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MARIA BITIRI

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AT THE ONSET OF THE MICOQUIAN IN CENTRAL EUROPE: RAW MATERIAL CONSTRAINTS AND TECHNOLOGICAL VERSATILITY AT NEUMARK-NORD 2/0 (GERMANY)

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Key words: *Middle Paleolithic, Central and Eastern European Micoquian, asymmetric backed knives, Neanderthals*
Abstract: *After the Eemian, Neanderthals of Central Europe produced new stone tools for coping with the increased seasonality and climatic deterioration of the Last Glacial. This new cultural tradition is named Micoquian, and is characterized by a broad range of asymmetric backed bifaces, foliate artefacts and bifacial scrapers. Despite the abundant number of sites and the broad geographical expansion, technological information on the early stages of development of the Micoquian are still few. This paper presents new data on the lithic assemblage of Neumark-Nord NN2/0, a Micoquian occupation dated to the MIS 5c/5a. The results point out a technical continuity with the previous Eemian settlements whereas the production of backed bifaces shows to be associated to new strategies of raw material economy in the technological context of Quina scrapers. This behaviour is different from other sites in Central Europe suggesting that the emergence of the Micoquian at the beginning of the Weichselian followed different trajectories.*

Cuvinte-cheie: *Paleolitic Mijlociu, Micoquian central și est-european, cuțite à dos asimetrice, Neandertali*
Rezumat: *După Eemian, Neandertalii din Europa Centrală au început să producă noi tipuri de unelte pentru a face față deteriorărilor climatice ale Ultimului Glaciar. Această nouă tradiție culturală, denumită Micoquian, este caracterizată de o gamă largă de bifaciale à dos asimetrice, piese foliacee și racloare bifaciale. În ciuda numărului mare de situri și a largii răspândiri geografice, datele tehnologice despre începuturile Micoquianului sunt puține. Articolul de față prezintă informații despre industria litică a nivelului NN 2/0 din situl Neumark-Nord, datat în MIS 5c/5a. Rezultatele indică o continuitate tehnică cu mai vechile locuiri Eemiene, în vreme ce producerea de bifaciale à dos arată că este asociată cu noi strategii de gestionare a materiei prime, în contextul tehnologic al prezenței racloarelor Quina. Acest comportament este diferit de cel din Europa Centrală, sugerând că dezvoltarea Micoquianului la începutul Weichselianului a urmat traiectorii diferite.*

INTRODUCTION

A debated aspect in Palaeolithic Archaeology is the understanding of technological organization in prehistoric hunter-gatherers and timing the changes in their technical behaviours (Bamforth 1986; Binford 1979; Kuhn 1994; Nelson 1991). In studies on the Early Middle Palaeolithic (MIS 9–MIS 6), a broad attention has been addressed to the emergence of the Levallois technology and its relationship with the preceding Acheulean cultural tradition (Fontana *et alii* 2013; Hérisson *et alii* 2016; Key *et alii* 2021; Picin 2018; Picin *et alii* 2013; Wiśniewski 2014). In the research related to the Late Middle Palaeolithic (MIS 5e–MIS 3), instead, a greater interest has been directed towards technological entities that were distinctive and circumscribed to a particular territory (e.g. laminar industries, Quina, Vasconian, Micoquian, bout coupé handaxes) (Delagnes *et alii* 2007; Deschamps, Mourre 2009; Goval 2012; Jöris 2006; Ruebens 2013; White, Jacobi 2002). Thus far, these regional techno-complexes are found in the *Mammuthus-Coelodonta* biome, and are absent in the southern Mediterranean regions suggesting a close relation of these technical innovations with low biomass environments and migratory animals. The comprehension of when and where these cultural facies emerged in the archaeological record are crucial for reconstructing the Neanderthals' trajectories of technological advancement and adaptation to the climatic deterioration of the Last Glacial.

At the onset of the Weichselian, in Central and Eastern Europe is documented the diffusion of a wide range of asymmetric bifacial tools (Bosinski 2006; Jöris 2006; Kulakovskaya *et alii* 1993). These artefacts were generally grouped in a techno-complex named Micoquian, due to the similarities with stone tools of complex VI of La Micoque (Hauser 1915; Peyrony 1933), or *Keilmessergruppen*, stemming from the German word for the asymmetric backed knife, the *Keilmesser* (Bosinski 1967; Conard, Fischer 2000; Veil *et alii* 1994). In other regions, morphological differences of bifacial tools and regional variations in the artefacts' proportions favoured the use of different terms such as Pradnik Cycle (Krukowski 1939), Micoquo-Prondnikien (Chmielewski 1969), Eastern Micoquian (Gladilin 1970; Yevtushenko 1998), *Industries charentiennes à influences micoquiennes* (Farizy 1995), or Micoquian with Mousterian Option (MMO) (Richter 1997). Recent archaeological and genetic studies point out a strict relationship between the Western and the Eastern assemblages (Golovanova 2015; Hajdinjak *et alii* 2018; Kolobova *et alii* 2020; Mafessoni *et alii* 2020; Picin *et alii* 2020b) prompting the use of the unifier category Central and Eastern European Micoquian (CEEM). In addition to asymmetric bifacial tools, the CEEM toolkit comprises leaf-shaped artefacts, bifacial scrapers, handaxes, and *groszaks* (small and rounded coin-like scrapers), used probably hafted for processing soft vegetal material (Bosinski 1967; Chabai 2000; Gladilin 1970; Lass 1994; Richter 1997; Veil *et alii* 1994). Within the core reduction strategies, the use of discoid, Levallois, hierarchized technologies with simple knapping methods are documented (Chabai *et alii* 2008; Demidenko, Uthmeier 2013; Farizy 1995; Jöris 2001; Neruda 2011; Pastoors 2001; Picin 2016; Picin *et alii* 2020b; Richter 1997; Weiss 2016).

In Central and Eastern Europe, however, the technical behaviours were not homogeneous and alongside with the CEEM, other cultural traditions were present (Conard, Fischer 2000). During MIS 5d–5a, laminar industries developed in northern France, Belgium, Netherlands, and eastern Germany (Conard 1990; Conard 1992; Goval 2012) whereas in Poland, Czech Republic, Slovakia and western Germany is found a microlithic industry, named Taubachian (Cieśla 2013; Moncel, Neruda 2000; Păunescu 1993; Schäfer 1981; Valde-Nowak, Nadachowski 2014; Valoch 1984; Valoch 1988). Together with these examples, other industries shared the same geographical extension of the CEEM between MIS 5a–MIS 3 and are grouped in the facies Levallois-Mousterian, due the extensive use of Levallois technology (Chabai 2000; Conard, Fischer 2000; Conard *et alii* 2019; Kozłowski 2014). Current hypotheses on the interpretation of the CEEM and Levallois-Mousterian techno-complexes suggest the presence of two distinct cultural traditions (Kozłowski 2014; Mania, Toepfer 1973) or the result of different settlement strategies performed by the same groups of Neanderthals (Richter 1997, 2006; Uthmeier 2004).

A general issue in the interpretation of the CEEM and Levallois-Mousterian is the greater attention addressed to bifacial knives (Gladilin 1970; Jöris 2006; Ruebens 2013). Although these stone tools are found in lower frequencies in comparison with the total amount of the assemblages, bifacial knives are considered the markers of the CEEM, overlooking the total composition of the toolkit. The absence of bifacial knives or bifacial by-products at one site could not exclude that they were used or produced in other locations. In the CEEM, Neanderthals applied different core strategies (Conard *et alii* 2012; Demidenko, Uthmeier 2013; Jöris 2001; Kozłowski 2006; Pastoors 2001; Păunescu 1993; Picin 2016; Richter 1997; Valde-Nowak *et alii* 2016) and the Levallois-Mousterian could be considered as an aspect of this versatility and not necessarily as a separate entity. At Hallera Avenue open-air site (Wiśniewski 2006) and at Kabazi V rock-shelter (Chabai *et alii* 2008), bifacial by-products and tools are discovered in Levallois-Mousterian contexts. Chabai *et alii* (2008), however, interprets the example of Kabazi V as the result of a mechanical mixing between layers. At Königsaue open-air site, the CEEM (layers A and C) and the Levallois-Mousterian (layer B) share a similar technological background and the main difference is found in the patterns of artefacts transport off-site (Picin 2016). Similarly to the Acheulean handaxes, bifacial knives are interpreted as components of the personal gear that could be used as stone tools or cores on need basis (Bamforth 1991; Jöris 2006; Kelly 1988). Thus, during the forays, re-sharpening events could progressively change the morphology of these bifacial artefacts (Iovita, McPherron 2011; McPherron 2006) making difficult the cultural and geographical correlation of the various typological types (Rosendahl 2011).

Beyond the techno-typological differences (Burdukiewicz 2000; Chabai 2000; Demidenko 2015; Jöris 2006), the other main issue of the CEEM is related to the chronological uncertainty of its development. Some authors suggested that the introduction of backed bifacial knives arose during the late Acheulean (Cyrek *et alii* 2014; Kozłowski 2014) whereas others associated these stone tools to the beginning of the Last Glacial (MIS 5c–5a) (Chabai *et alii* 2006; Jöris 2003). Conversely, Richter (1997, 2006) supported a shorter chronology restricted to the end of MIS 4 and the first half of MIS 3. The main assumption is that while numerous CEEM assemblages are younger than 50.000 years BP (see references in Richter 2016), most of the sites with long sedimentary sequences (e.g. Balve Cave, Buhlen, and Wylotne Cave) are lacking secure chronostratigraphic attributions. In several examples, the early Weichselian age of the lower units is based on geological correlations or typological studies (Jöris 1992; Jöris 2003; Kozłowski 2006). The application of the chronometric absolute method could change this interpretation as it occurred, for example, at Königsaue, attributed for long time to MIS 5a (Mania, Toepfer 1973), and successively radiocarbon dated to MIS 3 (Grunberg 2002; Picin 2016). In the last decade, multidisciplinary studies at some sites in Central Europe support the emergence of the CEEM during the early Weichselian (Borel *et alii* 2017; Hein *et alii* 2020; Picin *et alii* 2020b; Richter *et alii* 2014; Valde-Nowak *et alii* 2014). This paper aims to contribute to the ongoing debate adding new data from the lithic assemblage of Neumark-Nord 2/0, one of the few CEEM assemblages dated to MIS 5c–5a.

METHOD AND MATERIAL

The study of the lithic assemblage is carried out following the *chaîne opératoire* approach (Boëda 2013; Pelegrin *et alii* 1988). The Levallois and discoid technology is identified following the criteria defined by Boëda (2013). The intermediate core morphologies, characterised by a hierarchisation of the flaking surfaces and core configuration with secant fracture planes, are considered hierarchised, and differentiated on the base of the direction of detachments (e.g. unidirectional, bidirectional or centripetal) as described in Picin (2018); Picin *et alii* (2020a). The analysis of the flake assemblage is performed by examining the presence (cortex >50% = cortical flake; cortex <50% = semi-cortical flake) or absence of cortex, the number and direction of detachments on the dorsal face, the angle and the type of striking platform, the flaking axis, the presence of knapping accidents (e.g. overshot and hinged removal, siret fracture), and the retouch (Inizian *et alii* 1992). Retouched tools are distinguished following Bordes (1961)'s and Bosinski (1969a)'s typological lists whereas denticulates and notched tools are analysed according to Picin *et alii* (2011).

THE OPEN-AIR SITE OF NEUMARK-NORD

The open-air site of Neumark-Nord (51°19'28''N, 11°53'56''E) is located 20 km south of the city of Halle in Eastern Germany (Fig. 1). Since the end of the 19th century, the area was renowned for the exploitation of lignite and in the late 1990s, the old pit mine was converted into a recreation lake named Geiseltalsee. In 1985, a lake basin filled with interglacial deposits and two archaeological horizons were discovered (Mania *et alii* 2010; Mania, Thomae 1987; Mania *et alii* 1990).

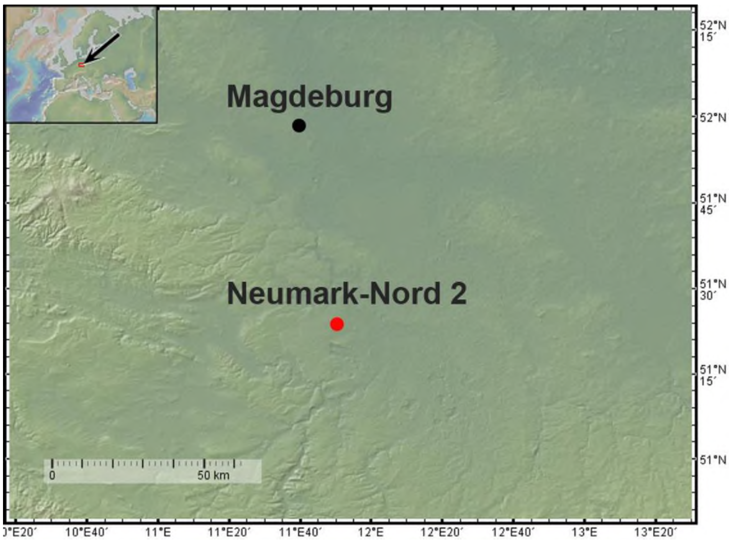

Figure 1. Geographical location of Neumark-Nord open-air site (base map from GeoMappApp).

The site was named Neumark-Nord 1 (NN1) and was investigated until 1996 when the extension of the quarry activities led to the closure of the archaeological excavations. In 1995, another lake basin, named Neumark-Nord 2 (NN2), was found ca. 400 meter east from NN1. This new basin was also filled with lacustrine interglacial deposits overlaid by fluvial gravels and Weichselian loess. In 2003, the *Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt* carried out fieldwork in the Weichselian find level (NN2/0) (Brühl and Laurat 2010). The lower archaeological horizon (NN2/2) was excavated between 2004 and 2008, and from 2006 the fieldwork was performed in collaboration with the Archaeological Research Centre and Museum for Human Behavioural Evolution (Monrepos) of the *Römisch-Germanisches Zentralmuseum* (Germany) and the Faculty of Archaeology of Leiden University (The Netherlands) (Gaudzinski-Windheuser *et alii* 2014a; Gaudzinski-Windheuser *et alii* 2014b).

The stratigraphic sequence of NN2 is composed of a diamict soil (unit 1) at the bottom overlaid by a loamy and sandy deposit (unit 2) covered by a 6–8 m thick accumulation of silt loams (unit 3–19). The archaeological horizon (NN2/2) was found in the middle part of this latter deposit (unit 8). Paleomagnetic analysis and thermoluminescence (TL) dating on heated flint flakes indicate an age of 121 ± 5 ka BP for the Neanderthals' settlements (Richter *et alii* 2014; Sier *et alii* 2011). Then, the lake basin infill is overlain by approximately 6 m of Weichselian loesses. Unfortunately, during recent quarry activities, the soils overlain level NN2/0 were removed exposing the archaeological horizon to post-depositional disturbances caused by bioturbation and small mammals burrowing (De Loecker, Kuijper 2014). OSL dating of the anthropogenic level NN2/0 returned the result of 93 ± 7 ka and attributed it to MIS5c or MIS5a (Richter *et alii* 2014). The faunal assemblage is dominated by remains of *Bison priscus* and *Equus* sp., followed by cervids. Single pieces of *Asinus hydruntinus, Ursus spelaeus* and *Vulpes* sp. are also documented (Brühl, Laurat 2010). In the central area of the excavation, 22 erratic blocks of several dimensions up to 25 kg forming a circular structure of a radius of 2.5/3.5 m were found. These nodules are interpreted as manuports, transported at the site probably for securing the tent-pole orts of a dwelling structure (Brühl, Laurat 2010).

RESULTS

The lithic assemblage of Neumark-Nord 2/0 comprises 7.498 artefacts (2.246 lithic items, 4.963 chips, 34 chunks, 8 tested cobbles, and 32 pebbles) recovered from an area of ca. 385 m^2 (Tables 1–3). Erratic flint (99.7%) is the most common raw material whereas one quartz flake fragment and 15 quartzite flake fragments and three cores represent other categories of rocks. Generally, the dimensions of the lithic artefacts are small, giving to the assemblage a microlithic character (Fig. 2).

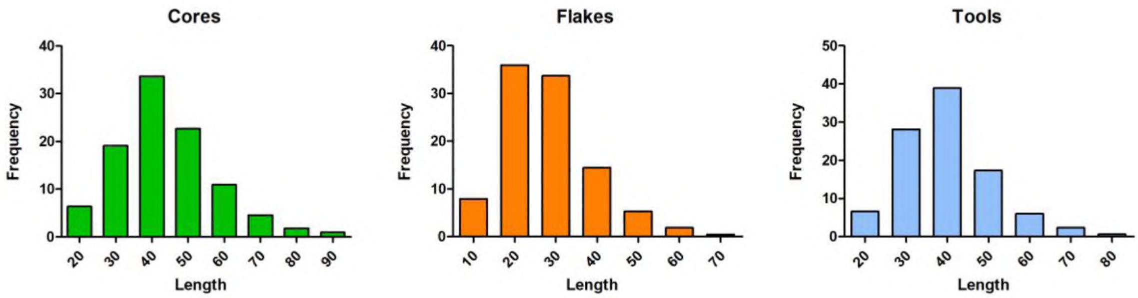

Figure 2. Bar-chart of comparison between the frequencies of cores, flakes, and retouched tools by length intervals at Neumarkt-Nord 2/0.

In order to cope with the small size of the flint nodule, the cores are mostly exploited following the unidirectional pattern (Table 1), and the striking platforms are often flat resulting from the removal on one end of the pebble. In the assemblage, simple unidirectional cores are the most numerous (Table 1). In this category, the artefacts show no preparation of the flaking surface and the use of the natural convexity of the pebbles. In thirteen cores, this approach led to knapping accidents with the removal of the flaking surface and the production of overshot flakes. In 22 artefacts, the exploitation is recurrent whereas in five cores, the small size of the nodule allowed the production of only one flake. In the remaining 16 cores, the reduction strategy is opportunistic and, in addition to the main production face, the dorsal or the lateral faces are also exploited using the principal or supplementary striking platforms. In a similar way, bidirectional and orthogonal cores are as well the result of opportunistic reductions of small pebbles.

	Flint	%	Quartzite	%
Levallois preferential	4	*3.3*		
Hierarchized bidirectional	2	*1.7*		
Hierarchized centripetal	2	*1.7*		
Unidirectional	56	*46.7*	2	*66.7*
Bidirectional	6	*5*		
Orthogonal	1	*0.8*		
Centripetal	4	*3.3*		
Discoid	10	*8.3*		
Polyhedral	5	*4.2*		
Simple cores	12	*10*		
Salami slice			1	*33.3*
Core-on-flake	18	*15.0*		
Total	120	*100*	3	*100*

Table 1. Total numbers and percentages of cores at Neumarkt-Nord 2/0.

In the assemblage, some other cores are characterized by the preparation of the lateral and distal convexities on the flaking surface. In this group, four Levallois preferential cores are distinguished, of which one was recycled successively into a scraper, and two pairs of hierarchized bidirectional and hierarchized centripetal cores (Table 1, Fig. 3).

Figure 3. Cores of Neumarkt-Nord 2/0: 1, 2 Levallois core; 3, 4 hierarchized core; 5, 6 unidirectional core; 7 discoid core; 8 centripetal core.

Within the non-prepared cores, 10 cores are discoid and distinguished by the bifacial exploitation of two flaking surfaces (Table 1). Although these cores were discarded at different stages of reduction, it is worth noting one artefact characterized by the translation of the striking platform and the change of the pattern of reduction to unidirectional (Fig. 3). Secondary operative chains include simple cores, artefacts made on chunks or damaged nodules from which few small blanks were detached, and flake-on-cores (Table 1). In this latter category, the striking platforms are prepared by truncations on the proximal side and the production is largely limited to a single small flake. The comparison of the length of the different types of cores show that the median length values are similar and only prepared cores and bidirectional cores have lower values (Fig. 4). It is worth noting that core-on-flakes have average values analogous to simple cores (Fig. 4).

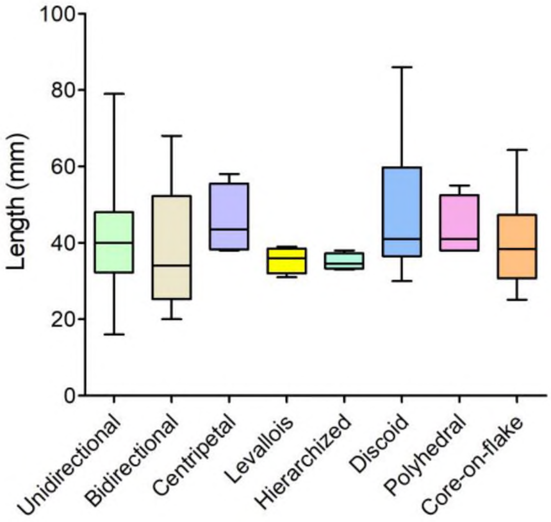

Figure 4. Box-plot of comparison between the lengths of the different categories of cores at Neumarkt-Nord 2/0.

In the flake assemblage, cortical and semi-cortical flakes are common (Table 2) suggesting that flint nodules were transported and knapped at the site. However, between flakes generated during the stages of core configuration and exploitation, core-edge removal flakes are frequent revealing the use of these technical blanks for maintaining the convexity of the flaking surface (Table 2). In the collection, some pseudo-Levallois points and flakes, created by the translation of discoid striking platform, were also found although discoid cores *sensu stricto* are very few. As suggested by the pattern of exploitation of the cores, unidirectional flakes are various whereas only one Levallois recurrent bidirectional is found (Table 2). Other types of flakes discovered are ordinary, bidirectional, orthogonal and centripetal (Table 2). The comparison of the length of complete flakes indicates that the bulk of the assemblage range between 20 and 30 mm whereas bigger blanks are very few (Fig. 2).

The collection of stone tools is dominated by side-scrapers and, in less frequency, by Quina and demi-Quina scrapers (Table 3). These latter artefacts are made on cortical and natural core-edge flakes produced during the early stages of the nodule decortication and unidirectional exploitation whereas by-products related to Quina technology are absent (Fig. 5). Generally, the blanks selected have a triangular cross-section facilitating the shaping with Quina/demi-Quina retouch. Steep/scalar retouch is regularly applied also to portions of the cutting edges of other stone tools as, for example, to the distal side of a semi-cortical flake reshaped in a Mousterian point (Fig. 5, no. 5). Within the stone tools related to the CEEM, bifacial scrapers, backed bifacial knives (*Keilmesser*), foliate leaf points (*Blattspitze*), leaf-shaped scraper, and small handaxes (*Faustel)* were found (Table 3, Fig. 5). Generally, the production of *Keilmessers* is performed on small flat flint plaquettes or flakes while only in three examples, the original shapes of the blanks remain difficult to assess due to the extent of the retouch (Fig. 5, no. 6–9). The analysis pointed out that the backed side of the *Keilmesser* corresponds often to the platform or, to the natural or prepared core-edge side of the blanks. The *façonnage* is carried out following the plano-convex volumetric concept, and the dorsal sides of the artefacts are retouched more intensively than the ventral surfaces that are shaped by fewer and larger detachments (Fig. 5, no. 6–9). In the assemblage, four elongated and finely retouched leaf points are also found (Fig. 5, no. 4, 10, 11). Another stone tool, probably made on a large flake, is recorded as a leaf scraper since the ventral surface is partially retouched and a backed side is absent (Fig. 5, no. 12). Within bifacial knives, it is worth noting an artefact with a portion of fresh cortex on the dorsal side and the ventral surface covered by a thick patina (Fig. 5, no. 3). This blank was probably a frost flake that was successively recycled into a stone tool. The comparison of the lengths of complete retouched artefacts shows that a greater part of the assemblage is comprised between 30 and 40 mm (Fig. 2). If only the best represented tool-types are considered, the median length values of scrapers, Quina, demi-Quina, and bifacial scrapers are very similar and only the *Keilmesser* are slightly longer (Fig. 6).

	N (> 2cm)	%	n (< 2cm)	%	Total	%
Cortical flake (>50%)	119	*7.7*	25	*3.8*	144	*6.6*
Cortical flake (<50%)	176	*11.4*	41	*6.3*	217	*9.9*
Naturally core-edge flake	39	*2.5*	10	*1.5*	49	*2.2*
Cortical core-edge flake	22	*1.4*	1	*0.2*	23	*1*
Trimming striking platform	38	*2.5*	22	*3.4*	60	*2.7*
Ordinary flake	39	*2.5*	24	*3.7*	63	*2.9*
Levallois rec. bi-directional	1	*0.1*			1	*0.0*
Core edge removal flake	59	*3.8*	9	*1.4*	68	*3.1*
Pseudo-Levallois point	7	*0.5*	1	*0.2*	8	*0.4*
Unidirectional flake	37	*2.4*	8	*1.2*	45	*2*
Bidirectional	8	*0.5*			8	*0.4*
Centripetal	3	*0.2*			3	*0.1*
Orthogonal	7	*0.5*			7	*0.3*
Flakes from bifacial shaping	35	*2.3*	14	*2.1*	49	*2.2*
Flake from the retouch	1	*0.1*	17	*2.6*	18	*0.8*
Kombewa-type flake	15	*1*	8	*1.2*	23	*1*
Re-shaping flaking surface	36	*2.3*	1	*0.2*	37	*1.7*
Translation of the striking platform	13	*0.8*	2	*0.3*	15	*0.7*
Knapping accident	127	*8.2*	27	*4.1*	154	*7*
Fragment with cortex	320	*20.7*	83	*12.7*	403	*18.4*
Fragment without cortex	441	*28.6*	185	*28.3*	626	*28.5*
Debris			175	*26.8*	175	*8*
Total	1543	*100*	653	*100*	2196	*100*

Table 2. Total numbers and percentages of knapping by-products at Neumarkt-Nord 2/0.

DISCUSSION

The study of the lithic assemblage of Neumark-Nord NN2/0 reveals new insights into the development of the CEEM at the onset of Weichselian in Europe. Although bigger nodules up to 25 kg were found at the site (Brühl, Laurat 2010), the size of the lithic items (Fig. 2, 4, 6) indicates that Neanderthals preferred to collect small flint pebbles for coping with their daily needs of sharp cutting edges. In order to overcome the reduced dimension of the cobbles, a great number of the cores were knapped using the unidirectional method (Table 1), a strategy that allowed a more efficacious exploitation of the flaking surface and the production of longer flakes. In several examples, the knapping events were opportunistic and aimed at detaching one or two small flakes from damaged or broken pebbles whereas in fewer artefacts the production is recurrent. Although a minimal preparation of the distal and lateral convexities is documented, Levallois and hierarchized cores share some features with simpler unidirectional artefacts and they could correspond to the same broad knapping scheme. This aspect raises the issue if the use of prepared core technology was intentional or was the result of morphological convergence due to the intensive reduction of small cores (see for discussion Marwick *et alii* 2016; Vaquero,Romagnoli 2018).

Figure 5. Retouched tools of Neumarkt-Nord 2/0: 1, 2 Quina scraper; 3 bifacial scraper; 4, 10, 11 leafpoint; 5 Mousterian point; 6-9 *Keilmesser*; 12 leaf scraper.

The reconstruction of the operative chains at the site reveals the presence of other knapping methods as well (Table 1). However, while in unidirectional contexts, the presence of bidirectional or centripetal methods are used as technical expedients for maintaining the upper core convexities or for producing the last flakes before the discard (e.g. Königsaue (Picin 2016)), at NN2/0 the comparison of the length values indicates that they were probably independent strategies. The use of different approaches could have been favoured by the morphology of the flint pebbles or for overcoming the presence of inclusions or frost cracks. Ramified operative chains (Bourguignon *et alii* 2004; McPherron 2009) are also present at site, and longer flakes were selected for the exploitation of the ventral surfaces (Fig. 4). The Kombewa-type flakes are generally bigger than 2 cm (Table 2) matching the size range of blanks produced by core knapping. This pattern suggests that the ramified behaviour was integrated in the production system and could be considered as an additional method for fully exploiting the raw material.

Beyond the great number of cores, the assemblage of NN2/0 is abundant also in retouched tools (Table 3). The small dimension of the knapping by-products that probably turned blunt very quickly during butchering tasks, promoted the development of new strategies for prolonging the use life of the blanks. The first innovation is the systematic use of the scalar-stepped retouch for re-sharpening thick cortical elements. The transformation of these blanks into Quina and demi-Quina scrapers allowed increasing the stages of edge modification whereas the natural back permitted a better prehension of the stone tools and the application of more strength during butchering/cutting activities (Bourguignon 2001; Zupancich *et alii* 2016). The second main improvement is the development of a new concept of tools, absent in the previous Mousterian tradition, such as the backed bifaces, bifacial scrapers, and foliate points (Table 3). At NN2/0, the *Keilmesser* artefacts and bifacial knives were rooted in the technological context of the Quina scrapers, and in some tools, the extension of the retouch on the dorsal side is very similar to the scalar/steep retouch. The ventral surface is often less modified, and, in some examples, invasive and large detachments were performed for regularizing the cutting edges rather than for creating two convex surfaces.

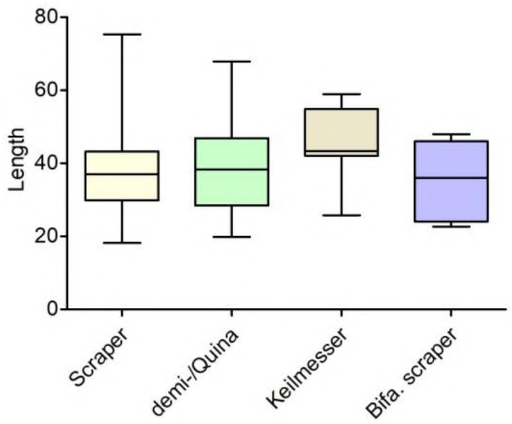

Figure 6. Box-plot of comparison between the lengths of the different categories of retouched tools at Neumarkt-Nord 2/0.

Moreover, in several *Keilmesser* tools, the backed surface is limited to the flake's platform or to a small core-edge side, and their handling characteristics are very different from those of the Quina scrapers. Some authors have associated the success of asymmetric bifacial knives to the combination of their prehension characteristics and versatile functionality (Delpiano, Uthmeier 2020; Jöris, Uomini 2019; Wiśniewski *et alii* 2020). At NN2/0, instead, the backed side and, consequently, the handling feature of the *Keilmesser* tools is not strongly pursued and more technical investment is devoted to the thinning of the blank and the extension of the retouch (Fig. 5, no. 8–9). This characteristic could be related to the frequent hafting of these stone tools in wooden implements or leather wrapping (Rots 2009, 2015). Following this technological aim, the extensive modification of the blanks led to the production of elongate, thin, and a-/symmetrical foliate artefacts that resemble leaf points and leaf scrapers (Fig. 5, no. 4, 10–12). Leaf points are generally common in a later phase of the Middle Palaeolithic (e.g. *Blattspitzen*, Szeletian (Bolus 2004; Markó 2015)) although some earlier isolated examples are documented since the late Middle Pleistocene (Kot 2014, Kot 2017). At NN2/0, the production of these stone tools is not considered as a foremost evidence but more likely, as a by-product of the combination between small size raw material and hafting purposes.

	N	%
Scraper	82	*49.1*
Bifacial scraper	13	*7.8*
Double scraper	6	*3.6*
Convergent scraper	2	*1.2*
demi-Quina scraper	18	*10.8*
Quina scraper	24	*14.4*
Leaf scraper	1	*0.6*
Leaf point	4	*2.4*
Faustel	3	*1.8*
Keilmesser	9	*5.4*
Mousterian point	1	*0.6*
Denticulate	3	*1.8*
Simple notch	1	*0.6*
Total	167	*100*

Table 3. Total numbers and percentages of retouched tools at Neumarkt-Nord 2/0.

The comparison of the lithic assemblage of NN2/0 with that of the lower level reveals some similarities in terms of raw material economy and technological approaches. In the Eemian horizon NN2/2, the size of the flint nodules was small as well, and the core reduction strategies were analogous to those in the Weichselian settlements (Pop 2014). The unidirectional method was systematically used whereas the Levallois technology is documented in only two cores (Pop 2014). The main difference is observed in the types of retouched tools. Steep retouch is applied for the production of denticulates and notched tools whereas Quina and demi-Quina scrapers are absent (Pop 2014). The number of side scrapers is also small in comparison with the upper horizon. This diversity in stone tools configuration could be related to shifts in hunting strategies due to the environmental changes from forested to open landscape.

The new ecological conditions of the Weichselian and the increased migratory radius of cold adapted fauna promoted the development of tools that could be re-sharpened frequently, and in case of need, turned into cores. However, even if from a typological perspective, bifacial knives and backed bifaces show broad similarities across a huge territory, their emergence in Central Europe followed different trajectories. At Balve III (Günther 1964; Jöris 1992), Buhlen IIIb (Germany) (Bosinski, Kulick 1973; Jöris 2001), and Ciemna (Kowalski 2006; Krukowski 1939; Valde-Nowak *et alii* 2014) (Poland), the distal part of bifacial knives were often shaped or re-sharpened using the Prądnik (or para-burin) technique, a method characterized by the removal of one or more elongated spalls (Bosinski 1969b; Jöris 2001). The use of this technique entails extensive training because if applied incorrectly, the biface point will fracture forcing the knapper to re-configure the cutting edge or discard the artefact (Jöris 2001). At NN2/0, this technical expedient was not documented suggesting that the raw material economy might have played a role in diversifying the development of asymmetric bifacial knives. Another difference is the scant number of cores found in association with Prądnik artefacts (Günther 1964; Jöris 2001; Kowalski 2006; Valde-Nowak *et alii* 2014) suggesting higher mobility patterns and a more common use of backed bifaces as cores. At NN2/0, the presence of complete *chaînes opératoires* and the import of stone tools scattered over a large area of the lakeshore imply settlement dynamics characterized by recurrent short-term occupations of different durations. This strategy of land use was common in the periglacial environments of Central Europe and documented in several sites since the late Middle Pleistocene (Jöris 2001; Picin 2016; Picin 2020; Serangeli, Conard 2015; Valde-Nowak, Cieśla 2020).

CONCLUSION

The climatic deterioration at the onset of the Last Glacial favoured the elaboration of new subsistence strategies by the groups of prehistoric foragers for coping with the high seasonality of boreal forests and steppe in Central Europe. In these new ecological conditions, Neanderthals reacted differently to the environmental changes applying laminar technologies in the north-west, and microlithic or biface-based industries in central-eastern territories. The lithic assemblage of NN2/0 shows some features of fusion between the last two cultural traditions with the recurrent production of small flakes and the elaboration of backed bifacial knives and leaf artefacts. Although flint nodules available in the neighbourhood of the lake were small, similarly to other Taubachian sites, at NN2/0 were documented new technical expedients for prolonging the use life of stone tools. The introduction of the Quina retouch in some way promoted the application of bifacial shaping and the production of new types of tools. In other CEEM sites, dated to the early Weichselian, the trajectories of innovation were different suggesting a mosaic of adaptive strategies to the increasing foraging radius of *Mammuthus-Coelodonta* faunal complex. Future studies crossing hunting strategies with technological and paleo-environmental data from other CEEM sites will be crucial for disentangling the Neanderthals' lifestyle and mobility patterns at the beginning of the Late Middle Palaeolithic.

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REFERENCES

Bamforth 1986 – D. B. Bamforth, *Technological efficiency and tool curation*, American Antiquity 51, 1986, p. 38–50.

Bamforth 1991 – D. B. Bamforth, *Technological Organization and Hunter-Gatherer Land Use: A California Example*, American Antiquity 56, 1991, p. 216–234.

Binford 1979 – L. R. Binford, *Organization and Formation Processes: Looking at Curated Technologies*, Journal of Anthropological Research 35, 1979, p. 255–273.

Boëda 2013 – E. Boëda, *Techno-logique & Technologie. Une Paléo-histoire des objects lithiques tranchants*, Paris, 2013.

Bolus 2004 – M. Bolus, *Settlement analysis of sites of the Blattspitzen complex in central Europe*, in: N. Conard (ed.), *Settlement dynamics of the Middle Paleolithic and Middle Stone Age II*, Tübingen, 2004, p. 201–226.

Bordes 1961 – F. Bordes, *Typologie du Paléolitique ancien et moyen*, CNRS, Paris, 1961.

Borel *et alii* 2017 – A. Borel, V. Dobosi, M.-H. Moncel, *Neanderthal's microlithic tool production and use, the case of Tata (Hungary)*, Quaternary International 435, 2017, p. 5–20.

Bosinski 1967 – G. Bosinski, *Die Mittelpaläolithischen Funde im Westlichen Mitteleuropa*, Fundamenta A/4, Köln, 1967.

Bosinski 1969a – G. Bosinski, *Die Steinartefakte*, in: R. Wetzel, G. Bosinski (eds.), *Die Bocksteinschmiede im Lonetal (Markung Rammingen, Kr. Ulm)*, Veröffentlichungen des Staatlichen Amtes für Denkmalpflege Stuttgart, Reihe A, Heft 15, Stuttgart, 1969a, p. 21–70.

Bosinski 1969b – G. Bosinski, *Eine Variante der Micoque-Technik am Fundplatz Buhlen, Kreis Waldeck*, Jahresschrift für Mitteldeutsche Vorgeschichte 53, 1969b, p. 59–74.

Bosinski 2006 – G. Bosinski, *Les premiers peuplements de l'Europe centrale et de l'Est*, C.R. Palevol 5, 2006, p. 311–317.

Bosinski Kulick 1973 – G. Bosinski, J. Kulick, *Der mittelpaläolithische Fundplatz Buhlen, Kr. Waldeck. Vorbericht über die Grabungen 1966–1969*, Germania 51, 1973, p. 1–41.

Bourguignon 2001 – L. Bourguignon, *Apports de l'expérimentation et de l'analyse techno-morpho-fonctionelle à la reconnaissance du processus d'aménagement de la retouche Quina*, in: L. Bourguignon, I. Ortega, M.-C. Frère-Sautot (Eds.), *Préhistoire et approche expérimentale*, Préhistoire 5, Montagnac, 2001, p. 35–66.

Bourguignon *et alii 2004* – L. Bourguignon, J.-P. Faivre, A. Turq, *Ramification des chaînes opératoires : Une spécificité du moustérien ?* Paléo 16, 2004, p. 37–48.

Brühl, Laurat 2010 – E. Brühl, T. Laurat, *The Middle Palaeolithic at the Geisel valley - recent excavations at the fossil lake Neimark-Nord 2 (Sachsen-Anhalt, Germany)*, in: J. M. Burdukiewicz, A. Wisniewski (eds.), *Middle Palaeolithic Human Activity and Palaeoecology: New Discoveries and Ideas*, Wydawnictwo Uniwersytetu Wrocławskiego, Wroclaw, 2010.

Burdukiewicz 2000 – J. M. Burdukiewicz, *The backed biface assemblages of East Central Europe*, in: A. Ronen, M. Weinstein-Evron (eds.), *Toward Modern Humans. The Yabrudian and Micoquian. Proceedings of a Congress held at the University of Haifa, November 3–9, 1996*, BARIntSer 850, Oxford, 2000, p. 155–165.

Chabai *et* alii 2008 – V. Chabai, D. Richter, T. Uthmeier, *Kabazi V: Interstratification of Micoquian & Levallois-Mousterian Camp Sites. Palaeolithic sites of Crimea*. Shlyakh, Simferopol – Cologne, 2008.

Chabai *et alii* 2006 – V. Chabai, J. Richter, T. Uthmeier, *Kabai II: the last 70000 years since the Last Interglacial*, Shlyakh, Simferopol – Cologne, 2006.

Chabai 2000 – V. Chabai, *The evolution of the Western Crimean Mousterian industry*, in: J. Orschiedt, G.-C. Weniger (eds.), *Neanderthals and modern humans-discussing the transition: Central and Eastern Europe from 50,000–30,000 B.P.*, Wissenschaftliche Schriften des Neanderthal Museums, Mettmann, 2000, p. 196–211.

Chmielewski 1969 – W. Chmielewski, *Ensembles micoquo-prondnikiens en Europe Centrale*, Geographia Polonica 17, 1969, p. 371–386.

Cieśla 2013 – M. Cieśla, *Taubachian in context of layer XIX of the Obłazowa Cave (2008 excavations)*, Prace Archeologiczne Studia 66, 2013, p. 15–27.

Conard 1990 – N. J. Conard, *Laminar Lithic Assemblages from the Last Interglacial Complex in Northwestern Europe*, Journal of Anthropological Research 46, 1990, p. 243–262.

Conard 1992 – N. J. Conard, *Tönchesberg and its Position in the Palaeolithic Prehistory of Northern Europe*, Monographien Römisch-Germanisches Zentralmuseum 20, Bonn, Habelt Verlag, 1992.

Conard, Fisher 2000 – N. J. Conard, B. Fischer*, Are there recognisable cultural entities in the German Middle Palaeolithic?*, in: Ronen, A., Weinstein-Evron, M. (eds.), *Toward Modern Humans: the Yabrudian and Micoquian 400–50 K-years*, BARIntSer 850, Oxford, 2000, p. 7–24.

Conard *et alii* 2012 – N. J. Conard, M. Bolus, S. C. Münzel, *Middle Paleolithic land use, spatial organization and settlement intensity in the Swabian Jura, southwestern Germany*, Quaternary International 247, 2012, p. 236–245.

Conard *et alii* 2019 – N. J. Conard, V. C. Schmid, M. Bolus, M. Will, *Lithic assemblages from the Middle Paleolithic of Geißenklösterle Cave provide insights on Neanderthal behavior in the Swabian Jura*, Quartär 66, 2019, p. 51–80.

Cyrek *et alii* 2014 – K. Cyrek, M. Sudoł, Ł. Czyżewski, G. Osipowicz, M. Grelowska, *Middle Palaeolithic cultural levels from Middle and Late Pleistocene sediments of Biśnik Cave, Poland*, Quaternary International 326–327, 2014, p. 20–63.

De Loecker, Kuijper 2014 – D. De Loecker, W. Kuijper, *Recent bioturbation on the exposed sediment surface and sub-surface find layers at Neumark-Nord 2/0 (Saxony-Anhalt, Germany)*, in: S. Gaudzinski-Windheuser, W. Roebroeks, H. E. Meller (eds.), *Multidisciplinary Studies of the Middle Palaeolithic Record from Neumark-Nord (Germany) vol. I,* Veröffentlichungen Des Landesamtes Für Denkmalpflege Und Archäologie Sachsen-Anhalt. Landesmuseum für Vorgeschichte, Band 69, Halle, 2014, p. 221–240.

Delagnes *et alii* 2007 – A. Delagnes, J. Jaubert, L. Meignen, *Les technocomplexes du Paléolithique moyen en Europe Occidentale dans leur cadre diachronique et géographique*, in: B. Vandermeersch, B. Maureille (Eds.), *Les Néandertaliens. Biologie et cultures*, Documents Préhistoriques 23, Paris, 2007, p. 213–229.

Delpiano, Uthmeier 2020 – D. Delpiano, T. Uthmeier, *Techno-functional and 3D shape analysis applied for investigating the variability of backed tools in the Late Middle Paleolithic of Central Europe*, PLoS ONE 15, 2020, p. e0236548.

Demidenko 2015 – Y. Demidenko, *Palaeolithic industries with bifacial technologies and Crimean Micoquian Tradition as one of their Middle Palaeolithic industrial examples*, Litikum 3, 2015, p. 70–84.

Demidenko, Uthmeier 2013 – Y. Demidenko, T. Uthmeier, *Kiik Koba grotto, Crimea (Ukraine).Re-analysis of a key site of the Crimean Micoquian*, KSPA 3, Rahden, 2013.

Deschamps, Mourre 2009 – M. Deschamps, V. Mourre, *Le Vasconien, un demi-siècle après sa définition par François Bordes*, in: F. Delpech, J. Jaubert (Eds.), *François Bordes et la Préhistoire. Colloque international François Bordes, 134ème Congrès national des sociétés historiques et scientifiques*, CTHS, Paris, 2009, p. 269–279.

Farizy 1995 – C. Farizy, *Industries charentiennes à influences micoquiennes, l'exemple de l'Est de la France*, Paléo 1, 1995, p. 173–178.

Fontana *et alii* 2013 – F. Fontana, M. H. Moncel, G. Nenzioni, G. Onorevoli, C. Peretto, J. Combier, *Widespread diffusion of technical innovations around 300,000 years ago in Europe as a reflection of anthropological and social transformations? New comparative data from the western Mediterranean sites of Orgnac (France) and Cave dall'Olio (Italy)*, Journal of Anthropological Archaeology 32, 2013, 478–498.

Gaudzinski-Windheuser *et alii* 2014a – S. Gaudzinski-Windheuser, L. Kindler, E. Pop, W. Roebroeks, G. Smith, *The Eemian Interglacial lake-landscape at Neumark-Nord (Germany) and its potential for our knowledge of hominin subsistence strategies*, Quaternary International 8, 2014a, 31–38.

Gaudzinski-Windheuser *et alii* 2014b – S. Gaudzinski-Windheuser, W. Roebroeks, H.E. Meller, *Multidisciplinary Studies of the Middle Palaeolithic Record from Neumark-Nord (Germany), vol. I*, Veröffentlichungen Des Landesamtes Für Denkmalpflege Und Archäologie Sachsen-Anhalt, Landesmuseum für Vorgeschichte, Band 69, Halle, 2014b.

Gladilin 1970 – V. Gladilin, *Les variantes techniques et les types d'industrie dans le Moustérien de la Plaine russe et de la Crimée*, in: *Actes du VIIe Congrès International des Sciences Préhistoriques et Protohistoriques, Prague 21–27 août 1996*, Prague, 1970, p. 269–274.

Golovanova 2015 – L. V. Golovanova, *Les hommes de Néandertal du Caucase du Nord : entre l'Ouest et l'Est*, L'Anthropologie (Paris) 119, 2015, p. 254–301.

Goval 2012 – E. Goval, *Peuplements néandertaliens dans le nord de la France,* Recherches archéologiques 4, Paris, 2012.

Grunberg 2002 – J. M. Grunberg, *Middle Palaeolithic birch-bark pitch*, Antiquity 76, 2002, p. 15–16.

Günther 1964 – K. Günther, *Die Altsteinzeitlichen Funde der Balver Höhle*, BodenaltertÜmer Westfalens VIII, 1964.

Hajdinjak *et alii* 2018 – M. Hajdinjak, Q. Fu, A. Hübner, M. Petr, F. Mafessoni, S. Grote, P. Skoglund, V. Narasimham, H. Rougier, I. Crevecoeur, P. Semal, M. Soressi, S. Talamo, J.-J. Hublin, I. Gušić, Ž. Kućan, P. Rudan, L. V. Golovanova, V. B. Doronichev, C. Posth, J. Krause, P. Korlević, S. Nagel, B. Nickel, M. Slatkin, N. Patterson, D. Reich, K. Prüfer, M. Meyer, S. Pääbo, J. Kelso, *Reconstructing the genetic history of late Neanderthals*, Nature 555, 2018, p. 652.

Hauser 1915 – O. Hauser, *Letter of Otto Hauser to Berliner Gesellschaft für Anthropologie*, Ethnologie und Urgeschichte, 1915, p. 443–444.

Hein *et alii* 2020 – M. Hein, M. Weiss, A. Otcherednoy, T. Lauer, *Luminescence chronology of the key-Middle Paleolithic site Khotylevo I (Western Russia) - Implications for the timing of occupation, site formation and landscape evolution*, Quaternary Science Advances 2, 2020, p. 100008.

Hérisson *et alii* 2016 – D. Hérisson, M. Brenet, D. Cliquet, M.-H. Moncel, J. Richter, B. Scott, A. Van Baelen, K. Di Modica, D. De Loecker, N. Ashton, L. Bourguignon, A. Delagnes, J.-P. Faivre, M. Folgado-Lopez, J.-L. Locht, M. Pope, J.-P. Raynal, W. Roebroeks, C. Santagata, A. Turq, P. Van Peer, *The emergence of the Middle Palaeolithic in north-western Europe and its southern fringes*, Quaternary International 411, Part A, 2016, p. 233–283.

Inizian *et alii* 1992 – M.-L. Inizian, H. Roche, J. Tixier, *Technology of Knapped Stone*, CREP, Meudon, 1992.

Iovita, McPherron 2011 – R. Iovita, S. J. P. McPherron, *The handaxe reloaded: A morphometric reassessment of Acheulian and Middle paleolithic handaxes*, JHE 61, 2011, p. 61–74.

Jöris 1992 – O. Jöris, *Pradniktechnik im Micoquien der Balver Höhle,* ArchKorr 22, 1992, p. 1–12.

Jöris 2001 – O. Jöris, *Der spätmittelpaläolithische Fundplatz Buhlen (Grabungen 1966–69). Stratigraphie, Steinartefakte und Fauna des Oberen Fundplatzes*, UPA 73, 2001.

Jöris 2003 – O. Jöris, *Zur chronostratigraphischen Stellung der spätmittelpaläolithischen Keilmessergruppen: Der Versuch einer kulturgeographischen Abgrenzung einer mittelpaläolithischen Formengruppe in ihrem europäischen Kontext*, BerRGK 84, 2003, p. 49–153.

Jöris 2006 – O. Jöris, *Bifacially backed knives (Keilmesser) in the Central European Middle Palaeolithic*, in: N. Goren-Imbar, G. Sharon (eds.), *Axe Age. Acheulian Tool-making from Quarry to Discard*, London, 2006, p. 287–310.

Jöris, Uomini 2019 – O. Jöris, N. Uomini, *Evidence for Neanderthal Hand Preferences from the Late Middle Palaeolithic Site of Buhlen, Germany: Insights into Neanderthal Learning Behaviour*, in: Y. Nishiaki, O. Jöris (eds.), *Learning Among Neanderthals and Palaeolithic Modern Humans: Archaeological Evidence*, Singapore, 2019, p. 77–94.

Kelly 1988 – R. L. Kelly, *The Three Sides of a Biface*, American Antiquity 53, 1988, p. 717–734.

Key *et alii* 2021 – A. J. M. Key, I. Jarić, D. L. Roberts, *Modelling the end of the Acheulean at global and continental levels suggests widespread persistence into the Middle Palaeolithic*, Humanities and Social Sciences Communications 8, 2021, p. 55.

Kolobova *et alii* 2020 – K. A. Kolobova, R. G. Roberts, V. P. Chabai, Z. Jacobs, M. T. Krajcarz, A. V. Shalagina, A. I. Krivoshapkin, B. Li, T. Uthmeier, S. V. Markin, M. W. Morley, K. O'Gorman, N. A. Rudaya, S. Talamo, B. Viola, A. P. Derevianko, *Archaeological evidence for two separate dispersals of Neanderthals into southern Siberia*, PNAS 117 (6), 2020, p. 2879–2885.

Kot 2014 – M. A. Kot, *The earliest Palaeolithic bifacial leafpoints in Central and Southern Europe: Techno-functional approach*, Quaternary International 326–327, 2014, p. 381–397.

Kot 2017 – M. Kot, *Bifacial and unifacial technology: A real difference or a problem of typo–technological approach? The example of the Ehringsdorf assemblage*, Quaternary International 428, 2017, p. 66–78.

Kowalski 2006 – S. Kowalski, *Remarks on Paleolithic settlement in the Ciemna and Mamutowa Caves in view of excavations in the years 1957–1974*, in: J. Lech, J., Partyka (eds.), *The Ojców Jura in prehistory and in the beginnings of the Polish state*, Wydawnictwo OPN, Ojców, 2006, p. 335–354.

Kozłowski 2014 – J. K. Kozłowski, *Middle Palaeolithic variability in Central Europe: Mousterian vs Micoquian*, Quaternary International 326–327, 2014, p. 344–363.

Kozłowski 2006 – S. K. E. Kozłowski, *Wylotne and Zwierzyniec: Paleolithic sites in southern Poland*, Polish Academy of Arts and Sciences, 2006.

Krukowski 1939 – S. Krukowski, *Paleolit*, in: S. Krukowski, J. Kostrzewski (eds.), *Prehistoria ziem polskich*, Polska Akademia Umiejetnosci, Kraków, 1939, p. 1–117.

Kuhn 1994 – S. L. Kuhn, *A Formal Approach to the Design and Assembly of Mobile Toolkits*, American Antiquity 59, 1994, p. 426–442.

Kulakovskaya *et alii* 1993 – L. Kulakovskaya, J. Kozlowski, K. Sobczyk, *Les couteaux micoquiens du Würm ancien*, Préhistoire Européenne 4, 1993, p. 9–3.

Lass 1994 – G. Lass, *Gebrauchsspurenuntersuchungen an den "Mikrolithen" der Sesselfelsgrotte*, Münster, 1994.

Mafessoni *et alii* 2020 – F. Mafessoni, S. Grote, C. de Filippo, V. Slon, K. A. Kolobova, B. Viola, S. V. Markin, M. Chintalapati, S. Peyrégne, L. Skov, P. Skoglund, A. I. Krivoshapkin, A. P. Derevianko, M. Meyer, J. Kelso, B. Peter, K. Prüfer, S. Pääbo, *A high-coverage Neandertal genome from Chagyrskaya Cave*, PNAS 117 (26), 2020, p. 15132–15136.

Mania, Meller 2010 – D. Mania, H. Meller, *Neumark-Nord-ein interglaziales Ökosystem des mittelpaläolithischen Menschen*, Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt – Landesmuseum für Vorgeschichte, Halle, 2010.

Mania, Thomae 1987 – D. Mania, M. Thomae, *Neumark-Nord – Fundstätte eines Interglazialen Lebensraumes mit anthropogenen Besiedlungsspuren*, Technische Kurzinformationen – Betriebssektion Kammer der Technik "BKW Geiseltal" 43, 1987, p. 32–51.

Mania, Toepfer 1973 – D. Mania, V. Toepfer, *Königsaue. Gliederung, Ökologie und mittelpaläolithische Funde der letzten Eiszeit*, Berlin, 1973.

Mania *et alii* 1990 – D. Mania, M. Thomae, T. Litt, T. E. Weber, *Neumark-Gröbern. Beiträge zur Jagd des mittelpaläolithischen Menschen*, Veröffentlichungen des Landesmuseums für Vorgeschichte in Halle, 1990.

Markó 2015 – A. Markó, *Considerations on the lithic assemblages from the Szeleta cave*, Communicationes Archaeologicae Hungariae, 2015–2016, 2015, p. 5–44.

Marwick, *et alii* 2016 – B. Marwick, C. Clarkson, S. O'Connor, S. Collins, *Early modern human lithic technology from Jerimalai, East Timor*, JHE 101, 2016, 45–64.

McPherron 2006 – S. P. McPherron, *What typology can tell us about Acheulian handaxe production*, in: N. Goren-Inbar, S. Gonen (Eds.), *Axe age: Acheulian tool-making from quarry to discard*, London, 2006, p. 267–286.

McPherron 2009 – S. E. McPherron (ed.), *Tools versus cores: alternative approaches to stone tool analysis*, Cambridge, 2009.

Moncel, Neruda 2000 – M.-H. Moncel, P. Neruda, *The Kůlna level 11: Some observations on the débitage rules and aims. The originality of a Middle Palaeolithic microlithic assemblage (Kůlna Cave, Czech Republic)*, Anthropologie (Brno) 38 (2), 2000, p. 219–248.

Nelson 1991 – M. C. Nelson, *The study of technological organization*, Archaeological Method and Theory 3, 1991, p. 57–100.

Neruda 2011 – P. Neruda, *Middle Palaeolithic in Moravian Caves*, Brno, 2011.

Pastoors 2001 – A. Pastoors, *Die mittelpaläolithische Freilandstation von Salzgitter-Lebenstedt: Genese der Fundstelle und Systematik der Steinbearbeitung*, Archiv der Stadt Salzgitter, Salzgitter, 2001.

Păunescu 1993 – A. Păunescu, *Ripiceni-Izvor. Paleolitic și Mezolitic*, București, 1993.

Pelegrin *et alii* 1988 – J. Pelegrin, C. Karlin, P. Bodu, « *Chaînes opératoires* » *: un outil pour le préhistorien,* in : J. Tixier (dir.), *Technologie Préhistorique,* Notes et Monographies Techniques 25, Paris, 1988, p. 55–62.

Peyrony 1933 – D. Peyrony, *La Micoque et ses diverses industries*, in: *XV^e^ Congrès International d'Anthropologie et d'Archéologie Préhistorique (suite), V^e^ Session de l'Institut International d'Anthropologie, Paris 20–27 septembre 1931*, Paris, 1933, Extrait, p. 1–6.

Picin 2016 – A. Picin, *Short-term occupations at the lakeshore: a technological reassessment of the open–air site Königsaue (Germany)*, Quartär 63, 2016, p. 7–32.

Picin 2018 – A. Picin, *Technological adaptation and the emergence of Levallois in Central Europe: new insight from the Markkleeberg and Zwochau open-air sites in Germany*, JQS 33, 2018, p. 300–312.

Picin 2020 – A. Picin, *Short-Term Occupations During the Early Middle Paleolithic in Eastern Germany*, in: J. Cascalheira, A. Picin (eds.), *Short-Term Occupations in Paleolithic Archaeology: Definition and Interpretation*, Cham, 2020, p. 73–103.

Picin *et alii* 2011 – A. Picin, M. Peresani, M. Vaquero, *Application of a new typological approach to classifying denticulate and notched tools: the study of two Mousterian lithic assemblages*, JAS 38, 2011, p. 711–722.

Picin *et alii* 2013 – A. Picin, M. Peresani, C. Falguères, G. Gruppioni, J.-J. Bahain, *San Bernardino Cave (Italy) and the Appearance of Levallois Technology in Europe: Results of a Radiometric and Technological Reassessment*, PLoS ONE 8, 2013, p. e76182.

Picin *et alii* 2020a – A. Picin, M. G. Chacón, B. Gómez de Soler, R. Blasco, F. Rivals, J. Rosell, *Neanderthal mobile toolkit in short-term occupations at Teixoneres Cave (Moia, Spain)*, JAS: Reports 29, 2020a, p. 102165.

Picin *et alii* 2020b – A. Picin, M. Hajdinjak, W. Nowaczewska, S. Benazzi, M. Urbanowski, A. Marciszak, H. Fewlass, P. Socha, K. Stefaniak, M. Żarski, A. Wiśniewski, J.-J. Hublin, A. Nadachowski, S. Talamo, *New perspectives on Neanderthal dispersal and turnover from Stajnia Cave (Poland)*, Sci Rep 10, 2020b, p. 14778.

Pop 2014 – E. Pop, *Analysis of the Neumark-Nord 2/2 lithic assemblage: results and interpretations*, in: S. Gaudzinski-Windheuser, W. Roebroeks (Eds.), *Multidisciplinary studies of the Middle Palaeolithic record from Neumark-Nord (Germany). Volume 1*, Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Landesmuseum für Vorgeschichte 69, Halle an der Saale, 2014, p. 143–196.

Richter 1997 – J. Richter, *Der G-Schichten-Komplex der Sesselfelsgotte - Zum Verständnis des Micoquien*, Quartär-Bibliothek 7, Köln, 1997.

Richter 2006 – J. Richter, *Neanderthals in their landscape*, in: B. Demarsin, M. Otte (eds.), *Neanderthals in Europe*, ERAUL, Liège, 2006, p. 51–66.

Richter 2016 – J. Richter, *Leave at the height of the party: A critical review of the Middle Paleolithic in Western Central Europe from its beginnings to its rapid decline*, Quaternary International 411, Part A, 2016, p. 107–128.

Richter *et alii* 2014 – D. Richter, M. Krbetschek, H. Meller, *Preliminary Luminescence Dating Results for two Middle Palaeolithic Occupations at Neumark-Nord 2,* in: S. Gaudzinski-Windheuser, W. Roebroeks (Eds.), *Multidisciplinary studies or the Middle Paleolithic record from Neumark-Nord (Germany). Volume 1*, Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Landesmuseum für Vorgeschichte, Band 69, Halle an der Saale, 2014, p. 131–136.

Rosendahl 2011 – G. Rosendahl, *Technological Analysis of the Bifacial Tools from La Micoque and Its Implications*, in: N. J. Conard, J. Richter (eds.), *Neanderthal Lifeways, Subsistence and Technology: One Hundred Fifty Years of Neanderthal Study*, Dordrecht, 2011, p. 133–138.

Rots 2009 – V. Rots, *The functional analysis of the Mousterian and Micoquian assemblages of Sesselfelsgrotte, Germany: Aspects of tool use and hafting in the European Late Middle Palaeolithic*, Quartär 56, 2009, p. 37–66.

Rots 2015 – V. Rots, *Hafting and Site Function in the European Middle Paleolithic*, in: N. J. Conard, A. Delagnes (eds.), *Settlement Dynamics of the Middle Paleolithic and Middle Stone Age IV*, Tübingen, 2015, p. 383–410.

Ruebens 2013 – K. Ruebens, *Regional behaviour among late Neanderthal groups in Western Europe: A comparative assessment of late Middle Palaeolithic bifacial tool variability*, JHE 65, 2013, p. 341–362.

Schäfer 1981 – D. Schäfer, *Taubach: Zur Merkmalsanalyse von Feuersteinartefakten der mittelpaläolithischen Travertinfundstelle sowie zu ihrem Verhältnis zur Technologie anderer alt- und mittelpaläolitischer Fundplätze*, Ethnographisch-archaologische Zeitschrift 22, 1981, p. 369–396.

Serangeli, Conard 2015 – J. Serangeli, N. J. Conard, *The behavioral and cultural stratigraphic contexts of the lithic assemblages from Schöningen*, JHE 89, 2015, p. 287–297.

Sier *et alii* 2011 – M. J. Sier, W. Roebroeks, C. C. Bakels, M. J. Dekkers, E. Brühl, D. De Loecker, S. Gaudzinski-Windheuser, N. Hesse, A. Jagich, L. Kindler, W.J. Kuijper, T. Laurat, H.J. Mücher, K. E. H. Penkman, D. Richter, D. J. J. van Hinsbergen, *Direct terrestrial–marine correlation demonstrates surprisingly late onset of the last interglacial in central Europe*, Quaternary Research 75, 2011, p. 213–218.

Uthmeier 2004 – T. Uthmeier, *Micoquien, Aurignacien und Gravettien in Bayern. Eine regionale Studie zum Übergang vom Mittel- zum Jungpaläolithikum*, Bonn, 2004.

Valde-Nowak *et alii* 2014 – P. Valde-Nowak, B. Alex, B. Ginter, M. T. Krajcarz, T. Madeyska, B. Miękina, K. Sobczyk, D. Stefański, P. Wojtal, M. Zając, K. Zarzecka-Szubińska, *Middle Paleolithic sequences of the Ciemna Cave (Prądnik valley, Poland): The problem of synchronization*, Quaternary International 326–327, 2014, p. 125–145.

Valde-Nowak *et alii* 2016 – P. Valde-Nowak, B. Alex, B. Ginter, M. T. Krajcarz, T. Madeyska, B. Miękina, K. Sobczyk, D. Stefański, P. Wojtal, M. Zając, K. Zarzecka-Szubińska, *Late Middle Palaeolithic occupations in Ciemna Cave, southern Poland*, JFA 41, 2016, p. 193–210.

Valde-Nowak, Cieśla 2020 – P. Valde-Nowak, M. Cieśla, *Models of Raw Material Exploitation as an Indicator of Middle Paleolithic Mobility: Case Studies from Uplands of Northern Central Europe*, in: J. Cascalheira, A. Picin (Eds.), *Short-Term Occupations in Paleolithic Archaeology: Definition and Interpretation*, Cham, 2020, p. 105-120.

Valde-Nowak, Nadachowski 2014 – P. Valde-Nowak, A. Nadachowski, *Micoquian assemblage and environmental conditions for the Neanderthals in Obłazowa Cave, Western Carpathians, Poland*, Quaternary International 326–327, 2014, p. 146–156.

Valoch 1984 – K. Valoch, *Le Taubachien, sa géochronologie, paléoécologie et paléoethnologie*, L'Anthropologie (Paris) 88, 1984, p. 193–208.

Valoch 1988 – K. Valoch, *Die Erforschung der Kůlna-Höhle 1961–1976*, Moravské muzeum-Anthropos Institut, Brno, 1988.

Vaquero, Romagnoli 2018 – M. Vaquero, F. Romagnoli, *Searching for Lazy People: the Significance of Expedient Behavior in the Interpretation of Paleolithic Assemblages*, Journal of Archaeological Method and Theory 25, 2018, p. 334–367.

Veil *et alii* 1994 – S. Veil, K. Breest, H.-C. Höfle, H.-H. Meyer, H. Plisson, B. Urban-Küttel, G.A. Wagner, L. Zöller, *Ein mittelpaläolithischer Fundplatz aus der Weichsel-Kaltzeit bei Lichtenberg, Lkr. Lüchow-Dannenberg*, Germania 72, 1994, p. 1–66.

Weiss 2016 – M. Weiss, *Stone tool analysis and context of a new late Middle Paleolithic site in western central Europe – Pouch-Terrassenpfeiler, Ldkr. Anhalt-Bitterfeld, Germany*, Quartär 62, 2016, p. 23–62.

White, Jacobi 2002 – M. J. White, R. M. Jacobi, *Two Sides to Every Story: Bout Coupé Handaxes Revisited*, OJA 21, 2002, 109–133.

Wiśniewski 2006 – A. Wiśniewski, *The Middle Palaeolithic in Odra Valley*. *Wydawnictwo Uniwersytetu Wroclawskiego*, Wroclaw, 2006.

Wiśniewski 2014 – A. Wiśniewski, *The beginnings and diversity of Levallois methods in the early Middle Palaeolithic of Central Europe*, Quaternary International 326–327, 2014, p. 364–380.

Wiśniewski *et alii* 2020 – A. Wiśniewski, M. Chłoń, M. Weiss, K. Pyżewicz, W. Migal, *On Making of Micoquian Bifacial Backed Tools at Pietraszyn 49a, SW Poland*, J Paleo Arch 3, 2020 p. 856–888.

Yevtushenko 1998 – A. Yevtushenko, *The industries of the Eastern Micoquian: some approaches to typological variability*, in: M. Otte (éd.), *Préhistoire d'Anatolie, Genèse de deux mondes I*, ERAUL 85, 1998, p.113–123.

Zupancich *et alii* 2016 – A. Zupancich, C. Lemorini, A. Gopher, R. Barkai, *On Quina and demi-Quina scraper handling: Preliminary results from the late Lower Paleolithic site of Qesem Cave, Israel*, Quaternary International 398, 2016, p. 94–102.