Spatial analysis of the late Middle Palaeolithic open-air site of Bout-des-Vergnes (Bergerac, Dordogne) based on lithic technology and refitting

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contemporaneous and, by extension, to form part of a single Mousterian occupation with multiple technological components. The majority of discoidal products produced on the site were exported for future use, while the imported bifaces and Levallois scrapers with longer use-lives were transported multiple times by Neanderthal groups.

Key Word: Mousterian**,** spatial analysis, refitting, discoidal, Levallois, bifaces

1 Introduction

Disentangling reliable signatures of particular technological behaviours within lithic assemblages remains one of the key challenges for Palaeolithic archaeology. This is especially the case for cave and rockshelter sites, where often-complex site formation processes and post-depositional reworking can render it difficult to reliably discern if different technological components, human remains, or faunal elements within an archaeological layer or stratigraphic unit are, in fact, contemporaneous or represent a mixed signature of different unrelated occupations (examples include Vallverdu et al, 2005; Morin et al., 2005; Bordes, 2000, 2002; Teyssandier, 2007; Discamps et al., 2012; Machado et al., 2016; Gravina et al., 2018, Discamps et al., 2019; Rusch et al., 2019; Daschek and Mester, 2020). These processes can equally confound assessing the degree of artefact import/export and its overall effect on assemblage variability and composition.

On the other hand, open-air sites, although subject to their own suite of preservation issues, often better preserve the sometimes near-original spatial patterning of tool production, transport, and use, as well as in unique cases, their articulation with faunal remains or evidence of fire use. The most well-known examples of such unique preservation conditions are, perhaps, the Middle Palaeolithic open-air sites of northern Europe (examples include Roebroeks et al., 1997; Roebroeks et al., 2011; Bringmanns, 2006; Goval, 2012; Locht et al., 2016).

While these examples of exceptional preservations conditions not only give us a unique window on prehistoric spatial organisation, what are often much smaller, more temporally resolved lithic assemblages shed important light on how we define and compare lithic techno-complexes and the relationship between different artefact or tool types. This is particularly important given what are potentially important differences in site function between open-air and enclosed sites.

Over the last 25 years, substantial construction work in the Bergerac region of south-western France has led to the discovery and excavation of multiple Middle Palaeolithic open-air sites. Here we present a spatial and technological analysis of a recently excavated late Middle Palaeolithic open-air site and explore the relationship between imported artefacts and stone tool production carried out on the site.

2 Materials and Methods

The Late Mousterian open-air site of Bout-des Vergnes

Rescue excavations at the open-air site of Bout-des-Vergnes (Bergerac, Dordogne) by the Dordogne Archaeological Service over 5 months between 2012 and 2013 documented multiple Palaeolithic (Mousterian, Châtelperronian, Late Aurignacian), proto-historic, and medieval occupations over approximately 4500 m². The site is located in alluvial deposits on the right bank of the Caudeau, at its confluence with the Marmelet, both waterways emptying into the Dordogne River. The deposits lie on a flat terrace directly overlying the flood plain of the Dordogne (Fig. 1). The Mousterian artefacts were recovered from a 20 cm thick level at the top of a sandy-loam sequence partially mixed with the base of a well-developed palaeosol. The surface of the palaeosol was delimited by a lens of quartz gravels, referred to as “grain de sel”, which is not consistently present across the site and in places lay at the base of the palaeosol. These quartz gravels result from multiple erosional phases of the alluvial terrace following flooding from the Marmelet and Caudeau. An OSL date of 48.8 ± 4.3 Ky obtained from the palaeosol places the Mousterian occupation of Bout-des-Verges within Marine Isotope Stage 3, and therefore towards the end of the region’s Middle Palaeolithic sequence.

Figure 1: *Geological Map (Bureau des recherches géologiques et minières) of the Bergerac region showing the position of the site (scales at 1/50,000 and 1/100,000.*

Lithic Assemblage

The Mousterian lithic assemblage comprises 917 piece-plotted lithics spread across the excavated surface but clustered in three main concentrations in the southwest sector of the site. This generally well-preserved lithic assemblage has, however, been substantially winnowed and lightly redistributed by surface water runoff, with between 10 to 15 % of the smallest lithic objects absent from the different concentrations. Use-wear analysis of a sample of the Bout-des-Vergnes lithic material nevertheless revealed a generally well-preserved lithic assemblage, with little evidence for post-depositional surface alterations. Any potential reworking of the lithic assemblage therefore appears relatively limited, with the middle- to larger-sized objects most likely undergoing little post-depositional transport.

All of the raw materials exploited at Bout-des-Vergnes are local or sub-local flint varieties available, respectively, from the terraces of the Dordogne River or eroded out-crops on the plateau. The assemblage is dominated by grey and black, or more rarely, blond Senonian flint (56.4%, n=517) and Maastrichtian flint commonly referred to as “Bergeracois” (324, n=35.3%) together with a single block and several flakes of Tertiary or unidentified flints (1.8%, n=16). Smaller numbers of harder volcanic and metamorphic rocks (6.5%; n=60), such as basalt, quartz, and granite, were equally introduced to the site from nearby alluvial deposits.

Refitting Methodology and Technological Analysis

The refitting programme followed a detailed, systematic protocol designed to be as thorough as possible. Artefacts were first sorted by raw material and then sub-sorted, grouping elements potentially deriving from the same blocks as a *raw material unit* or *RMU* (see Vaquero et al., 2014). Even when no refits were found amongst the different RMU, they nevertheless provide informative spatial data. Finally, all refitting sequences were analysed from a technological perspective in order to identify missing elements that could potentially be found elsewhere in the collection. Identifying these missing elements equally provides indications concerning the transport of objects across the site by both natural processes and humans.

3 Results

Lithic Technology

Despite its relatively small size, the Bout des Vergnes assemblage nevertheless comprises 66 cores, indicating substantial core reduction to have occurred on-site. Amongst identifiable cores, discoidal cores are most frequent (88 %, n=38) and are accompanied by significantly smaller numbers of Levallois (n=2) and unipolar cores with oblique edges (n=5) (Brenet, 2013). The presence of 29 pseudo-Levallois points and 10 *éclats débordant* further reinforces the predominantly discoidal nature of the lithic assemblage. The site equally yielded 15 bifaces, 7 bifacial-thinning flakes, and several large Levallois flakes (n=6) retouched as sidescrapers or left unmodified. The absence of corresponding Levallois cores or any substantial evidence of bifacial shaping argues in favour of these elements having been imported to the site.

Refitting

Our refitting programme produced 231 connections; 200 debitage conjoins and 31 break conjoins, representing a total of 315 pieces or 34.4 % of the lithic assemblage. Overall, 90 blocks were refitted, 57 of which involved three or more elements and 4 of which comprised more than 10 pieces.

The refitting programme also allowed us to group 44.3 % (n=406) of pieces into 72 different *RMU* (tested blocks excluded) and 22 individual cores. Although it was impossible to assign all pieces to a raw material unit, the reduction of 94 different blocks of raw material at Bout-des-Vergnes remains a good overall estimate.

Apart from a second-order refit (Petraglia, 1992) between a biface and a bifacial thinning-flake in the same raw material variety, no bifacially-shaped pieces or large Levallois flakes were connected to a refit sequence or a raw material unit. Importantly, the refitted sequences confirm the initial technological description of the assemblage; 73.7 % of the refit sequences attributable to a reduction method are discoidal. At least 10 discoidal refits reveal a ramified chaîne opératoire (Bourguignon et al., 2004), where flakes were re-used as cores, a pattern that had previously been identified for other discoidal industries in southwestern France (Bourguignon and Turq, 2003; Gravina and Discamps, 2015; Faivre et al., 2016; Thomas and Gravina, in press).

Four refit sequences, as well as an isolated core, provide evidence for the production of blanks from unipolar cores with oblique edges (Fig. 2) (Brenet and Folgado, 2003; Brenet, 2013). This type of reduction could appear similar to a discoidal core conception, in the sense that both involve a degree of ‘opportunism’. For instance, both conceptions entail preparation of the striking platform and blows are delivered away from the core’s edge. The flakes obtained from both methods are short with pronounced bulbs of percussion. While these cores could fit with Slimak’s (2003) description of unipolar discoidal reduction, all flakes are detached from a fixed striking platform and therefore do not contribute to maintaining the core’s peripheral convexity, which is one of the defining traits of discoidal reduction (Boëda, 1993; Mourre, 2003, articles in Peresani (Ed.), 2003).

The majority of the assemblage reflects the first stages of the chaîne opératoire (Geneste, 1985); cortical flakes make up 66 % of the assemblage and correspond to the roughing-out or testing of blocks. This is consistent with experimental reproduction of different discoidal reduction sequences, which showed that, independent of the experimenter or

modality; replicated discoidal assemblages contain on average 69 % cortical flakes (Brenet et al., 2009; Bourguignon et al., 2011; Brenet, 2013).

With that said, refit reduction sequences and comparisons with experimental data reveals desired end-products, notably pseudo-Levallois points, to be under-represented. Experimental data (Bourguignon et al., 2011) predicts each core to produce on average 5.4 pseudo-Levallois points. Based on this model, the 38 discoidal cores at Bout-des-Vergnes should have produced 205 pseudo-Levallois points; however, only 30 points were found, reflecting an overall export of 175 pieces, or around 85 % of pseudo-Levallois points potentially produced on-site.

Reduction concepts	Black Senonian	Bergeracois	Blond Senonian	Other	Total	%
Discoid	12	13	3	-	28	36.8
Unipolar	1	2	1	-	4	5.3
Levallois	-	-	-	1	1	1.3
Undetermined	26	4	7	1	38	50
Tested blocks	2	1	-	1	4	5.3
Bifaces	-	1	-	-	1	1.3
Total	42	21	10	3	76	100

Table 1 : *Reduction concepts according to raw material types.*

All raw materials were treated in a similar fashion despite important volumetric differences between blocks of Bergeracois flint and grey, black, and blond Senonian varieties (Fig. 2). Tested blocks of Bergeracois flint weigh on average 536 grams compared to 234 grams for Senonian blocks. This difference is equally borne out by the four refit sequences comprising more than 10 flakes, with the three Senonian examples weighing between 417 grams and 321 grams and the refit Bergeracois block, 720 grams. Blocks of Bergeracois flint are generally larger on average, rendering them more apt to produce large Levallois products. The fact they were nevertheless exploited according to a discoidal reduction concept therefore reflects a deliberate choice rather than raw material constraints.

Figure 2: *a. Refit n° 14, bifacial discoidal core: b. Refit n° 62 unifacial discoidal core; c. Refit n°4, unipolar core with oblique edges.*

Spatial Analysis

The spatial analysis of the Bout-des-Verges assemblage focused on the horizontal distribution of lithic objects with different techno-economic criteria. The majority of pieces were found in three concentrations (C1, C2, C3) excavated by hand in the southwest sector of the site. The remaining lithic objects were found outside these concentrations (OC) and comprise 61% of the assemblage found over but 3 % of the total excavated surface. The limits (Fig. 3 and 4) of each concentration were defined using artefact densities according to the method described by Clark (2016). While these concentrations are difficult to describe as genuine *in-situ* knapping scatters, they nevertheless correspond to the relatively undisturbed remains of reduction sequences and, thus, an overall good preservation of the near-original spatial organisation of the occupation.

Figure 3 : Distribution of lithics in the Mousterian level.

Figure 4 : Projection of all Mousterian refit sequences. Connections between objects reflect the order of detachement.

First, flakes from the initial phases of roughing-out blocks and decortication are most frequent, with 68 % found within the three concentrations. Certain differences between the four zones are, however, observable in terms of blank production (Table 2).

Concentrations C1 and C2 yielded relatively few blanks compared to cortical flakes while the opposite is true of material recovered outside of the concentrations. This may suggest that blanks were transported away from the concentrations to another area of the site. The same would be true of imported elements, such as the large Levallois flakes.

Concentration C3, on the other hand, falls between the other two in terms of content. Although containing similar numbers of cortical flakes, non-cortical blanks are over-represented compared to the other two concentrations. This could be explained by the preferential exploitation of Bergeracois flint, as 9 blocks of this flint variety were recovered from C3 compared to only 2 and 3 from C1 and C2, respectively. Blocks of Bergeracois flint are generally larger and thus produce more cortical flakes.

	C2		C3		C1		OC	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Primary flakes (100 % cortical flakes)	15	12.6	22	9.4	20	10	12	3.5
>50 % cortical flakes	27	22.7	31	13.3	31	15.5	34	10
<50 % cortical flakes	25	21	57	24.5	43	21.5	81	23.9
Naturally backed flakes	5	4.2	5	2.1	5	2.5	4	1.2
Elongated cortical flakes	-	-	-	-	-	-	4	1.2
Total cortical flakes	***72***	***60.5***	***115***	***49.4***	***99***	***49.5***	***135***	***39.8***
Flakes	12	10.1	47	20.2	18	9	57	16.8
Pseudo-Levallois points	4	3.4	6	2.6	8	4	11	3.2
Eclats débordants	2	1.7	3	1.3	7	3.5	7	2.1
Bifacial thinning flakes	2	1.7	2	0.9	2	1	4	1.2
Levallois flakes	1	0.8	1	0.4	1	0.5	4	1.2
Elongated flakes	-	-	-	-	-	-	2	0.6
Total non-cortical flakes	***21***	***17.7***	***59***	***25.3***	***36***	***18***	***85***	***25.1***
Bifaces	-	-	-	-	-	-	15	4.4
Discoid cores	5	4.2	8	3.2	12	6	13	3.8
Core fragments	1	0.8	2	0.9	-	-	3	0.9
Undetermined cores	3	2.5	-	-	8	4	4	1.2
Unipolar cores	1	0.8	-	-	2	1	2	0.6
Levallois cores	-	-	-	-	1	0.5	-	-
Hammerstones	2	1.7	2	0.9	5	2.5	7	2.1
Tested blocks	2	1.7	-	-	2	1	11	3.2
Chunks	6	5	47	20.2	17	8.5	52	15.3
Pebbles	6	5	-	-	18	9	12	3.5
Total	***119***	***100***	***233***	***100***	***200***	***100***	***339***	***100***

Table 2: *Technological counts by concentration and isolated objects (OC = outside concentrations).*

Spatial analysis of a sample of refit sequences

The majority of refit sequences were found within the three concentrations. As these areas were excavated by hand, the fact that they yielded more refits should come as no surprise (Fig. 4). The near-complete reduction sequences within the concentrations suggest they represent knapping scatters that were only slightly redistributed by post-depositional processes. The distances between conjoins equally argues in favour of the lithic material be dispersed over very short distances; 40.7 % are separated by between 0.5 to 2 m and 16.3 % less than 0.5 m (Fig. 5).

Figure 5 : *Proportions of conjoins by distance between connections*

The non-negligible number of conjoins involving distances of between 2 and 5 m (26.2%) could reflect the transport of objects by Mousterian groups or the result of surface water runoff. Finally, while long distance conjoins are fairly rare (16.8 % over more than 5 m) they nevertheless provide the most reliable information concerning the human transport of artefacts as well as connections between concentrations.

Two refit sequences connect concentrations C2 and C3 (Fig. 6 and 7). The first, refit 40 (Fig. 6), is a tested block of black/grey Senonian flint onto which refit 5 cortical flakes or debris from a single, short reduction sequence. The nodule was tested at two different ends but was never exploited due to the poor quality and fragility of flint. While flakes from the decortification of the block and a notched piece were found in C3, the tested block itself was recovered at the periphery of concentration 2.

This distribution suggests two hypotheses:
-The block was tested near C3, where the refit cortical flakes were found, and then transported and discarded near C2 without any subsequent reduction (Hypothesis 1) or;
-the block was tested and abandoned in C2, with shatter and cortical flakes transported to and discarded in C3 (Hypothesis 2), which would represent a discard zone similar to what has been described at the Upper Palaeolithic open-air site of Pincevent (Bodu, 1993). It is also possible that the transport of the core from C3 to C2 could reflect what has been described ethnographically as a “toss zone” (Binford, 1978).

Figure 6 : *Refit n° 40*

The second refitted sequence evinces potential relationships between concentrations 2 and 3. Refit n° 7 (Fig. 7) is a block of black Senonian flint collected from the alluvial deposits of the Dordogne River. With 13 elements, it is the second most complete of the assemblage. Exploited following a bifacial discoidal core conception, the core is absent and a large portion of the blank production phase is equally missing. The majority of refit flakes are cortical and were all recovered from C3 except for a single retouched piece. As suggested above, this tool was transported for a potential use not very far from where it was produced (around 3.5 m).

Refit sequence n° 70 (Fig. 8) is a small, grey Senonian flint pebble onto which two flakes were refit and connects concentrations 1 and 3. Seven other flakes were subsequently detached from the same pebble but were not found. A cortically-backed flake was found in concentration 3, and the other cortical flake was found isolated, more than 20 m to the northwest of the concentration, while the core was recovered at the edge of concentration 1.

Three hypotheses could explain the distribution of material from refit 70 (Fig. 8):
-Core reduction began in concentration 3 with the removal of the two flakes, and the core was subsequently transported to concentration 1, where it was re-exploited and the resulting material not recovered during excavations (Hypothesis 1);
-the core was reduced in concentration 1, with the two refitted flakes subsequently transported (Hypothesis 2);
-core reduction began in concentration 3 and continued in another unidentified area before the core was discarded in concentration 1 (Hypothesis 3).

Figure 7 : *Refit Sequence n° 7*

Figure 8: *Refit sequence n° 70*

A final long-distance conjoin concerns material found outside the three concentrations. Refit sequence n° 59 shows piece n° 461, an atypical pseudo-Levallois point in Bergeracois flint, was clearly transported from knapping scatter C3. No use-wear evidence is currently available that might shed light on the still unexplained transport of what appears to be an unused artefact. In fact, very few flakes debited on-site were transported beyond knapping concentrations for subsequent use, and the majority of sought-after end-products were exported.

Spatial distribution of raw materials

The distribution of the identified raw material units (Fig. 9), non-conjoined/refitted material included, provides complementary information concerning the residual organisation of space at Bout-des-Vergnes. For example, RMU n° 340 comprises 2 refit sequences of 2 and 4 pieces, as well as 2 conjoined pieces, detached from a block of blond-black Senonian

flint that stands out from the other RMUs. As the centre of the block was unexploitable, the two large cortical flakes were re-used as cores. All pieces were found in or near concentration 3, apart from one unmodified piece recovered from concentration 1. The spatial distribution of RMU 340 once again highlights connections between these two knapping concentrations.

Figure 9 : Distribution of raw material types across the excavated surface.

Spatial distribution of tools

A sample of retouched tools and unmodified blanks were the subject of a use-wear analysis. Retouched tools are relatively limited at Bout-des-Vergnes (n=45, Table 3) and include imported bifaces and large scrapers on Levallois blanks. These tools primarily concern Bergeracois flint (16 of 26) and bear numerous traces of use. Their distribution across the excavated area precludes identifying any dedicated butchery area.

Denticulates, notches and partially retouched pieces, on the other hand, are all made on blanks produced on-site, notably discoidal varieties. Amongst this small subset of tools, the majority in Senonian flint (18 of 21), 12 pieces could be attributed to specific RMUs, 9 issuing from the same refit sequence. Unlike the imported tools, many of these tools were recovered within the concentrations (11 of 21), and could reflect the rapid transformation and use of tool blanks, however this was not confirmed by the use-wear analysis. The only cluster of tools with trace of use that might reflect a butchery area was found at the edges of concentration 1. Composed of unmodified flakes, some coming from other areas of the site, this cluster also includes a backed knife in Bergeracois flint that was not attributed to any of the identified RMUs.

	Raw Material			**Concentration**				
Tool type	**Black Senonian**	**Bergeracois**	**Blond Senonian**	**C2**	**C3**	**C1**	**OC**	**Total**
Bifaces	6	9	-	-	-	-	15	15
Scrapers	2	7	-	-	1	-	8	9
Denticulates	5	1	1	1	2	2	2	7
Notches	2	-	-	-	-	1	1	2
Partially retouched pieces	8	2	2	-	3	2	7	12
Total	23	19	3	1	6	5	33	45

Table 3 : Tool counts by raw material and concentration (OC = Outside of a concentration)

4. Interpretation

Artefact contemporaneity

While previous research using refitting has focused on evaluating the stratigraphic integrity of sites reworked by natural processes (Cahen and Moeyersons, 1977; Bordes, 2000, 2002; Morin et al., 2005; Bachellerie, 2007, 2011; Gravina et al., 2018) or disentangling palimpsests (articles in Mallol and Hernandez, 2016; Discamps et al., 2019), the Mousterian material from Bout-des-Vergnes is contained within a single, 20 cm-thick level which makes it difficult to discern different occupation phases. This being the case, several lines of evidence nevertheless argue in favour of the various artefact concentrations being contemporaneous.

Contemporaneity of the concentrations

Demonstrating the contemporaneity of the different knapping concentrations is based primarily on the techno-economic analysis of the assemblage. The three concentrations in the southwest sector are almost exclusively discoidal. The only difference between these technologically coherent concentrations is the preferential exploitation of Bergeracois flint in concentration 3, which seems insufficient to justify it representing a different occupation phase.

The refit sequences also argue in favour of the concentrations being contemporaneous. First, in terms of RMUs, the recovery of an object from RMU 340, primarily reduced in concentration 3 but with one object recovered from concentration 1, clearly demonstrates a temporal connection between the groups of objects. Second, the spatial analysis of the refits depicts a clear contemporaneity between all objects, in the sense that they theoretically represent a single phase of reduction (Cahen, 1980), despite several known exceptions (Bordes, 1980; Romagnoli, 2013). Two refit sequences also connect concentrations 2 and 3; a tested block and several flakes were transported from one concentration to the other. In the case of concentrations C1 and C3, a flake was recovered within C3 and the block from which it was detached at the edges of C1. A cortical flake detached between the removal of this flake and the discard of the core was found isolated, outside the concentrations.

While the precise nature of the transports is difficult to determine, the movement of the artefacts is clear and provides the most reliable evidence for the contemporaneity of the different concentrations. Although inter-concentration movements are rare, they are nevertheless significant. In fact, relatively few pieces were transported any substantial distance away from concentrations. It therefore seems unlikely that the transfer of one-third of this limited number of pieces to another concentration was unintentional, especially as the

concentrations make up only 5 % of the excavated surface. Although the potential recycling of previously debited artefacts cannot be dismissed out of hand, the absence of artefacts with double patinas and geological data indicating the rapid burial of the material argues convincingly against such a possibility.

Contemporaneity of objects found outside concentrations and intra-site connections

The Bout-des-Vergnes assemblage contains two highly different components, both in terms of technology and raw material economy. Abundant evidence for discoidal reduction and a smaller number of unipolar cores were found within the concentrations. These components are complemented by biface and large scrapers on imported Levallois blanks found outside the concentrations and not associated with any of the identified RMUs. Several bifacial-thinning flakes, while recovered from within the concentrations, could not be attributed to any of the raw materials exploited on the site. This suggests that additional bifacial tools passed by the site and were carried away or discarded in an unexcavated area of the site. The most notable difference between the two technological components is therefore not linked to two different occupations but to distinct technological choices of the same group.

5. Discussion

Regional Context and Inter-site Comparison

The numerous late Mousterian open-air sites in the Aquitaine Basin reflect substantial diversity in terms of lithic assemblage composition, technology, and site function. The lithic assemblage from Bout des Verges provides yet another example of such diversity. Across this large region, many but not all of these open-air sites are associated with a discoidal technology, as at Champs de Boussuet in the Gironde, Les Forets in the Dordogne, Combemenue in the Corrèze, Latrote in the Landes, or Prissé and Jupiter in the Basque Country (Bourguignon et al., 2000; Bourguignon and Turq, 2003; Brenet and Folgado, 2003; Brenet and Cretin, 2008; Bernard-Guelle et al., 2010; Deschamps, 2014; Colonge et al., 2015). Other sites, such as La Rogère, Bois de Reymondeau and Combe Brune 1 in the Dordogne or Chemin d'Herbe in the Lot-et-Garonne (Brenet and Folgado, 1998; Detrain et al., 1999; Bidard et al., 2011; Brenet, 2012) yielded Levallois dominated assemblages. Alongside these sites characterised by single flake production methods, others, including La Conne de Bergerac, La Graulet and La Mouline

in the Dordogne, or Jonzac in the Charente (Jaubert et al., 2008; Folgado and Brenet, 2010; Brenet et al., 2017), yielded multi-component lithic assemblages combining Levallois and discoidal technologies. These different assemblage types almost certainly reflect different, still difficult to discern site functions, especially in the absence of faunal data for open-air occurrences in the region. Potential functions would include mixed activity sites, knapping workshops, and short stopover sites with evidence for the use of imported tools.

Common to a large majority of these open-air sites is the presence of what are often imported bifaces or bifacial pieces, reinforcing the highly mobile nature of these artefact types (Claud, 2008; Deschamps, 2014, 2016; Thiébaut et al., 2014; Brenet et al., 2017). Despite discoidal reduction and bifacial shaping appearing to be technologically incompatible, the site of Bout-des-Vergnes is not an isolated case of these two systems coexisting (Geneste,1985; Soressi, 2002; Brenet et al., 2017; Faivre et al., 2017). In fact, during the early Middle Palaeolithic of southwestern France, bifacial shaping has been identified with discoidal, Levallois, and blade debitage as at, for example, Combe Brune 2, Cantalouette 1 (Brenet, 2013) or Les Bessinaudes (Brenet in Chadelle, 2018). During later phases of the Mousterian, multiple biface-bearing assemblages are equally characterised by multiple flake production methods (Soressi, 2002; Faivre et al., 2017; Gravina, 2017). At Bout-des-Vergnes, the discoidal and bifacial shaping (Fig. 10) chaînes opératoires are independent, in other words, they involve different blocks of raw material (Brenet et al., 2014) and reflect different forms of raw material economy; one local, the other highly mobile. Taken together, the above reveals the Bout-des-Vergnes assemblage to fit well with what is currently known for the late Mousterian in the region.

Figure 10 : Triangular biface in Bergeracois flint with a lateral tranchet blow..

Inter-site comparisons

A comparison of the Bout-des-Vergnes assemblage with discoidal assemblages from three other open-air sites excavated as part of salvage operations (Fig. 11), Champ de Bossuet (Bourguignon et al., 2000) and Les Forêts (Brenet and Folgado, 2003) in the Dordogne and Le Prissé in the Basque Country (Deschamps et al., 2016), reveals clear similarities between them, apart from the higher proportion of non-cortical flakes at Le Prissé, which is almost certainly connected to the fact that the large slabs exploited at the site bear only two cortical surfaces (Fig. 12). The most similar assemblages come from Champ de Bossuet and Les Forêts. At both of sites, blocks of a grey/black Senonian flint similar in size to those exploited

at Bout-des-Vergnes were used. It is interesting to note that Champ de Bossuet is the only site not to yield any evidence for bifacial shaping. Finally, Bout-des-Vergnes produced the smallest quantity of non-cortical flakes as well as an under-representation of pseudo-Levallois points compared to the high number of cores recovered from the site. This pattern is consistent with these artefact types being preferentially exported for later use.

Figure 11 : Location of sites mentioned in the text. 1 : Le Prissé, 2 : Champ de Bossuet, 3 : Les Forêts, 4 : Bout-des-Vergnes, 5 : Combe-Brune 2 et Cantalouette 1, 6 : Les Bessinaudes.

Figure 12 : Comparison of technological data from the sites of Prissé, Champ de Bossuet, Les Forêts and Bout-des-Vergnes.

Site-function

The main activity carried out at Bout-des-Verges was the production of pseudo-Levallois points in locally available flint. These thick flakes with convergent cutting edges were destined for immediate use and it is unlikely that they were curated or transported over long distances. This suggests the site to have primarily functioned as a short-term workshop, where groups retooled, rather than as long-term habitation site. Imported tools, notably bifaces, several scrapers, and Levallois flakes, add some nuance to this interpretation. While difficult to prove that these pieces were used exclusively on the site, their presence nevertheless suggests some functional consideration or need. The groups that occupied Bout-des-Vergnes also likely pursued other activities other than knapping, including those connected to subsistence concerns; however, the absence of preserved faunal remains makes exploring such a likelihood impossible.

Taken together, the Bout-des-Vergnes Mousterian occupation is consistent with a workshop site “located on a high-quality source of raw material with a focus tool production according to diverse debitage methods and conceptions, with or without the presence of bifacial shaping. Tool blanks and retouched tools are rarely used on-site but are instead reserved for later uses to fulfil anticipated needs. The under-representation of significant numbers of characteristic sought-after endproducts is consistent with their preferential exportation.” (Brenet et al., 2014, p.92)

Technological differences between flakes produced on-site and imported examples are at least partially due to differences in the way they were retouched. Discoidal products, particularly pseudo-Levallois points, can be used unmodified. Certain flakes were however notched or denticulated, which suggest a more expedient use. Conversely, the larger bifaces and Levallois flakes could see several episodes of use, with their edges repeatedly re-sharpened. Moreover, bifaces afford multiple functions (Claud, 2012) and can serve to cut soft organic materials, perform percussive activities, or represent a mobile raw material reserve (Bourguignon et al*.,* 2006). This, however, is not the case at Bout-des-Vergnes, where use-wear evidence suggest these tools were used essentially for butchery, although several examples bear concentrated traces of percussion or abrasion, potentially indicating their use as strike-a-lights (Sorensen et al., 2018)(Fig. 13).

Due to their long use-lives, bifaces and Levallois flakes were almost certainly transported and could be discarded at any moment following multiple phases of re-sharpening or recycling. The opposite is true of discoidal products, which would have been used quickly and transported over only short distances.

Figure 13 : Percussion traces on a biface

6. Conclusion

It remains difficult to identify the exact mobility system of the last Neanderthal hunter-gatherers who occupied the open-air site of Bout-des-Vergnes. What is clear, however, is that part of or the entire group stopped at the site and exploited the high-quality raw materials immediately available in the local alluvial deposits. The nearby Caudeau and Marmelet streams likely attracted game species that these groups tracked along the river valley. The expedient tools afforded by discoidal reduction were complemented by larger tools with longer use-lives, such as bifaces and Levallois flakes, which fulfilled anticipated needs encountered during the movement of the group across their subsistence territory. The duration and absolute distances involved are, however, difficult to evaluate and may incorporate movements between raw material sources, one or several workshop or occupation sites, or hunting camps where prey was consumed.

Acknowledgements

The lead author would like to thank the University of Bordeaux, especially the PACEA laboratory, particularly A. Delagnes. We would also like to thank the Dordogne Departement for granting us access to the Bout-des-Vergnes assemblage, M. Régeard, head of the departemental archaeology service, and E. Ihuel, director of the Bout-des-Vergnes excavations. Finally, we are grateful to the organisers of the USIPP session where this work was initially presented, A. Picin, R. Blasco, M. Andres Chain and J. Rosell Ardèvol. The comments of the anonymous reviewers and the journal editors helped improve the research presented here.

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Highlights

- Refitting provides a fuller understanding of the spatial organisation of open-air sites.
- Discoidal debitage found across the site is contemporaneous with imported scrapers on Levallois blanks and bifaces.
- Differences between technological components of the assemblage reflect the function and use-lives of tools.