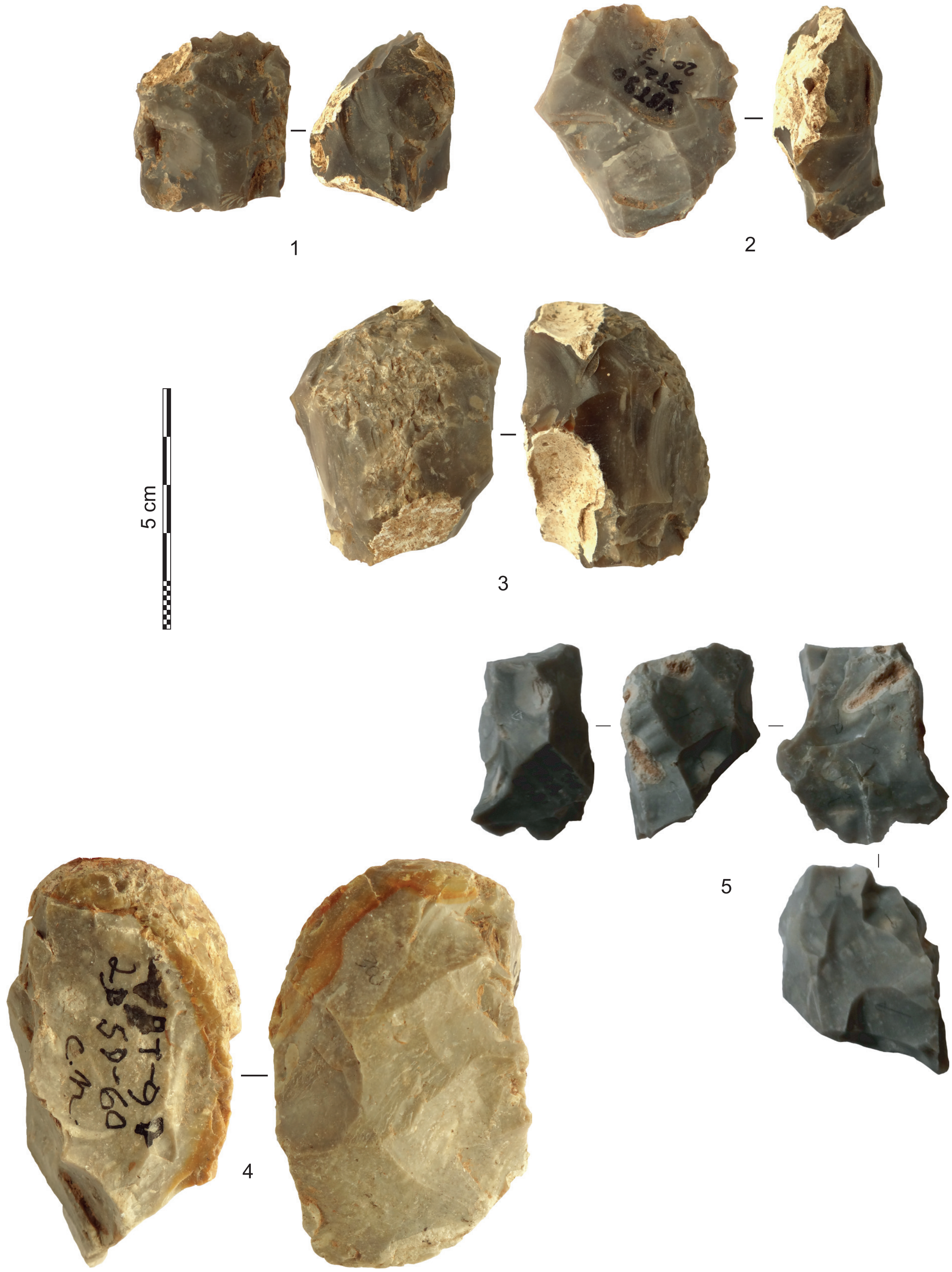

Fig. 6 – Typological groups from Vaux-et-Borset: **1**, polyhedron shaped by bifacial removals, high intensity of macro-traces; **2**, faceted denticulated piece; **3**, faceted tool with triangular or trapezoidal section with macro-traces localized on the transversal edges (polyhedron family); **4**, faceted tool with triangular or trapezoidal section with macro-traces localized on one extremity; **5**, spheroid piece without any macro-traces (polyhedron family).

***Fig. 6 –** Groupes typologiques identifiés à Vaux-et-Borset : **1**, polyèdre façonné par des enlèvements bifaciaux, macro-traces d'utilisation nombreuses ; **2**, denticulé facetté ; **3**, outil facetté à section triangulaire ou trapézoïdale avec macro-traces localisées sur les arêtes longitudinales (famille des polyèdres) ; **4**, outil facetté à section triangulaire ou trapézoïdale avec macro-traces localisées à une extrémité; **5**, pièce sphéroïde sans macro-trace (famille des polyèdres).*

maximal length which could be in line with flake tools. They are interpreted as exhausted cores. The third category corresponds to the denticulated pieces (fig. 6, no 2). The small negatives of removals (retouches) are bifacial, and these pieces have very few macro-traces. The fourth category presents pieces of larger dimensions, with triangular or trapezoidal section (fig. 6, no 3). High intensity of traces is notable, and they are mostly confined on a dorsal ridge. One piece has the same shape, but the traces are localized on one extremity and hence is distinguished in a category 6 (fig. 6, no 4). The fifth category corresponds to a spheroid piece with very small negatives of removals (less than 20x20 mm) but with almost no traces (fig. 6, no 5). Categories 1, 4 and 5 could correspond to polyhedrons but category 1 is clearly smaller and macro-traces seem not localized at the same place, i.e. along the edges for category 1 and on the (dorsal) ridges for category 4.

Functional analysis

Use-wear analysis of faceted tools

For this study an extensive, detailed microwear analysis was carried out. Within the Lower-Scheldt basin 48 faceted tools from Bazel (n=27 from a total of 89), Doel B-1 (n=16 from a total of 39) and Doel M-2 (n=5 from a total of 18) have been selected for this study. The selection was influenced by the size of the specimens, as the larger pieces did not fit under the metallographic microscope. The tools are very well-preserved, chemical or mechanical alteration traces were not detected. For Vaux-et-Borset a selection of 21 tools was analyzed. They were selected from the same pit and were representative of the variability existing (different shapes/size) to prevail the potential diversity of activities conducted in one household.

The tools were analyzed according to a combination of the methods established by Semenov (1964) and Keeley (1980) and used by many researchers since (e.g. Vaughan, 1985 ; Van Gijn, 1990). It is a combination of the so-called low-power (1-50x magnification) and high-power (50-1000x magnification) approach. Two microscope systems were used to analyze the microwear traces. For the low-power approach, an Olympus SX7 stereomicroscope was used with magnifications ranging from 8x to 56x. Micrographs were taken by an Olympus SC100 camera and processed by the Olympus Stream Basic 1.9.4 software. For the high-power approach, an Olympus BX53 metallographic microscope was used with a Nikon D750 DSLR camera and Best Scientific 1.9X coupler. Micrographs were captured with Helicon Remote software and processed with Helicon Focus software. The use of 500x magnification was hindered by the working distance of the objective, which was limited to approximately one mm. The use of dental silicon casts was avoided, as we wanted to preserve the present residues on the tools for future analyses. All pieces were regularly cleaned with 96 % alcohol and/or lighter fluid during the examination. Edge damages were registered with both the stereo and the metallographic microscope. Polish attributes (texture, topography, brightness, distribution, directionality and location) were assessed under the reflected light microscope. Striations were also noted according to attributes such as width, depth and length.

Experiments with faceted tools

Experiments are mainly used in material culture studies to replicate past activities and tools. Here experiments were carried out because previously unknown traces were identified, and experiments are the only way to get a grasp on the possible causes behind these traces. As the raw material of the tools influences the development of traces, the raw materials were selected to match raw materials from the studied archaeological sites, in particular those from the Scheldt basin. Tools were knapped with replica hammers (stone and antler) using direct percussion. The tools were used by bare hand (sometimes gloves for hygienic reasons). The experiments were carried out as controlled field experiments. The controlled parameters were time, contact material, raw material of tool, and movement. Other parameters were also monitored, such as the expertise level and the dominant hand of user, damage of the tools during use, and personal comments, such as anvil used or not, type of anvil, with or without gloves.

In total, 13 experimental faceted tools were used for a total of 337 minutes. They were used mostly in crushing, but also in grinding and wedging motions. These experimental tools were tested on ceramics, sandstone, fish, fresh and burnt bone, and mallards. The reader is referred to Table 3 for details on the experiments.

The terms used to describe the motions will be described below to help understanding the exact actions carried out.

Crushing refers to a fast, powerful, dynamic hitting action carried out repeatedly in a more or less straight line from up to down, ended with a push on the surface.

Grinding refers to the movement when one pushes the tool on the surfaces of the worked material and turns it to a direction repeatedly with force.

Wedging is used for the hitting action with a lot of force aimed to the same spot. It is repeated quickly for many times.

Pecking is used for a softer, repeated hammering of the surface of the contact material with the aim of chipping of small bits.

Battering is used for a similar movement to pecking just with more force.

Butchering is as a collective term to skin and dissemble mallards. The complete process was carried out with multiple tools, also with blades. In fact, faceted tools were mainly used to break joints. During which both wedging and crushing were used with finer, softer, more cutting-like movements.

Ceramics were crushed/grinded on a surface of a sandstone slab in order to produce temper in different

No	Tool type	Subtype	Raw material	Contact material	Used for	Action type
1180	faceted tool	polyhedron	Vlissingen	fired ceramic	30	crushing/grinding
1181	faceted tool	polyhedron	Bouvines	fired ceramic	30	crushing/grinding
1182	faceted tool	faceted flake	Bouvines	fired ceramic	30	crushing
1183	faceted tool	polyhedron	Bouvines	fired ceramic	30	crushing
1184	faceted tool	polyhedron	Vlissingen	sandstone	15	pecking/battering
1185	faceted tool	polyhedron	Haubourdin	sandstone	29	pecking/battering
1186	faceted tool	polyhedron	Spiennes H	fired ceramic	30	crushing/grinding
1187	faceted tool	polyhedron	Haubourdin	unfired pot	27	crushing/grinding
1240	faceted tool	polyhedron	Haubourdin	fish	21	crushing
1241	faceted tool	faceted debris	Haubourdin	fresh bone	16	crushing
1242	faceted tool	polyhedron	Haubourdin	burnt bone	60	crushing
1243	faceted tool	polyhedron	Bouvines	mallard	7	crushing
1246	faceted tool	polyhedron	Spiennes H	mallard	12	crushing

Table 3 – Details of experiments carried out with faceted tools. Numbers in “used for” stand for the duration of time of use in minutes.

***Tabl. 3 –** Détails des expérimentations conduites avec les outils facettés.*
La colonne intitulée « used for » fait référence au temps d'utilisation en minutes.

grain sizes (fig. 7, no 2). The surface of the same sandstone slab was later worked by pecking/battering in order to rejuvenate the working platform (fig. 7, no 4). In the fish experiment, the tool was used to remove the fins and the heads of multiple carps bought from Hungarian fisheries (fig. 7, no 1). For fresh bone, a long bone of a modern cow was used (fig. 7, no 6). The bone was worked on top of an fieldstone (glauconite-bearing silicified sandstone; Messiaen *et al.*, 2018) anvil in order to extract the marrow. However, we did not succeed in this, which could be caused by the size of the used tool, the used force, and/or the lack of experience in executing this kind of task. In the burnt bone experiments, bones of a deer were crushed and grinded on top of the fieldstone anvil to produce temper (fig. 7, no 3). Two tools were used in the butchering of two mallards. They were used to dissemble the carcasses and later to crush the hollow bones to access marrow (fig. 7, no 5). During the butchering a brick, and during the crushing a fieldstone slab was used as anvil.

The experimental setup was based on residues that were found on archaeological tools from the Scheldt basin, i.e. bone/collagen and feather, and limited by time and resources. For a more thorough reference collection, especially for the BQY material, more contact materials and actions should be tested.

RESULTS

Experiments

The obtained experimental traces constitute the reference collection to compare the archaeological material. Traces and exact motions can be described according to the different activities as follow:

a) Pottery crushing/grinding

The macro-traces include edge scars with material loss in several layers above each other in a continuous line on the working edge, and superimposed scaling removals with crushing (fig. 8, Exp1180). The traces concentrate on the edges, tips and ridges of the tools and some bands of straited polish stripes are also visible in the background. The micro-traces include polish that is very bright, matt, smoothening to smooth, somewhat domed, sometimes pitted. Striation is mostly present with thin, deep, and short to medium length striae. The tools preserved a lot of residues even after cleaning in ultrasonic bath with Derquim phosphate-free soap.

Always the longest concave edge/ridge of the tools was predominantly used for these experiments. However, in the case of Exp1180 and Exp1182, the flat surface closest to the used ridge was also tried out. The smaller the tool, the better the flat surface worked to grind the pottery.

b) Sandstone pecking/battering

Among the macro-traces, edge damage includes large number of scars in layers, mainly in a circular fashion, superimposed scales with heavy crushing/battering traces and rounded edges (fig. 8, Exp1184). Micro-traces displayed as polish is mineral polish, very bright, matt, smooth, flat, it spreads in the background in strikes. The directionality is mixed, but mainly transversal. Striation are long, wide, and shallow.

Traces mostly developed on the edges and at the tip of the ridges.

In an attempt to rejuvenate the surface of our sandstone slab, we used the edges, ridges, and tips of the

Fig. 7 – Experiments carried out with faceted tools: **1**, processing fish (removing fin); **2**, grinding up pottery; **3**, crushing/grinding burnt bone; **4**, pecking/battering the surface of a sandstone slab; **5**, butchering a mallard; **6**, crushing/wedging cow bone.

***Fig. 7 –** Expérimentations réalisées avec les outils facettés : **1**, traitement de poisson (enlèvement de la nageoire) ; **2**, concassage de poterie ; **3**, écrasage/broyage d'os brûlés; **4**, piquetage/martelage d' une surface d'une dalle de grès; **5**, dépeçage d'une carcasse de colvert; **6**, écrasage/fendage d'un os de vache.*

tools. However, the tools were not very effective and a lot of pieces were chipping off the tools.

c) Processing fish

Macro-traces developed on the tips of the tool. Edge scars, scaling vary in size from small to medium, and shape but are very present, superimposed and multilayered with (heavy) crushing on top of them. The edge is only slightly rounded or not rounded at all (fig. 8, Exp1240). The polish is distributed randomly as linear streaks, but mainly along the edge. It is dull and greasy with bright spots, flat, and more rough.

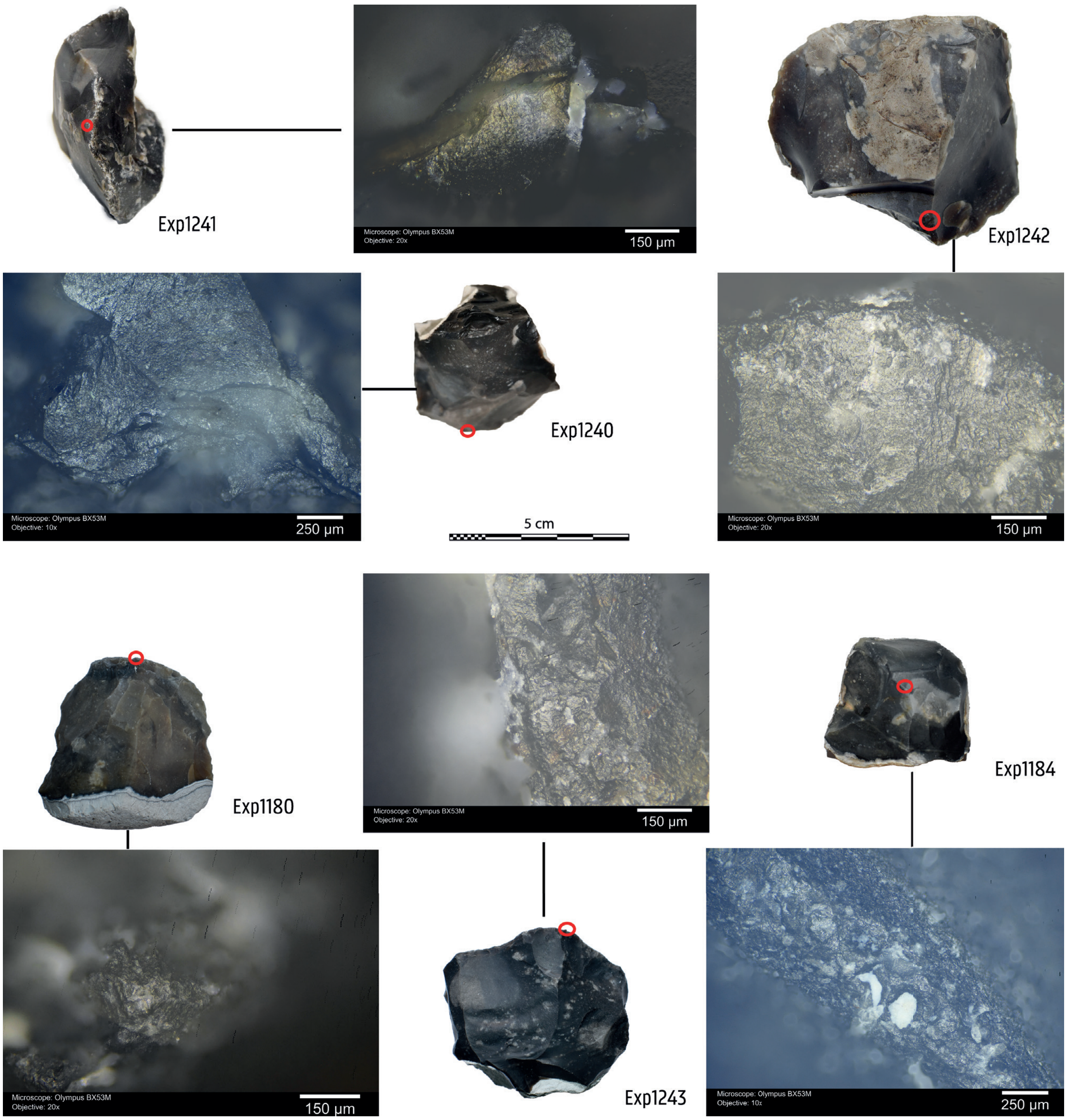

Fig. 8 – Microwear traces on experimental faceted tools: Exp1241 fresh bone crushing/wedging; Exp1240 fish processing; Exp1242 burnt bone crushing/grinding; Exp1180 pottery crushing/grinding; Exp1243 mallard butchering; Exp1184 pecking/crushing sandstone surface.

Fig. 8 – *Traces microscopiques d'utilisation sur les outils facettés : Exp1241, os frais, écrasage/fendage; Exp1240, traitement de poisson; Exp1242, os brûlé, écrasage/broyage; Exp1180, poterie, écrasage/broyage; Exp1243, dépeçage d'une carcasse de canard; Exp1184, piquetage/écrasage d'une surface en grès.*

All the edges of the tool were used for crushing the joints and bones, fish vertebrae, and to cut through the skin and meat at the pectoral fins. We used this tool in an attempt to remove the pharyngeal teeth and to behead the fish.

d) Fresh bone crushing/wedging

Macro-traces are extensive edge scarring, with large and small multilayered scaling, and small impact points at the flat surfaces above the edge displaying most traces. (fig. 8, Exp1241). For micro-traces, the polish is bright, greasy, flat, and smoothening. It is most developed on the edges, but spreads in the background. The directionality is mixed with indication of dynamic action.

The edges of the tool were used to directly wedge the surface of a cow long bone in an attempt to break the bone and reach the marrow.

e) Burnt bone crushing/grinding

The traces are very similar to the fresh bone crushing traces with the exception for macro-traces where the edge scars are very battered and smaller. The scaling is

Typology	Doel B	Doel M	Doel C	Bazel
Armatures				
microlith fragment	1	2	0	14
trapeze	16	3	0	130
trapeze fragment	9	0	0	0
transverse arrowhead	4	4	3	11
leaf-shaped/triangular arrowhead	0	0	2	10
Common tools				
scraper	106	35	1	194
retouched blade(let)	62	12	7	309
retouched flake	26	10	2	85
drill	5	7	0	14
burin	9	1	0	10
rounded piece	4	0	0	6
splintered piece	19	31	1	15
faceted tool	39	18	1	89
combination tool	2	1	0	6
flake adze/polished axe	0	1	2	27
undetermined tool	2	21	0	9
undetermined tool fragment	37	7	6	238
Total	**341**	**153**	**25**	**1167**

Table 4 – Typological composition of the lithic toolkit at Doel-Deurganckdok and Bazel-Sluis.

Tabl. 4 – *Composition de l'outillage lithique des sites de Doel-Deurganckdok and Bazel-Sluis.*

very intensive with small, multilayered scars and no crushing. On the tip of the tool there are larger and deeper scars. The edges are very rounded. For the micro-traces, the polish is less greasy than for the fresh bone (fig. 8, Exp1242).

The edges and ridges of the tool were used to crush and grind bone pieces burnt to different degrees. The tool got in contact with the fieldstone anvil.

f) Mallard processing

Macro-traces include very rounded edges with large scars that are smoothened out, small, shallow scaling in multiple layers with crushing/battering marks especially at the tips of the ridges. (fig. 8, Exp1243). For micro-traces, the polish is bright, very greasy, smooth, and flat with a very clear mixed directionality.

The edges and ridges were used to crush the joints to remove the wings and legs of the animals, and to open up the hollow bones and grind them.

In general, crushing, wedging motions were carried out with a straight movement, and grinding was done by exchanging back-and-forth and circular movements, whichever was more effective.

Faceted tools from the Lower-Scheldt basin

Typology

Altogether 147 faceted tools were identified over the four sites (Table 4). The vast majority (ca. 60 %) comes from Bazel, followed by Doel B (ca. 26 %). On site level, they represent between ca. 4 % (Doel C) and ca. 11/12 % (Doel B and M) of all tools. There are no anvils reported from these sites.

A common feature of the faceted tools is the presence of multiples short detachments which gives them a multifaceted appearance. They all also display macroscopically visible traces of use such as impact traces and extensive wear from pecking/battering or crushing (fig. 2). A detailed typological analysis (fig. 9) has only been applied on the faceted tools of Bazel, resulting into the identification of predominantly polyhedrons (*polyèdres*; ca. 26 %), followed by faceted flakes and debris (*éclats et débris facettées*; ca. 18 %) and denticulated faceted debris or flakes (*denticulés facettées*; ca. 17 %).

Polyhedrons (fig. 5, nos 1 to 3) are tools that are entirely faceted, often the blank cannot be identified but a part of them are re-used cores, thick flakes or small blocks.

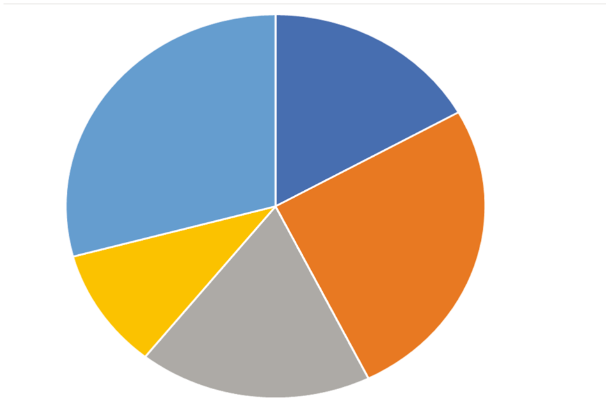

Fig. 9 – Typological composition of the faceted tools at Bazel-Sluis (n=89).

Fig. 9 – *Classement typologique des 89 outils facettés de Bazel-Sluis.*

Length (mm)	Doel B1 & M2 (n=27)	Bazel (n=59)
16-20	1	1
21-25	1	6
26-30	6	13
31-35	8	18
36-40	4	6
41-45	4	8
>45	3	7
Width (mm)	Doel B1 & M2 (n=27)	Bazel (n=59)
16-20	0	3
21-25	4	7
26-30	4	13
31-35	7	12
36-40	7	9
41-45	3	10
>45	2	5
Thickness (mm)	Doel B1 & M2 (n=27)	Bazel (n=59)
6-10	1	1
11-15	6	12
16-20	6	19
21-25	4	14
26-30	6	6
31-35	3	3
>35	1	4

Fig. 10 – Dimensions of faceted tools at Doel B1, Doel M2 and Bazel-Sluis.

Fig. 10 – *Dimensions des outils facettés de Doel B1, M2 et Bazel-Sluis.*

They often have a spherical shape and are faceted by small multi-directional detachments that are rarely longer than 2 cm. The dihedral ridges that are created this way are the active parts of these tools, apparent through traces of percussion, crushing or fine retouches, scars. The blanks might have been bigger to start with, but repeated rejuvenation brings them to their final dimensions. The latter is corroborated by numerous finds of small flakes (< 25 mm; ca. 29 %; fig. 10), which present the same heavy-duty traces on their dorsal side probably resulting from rejuvenation and/or use. Denticulated faceted tools are thick flakes of which the edges are retouched with successive notches, while faceted flakes and debris (fig. 5, nos 4 to 5) are tools with the same kind of detachments as the *polyèdres*, but with an incomplete faceting. The registered dimensions (fig. 10) demonstrate the use of large (main length between 25 and 35 mm; main width between 25 and 45mm) and thick blanks or cores (main thickness between 10 and 30mm) for the production of these tools.

Contrary to other tool-types, except for splintered pieces, faceted tools are predominately produced on local, poor-quality flint, originating either from tertiary gravel layers and/or the North Sea beaches (fig. 11 and 12). The remaining are made on better-quality flint imported from different outcrops in the cretaceous regions of Middle Belgium and northern France (Messiaen *et al.*, 2022).

Microwear analysis

From the 48 selected tools, 22 have been interpreted as used, however, in the case of Bazel, the rest of the tools could not be analyzed because of the large amount of organic residues on the surfaces. These residues have been preserved for later research.

Most of the analyzed tools (n=15) are interpreted as used on hard animal material (fig. 13 and 14, ID1228, ID1155, ID1847, ID2085, ID2230, ID2545, ID2572, ID7561, ID7978, ID11064, ID8001, ID8062), most probably bone in a dynamic action, like crushing, powdering, based on partial overlap with experimental tools. On all tools the traces are well-developed. The hard animal material traces include smooth, flat, greasy, and bright polish along the edges, sometimes more spread in the background (fig. 15 and 16). All polish has mixed directionality. These polishes are always connected to large edge scars in multiple layers, heavy battering traces with chipping concentrated on the edges and ridges, and heavily rounded edges. Similar traces have been reported on experimental faceted tools (fig. 8 nos 1, 3, 5, and 6) used to process fish, two mallards, burnt deer bones, and long bones from cow. The traces all include bright, smooth, flat, and greasy polish that is developed to well-developed on the edges but spread to the background and connected with relatively large scars in multiple layers. The scars are the largest on the tools that were used on fresh cow bone. Although, some of the experiments were carried out on an anvil, mineral micro traces were not recorded on the tools, not even on the tools used for crushing/grinding burnt bones.

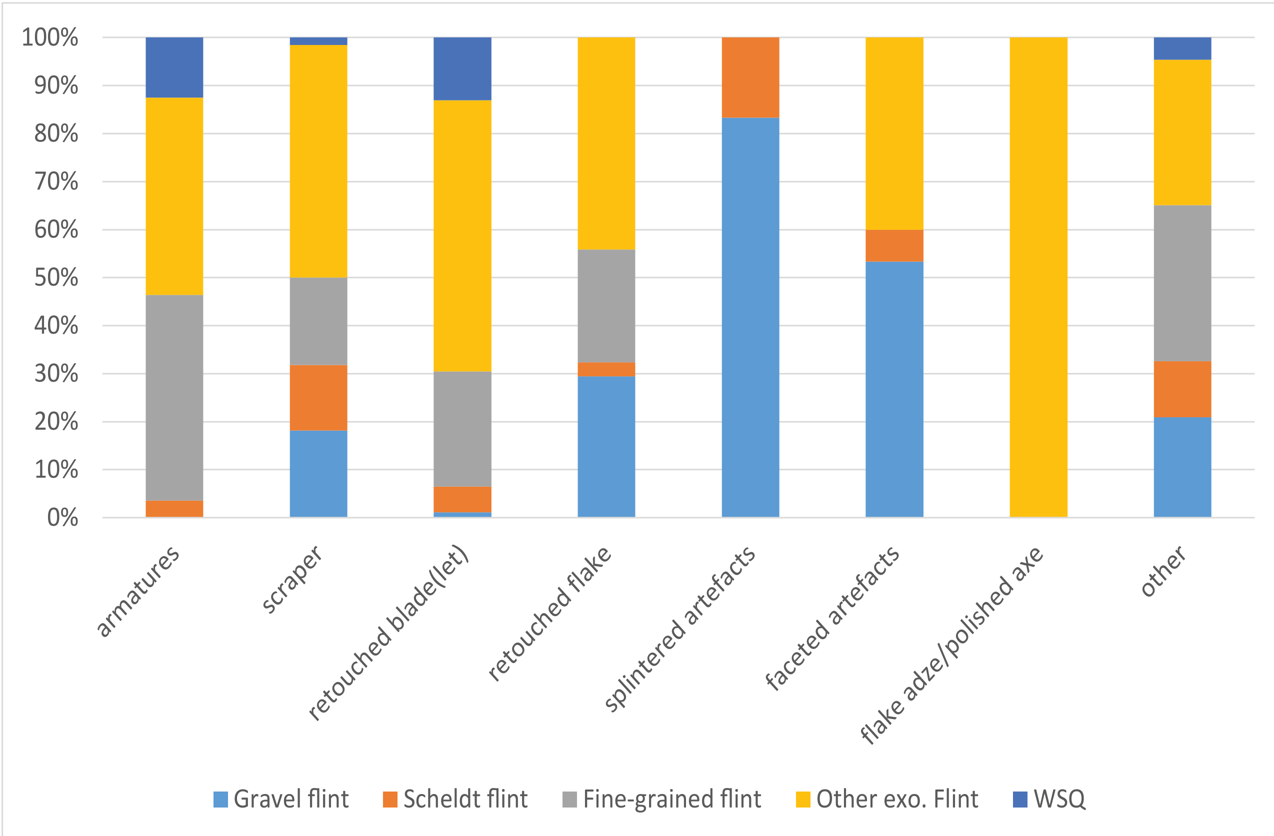

Fig. 11 – Raw material spectrum per tool type at Bazel-Sluis.

***Fig. 11 –** Matières premières selon les types d'outils identifiés à Bazel-Sluis.*

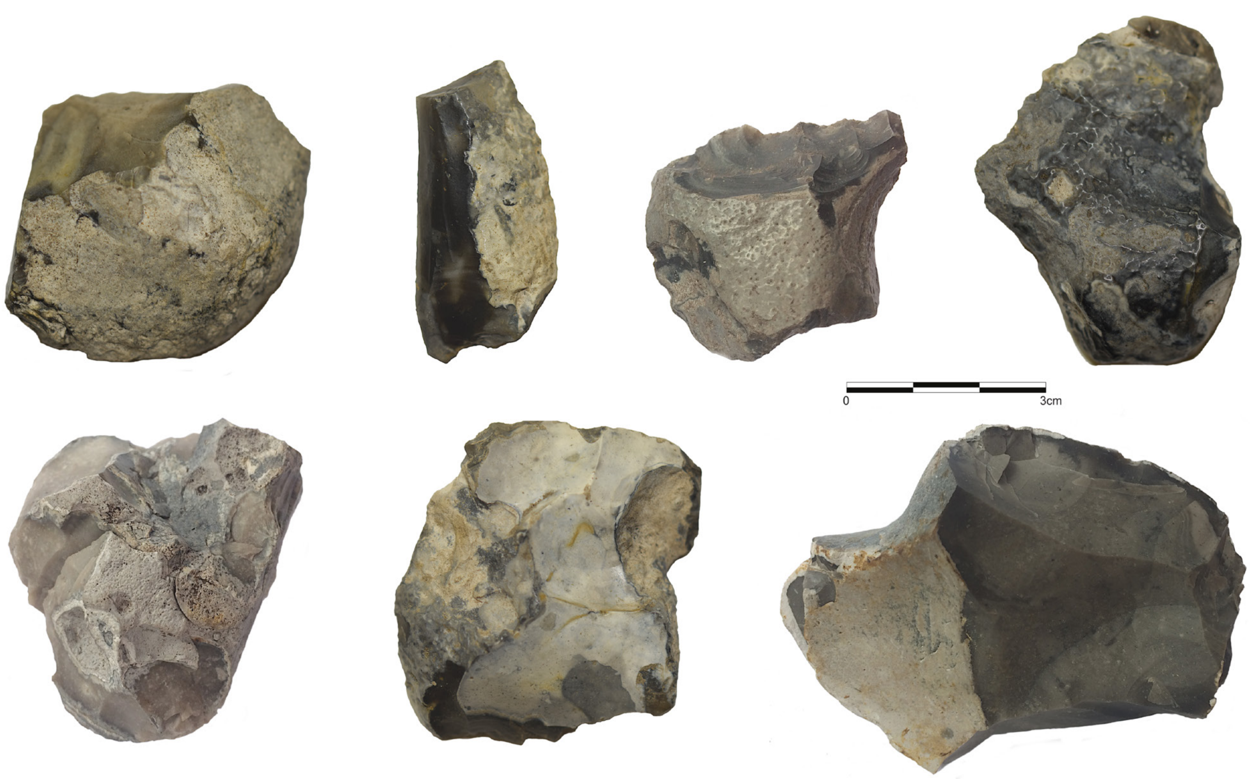

Fig. 12 – Doel B-1: Selection of pebble flint artefacts with a variety of rough rolled cortex and natural surfaces.

***Fig. 12 –** Doel B-1, galets de silex à cortex roulés et surfaces naturelles sélectionnés comme supports d'outils.*

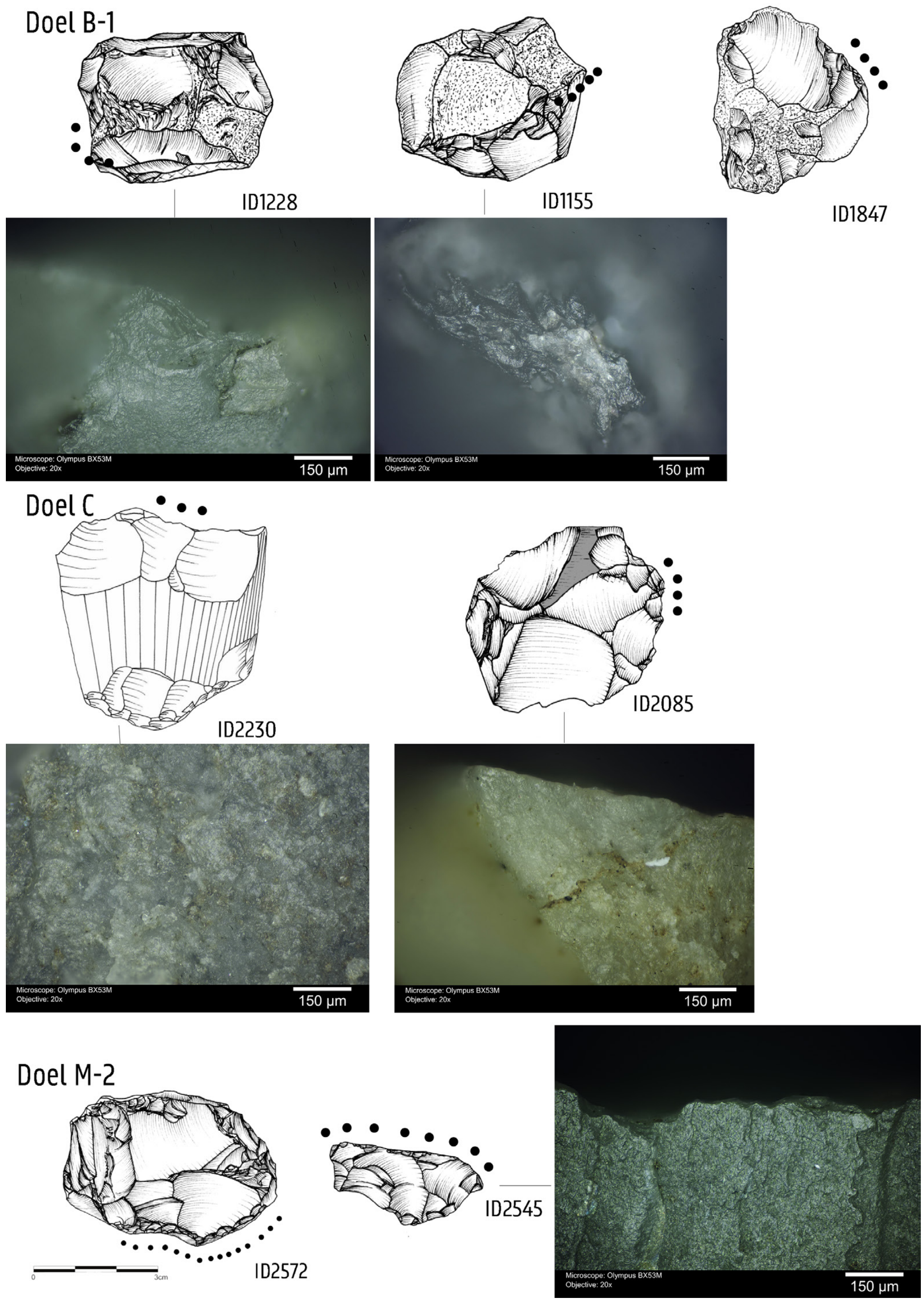

Fig. 13 – Faceted tools from the Doel-sites with indication of use and micrographs of traces. ID1228: multiple use on hard animal material (bone), smoothening, flat, greasy, bright polish and multilayers micro-scars; ID1155: dynamic action (grinding) on hard animal material (bone), smooth, flat, greasy, bright polish, parallel directionality, very rounded edges, crushed scales; ID1847: dynamic action on hard material; ID2085: dynamic action on hard animal material, smooth, flat, greasy, bright polish more on higher parts, rounded edges; ID2230: wedging hard animal material, smoothening, flat, greasy, bright polish, with strong transversal directionality; ID2545: dynamic activities meat and bone, more rough, flat, very greasy, bright polish, rounded edges, less edge scarring; ID2572: crushing hard animal material (bone).

***Fig. 13 –** Outils facettés des sites de Doel avec indication, illustration et localisation des zones utilisées. ID1228 : utilisation multiple sur de la matière dure animale (os), poli lisse, plat, gras, brillant et imbrication de micro-ébréchures sur les bords ; ID1155 : action dynamique (broyage) sur de la matière dure animale (os), poli lisse, plat, gras et brillant, d'orientation parallèle, bords très émoussés et ébréchures écrasées ; ID1847 : action dynamique sur de la matière dure ; ID2085 : action dynamique sur de la matière dure animale, poli lisse, plat, gras et brillant localisé sur les zones les plus saillantes, bords émoussés ; ID2230 : fendage de matière dure animale, poli lisse, plat, gras et brillant d'orientation strictement transversale ; ID2545 : activités dynamiques sur viande et os, poli plus rugueux, plat, très gras et brillant, bords émoussés et moins affectés par des esquillements ; ID2572 : écrasage de matière dure animale (os).*

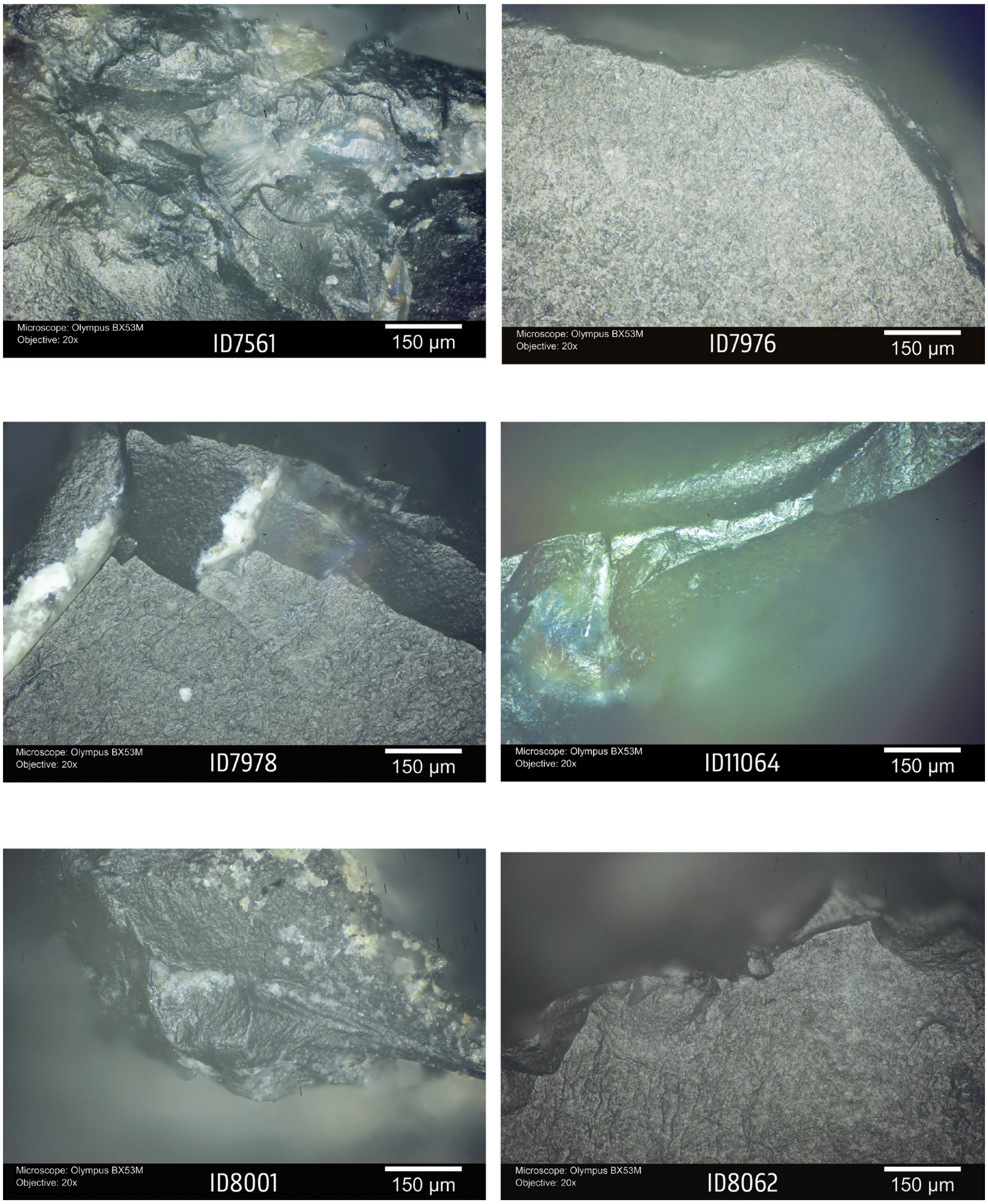

Fig. 14 – Traces on the faceted tools from Bazel-Sluis. ID7561: crushing/grinding hard animal material, smoothening, flat, very greasy, bright polish, extensive multilayered scarring with rounded edges; ID7976: scraping dry hide, rough, flat, matt, bright polish with transversal directionality, very rounded edges, no edge scars; ID7978: crushing hard animal material, probably bird, smooth, flat, greasy, bright polish with mixed directionality, large, deep scars, bit rounded edges, bone residue; ID11064: dynamic action on hard animal material, smooth, flat, greasy, bright polish with mixed directionality, very rounded edges, varying size of edge scars; ID8001: crushing hard animal material, probably bone, smooth, flat, greasy, bright polish with mixed directionality, rounded edges, bone residue; ID8062: dynamic action on hard animal material, probably bone, smooth, flat, greasy, bright polish with mixed directionality, rounded edges, varying size of edge scars, bone residue.

***Fig. 14 –** Outils facettés du site de Bazel-Sluis avec indication, illustration et localisation des zones utilisées. ID7561 : concassage d'une dure matière animale, poli lisse, plat, très gras et brillant, imbrication de plusieurs générations d'ébréchures envahissantes ; ID7976 : grattage d'une peau sèche, poli rugueux, plat, mat et brillant d'orientation transversale, bords très émoussés sans ébréchure ; ID7978 : écrasage d'une matière dure animale, probablement un oiseau, poli lisse, plat, gras et brillant sans orientation préférentielle, ébréchures larges et profondes, bords légèrement émoussés et résidu d'os ; ID11064 : action dynamique sur la matière dure animale, poli lisse, plat, gras, brillant sans orientation préférentielle, bords très émoussés et ébréchures de taille variable ; ID8001 : écrasage d'une matière animale dure, probablement de l'os, poli lisse, plat, gras et brillant sans orientation préférentielle, bords émoussés, résidu d'os ; ID8062 : action dynamique sur une matière dure animale, probablement de l'os, poli lisse, plat, gras et très brillant sans orientation préférentielle, bords émoussés, ébréchures de taille variable, résidu d'os.*

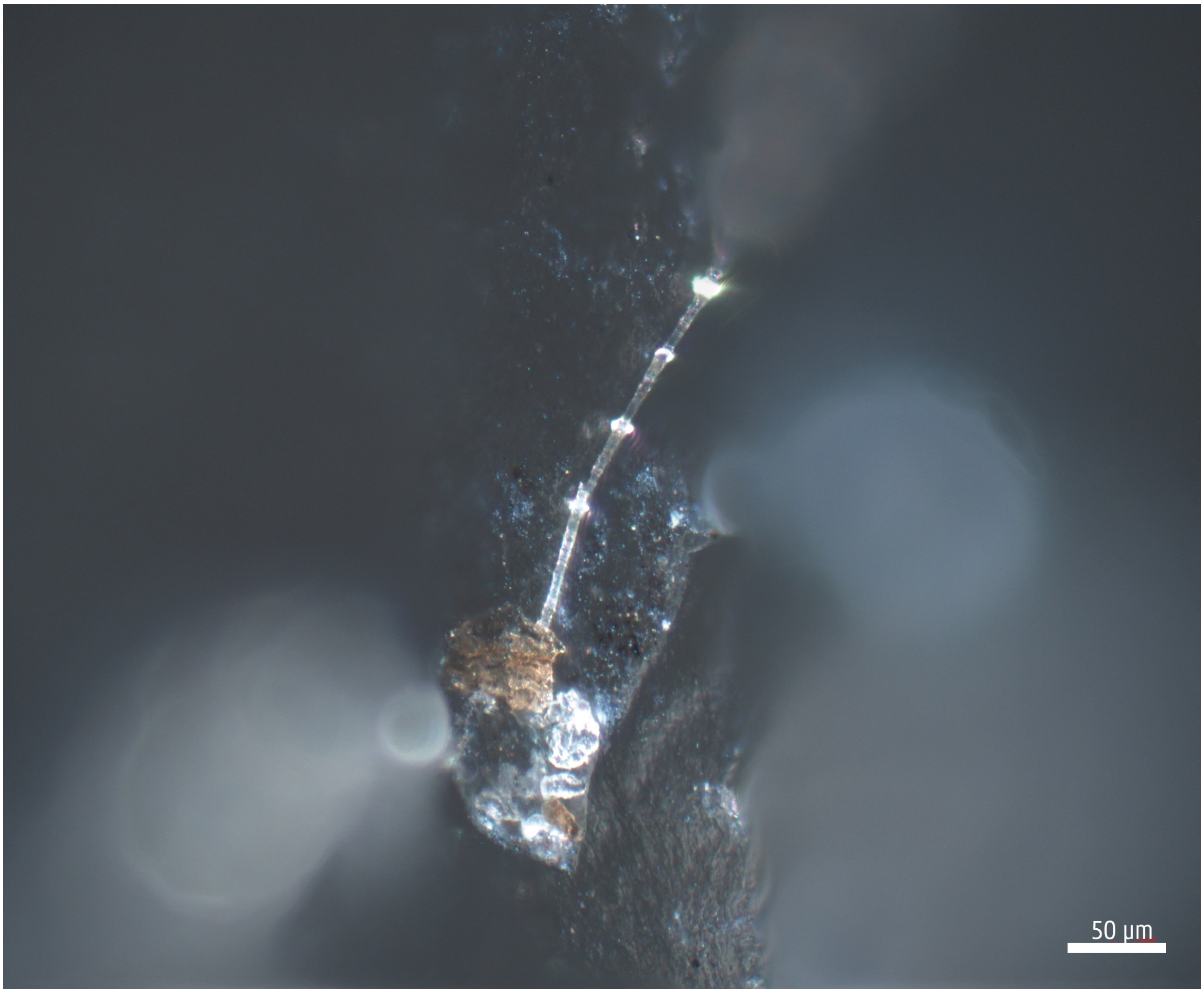

Fig. 15 – Feather of Anatidea family stuck to the surface of faceted tool ID7978.

***Fig. 15 –** Plume de la famille Anatidea coincée à la surface de l'outil facetté ID7978.*

Some chipping and scarring at the edges could result from getting in contact with the anvil mostly in the case of the mallard processing activity, but again, no micro traces characteristic to minerals were displayed.

Most archaeological tools (all from the collection of Bazel) have macroscopically visible organic (and inorganic) residues attached to their surfaces. On some (n=12) these residues were analyzed by Emanuela Cristiani (DANTE Lab, Sapienza University). Three of them were interpreted as remains of bone (ID2601, ID8062 and ID7978), and in one case even feathers from the Anatidea family (ID7978) was recognized (fig. 15). The two tools from Bazel (ID8062 and ID7978) were also measured with FTIR by Dr. Stella Nunziante Cesaro (Italian National Research Council), and showed some indications of collagen and fat. In all cases, the residues were connected with micro traces and smashed onto the surface, as it can be seen on fig. 17 at the root of the feather.

Faceted tools from the BQY/VSG site from Vaux-et-Borset

Typo-technological analysis (see database in Supplementary Material)

According to the different typo-technological categories presented above, five pieces are considered as exhausted cores (group 2) and two pieces present too ambiguous characteristics to interpret them (Table 5). The pieces interpreted here as cores often presents some impact points, but contrary to the faceted tools, they are localized mostly close to the edges and seem related to the debitage. The 14 remaining artefacts could be related to the toolkit of the farmers-herders from Vaux-et-Borset. Most of the tools could be classified in the polyhedrons typological class (10 artefacts).

Tool dimensions are essentially confined between 30 to 55 mm in length, 30 to 45 mm in width and 20 to 40 mm in thickness (fig. 16). The polyhedron without clear traces is the smallest piece, and one piece is clearly longer than the other ones (fig. 6, no 4). This tool presents

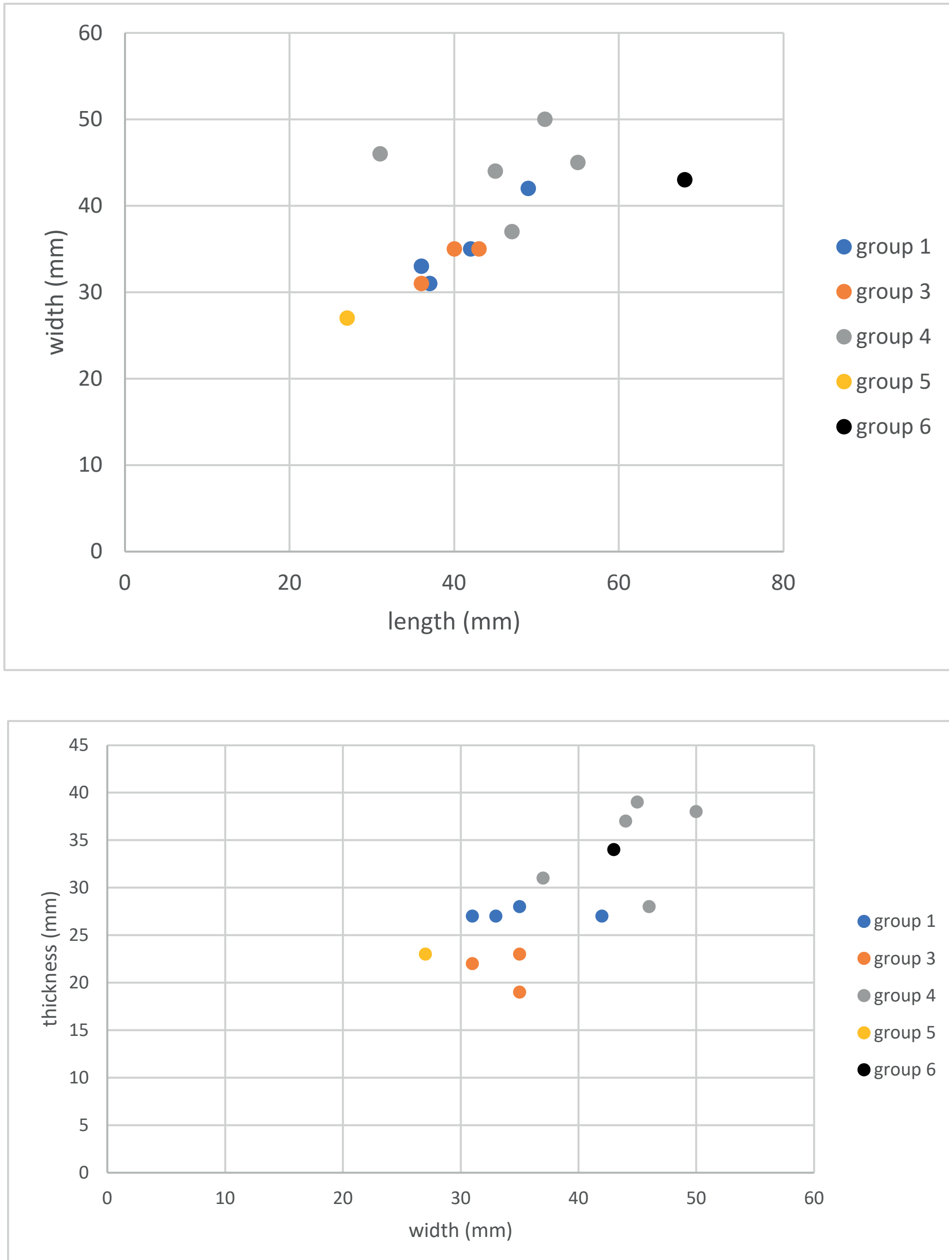

Fig. 16 – Dimensions of faceted tools from Vaux-et-Borset.

Fig. 16 – *Dimensions des outils facettés de Vaux-et-Borset.*

peculiar traces situated at one extremity and has therefore been classified in category 6. The denticulated pieces are the flattest artefacts (fig. 6, no 2). Pieces classified in the 4th category with a triangular or quadrangular section (fig. 6, no 3) are clearly more massive as testified by their important weight (Table 6).

Almost all tools are shaped by bifacial removals (B11 code in the database, according to Denis, 2019), except for the pieces interpreted as cores. These are mostly shaped by a succession of unipolar sequences.

Microwear analysis

The use-wear analysis conducted on the same 21 artefacts identifies 12 pieces with recognizable traces of use (Table 7). Interestingly, artefacts interpreted as exhausted cores do not present microwear traces, neither does artefact no 7, classified as faceted denticulated artefact and one polyhedron (artefact no 18). All used tools, except one, were used in a crushing, grinding motion. The one exception was used in a wedging motion, probably without a hammer (fig. 20, no 16). On three tools, wear from contact with mineral/stone could be observed (fig. 17 and 18, nos 1, 12 and 14).

There were no tools interpreted as used as hammerstone, based on the combination of location intensity, characteristics of the macro-traces, and their linked microtraces.

Three tools have multiple use (fig. 18 and 19, nos 5, 8 and 9), and on five tools contact with hard animal material is identified (fig. 17, 19, and 20, nos 2, 3, 4, 13, and 15). Among the latter, two also show contact with hard

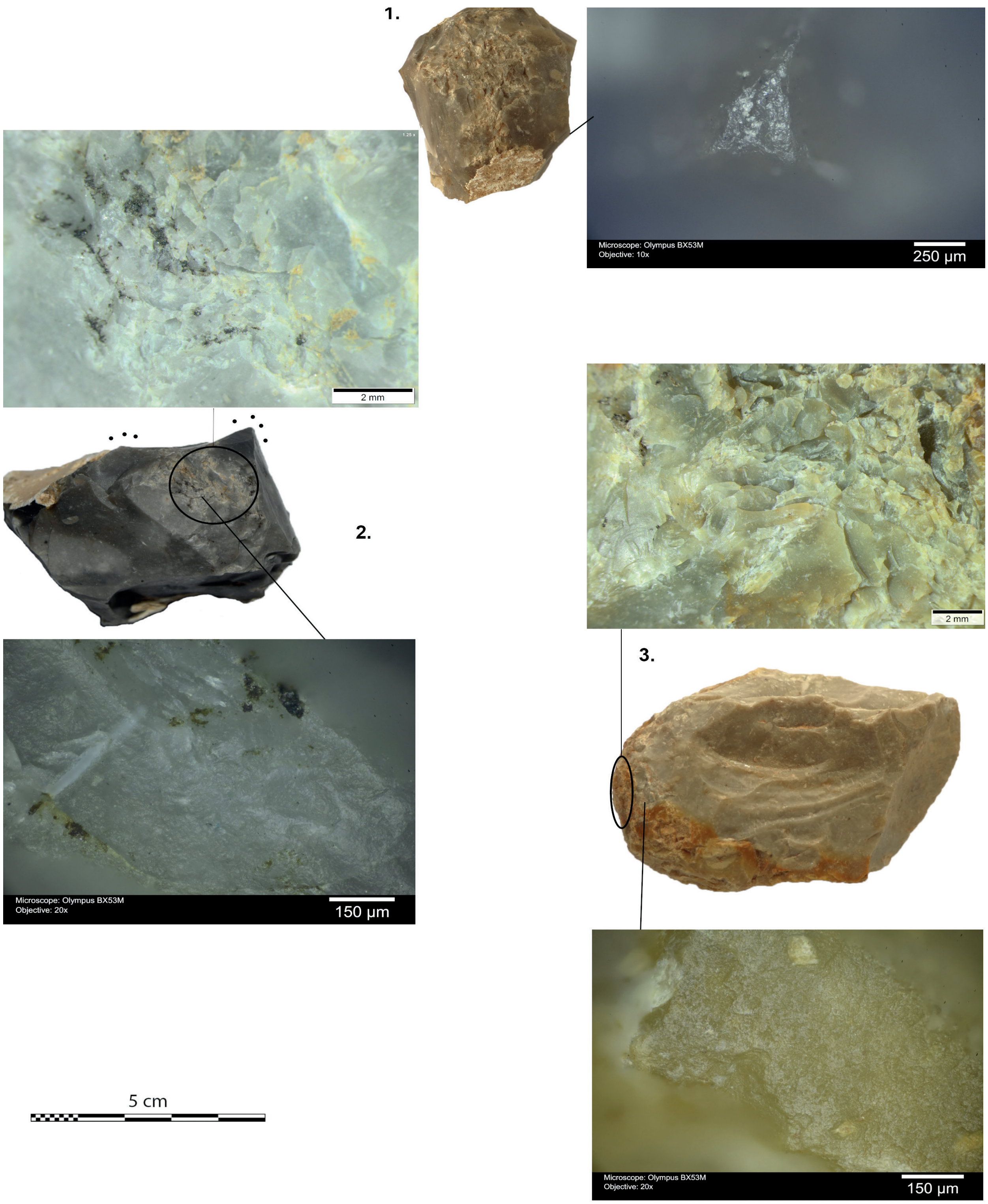

Fig. 17 – Traces of use on tools from Vaux-et-Borset: **1**, battering mineral, smoothening, flat, matt, very bright polish mixed directionality, rounded edges, mineral residues; **2**, mixed traces from stone and hard animal material (bone), heavy crushing and superimposed scaling as macro-traces, smooth, flat, greasy, bright polish with very rounded edges as micro-traces; **3**, crushing bone and soft tissue, medium to small size multilayered, superimposed scaling with minimal crushing as macro-traces, smooth, flat, greasy, bright polish with very rounded edges as micro-traces.

***Fig. 17** – Traces d'utilisation identifiées sur les outils facettés de Vaux-et-Borset : **1**, martelage sur matière minérale, poli lisse, plat, mat et très brillant sans orientation préférentielle, bords émoussés et résidus minéraux; **2**, traces mixtes de matière minérale et de matière dure animale (os), macro-traces caractérisées par des écrasements intenses couplés à des ébréchures et poli lisse, plat, gras et brillant avec des bords très émoussés; **3**, écrasement d' os et de tissus mous, macro-traces caractérisées par différentes couches imbriquées d'ébréchures de taille moyenne à petite avec des légères traces d'écrasement couplées à un poli lisse, plat, gras et brillant et des bords extrêmement émoussés.*

Typo-technological category	Number of pieces
1	4
2	5
3	3
4	5
5	1
6	1
Indet	2
Total	**21**

Table 5 – Typo-technological classification of studied faceted tools from Vaux-et-Borset: **1**, polyhedron shaped by bifacial removals, high intensity of macro-traces; **2**, exhausted core; **3**, faceted denticulated piece; **4**, faceted tool with triangular or trapezoidal section with macro-traces localized on the transversal edges (polyhedron family); **5**, spheroid piece without any macro-traces (polyhedron family); **6**, faceted tool with triangular or trapezoidal section with macro-traces localized on one extremity.

***Tabl. 5 –** Classement typo-technologique des outils facettés de Vaux-et-Borset : **1**, polyèdre façonné par des enlèvements bifaciaux, macro-traces d'utilisation nombreuses; **2**, nucléus arrivé à exhaustion; **3**, denticulé facetté; **4**, outil facetté à section triangulaire ou trapézoïdale avec macro-traces localisées sur les arêtes longitudinales (famille des polyèdres); **5**, pièce sphéroïde sans macro-trace (famille des polyèdres); **6**, outil facetté à section triangulaire ou trapézoïdale avec macro-traces localisées à une extrémité.*

Typo-technological category	Mean weight (g)
1	42
3	34
4	87,6
5	22
6	135
Total	**61,8**

Table 6 – Mean weight of the different kinds of faceted tools identified through typo-technological analysis.

***Tabl. 6 –** Poids moyen des différentes catégories typo-technologiques d'outils facettés.*

Material worked	Typo-technological categories				Total
	1	**3**	**4**	**6**	
hard animal	-	2	1	1	4
mineral	2	-	1	-	3
mineral+hard animal	1	-	1	-	2
multiple	1	-	2	-	3
Total	**4**	**2**	**5**	**1**	**12**

Table 7 – Comparison of results of the use-wear analysis according to typo-technological categories.

***Tabl. 7 –** Comparaison entre les résultats de l'analyse tracéologique et les catégories typo-technologiques.*

inorganic material, i.e. stone, but mixed with the animal related traces. Probably the processing of animal material was carried out on a stone surface. The other three only show traces of hard animal material, i.e. bone.

The mineral traces appear like heavily crushed surfaces and rounding. On a microscopic level, the polish is rough, flat, matt, very bright with mixed directionality. The traces are very abrasive and motion is interpreted as, dynamic pounding. They all have striations, which are deep, short and thin to wider.

On the tools where multiple use was interpreted, some edges show mineral and/or stone contact and others contact with different animal materials. On tool no 5, most edges were used to crush minerals resulting in a smoothened, flat, matt, very bright polish with mixed directionality and longer, thin, shallow striations, extensive edge scarring

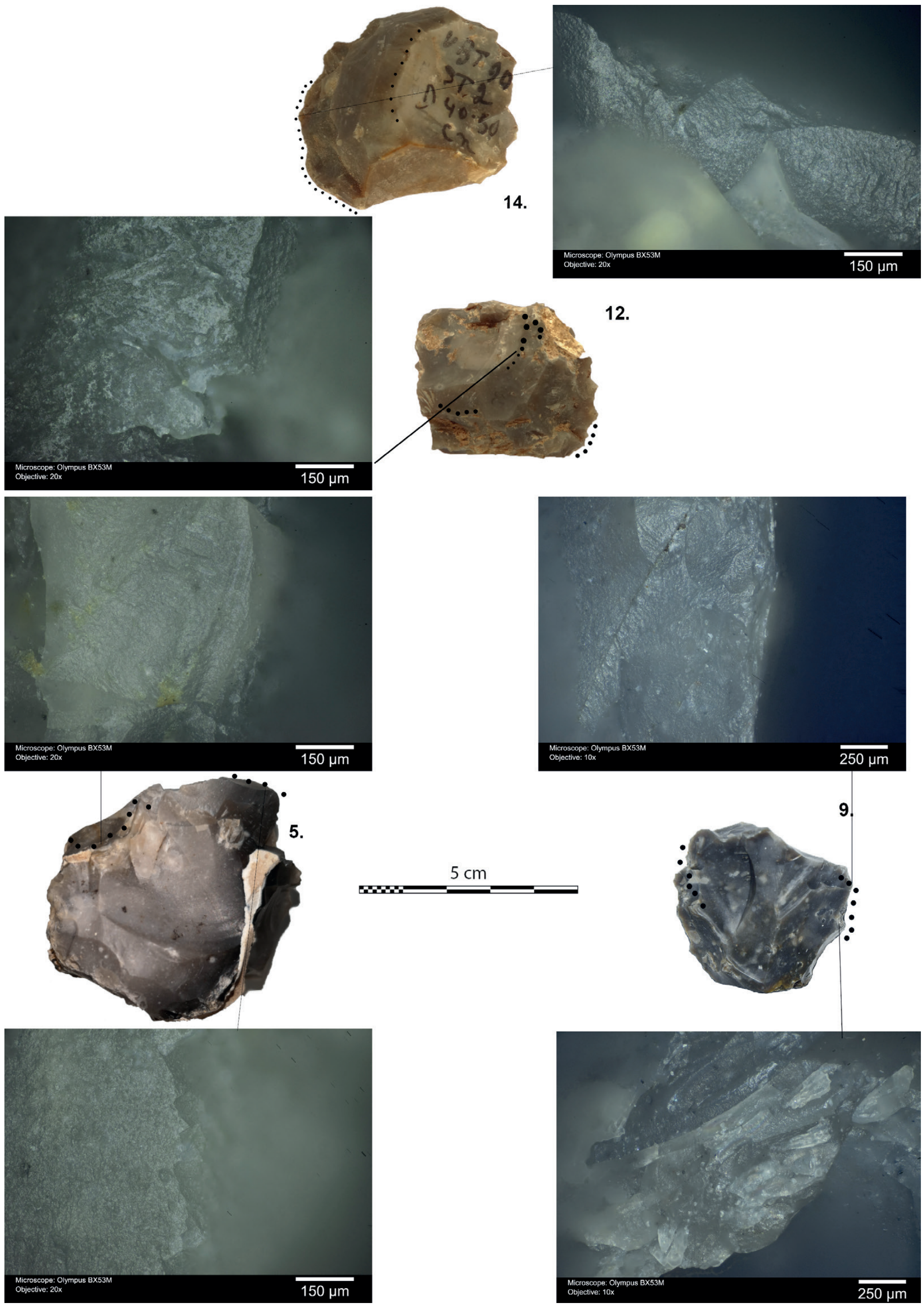

Fig. 18 – Traces of use on tools from Vaux-et-Borset: **14**, crushing mineral smoothening, flat, matt, very bright polish, somewhat rounded edges, extensive edge scarring; **12**, crushing/grinding mineral, smooth, flat, matt, very bright polish, mixed directionality, somewhat rounded edges, extensive edge scarring; **5**, crushing mineral (top) smooth, flat, matt, very bright polish, mixed directionality, somewhat rounded edges and bone related traces (bottom), smoothening, flat, greasy, bright polish mostly at the edges, some edge rounding, small edge scars; **9**, mineral (top), smooth, flat, matt, very bright polish, mixed directionality, somewhat rounded edges, maybe fish (bottom), smooth, flat, greasy, bright polish in stripes on higher points, mixed directionality rounded edges, multilayered scaling and maybe hide traces.

***Fig. 18 –** Traces d'utilisation identifiées sur les outils facettés de Vaux-et-Borset : **14**, écrasage d'une matière minérale, poli plat, lisse, mat et très brillant, bords émoussés et ébréchures intenses sur les bords; **12**, écrasage/broyage d'une matière minérale, poli lisse, plat, mat et très brillant sans orientation préférentielle, bords légèrement émoussés, ébréchures intenses sur les bords; **5**, écrasage d'une matière minérale (en haut), poli lisse, plat, mat et très brillant, sans orientation préférentielle, bords légèrement émoussés et traces relatives à de l'os (en bas), poli lisse, plat, gras et brillant, concentré sur les bords, bords émoussés et légèrement ébréchés; **9**, travail d'une matière minérale (haut), poli lisse, plat, mat et très brillant sans orientation préférentielle, bords légèrement émoussés et traces peut-être liées à du poisson (en bas), poli lisse, plat, gras organisés en bandes localisées sur les points saillants, sans orientation préférentielle, bords émoussés, imbrication de plusieurs générations d'ébréchures et peut-être traces liées au travail de la peau.*

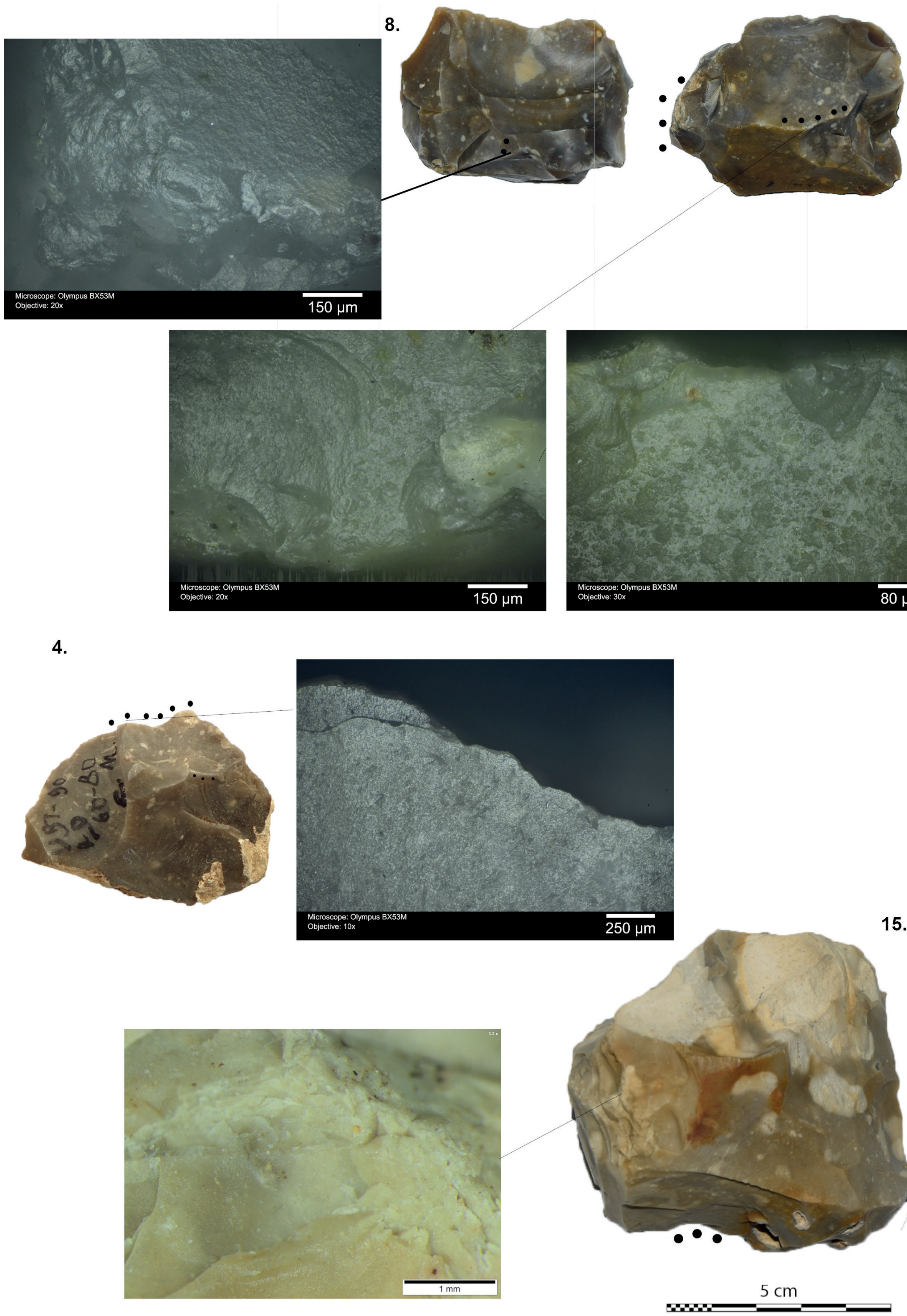

Fig. 19 – Traces of use on tools from Vaux-et-Borset: **8**, grinding mineral (left top)smooth, flat, matt, very bright polish, extensive multilayered scaling that is very battered, rounded and bone/fish (bottom two) more rough, flat, greasy, bright polish with mixed directionality, rounded edges, lots of scarring; **4**, weak animal related traces, rough, flat, greasy, bright polish with transversal directionality, spreads into the background; **15**, crushing hard and soft animal material, superimposed scaling of small size, very battered/rounded on top, along the edges.

***Fig. 19 –** Traces d'utilisation identifiées sur les outils facettés de Vaux-et-Borset : **8**, broyage d'une matière minérale (en haut à gauche), poli lisse, plat, mat et très brillant, avec différentes générations d'ébréchures imbriquées, très développées, usées et émoussées et os/poisson (en bas) poli plus rugueux, plat, gras et brillant, sans orientation préférentielle, bords émoussés, ébréchures nombreuses ; **4**, traces peu développées probablement liées à un travail sur matière animale, poli rugueux, plat, gras et brillant, d'orientation transversale, étendu ; **15**, écrasage de matières dures et molles animales, ébréchures imbriquées de tailles variables, très usées/émoussées sur les points hauts de la topographie le long des bords de la pièce.*

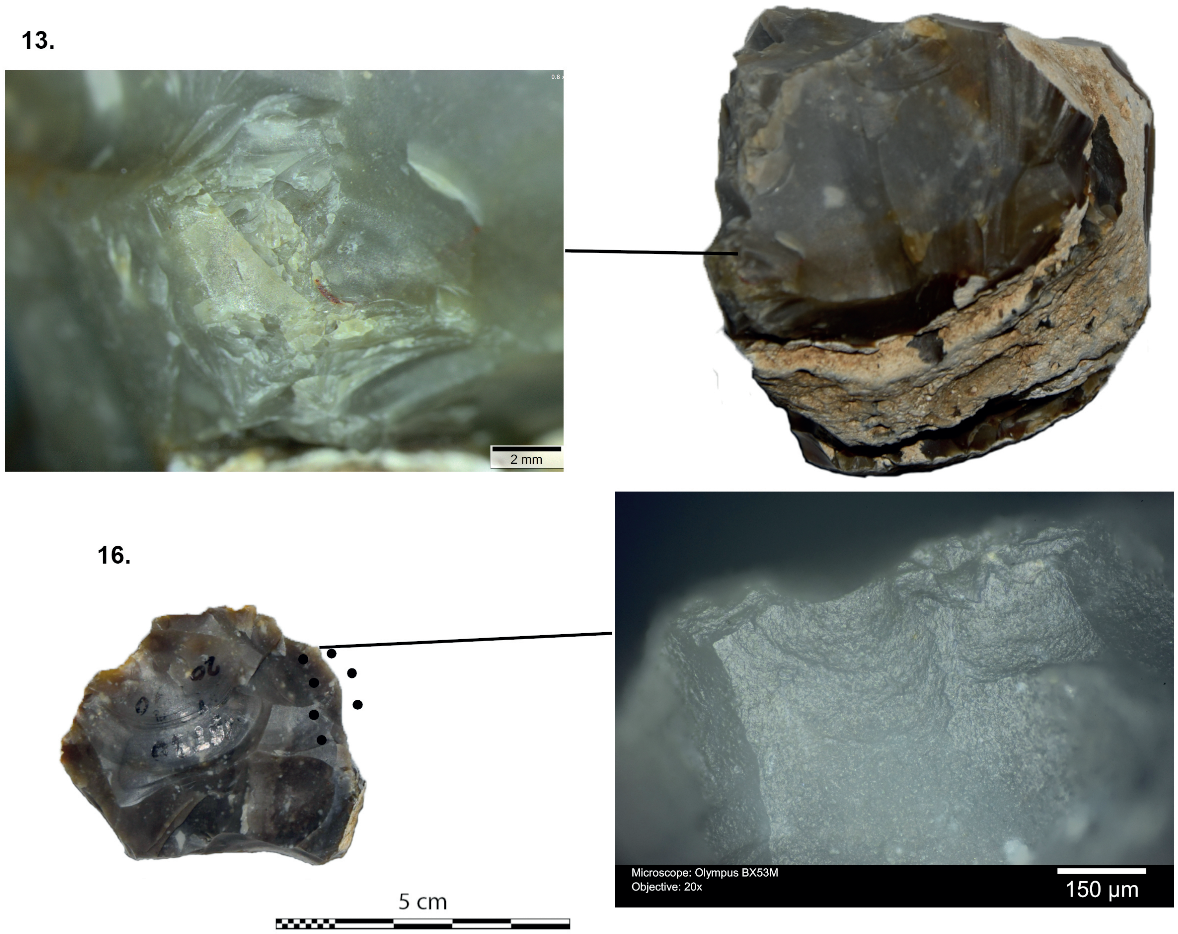

Fig. 20 – Traces of use on tools from Vaux-et-Borset: **13**, mixed traces from stone and hard animal material (bone), some smoothening, flat, more matt, very bright polish, which is more greasy and less bright in the background, lot of small scars, rounded; **16**, wedging hard animal material, smoothening, flat, greasy, bright, very pitted polish, with transversal directionality, large edge scars, polish spreads along the transversal edges.

***Fig. 20 –** Traces d'utilisation identifiées sur les outils facettés de Vaux-et-Borset : **13**, traces mixtes de matière dure minérale et animale (os), poli lisse, plat, mat, très brillant qui est plus gras et moins brillant en retrait de la partie active, de nombreuses ébréchures émoussées ; **16**, fendage de matière dure animale, poli lisse, plat, gras et très grêlé d'orientation transversale, bords affectés par des ébréchures larges, poli développé sur les arêtes transversales au bord actif.*

and somewhat rounded edges. Some of the edges, however, show traces of weak bone polish and probably bone residue. No 8 was a very extensively used multi-purpose tool, with traces of mineral grinding and crushing, bone crushing and grinding, and probable fish processing. There is also some probably bone residues preserved on its surface. No 9 also has traces of mineral and fish processing with dynamic motions which are connected. Furthermore, one of the edges shows weakly developed hide scraping traces, similar to traces developed on experimental tools used on hides from the reference collections at Ghent University and at Leiden University and wear traces from connection with bone on another edge.

The bone traces on the faceted tools are usually well-developed on some edge. They constitute of a rough, flat, greasy, bright, mostly a bit pitted polish with mixed directionality and dynamic motion, striations only developed on two tools, where they are short and wide, deep or shallow. The edges are crushed, with a bit of scarring, rounded and domed to an extent. When these traces are mixed with stone traces the edges are less abrasive, the scars are larger, and polish is mixed with matt, very bright spots.

There is no clear association with one typo-technological category and a kind of material worked (Table 7). Denticulated pieces seem, nevertheless, exclusively employed to work hard animal material, such as the larger piece (cat. 6). Distinction between groups 1 and 4 (fig. 6, nos 1 and 3) could not be very relevant despite their important weight difference. They can perhaps reflect different use stages.

DISCUSSION

The oldest, well-dated examples of faceted tools in the Scheldt basin come from the Swifterbant culture sites of Doel B and Doel M, and go back to the mid-5th millennium cal BC. The Bazel-specimens, or part of them, could easily be somewhat older given the fact that the site was already intensively occupied during the first half of the 5th millennium cal BC. Unfortunately, the mixed character of the lithic assemblage of this site does not allow us (yet) to verify this. However, it is clear that before ca. 5000 cal BC faceted tools were not part of the lithic traditions in the Scheldt basin. None of the studied Late Mesolithic sites, e.g. Verrebroek-Aven Ackers (Robinson *et al.*, 2011; Messiaen *et al.*, 2022), Moervaart, Kerkhove-Stuw (Vandendriessche *et al.*, 2019), Oudenaarde-Donk (Blancquaert, 1989), yielded faceted tools. Hence, this tool-type may be considered unique for the 5th millennium cal BC. This brings us to the debate about the origin of this tool-type.

This innovation represents around 10 % of the Swifterbant culture toolkit. This proportion is quite comparable with the BQY sites of Hainaut (Denis, 2017) and Vaux-et-Borset (Caspar, Burnez-Lanotte, 2008). The faceted tools first appeared in the final LBK (Allard, 2005), but became increasingly important from the BQY/VSG onwards, where they reached frequencies up to 6-12% in Middle Belgium, and 15 to 20 % in the Paris Basin (Allard, 1999). Furthermore, the different categories of faceted tools distinguished in BQY/VSG contexts seem also to be present in the Scheldt basin. Their respective proportions are difficult to compare, since the reliability of the used classification system must be questioned based on the results of the use-wear analysis. At least, shapes and dimensions seem comparable between the Neolithic and Mesolithic sites. Thus, from the present study it has become clear that the faceted tools from the Scheldt basin present morphometric similarities with those excavated in Early Neolithic contexts within the loess area of Middle Belgium and northern France.

Even more interesting is the unique use-wear analysis conducted on these artefacts coming from both archaeological contexts in combination with experiments. The experiments conducted with faceted tools did not yield the exact same traces that were found on the archaeological tools but did provide some clear similarities. The interpretation of motion as a rapid, quite powerful dynamic action, such as crushing/pecking/battering, and grinding is well comparable with the experimental collection in case of all contact materials. The traces interpreted as used on stones have also good parallels amongst the tools used on sandstone and their use on mineral is also suggested by the experimental pieces used on ceramics. The archaeological traces interpreted as hard animal material (probably in combination with fat and meat) are supported by all traces developed on the experimental tools used to process animal material. However, the exact fashion and animal material (i.e. fresh or burnt, large or small bone, antler, large or small animal, etc.) is not completely clear. Therefore, the interpretations of the archaeological tools currently remain quite general but might be altered in the future in the light of new experimental data and/or residue analysis. Even though our experiments were developed following data found on the archaeological material (i.e. scarring of edges, micro impact points, characteristics of micropolish, preliminary residue analysis), for a better understanding of the use of these artefacts it is important to further continue experimentation with faceted tools both in fashion of use and different contact materials.

Awaiting further experiments, some interesting observations on the use of faceted tools can be made based on the current research. Clearly, in both the BQY/VSG and Swifterbant culture contexts, these tools have been used almost exclusively for crushing/pecking/battering, mainly of hard animal material, such as bone and fish. Yet, in the Early Neolithic contexts their use seems somewhat more divers, with specimens exclusively used for stone working or in a combined manner. Following this, it is an interesting question why crushing of bone was done in both communities with different economies during the 5th millennium cal BC. It could be related to the extraction of marrow and/or grease, which are highly nutritious resource. If this was the case, it might relate to the fundamental shift in subsistence, with the introduction of the first domesticated animals and the way people processed their food, i.e. cooking in pots. Crushing bone could also be related to the making of adhesives. However, as there are basically no bone remains preserved on the Early Neolithic sites, any further speculation on contact material could only be a hypothesis. Therefore, only further organic residue analyses on both faceted tools and pottery can shed light on these questions. However, recent compound-specific ^{13}C analysis of absorbed fatty acids has demonstrated the processing of ruminant meat/fat, next to freshwater fish within several Swifterbant culture pots from the Scheldt basin[1]. Alternatively, the crushing of bone is linked to the production of bone fragments or powder, e.g. to be used as pottery temper. However, this explanation only holds for the BQY/VSG culture, which is characterized by bone-tempered pottery (Constantin and Courtois, 1980), while this practice is totally unknown from the Belgian and Dutch Swifterbant culture (Teetaert, 2020 ; Teetaert, Crombé, 2021)

In conclusion, the presence of faceted tools in the Lower-Scheldt basin clearly points to close and repeated contacts and exchanges between the last indigenous hunter-gatherers and first farming communities of the loess region. This fits perfectly with other evidence, such as the presence of cereal grains (mainly *Triticum aestivum* s.l./*turgidum* s.l.), and domesticated animals (sheep/goat and possibly also cattle and pig), or parts of these from ca. 4800/4600 cal BC onwards (Meylemans *et al.*, 2018 ; Crombé *et al.*, 2020 ; 2022) as well as local (Swifterbant) pottery production from at least 4600 ca. BC onwards (Teetaert, 2020 ; Teetaert, Crombé, 2021). Detailed technological analyses of the pottery (Teetaert, Crombé, 2021) and lithic knapping (Messiaen, 2020 ; Messiaen *et al.*, 2022) also revealed clear links with the BQY/VSG. Hence, it seems that the neolithization process of the Scheldt basin started much earlier than elsewhere in the NW European Plain under influence of the nearby BQY/VSG groups, and was not limited to the exchange of commodities but also involved the exchange of technological know-how. In particular, pottery manufacturing implies training by skilled specialists and hence direct and prolonged involvement of farmers/herders from the loess areas. This might even have led to intermixing of both groups as recent aDNA research has demonstrated much more hunter-gatherer ancestry in early farmer's genes in western Europe compared to central and SE Europe (Brunel *et al.*, 2020 ; Rivollat *et al.*, 2020).

Acknowledgements. This research was funded by the Research Foundation-Flanders (FWO) under grant number G008916N, entitled "The roles of demic diffusion and/or local adoption in the transitions toward agropastoral Neolithic lifeways in the Scheldt basin", as well as by the Special Research Fund of Ghent University (BOF-UGent, BOF16/IOP/001), project entitled "The impact of the physical characteristics of flint and their weathering on the preservation of prehistoric use wear traces". Furthermore, we would like to thank Prof. Laurence Burnez-Lanotte (Université de Namur) who allowed us to access/study the faceted pieces of Vaux-et-Borset.

NOTE

1. Results of ongoing research at the Department of Chemistry, Atomic and Mass Spectrometry and the Department of Archaeology, Ghent University.

BIBLIOGRAPHICAL REFERENCES

Allard P. (1999) – L'industrie lithique du groupe de Villeneuve-Saint-Germain des sites de Bucy-le-Long (Aisne), *Revue archéologique de Picardie*, p. 53-114.

Allard P. (2005) – *L'industrie lithique des populations rubanées du nord-est de la France et de la Belgique*, Rahden, Marie Leidorf (Internationale Archäologie), 242 p.

Augereau A. (2004) – *L'industrie du silex du Ve au IVe millénaire avant J.-C. dans le sud-est du Bassin parisien*, Paris, Maison des Sciences de l'Homme (Documents d'Archéologie française), 220 p.

Biard M., Riche C. (2017) – The Evolution of Flake Débitage During the Early And Middle Neolithic in Upper Normandy, *Journal of Lithic Studies*, 4, 2, p. 105-128.

Blancquaert G. (1989) – L'analyse tracéologique: l'exemple d'une concentration mésolithique à Oudenaarde-»Donk», *Les Cahiers De Prehistoire Du Nord*, 6, 2, p. 22-32.

Bostyn F. (1994) – *Caractérisation des productions et de la diffusion des industries lithiques du groupe néolithique du Villeneuve-Saint-Germain*, Thèse de doctorat, Paris X, 754 p.

Bronk Ramsey C. (2009) – Bayesian Analysis of Radiocarbon Dates, *Radiocarbon*, 51, 1, p. 337-360.

Brunel S., Bennett E.A., Cardin L., Garraud D., Emam H.B., Beylier A., Boulestin B., Chenal F., Ciesielski E., Convertini F., Dedet B., Desbrosse-Degobertiere S., Desenne S., Dubouloz J., Duday H., Escalon G., Fabre V., Gailledrat E., Gandelin M., Gleize Y., Goepfert S., Guilaine J., Hachem L., Ilett M., Lambach F., Maziere F., Perrin B., Plouin S., Pinard E., Praud I., Richard I., Riquier V., Roure R., Sendra B., Thevenet C., Thiol S., Vauquelin E., Vergnaud L., Grange T., Geigl E.-M., Pruvost M. (2020) – Ancient Genomes from Present-Day France Unveil 7,000 Years of its Demographic History, *Proceedings of the National Academy of Sciences*, 117, 23, p. 12791-12798.

Cahen D., Van Berg P.-L. (1979) – Un habitat danubien à Blicquy. I. Structures et industries lithiques, *Archaeologia Belgica*, 221, p. 39-p.

Cahen D., Caspar J.-P., Otte M. (1986) – *Industries lithiques danubiennes de Belgique*, Liège, Université de Liège, 88 p.

Caspar J.-P., Burnez-Lanotte L. (1994) – III. Le lithique, *in* J.-P. Caspar, C. Constantin, A. Hauzeur *et al.* (dir.), *Nouveaux éléments dans le groupe du Blicquy en Belgique : le site de Vaux-et-Borset «Gibour» et «A la Croix Marie-Jeanne»*, (Helinium), p. 3-93.

Caspar J.-P., Burnez-Lanotte L. (2008) – Les industries lithiques des cultures du Rubané et du Blicquy-Villeneuve-Saint-Germain: mises en convergences d'analyses croisées, *in* L. Burnez-Lanotte, M. Ilett et P. Allard (dir.), *Fin des traditions danubiennes dans le Néolithique du Bassin parisien et de la Belgique (5100-4700 av. J.-C), Autour des recherches de Claude Constantin*, Paris, Presses Universitaires de Namur, Namur, Société préhistorique française, p. 245-268.

Constantin C. (1985) – *Fin du Rubané, céramique du Limbourg et Post-Rubané en Hainaut et en Bassin Parisien*, BAR Publishing, Oxford, (BAR International serie), 356 p.

Constantin C., Courtois L. (1980) – Utilisation d'os comme dégraissant dans certaines poteries néolithiques, *in* E. A. Slater et J. O. Tate (dir.), *Proceedings of the 16th International Symposium on Archeometry and Archaeological Prospection, (Edinburgh, 1976)*, Edinburgh, National Museum of Antiquities of Scotland, p. 211-220.

Crombé P., Perdaen Y., Sergant J., Van Roeyen J.P., Van Strydonck M. (2002) – The Mesolithic-Neolithic Transition in the Sandy Lowlands of Belgium: New Evidence, *Antiquity*, 76(293), p. 699-706.

Crombé P. (2010) – Contact And Interaction Between Early Farmers And Late Hunter-Gatherers in Belgium During the 6th And 5th Millennium calBC, in D. Gronenborn & J. Petrasch (dir.), The Spread of the Neolithic to Central Europe, International Symposium Berichte der Römisch-Germanisches Zentralmuseum (Mainz, 2005), Mainz, Forschungsinstitüt für Vor- und Frühgeschichte, p. 551-566.

Crombé P., Verhegge J., Deforce K., Meylemans E., Robinson E. (2015) – Wetland Landscape Dynamics, Swifterbant Land Use Systems, And the Mesolithic–Neolithic Transition in the Southern North Sea Basin, *Quaternary International*, 378, p. 119-133.

Crombé P., Messiaen L., Teetaert D., Sergant J., Meylemans E., Perdaen Y., Verhegge J. (2019) – Bioturbation And the Formation of Latent Stratigraphies on Prehistoric

Sites, in J. Deák, C. Ampe et H.M. Jari (dir.),1207Geoarchaeological Meeting,Soils As Records Of Past And Present. From Soil Surveys To Archaeological Sites: Research Strategies For Interpreting Soil Characteristics (Bruges, 2019a),Raakvlak,1207p. 99-112.

Crombé P., Aluwé K., Boudin M., Snoeck C., Messiaen L., Teetaert D. (2020) – New Evidence on the Earliest Domesticated Animals And Possible Small-Scale Husbandry in Atlantic NW Europe, *Scientific Reports*, 10, 1, p. 20083.

Crombé P., Aluwé K., Boudin M., Snoeck C., Messiaen L., Teetaert D. (2022) – Reply To: No Compelling Evidence for Early Small-Scale Animal Husbandry in Atlantic NW Europe, *Scientific Reports*, 12, 1, p. 1403.

Deforce K., Bastiaens J., Crombé P. (2014) – A Reconstruction of Middle Holocene Alluvial Hardwood Forests (Lower Scheldt River, N-Belgium) And Their Exploitation During the Mesolithic-Neolithic Transition Period (Swifterbant Culture, c. 4500–4000 BC), *Quaternaire*, 25(1), p. 9-21.

Denis S. (2017) – *L'industrie lithique des populations blicquiennes (Néolithique ancien, Belgique): organisation des productions et réseaux de diffusion: petits échanges en famille*, Oxford, BAR Publishing (BAR international series), 257 p.

Denis S. (2019) – Perspectives sur l'étude des productions lithiques simples au Néolithique : le cas de la culture Blicquy/Villeneuve-Saint-Germain par le prisme du site de Vasseny (Aisne), *Bulletin de la Société préhistorique française*, 116, 4, p. 657-679.

Deramaix I., Zeebroek M., Jadin I., Denis S. (2018) – Le Néolithique ancien des «Haleurs» à Ath (Prov. de Hainaut, BE). Premiers résultats et perspectives, *Notae Praehistoricae*, 38, p. 267-289.

Devaux J. (2016) – *Le site Villeneuve-Saint-Germain d'Aubevoye « La Chartreuse » (Eure). Étude techno-économique de l'industrie lithique des fosses 804 et 854 bordant le bâtiment 6*, Université Paris Ouest Nanterre La Défense, Mémoire de Master 2, 147 p., 2016.

Dubouloz J. (2003) – Datation absolue du premier Néolithique du Bassin parisien : complément et relecture des données RRBP et VSG, *Bulletin de la Société préhistorique française*, 100, 4, p. 671-689.

Hachem L., Bedault L., Denis S., Fromont N., Hamon C., Maigrot Y., Meunier K., Pernaud J.-M. (2021) – *Tinqueux «la Haubette» (Marne, France): un site exceptionnel du néolithique ancien*, Oxford (GB), Archaeopress, 220 p.

Hachem L. (2001) – La faune du village blicquien de Vaux-et-Borset, *Bulletin de la Société préhistorique française*, 98, 1, p. 74-76

Halbrucker É. (2021) – *Tenacious Traces. The Impact of Burning And Patination on Microwear Traces on Experimental And Prehistoric Stone Tools from the Mesolithic-Neolithic Transition in the Scheldt Valley*, Ghent University, 235 p.

Jadin I. (2003) – *Trois petits tours et puis s'en vont...La fin de la présence danubienne en Moyenne Belgique*, Etudes et Recherches Archéologiques de l'Université de Liège, Liège, 721 p.

Keeley L.H. (1980) – *Experimental Determination of Stone Tool Uses: a Microwear Analysis*, Chicago, London, University of Chicago Press, 212 p.

Messiaen L., De Kock T., Dreesen R., Goemaere É., Crombé P. (2018) – Macrolithic stone artefacts from Swifterbant and Michelsberg Culture sites in the Lower Scheldt valley (NW Belgium) and their significance for understanding interregional contact and exchange during the Mesolithic-Neolithic transition, *Notae Praehistoricae*, 38/2018, p. 139-148.

Messiaen L. (2020) – *Lithics in Contact. The Neolithization Process in the Lower-Scheldt Basin (Mid-6th to Mid-4th Millennium BC) From a Lithic Perspective*, Ghent University, 287p.

Messiaen L., Vandendriessche H., Crombé P. (2022) – The Neolithization Process in the Lower-Scheldt Basin (Belgium, mid-6th to mid-4th millennium cal BC) from a Lithic Technological Perspective, *Lithic Technology*, 2022, p. 1-26.

Meylemans, E., Cordemans, K., Vanmontfort, B., Van Gils, M. (2018) – *Erosiegevoelige sites: Nederzettingen van de Bandkeramiek in Vlaanderen: inventaris en problematiek van beheer*, Agentschap Onroerend Erfgoed (Onderzoeksrapporten Agentschap Onroerend Erfgoed), Brussels, 56 p.

Meylemans E., Perdaen Y., Sergant J., Bastiaens J., Crombé P., Debruyne S., Deforce K., Du Rang E., Ervynck A., Lentacker A., Storme A., Van Neer W. (2016) – *Archeologische opgraving van een midden-mesolithische tot midden-neolithische vindplaats te 'Bazel-sluis 5' (gemeente Kruibeke, provincie Oost-Vlaanderen)*, Agentschap Onroerend Erfgoed (Onderzoeksrapporten Agentschap Onroerend Erfgoed), Brussels, 206 p.

Meylemans E., Bastiaens J., Boudin M., Deforce K., Ervynck A., Perdaen Y., Sergant J., Storme A., Crombé P. (2018) – The Oldest Cereals in the Coversand Area Along the North Sea Coast of NW Europe, Between ca. 4800 And 3500 cal BC, at the Wetland Site of 'Bazel-Sluis' (Belgium), *Journal of Anthropological Archaeology*, 49, p. 1-7.

Praud I., Bostyn F., Cayol N., Dietsch-Sellami M.-F., Hamon C., Lanchon Y., Vandamme N. (2018) – Les premières occupations du Néolithique ancien dans le Nord-Ouest de la France, *Gallia Préhistoire*, 58, p. 139-215.

Reimer P.J., Bard E., Bayliss A., Beck J.W., Blackwell P.G., Ramsey C.B., Buck C.E., Cheng H., Edwards R.L., Friedrich M., Grootes P.M., Guilderson T.P., Haflidason H., Hajdas I., Hatté C., Heaton T.J., Hoffmann D.L., Hogg A.G., Hughen K.A., Kaiser K.F., Kromer B., Manning S.W., Niu M., Reimer R.W., Richards D.A., Scott E.M., Southon J.R., Staff R.A., Turney C.S.M., van der Plicht J. (2013) – IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years cal BP, *Radiocarbon*, 55, 4, p. 1869-1887.

Rivollat M., Jeong C., Schiffels S., Küçükkalipçi İ., Pemonge M.H., Rohrlach A.B., Alt K.W., Binder D., Friederich S., Ghesquière E., GronenbornD., Laporte L., Lefranc P., Meller H., Réveillas H., Rosenstock E., Rottier S., Scarre C., Soler L., Wahl J., Krause J., Deguilloux M.F., Haak W. (2020) –

Ancient Genome-Wide DNA from France Highlights the Complexity of Interactions Between Mesolithic Hunter-Gatherers And Neolithic Farmers, *Science advances*, 6, 22, p. eaaz5344.

Robinson E., Lombaert L., Sergant J., Crombé P. (2011) – Armatures And the Question of Forager-Farmer Contact Along the North-Western Fringe of the LBK, *Archäologisches Korrespondenzblatt*, 41/2011, 4, p. 473-608.

Semenov S.A., Thompson M.W. (1964) – *Prehistoric Technology: An Experimental Study of the Oldest Tools and Artefacts from Traces of Manufacture and Wear*, London, Cory, 212 p.

Teetaert D. (2020) – *Routes of Technology. Pottery Production And Mobility During the Mesolithic-Neolithic Transition in the Scheldt River Valley (Belgium)*, Ghent University, 453 p.

Teetaert D., Crombé P. (2021) – The Start of Pottery Production by Hunter-Gatherers in the Low Countries (Swifterbant Culture, 5th Millennium BC): a Critical Assessment of the Available Radiocarbon Dates, *Notae Praehistoricae*, 41, p. 173-186.

van Gijn A. (1990) – *The Wear and Tear of Flint: Principles of Functional Analysis Applied to Dutch Neolithic Assemblages*, Leiden, University of Leiden, Institute of Prehistory (Analecta Praehistorica Leidensia), 182 p.

Van Neer W., Ervynck A., Lentacker A., Bastiaens J., Deforce K., Thieren E., Sergant J., Crombé P. (2013) – Hunting, gathering, fishing and herding: Animal Exploitation in Sandy Flanders (NW Belgium) During the Second Half of the Fifth Millennium BC, *Environmental Archaeology*, 18, 2, p. 87-101.

Vandendriessche H., Guéret C., Aluwé K., Messiaen L., Cruz F., Storme A., Allemeersch L., Van Neer W., Sergant J., Crombé P. (2019) – Deux millénaires d'occupations mésolithiques aux bords de l'Escaut à Kerkhove (Belgique). Première approche palethnographique, *Bulletin de la Société préhistorique française*, 116, 2, p. 283-316.

Vaughan P.C. (1985) – *Use-Wear Analysis of Flaked Stone Tools,* Tucson, University of Arizona Press, 204 p.

Éva Halbrucker
Ghent University
Department of Archaeology
Sint-Pietersnieuwsstraat 35
B-9000 Ghent

Liesbeth Messiaen
Ghent University
Department of Archaeology
Sint-Pietersnieuwsstraat 35
B-9000 Ghent

Solène Denis
CNRS UMR 8068 TEMPS
21 allée de l'Université
F-92023 Nanterre Cedex

Erwin Meylemans
Flanders Heritage Agency
Havenlaan 88 bus 5
B-1000 Brussels

Philippe Crombé
Ghent University
Department of Archaeology
Sint-Pietersnieuwsstraat 35
B-9000 Ghent