



LATE GLACIAL CENTRAL EUROPE: IN SEARCH OF HUNTING PRACTICES

C. F. HERMAN AND P. M. VERMEERSCH

1. INTRODUCTION

The aspects under investigation by the *Laboratorium voor Prehistorie* (K.U.Leuven) within the SSTC¹ -04 research Network, *Prehistory and evolution of the environment during the last 100.000 years in the European Plains*, are from the onset circumscribed in time, region, and subject. Our research focuses on the upper end of the time scale of the network's project: the Late Glacial transition into the Holocene (13.000 to 8.000 BP.), a period of strong climatic fluctuations after the last glacial maximum (from Older Dryas to Preboreal). For this period in time a research program was begun in order to investigate the past hunting practices and strategies of hunter-gatherers in the central part of the European Plain, specifically the Hamburgian and Federmesser cultures in Poland. The opportunity offered by the Belgian network was a welcomed new step in the laboratory's research history, giving the chance to compare "first-hand" Belgian and Polish sites and to put into perspective the transitions and breaks of the Late Glacial-Holocene Prehistoric cultures of our areas (VERMEERSCH, 1984; DE BIE & VERMEERSCH, In press)².

2. IN SEARCH FOR NEW ECOLOGICAL DATA

An archaeological point of departure guided the set-up of the *K.U.Leuven* sub-

project, *Diachronic Cultural Diversification of the Late Palaeolithic and Early Mesolithic Hunter/Gatherers in the European Plain*, while being adjusted to the diachronic approach in the investigations of the promoter-team of the *Royal Belgian Institute of Natural Sciences (R.B.I.N.S.)*, Brussels. The stratigraphic and chronological research on stratified Middle and Upper Palaeolithic sites preserved in loess deposits of the European Plain combined geological (P. Haesaerts, *R.B.I.N.S.*), anthracological, palynological, (F. Damblon, *R.B.I.N.S.*), pedological (R. Langohr, *U.G.*) and absolute dating (AMS, C-14) approaches (DAMBLON, HAESAERTS & VAN DER PLICHT, 1996). The generally excellent preservation of organic materials within these loess-sequences, unfortunately, is not matched in occupations during the transition from the Pleistocene to the Holocene, a well known and major problem for those dealing with environmental conditions during this period. Open air Late Glacial occupations in the European Plain proper are generally found after the deposition of cover sands or in dunes, and if located in the loess area, after these depositions came to an end³. Such conditions are poor to very bad for organic preservation. Only rarely they have been found in superior environments for organic preservation, such as silts, clays, turf or gyttja deposits⁴. Additionally, only exceptionally, has a site been found in which a sequence of Late

Laboratorium voor Prehistorie. Katholieke Universiteit Leuven. 16bis Redingenstraat, 3000 Leuven-Belgium.

¹ SSTC: Federal Services of Scientific, Technical and Cultural Affairs of Belgium.

² This is the first venture of the *Laboratorium voor Prehistorie* in archaeological field research in Central Europe.

³ The absolute chronology of the halt of loess depositions is still a point of discussion, cf. Magdalenian Orp-le-Grand (B) (VERMEERSCH *et al.*, 1983; VERMEERSCH & MAES 1996). At the site of Kraków-Spadzista street, Poland, typical loess deposits of SPB-F layer (5) are dated to 17400 ± 310 BP (LY-2541) at the latest, to which Gravettian C2 has been associated (KOZŁOWSKI & KOZŁOWSKI 1996: 66-67, Fig. 22), but loess-deposition continued thereafter (KOZŁOWSKI *et al.*, 1974).

⁴ This is true for Northern France, where sites like Conty, Hangest-sur-Somme, les Prés-du-Mesnil have been found under a thick silt cover within the actual flood plains (COUDRET & FAGNART, 1997).

Palaeolithic occupations could be recorded or where the above mentioned approaches did yield coherent results. In Poland, for instance, Ca3owanie does have numerous and stratified concentrations from the Early-Allerød until the Preboreal (SCHILD, 1984) for which a large number of ^{14}C dates are now available (SCHILD, 1996a, 1996b: 138-139). But it lacks the faunal information. Other important places such as the multiple Federmesser and Masovian concentrations at the Rydno ochre mining complex (SCHILD & KRÓLICK, 1981; SCHILD, 1984) have a lateral stratigraphy yielding insufficient ecological information for the period concerned. Within the context of Central Europe the restrictions in archaeological and palaeoenvironmental data, as is the case in the Lowlands, is hard to overcome, and only directed long-term, intensive fieldwork or accidental discoveries during e.g. rescue-excavations, can improve this situation. Therefore, our approach had, within the scope of the program, to be restricted to known occupational places, where more stratigraphic or ecological information could be expected. Ultimately Siedlnica 17, in West-Poland, was retained for more extensive fieldwork, in view of the Hamburgian and closely located ABPT occupations that were said to have been discovered in respective Bølling and Allerød soils (BRODZIKOWSKI & Van LOON, 1987; BURDUKIEWICZ & Van LOON, 1988; BURDUKIEWICZ, 1975, 1986a, 1986b, 1989; KOWALKOWSKI & DOWGIAŁŁO-MYCIELSKA, 1983).

3. TRAPS IN THE RESEARCH OF LATE GLACIAL HUNTING STRATEGIES

- Hamburgian of the Shouldered Point Technocomplex (SPT)

While discussing archaeological complexes of Central Europe, the recognised explanatory strategy of induction from distant places, both geographically and in its contents and data, is also apparent within the archaeological models for hunting practices, the chased game, and their biotope. Sets of archaeological and faunal records are used and generalised for occupations which do not necessarily display a similar micro-environment or for which the data are simply lacking. The reference site *par excellence* is Hamburgian Meiendorf (Ahrensburg valley, (D)), excavated by A.

Rust (1937). Until the mid eighties this site shaped on its own, a very stringent image of Hamburgian hunters with a uni-dimensional hunting practice on reindeer flocks by a group of hunters. This model was applied for Hamburgian occupations, whether in the Netherlands, Germany, Denmark⁵, or Western Poland for either supposedly early Classic or late Havelte Hamburgian (BOHMERS, 1947), or for either base camps, stand camps or tool-production sites, etc., being mostly exempt of bone remnants. B. Grønnow (1987) showed pertinently, based on the well documented reindeer bone and antler data of Meiendorf, that the model of communal drive-hunts was in fact erroneously borrowed from the later Youngest Dryas Ahrensburgian kill-site of Stellmoor. B. Bratlund's research on the actual bones (1991, 1996a, b) further fine tuned B. Grønnow's propositions of stalking solitary reindeer, on a more individual basis, while providing further strong proofs for communal hunting practices by the Ahrensburgian at Stellmoor. Until 1996, faunal information that could bear direct evidence of hunting practices of the Hamburgian, known from over a hundred findspots was restricted to only 4 sites: Meiendorf, Stellmoor, and Poggenwisch (RUST, 1937, 1943, 1958; HERRE & REQUATE, 1958), located in the Ahrensburg Valley of Schleswich-Holstein (D), and

⁵ Now a well established given is the early occupation of northerly regions, e.g., before the Allerød. In Denmark sites like Jels and Slotsing in Jutland, witness Hamburgian presence already during Bølling times (HOLM & RIECK 1987; HOLM 1996; ERIKSEN 1996a, b). Here, the traditional approach of a Havelte phase at the end of Bølling or even Younger Dryas, is put to the test. An AMS-date of 12520 ± 190 BP of a cut marked antler out of the Kettle hole at Slotsing (HOLM 1996), still a solitary date in association with a site --besides a later AMS date on a dredged, worked reindeer antler from Solrød Strand: 12140 ± 110 BP, AAR-1036 (FISHER 1996)--, would imply that the Havelte facies of the Hamburgian is not a late phase but fully contemporaneous to the classic Hamburgian. This date, asks for further substantiation before full acceptance. Even, when one refutes both traditional approaches of these points as a guide fossil and of a late chronology based on the morphology only -- i.e., the tanged aspect of the points--, the very specific morphology of the Havelte tanged points combined with a well defined geographic spreading area of this type likely has a chronological dimension in view of the geographic overlap with the classic Hamburgian groups. Refined explanations that take into account the dynamics in internal/external cultural evolution and/or distinct subsistence procurement strategies will be needed to explain a contemporaneous geographic overlap of Classic Hamburgian with the geographically more restricted and more northerly located Havelte group (see BRATLUND, 1996a: Fig. 3 & 4).

Olbrachcice 8 in the Kopanica Valley (PL) (BURDUKIEWICZ, 1986), the latter yielding numerous tiny bone fragments of which some were identified as from reindeer⁶. The faunal finds at Borneck are not retained because of their uncertain archaeological context. Recently Slotseng's Kettle Hole (DK) (HOLM, 1996) and Mirkowice (PL) (pers. comm. J. KABACIŃSKI) supplied additional faunal information. In general fauna remains are made up of a high majority of reindeer, although also horse, and occasionally some smaller game such as hare and swan (BRATLUND, 1996a) are also reported. A seasonal differentiation can be expected, in which reindeer (Autumn, Spring) is not always the main prey.

- Federmesser of the Arched Backed Pieces Technocomplex (ABPT)

What applies to the Hamburgian hunting practices is equally applicable to the Allerød associated Federmesser of the ABPT Technocomplex, where a similar inductive approach can be recognised in view of the very restricted faunal data. However, in recent years a number of breakthroughs have been recorded.

Firstly, in the domain of stratigraphy and chronology: the discovery of the stratified Federmesser occupations at Le Closeau (Reuil-Malmaison, Haute-Seine, (F)) opens new venues in recognising -at least in France- evolution in technology and typology of the material culture (e.g., the tools) of the Federmesser from late Younger Dryas/Early Allerød until late Allerød, within a stratigraphic, chronological scheme (BODU, 1995; BODU & VALENTIN, 1997). The new path taken in search of generic evolution within or between technocomplexes, e.g., the 'azilianisation', which emphasises technological changes and to a lesser degree 'typological taxonomies' -the latter subject to an array of environmental, and occupational-functional factors- is served by this new relative chronological scheme. It provides an additional basis for the seminal ideas and recognition by J.-P. Fagnart (1993, 1997) of the late Glacial occupations in Northern France as belonging to the Federmesser or Arched

Backed Pieces technocomplex. Similarly, results from the researches in the Neuwied basin, Central Rhineland (Niederbieber, Kettig, Andernach (D)) are crucial for the relative and absolute chronology of (late) Magdalenian and Federmesser occupations of Central Europe, because they are sealed by the securely dated stratigraphic marker of the Maria Laacher See Tephra layer (ca. 11.000 BP) at the end of the Allerød (BOSINSKI, STREET & BAALES, 1995). In addition, an ever accruing number of AMS-dates, on more reliable samples (hearths, bones with cut marks,...) strengthen the absolute chronological scheme notwithstanding the insecurities originating from the wiggles and plateaux in the ¹⁴C curve (STREET, BAALES & WENINGER, 1994; DE BIE & VERMEERSCH IN PRESS, with reference to CHARLES 1996⁷, KOBUSIEWICZ & KABACIŃSKI (eds.), 1993; FISHER & TAUBER, 1986; SCHILD, 1996a, b; KOZEOWSKI & KOZEOWSKI, 1996). Federmesser occupations can be more securely dated from the end of Younger Dryas until the end of Allerød.

Secondly, the above mentioned investigations in France and Germany uncovered a good number of faunal, pollen, and vegetal remains, providing the so much needed ecological information in dealing with subsistence and hunting. The drawback, however for our research area remains the mentioned geographic distance.

Finally, innovative is the purely archaeological analysis conducted by a team of the *Laboratorium voor Prehistorie*, on lithic projectiles at the Federmesser site of Rekem (B) (CASPAR & DE BIE, 1996). The ability of not only identifying projectiles (arrow points) but also of the past activities that were related to hunting are demonstrated by a full integration of metric-morphological, functional (micro- and macro-wear use traces analysis), technological, and spatial analyses of the Federmesser lithic concentrations.

The restricted ecological data in direct association with Late Glacial sites,

⁶ The unpublished Olbrachcice reindeer bone identification was done by T. Czyzewska (Dept. Palaeozoology, Wroclaw University (PL)).

⁷ Charles' research program of dating cut marked antlers and bones suggests that the Magdalenian occupation in Belgium was much more restricted, namely from the Older Dryas-Bølling boundary until possibly the end of Bølling.

compelled us to search for similar indirect evidence for the usage of hunting projectiles. Our question is mostly addressed towards the Allerød associated Federmesser groups and the preceding Bølling associated Hamburgian groups. The question is firstly: whether indices for the usage of bow and arrow could also be recovered in the eastern part of the Federmesser roaming area; and if so, did this important innovation already happen before, namely during the Bølling times, within the Hamburgian of the Shoulder Point Technocomplex culture? Or were the Hamburgians hunting in a similar way as the Magdalenian groups, using spear and spear drivers only?

4. SPEAR/SPEAR DRIVER VERSUS BOW AND ARROW

The oldest archaeological and direct proof for the use of bow and arrow comes from the Ahrensburgian deposits at Stellmoor (D) (RUST, 1943: Plates 91, 91), where more than one hundred pine wood arrows or arrow foreshafts fragments were recovered from the mud near the small dead ice lake. They seem to be the material witness of organized group hunts on reindeer (BOKELMAN, 1991; BRATLUND, 1991, 1996b). Before the Ahrensburgian, only indirect witnesses *sensu stricto* of bow and arrow are available, a topic of debate even when remains of projectile tips have been recovered in bone (See FISHER, HANSEN & RASMUSSEN, 1984; NUZHNYI, 1990). Although it has been suggested that in Upper Palaeolithic times already bow and arrow have been used, e.g., in the Gravettian (NUZHNYI, 1990) or maybe Solutrean (GENESTE & PLISSON, 1990), or thereafter, during the Late Palaeolithic period by the Hamburgian hunters (RUST, 1943; STURDY, 1975; BURDUKIEWICZ, 1986; ERIKSEN, 1996a), those involved with experimental research admit that from the types of micro- and macro-wear usage and breakage patterns a projectile function only can be derived, but not the exact type of weapon or the precise mode of propulsion. (GENESTE & PLISSON, 1990: 314; FISHER, HANSEN & RASMUSSEN, 1984: 24-25; ODELL & COWEN, 1986: 206; ODELL, 1988: 349). Weight, size or type of shaft is not linked one-to-one to those aspects of the "point". And, although some differences are suggested into the extent or

amount of damage, the high number or size of the macro-fractures has been once taken as an argument for the javelin (FISHER, HANSEN & RASMUSSEN, 1984) or sometimes for bow and arrow (CASPAR & DE BIE, 1996; ODELL, 1988). Moreover, the different set-ups for the experiments *and considerations of different wear types* may not have excluded distinct results (DOCKALL, 1997: 328, table 1). A focused, large experimental program, in search for inherent and distinct markers between both modes is still awaited.

J.-P. Caspar and M. De Bie identified, applying use-wear analysis, a high number of projectiles on slender (< 12 mm width) backed or lateral retouched laminar points and lithic elements from the ABPT concentrations of Rekem (Belgium). At this Allerød dated Federmesser site activities in preparation for hunting could be well established. The small "size of the projectiles and the degree of damage on used points" (CASPAR & DE BIE, 1996: 455) are seen as indications for the usage of bow and arrow, hunting instruments that are more suitable for the wooded environments that prevailed during the Allerød. However, the identification of a limited number of complete bladelets as barbs on arrow flanks, cannot be withheld as an argument for arrow use since they are also set in the foreshafts of spears, or javelins. (SULGOSTOWSKA, 1996: 302, Fig. 5., NUZHNYI, 1990: 118, Fig. 2: 41). Also, the idea that larger "points" are not fit for arrows was disproved by the Danish team that successfully implemented large Bromme points (FISHER, HANSEN & RASMUSSEN, 1984). Another source of information are the multiple finds of arrow shaft smootheners in Federmesser contexts (Pers. comm. M. DE BIE)⁸. Clearly, a number of conjectural givens, such as the reconstructed wooded environment, the bone remains of game --in small number-- that is small, skittish or fast running living solitary or in small groups (red deer, elk, wild pig, ibex, red fox, swan, (BOSINSKI, STREET & BAALES, 1995)), combined with archaeological observations of a high number of damaged projectiles, their spatial distribution, and the combination of the small size of these "tips", points tot the

⁸ A good example is a wide grooved, worked sandstone piece from the Federmesser site of Niederbieber (central Rhineland, (D)), decorated with a row of female abstract figurines, that has been interpreted as a shaft smoothener (BAALES & STREET, 1996: 297, Fig. 8: 1).

fact that bow and arrow use probably already occurred in the ABP Technocomplex, before the Ahrensburgian. But what about the Hamburgians, who roamed in scrubbed to slightly wooded tundra during Bølling time; Hamburgians, based on faunal analysis, are thought to have hunted during late summer and autumn, mostly reindeer, but also horse, hare, grouse, swans, and geese (BRATLUND, 1996b: 24)?

Where few are inclined to situate the 'invention' of bow and arrow with the later stages of the contemporaneous Magdalenians, who are seen, because of the numerous spear-driver finds, as the rather traditional practitioners of atlatls or spear throwers only (STODIEK, 1993), this is not so obvious for the Hamburgians. K. BOKELMAN (1991: 76) remarks that for the Hamburgian, we have *no idea* so far about their used hunting weapons. In opposition to Ahrensburgian Stellmoor where plenty of arrow shafts were found, no arrows were recovered from the mud of Meiendorf even though the conditions were equal for organic preservation⁹. Still, *the antler shaft from this site, and three from Hamburgian Stellmoor (D) may be interpreted as spear point ends. The shouldered points might have been attached obliquely with the truncation in the same axis as the shaft (Lund, 1993: Fig. 2 & 3).* Indirect, but doubtful evidence, for arrow use is found in the solitary sandstone arrow shaft shaping tools (*Pfeilglätter*) from Heber 127 (Soltau, (D)) (TROMNAU, 1975: Pl. 30-31), but Taute, the excavator of the site, however, was of the opinion that these pieces were kind of grinding stones for the fabrication of bone and ivory harpoons. He observed that the grooves were curved (TROMNAU, 1975a: 11).

An interesting line of thought has been expressed by G. ODELL (1988) in his research on the prehistoric hunting practices in Illinois, North America. In view of the absent diagnostic use-wear indices between arrow and spear, Odell proposes, based on the dynamics of fabrication, curation, recycling, and abandonment of projectile tips, that the recorded increase in the proportion of functional projectile points in assemblages may reflect an alteration of hunting

strategies. The introduction in Illinois, North America of bow and arrow in the Late Archaic (ca. 4.000 BP), becoming fully established in the Middle Woodland period (ca. 2020 - 1630 BP), is postulated. Being aware that sound comparisons between sites require spatial analyses for recognising the functional dimensions of the findspots, e.g. the location of repairing functional projectile points (ODELL, 1988: 349), the encampments, the dump areas, etc., he believes that the reversion to bow and arrow, brings about the production of a greater quantity of projectile tips. It ensures that the hunter would bring back in the camp spent points in greater profusion, whether in carcasses or not. In addition, if repairing or retooling occurs, as so well documented at Rekem, the great number of basal and medial fragments may indeed indicate arrow-repair.

Odell's inferences have guided our research to the extent that firstly, the hunting results of the Federmesser occupation at Rekem have been put to test in the Eastern zone of the ABPT roaming area; and secondly, the question was put whether a marked increase can be recognised in the number of functional projectiles in comparison with the Hamburgian.

5. FIELDWORK IN THE KOPANICA VALLEY.

Besides a number of participations at excavations in Poland¹⁰, fieldwork was started in co-operation with the Department

¹⁰ C. F. Herman participated in 1993 firstly at the excavation of Dudka I (Widminy (Mazuria, N-E Poland), a Final Palaeolithic (?)/Masovian(?), Older Mesolithic, Young Mesolithic, and Ceramic settlement (Late Pleistocene - until Atlantic) close to a peat-bog, directed by Dr. Witold Gumiński and Drs. Jan Fiedorzuck, *Institute of Archaeology and Ethnology (P.A.N.)*, Warszawa (GUMIŃSKI 1995; FIEDORZUCK, 1995 GUMIŃSKI & FIEDORZUCK, 1990); and secondly, at the excavation of Rydno (S-E Poland), the densest Late Palaeolithic site aggregation of Central Europe situated around the prehistoric Ochre Mine (Hamburgian (?), Federmesser, Masovian, Mesolithic, Bronze Age sites), directed by Dr. Jacek Tomaszewski, *Panstwowe Museumi Archeologiczne*, Warszawa, and Dr. H. Królick, *Institute of Archaeology and Ethnology (P.A.N.)*, Warszawa. Participation at Rydno was considered in view of the planned research on the hunting gear of Federmesser concentrations of Rydno and of getting better acquainted with the stratigraphic situations of Late Palaeolithic sites in sandy areas of Poland. The excavations of Rydno III/93, initially thought to be Federmesser was identified during the excavations as Masovian.

⁹ The assumption that Rust could have missed some small wooden fragments of the shafts are dismissed since pine wood arrow shafts were easily recognised in the Ahrensburgian layer.

of Archaeology, University of Wrocław (PL) at the site of Siedlnica 17/17a in the small Kopanica valley (W-Poland).

The investigations in this area were considered crucial for several reasons. At Siedlnica 17/17a Hamburgian and Federmesser occupations had been found by J. M. Burdukiewicz, Dept. of Archaeology, University of Wrocław, within a range of 100 m in a presumed lateral stratified position. K. BRODIKOWSKI and J. A. Van LOON (1987) had associated these sites respectively with superimposed Bølling and Allerød soils, yielding the prospect of finding additional, good stratigraphic and ecological data (HERMAN *et al.*, 1997). The Kopanica Valley had been intensely excavated in the seventies and eighties (BURDUKIEWICZ, 1986a, b; BURDUKIEWICZ & Van LOON, 1988), the sites not always been submitted to full archaeological analysis. The welcome exceptions were the excavations of the Hamburgian occupations Olbrachcice 8 and to some extent Siedlnica 17a, both of which constitute the most important data set for the archaeological characterisation of the limited Hamburgian occupation in Poland. And finally, the geographic position, at the border of the maximum Weichselian retreat was an asset for understanding the climatic fluctuations from Older Dryas to Preboreal.

The ever increasing co-operation with J. M. Burdukiewicz, started with the permission to study the hunting gear of the Federmesser concentrations of Siedlnica 17. An in depth analysis of the ABPT concentrations by means of data-bases was set-up and implemented¹¹ (e.g., MASOJÆ, 1997). Finally, in the Summer of 1995 actual excavations by teams of the Dept. of Archaeology, University of Wrocław (PL)

¹¹ The databases are a) LPSITE: an Access-2 database for the analysis of Late Palaeolithic concentrations: metric-morphological-technological classifications of concentrations. b) LPHUNT: an Access-2 database for the analysis of Late Palaeolithic hunting gear: metric-morphological-technological & functional classifications of lithics that eventually were used as projectiles: and LP-DTS: structure for a refined definition of the Dynamic Technological Structure of a late glacial occupation, a refinement on the respective DTS models as consecutively proposed by R. Schild (SCHILD & KRÓLICK 1981, GINTER, 1974, J. KOZŁOWSKI, and J. M. BURDUKIEWICZ (1986). This structure aims at reducing the "noise" in the very large categories of lithic fragments and waste, in order to have a better understanding of the composition of assemblages.

together with the *K.U.Leuven* (B), *R.B.I.N.S.* (B), and *U.G.* (B), produced a geological trench.

This fieldwork, results of which for the first two seasons have been presented more in depth elsewhere, continued for three seasons (BURDUKIEWICZ & HERMAN In press a, b, c, d; BURDUKIEWICZ, HERMAN & VERMEERSCH, 1996, In press a, b, c; BURDUKIEWICZ *et al.*, 1996). In short, this new Hamburgian concentration (silex artefacts N= 2487; silex tools N= 187) can be identified as a debitage station, with some activity areas around and on the densely concentrated debris (Fig. 1-4).

This conclusion is based on the technological structure of the assemblage, and the spatial distribution of the artefacts and tools. No hearth or dwelling structures could be identified, although a lot of charcoal was found. These remains, however, were stratigraphically posterior, which was further confirmed by the anthracological identifications by F. Damblon on the taxa *Quercus* and *Fagus* that belong to a Post-Atlanticum age (BURDUKIEWICZ *et al.*, 1996).

The research by P. Haesaerts, F. Damblon (*R.B.I.N.S.*), R. Langohr, and J. Mikkelsen (*U.G.*) suggests that the interpretations of the palaeogeography of the Kopanica valley and the Siedlnica 17a & Siedlnica 17 findspots proper, have to be adjusted. At Siedlnica 17, R. Langohr and J. Mikkelsen show that only traces of a truncated, A-Horizon and an unrelated truncated Podzol B-Horizon were recorded (Pl. 1-2; Fig. 5) (BURDUKIEWICZ *et al.*, 1996, BURDUKIEWICZ & HERMAN, In press) The fact that the new Hamburgian concentration was found in a Podzol B-Horizon hints for a formation of both horizons posterior to the occupation. The exact periodisation remains open. Additionally, the preliminary observations by P. Haesaerts and R. Langohr indicate that the presumed Bølling soil at Siedlnica 17a was no longer visible due to hydrocyclical impact. It follows that, as yet, in view of a mixed pollen-profile (DAMBLON 1996: 8-9), few secure arguments are available to identify Bølling or Allerød soils at Siedlnica 17/17a.

Another prehistoric site (Late Glacial (?) Siedlnica 74) was discovered in September 1995 in association with Gytjtja-layers. Such layers, found for the first time within the valley itself, offer the prospect that kill remains in the form of bone or antlers -if present-, may be preserved. An identification data set on fauna in association with the Polish Hamburgian has only recently been acquired at Mirkowice, besides the few small fragments of reindeer at Olbrachcice 8 (BURDUKIEWICZ & HERMAN, In press). This Gytjtja at Siedlnica 74 and sediments associated with Hamburgian artefacts at Siedlnica 17 suggest that a lake was present, of which the deposits have been for the most part eroded away.

Although the Kopanica valley belongs presently to the isolated eastern periphery of the Hamburgian roaming region, the find of a third concentration in the valley (besides Siedlnica 17a, Olbrachcice 8,) provides us the first hints that this valley may have attracted Hamburgian hunter-gatherers for specific subsistence or social activities. The thought expressed earlier (HERMAN *et al.*, 1997) that several other Hamburgian concentrations are waiting to be discovered in this valley, was proved during the 1997 season, when a fourth concentration Siedlnica 17-II/97 was discovered. Indeed, the Hamburgian occupation in Central Europe might have been much more substantial than previously assumed. The progress made in Southern Scandinavia with the discoveries of Hamburgian is also made on Polish territory. Six excavated sites, Olbrachcice 8, Siedlnica 17a, Siedlnica 17-I/95+I/96+I/97, Siedlnica II/97, Rogów Opolski, Liny, and Mirkowice mark the Polish, eastern periphery of the Hamburgian exploration zone. The Eastern and North-western border area of the Hamburgian occupation zone, e.g., closest to the ice front, are crucial areas for taxonomic and settlement pattern studies. They finally offer a required minimum of data to discern the functional, cultural and/or chronological variation..

6. THE ABPT CONCENTRATION SIEDLNICA 17 II/73: TRACES OF HUNTING

Projectile identification has been methodologically refined to the point that it can be applied to all types of excavated Late Glacial sites. Since functional and morphological categorisations have been shown on multiple occasions to be often distinct (ODELL, 1988; MOSS, 1988; CASPAR & DE BIE, 1996), all laterally altered tools were inspected, except flakes with partial/irregular retouch on the edges or edges. Neither, scrapers, burins, and perforators and borers were withheld. As such the following categories were retained: 1) *points*: backed or other; 2) *backed pieces*: fully or partly backed; 3) *laterally retouched blades, bladelets or eventually flakes*: this group includes 'pieces with micro-retouched edges' applied on short distances of the lateral edge(s); they were labelled pieces with "regular scars" or "scars only"; 4) *truncations*; and 5) *notched pieces*. Concentrations of Federmesser Siedlnica 17, Rydno, Ca3owanie, and Ahrensburgian Volentiny (Czech Republic) have been analysed for projectile elements, based on macro-wear. This research is still in progress.

The multi-dimensional approach (spatial analysis, preservation, analytical morpho-metric description, applied debitage technology, position of blank in the *chaîne opératoire*, and functional description based on *macro-wear* and *micro-wear* traces and patterns) has a number of advantages. Macro-wear studies optimise micro-wear analysis but are often the sole approach. Indeed, too often the bad state of preservation of the pieces does not allow such analysis. At ABPT Siedlnica 17-II/73 more than half of the objects cannot be analysed for micro-wear because they are burnt or chemically altered. But still a substantial number could be identified as projectiles (ca 34% of the considered tools (Fig. 6)) based on macro-wear (HERMAN, 1997). Moreover, this functional approach gives a new meaning to a large group of (mostly fragmented) tools that are usually counted in the 'waste bin' of 'tool fragments' or 'retouched pieces'. In addition, the technological characterisation combined with the metric-morphological descriptions provides, besides the 'classic' typologies, greater possibilities to discern eventual

stylistic traits from which lines of traditions might be better determined. And finally and most importantly, the spatial information linked to functional characterisation permit to fully investigate *loci* related to hunting.

As a test case in the search of 'functional' hunting projectiles, the concentration of Siedlnica 17 II/73 was selected. This is the largest and densest concentration of the ABP Technocomplex presence in the Kopanica Valley. Spread over an area of approximately 8m east-west x 6m north-south, this assemblage, located on a dune, consists of 5455 flint artefacts (all made of manuported Baltic erratic flint), two flat stones, and two round grinding(?) stones. A full analysis of the concentration is under way. It suffices here to mention that the tool-kit is slightly larger than was assumed shortly after the excavations: 6.6% instead of 5.0% of the whole assemblage (ca. 360 tools/tool fragments instead of ca. 274) (BURDUKIEWICZ, 1987). Approximately half are endscrapers, followed by fully or partially backed pieces (54 pieces, ca 15%), including backed points (14 pieces or circa. 4%). A number of burins, a few truncations (10), a Lingby point, a shouldered piece, rare notched pieces (2) and a few borers have been collected. The remaining tool-kit consists of a laterally retouched blades and bladelets (36 pieces or ca 10%) besides a number of retouched flakes and non-laterally retouched blades..

Macro-wear diagnostic fractures of projectile function: the identifications

Multiple experiments dealing with damage from projectile impact have been set up within the last two decades, including a most recent one at the *K.U.Leuven* (for bibliography on experiments, see CASPAR & DE BIE, 1996). Of the cone and bending initiating fractures with feather, hinge, and step-terminations (FISHER, HANSEN & RASMUSSEN, 1984), all agree that the latter is diagnostic for projectile impact, while snap bending fractures can be caused by a diverse array of distinct (post)- & occupational actions. Good agreement exists equally that when the surfaces of all these macro-fractures (of course except the snap bendings) are longer than 2 mm in longitudinal direction, they are to be considered diagnostic of a projectile function. In addition, lateral cone fractures and burin-

like spin-offs are also produced, often in combination with the bending fractures. Even with snap bending fractures they can be considered diagnostic if the lateral cone fractures on the tip are pointing obliquely towards the base, or at the base towards the tip, and if the burin-like spall spin-offs are larger than 3 mm. Despite that in the *K.U.Leuven* experiment almost half of the projectiles with bending fractures, smaller than 2 mm, have micro-wear traces (*Microscopic Linear Impact Traces*) --the same percentage being replicated in the archaeological laterally modified pieces from Rekem (CASPAR & DE BIE, 1996: 444-445)--, these pieces were not withheld at Siedlnica, 17-II/37 in the absence of micro-wear analysis. In consequence, the presented number of diagnostic 'functional projectiles' at Siedlnica should be considered as the minimum.

Based on diagnostic fracture features, the considered Siedlnica pieces in the above mentioned categories, reach nearly the same ratio of pieces with diagnostic macro-wear traces as at Rekem: Siedlnica 17 II/73: 32/91 or 35% for all pieces except truncation, notched, and uncertain pieces; 34/104 or 32% for all pieces (Fig. 6). At Rekem this is 118/297 or 40% of lateral altered pieces (CASPAR & DE BIE, 1996: 447, Table 3). Important is that the backed and retouched/scar pieces (mostly fragments) have also a high percentage of diagnostic projectile features. Certainly in case of the backed pieces, most of them must have been part of morphological point type, but the lack of the broken off point tip does not allow a metric-morphological categorisation in this specific group. The difference with Rekem is that in the group of robust pieces and points a few diagnostic projectile features were met. Micro-wear research at Rekem (B) showed that robust points (wider than 12 mm) were used for butchering only and spatial and technological analysis reveals that most of the other robust pieces can be viewed as being left in the process of fabrication. To suggest that this dichotomy in functional distinction according to size is completely lacking in central Europe would, in the absence of micro-wear analysis, be premature. This may appear at other sites as well, e.g., such as Rydno or Ca3owanie, where morphologically similar robust pieces occur. Size of these tools may be a reflection of past activities, e.g. unfinished stage of fabrication, or of quality

or size of the raw material. On the other hand, the heavier robust lithic points could indicate the perseverance of javelin-throwing, although the experiments with Bromme point replicas showed the feasibility of an implementation on the more agile arrow. Of interest is that within the categories of truncations and notched pieces a few diagnostic projectiles were found at Siedlnica 17-II/73.

The analysis on Siedlnica, focusing on the basic issue of hunting tools in the ABP Technocomplex, confirms the findings by M. De Bie and J.-P. Caspar that most of the backed pieces were used as projectiles (based on experiments and the observations on the Rekem assemblage). At Siedlnica 17-II/73, belonging to the eastern zone of the ABP Technocomplex, a comparatively great number of lithics can be directly linked to hunting practices. Although the identification of function in an assemblage, ideally combines macro-wear, micro-wear, study of technology, and spatial analysis, the first mentioned research method is able to give new meaning to the often large, and unclear group of fragments in the tool-kit. If the percentage of all the arrows used in the experiments, that show diagnostic macro-wear traces (between one third and a half: Pers. Comm. J.-P. Caspar) can be taken as relevant for approximating the actual number of projectile remains at Siedlnica 17 II/73, than it may be inferred that the large majority of the laterally modified laminar pieces had such a function. It would mean that Siedlnica 17-II/73 was very much linked to hunting practices, having at least the function of a hunting camp. Further analysis (spatial and technological) should bring to the foreground whether this was or wasn't the main purpose of this locus.

7. HUNTING GEAR IN THE HAMBURGIAN

So far only little use wear analysis has been executed, *in casu* at Oldeholtwolde (NL), a Hamburgian site of Havelte facies and at Stellmoor (D). H. Moss (1988: 402-404) applied some micro- and macro-wear analyses on shouldered points (N= 16), bladelets (N= 35) and backed bladelets (N= 3) from Oldeholtwolde. "*Most of the points so far examined have evidence of impact fractures or microscopic, linear impact traces*

(MLIT)... Not only is the evidence frequent but it is also extensive (MOSS, 1988: 402). Three different kinds of MLITs were found on one point. The few MLITs found perpendicular to the axis of some bladelets are considered arguments for their usage as transverse barbs near the tip, although such usage as an actual point is not excluded. According to H. Moss, "*the off-site loss rate was low, or at least... the same points were recovered and were used over and over again*" (MOSS, 1988: 403), a statement that asks for further substantiation. Three of the five shouldered points from Stellmoor Teich were projectiles: 2 with diagnostic features; 1 still *in situ* in a reindeer vertebra (FISHER, HANSEN & RASMUSSEN, 1984: 36). In both cases no evidence about the type of propulsion could be derived.

- Hamburgian Siedlnica 17-I/95+I/96

In our excavations conducted at Hamburgian Siedlnica 17-I/95+I/96, all preparatory work for a functional tool-identification has been executed. The lithic tools have been identified and selected for possible functional projectile usage. As yet, the category of notches and saws was not withheld because very few projectiles are to be expected amongst them. The planification of the tools has been prepared (Fig. 7). At this locus of debitage, where the distribution of burins to the Southeast and scrapers to the Northwest suggest distinct activities, so far, only restricted traces in relation with hunting can be postulated (Fig. 8). The spatial distribution of morphological shouldered and backed points do not, aside from their widespread distribution, reveal any specific activity. Refitting and the functional analysis of the points, backed pieces, lateral retouched pieces, and undetermined tool fragments should further clarify this issue and will reveal the degree of importance of specific activities dealing with hunting. On a few damaged Hamburgian points from Siedlnica I/95+I/96 projectile stigmata have been observed. The questions of a functional bimodality of projectile and knife as observed by J.-P. Caspar and M. De Bie in the distinct size of laterally modified pieces and points from Rekem (B), or an eventual bimodality within the projectile function (arrow & bow *versus* spear & spear driver) are at issue.

8. INCREASE OF THE NUMBER OF PROJECTILES FROM HAMBURGIAN TO FEDERMESSER: AN ESTIMATION

G. Odell's proposition of a sudden increase in number of projectiles as indication for the introduction of bow and arrow has been tested in a first stage of the present research on hunting during the Hamburgian. A number of Hamburgian assemblages were confronted with those Federmesser concentrations that were already researched for the presence of functional projectiles. For 21 selected Hamburgian assemblages (Fig. 8) the percentages of shouldered Hamburgian points, including the Havelte tanged points, the rare backed points and pieces, together with the percentages of retouched pieces and truncations have been retained. These categories are the main population of lithics in which functional projectiles are expected to be identified. In Figure 9 the same relevant tool categories of the Federmesser concentrations of Siedlnica 17 II/73 and those of Rekem with more than 60 tools are presented.

The comparison of both maximum populations of possible functional projectiles reveals already an important increase from an average 31% in the Hamburgian to 52% in the Federmesser groups (Fig. 10). The same trend is even more pronounced in the points and backed pieces category: from 9.5% to 33%. The higher percentage of retouched pieces in the Hamburgian concentrations (15%) needs qualification in that for many assemblages the specific category of lateral retouched laminar pieces has not been specified¹². Obviously the retouched pieces category is very uneven in quality, and an actual morphological and functional investigation will heavily reduce the actual population of diagnostic projectiles. This can be derived from the maximal population of retouched pieces in the selected Federmesser assemblages (see Fig. 10) which are in great majority lateral retouched laminar pieces. A high frequency of projectile damage has been recorded on these pieces: 41% at Rekem (based on CASPAR & DE BIE, 1996: Table 6),

¹² Sites like Houtigehage I, Havelte, Meiendorfer Teich have no retouched blades or flakes reported, an archaeological given that may be questioned. Liny 1 has a very high number of irregular retouched pieces, very few of which will qualify of possible projectile remnants.

and 34% at Siedlnica II/73 (based on Fig. 6). Finally, also in the truncations category an increase is observed from 6% to 13%. However, projectile identifications in this category is likely to be higher in the Hamburgian than in the Federmesser, since tip fragments of shouldered points may be more readily classified in this category. At Federmesser Siedlnica 17 II/73 and at Rekem only one truncation at both places each has been identified as projectile (HERMAN, 1997, pers. comm. J-P. CASPAR & M. DE BIE). Functionally diverse, Hamburgian truncations may be fragments of shouldered points or of other tools, or may represent preparatory stages for burins, or are indeed actual finished functional tools.

Obviously, this generalised trend of increase from Hamburgian to Federmesser is only an estimation. It is a starting point for the hypothesis that bow and arrow were not yet known to the Hamburgian hunters. One should remark that if absolute figures are retained, certain sites, such as Ureterp (NL), Deimern 42 (D), or Teltwisch (D), produced considerable numbers of points (including the rare backed pieces): respectively 59, 115, and 67. Before such proposition can be fully endorsed, a set of actual projectile identifications in Hamburgian assemblages showing activities dimensions are needed for comparison. If this marked increase pertains, than the meaning of it should be fully explored and weighed by additional spatial analytical, technological, and use-wear information.

9. CONCLUSIONS

Although, our research on hunting practices during the Late Glacial Period cannot be considered as finalised, the preparatory research and set-up in identifying hunting projectiles in the Hamburgian and ABPT assemblages of central Europe is in a stage, where conclusion may be reached in the near future. In Central Europe ABPT groups, like those of the westerly Lowlands seem to have indeed reverted to bow and arrow. The issue of a possible introduction of bow and arrow in the Hamburgian is the immediate problem to be attacked. The continued research on the Late Glacial in the Kopanica valley will

certainly add in fine tuning and solving this problem.

ACKNOWLEDGEMENTS

This work is a contribution to the Belgian programme Services Centres and Research Networks (Sc-004 Project) initiated by the Belgian State, Federal Office for Scientific, Technical and Cultural Affairs (OSTC).

Several people are sincerely thanked for their co-operation and advises on multiple occasions: Dir. Dr. R. Schild, Dr. Zofia Sulgostowska, Dr. H. Królick, Dr. W. Gumiński, Drs. J. Fiedorzuck (*Institute of Archaeology and Ethnology (P.A.N.), Warszawa (PL)*); Dr. M. Kobusiewicz, Dr. Jacek Kabaciński (*Institute of Archaeology and Ethnology (P.A.N.), Poznań (PL)*), Prof. Dr. S. K. Kozłowski (*University of Warszawa, Warszawa (PL)*); Dr. J. Tomaszewski, *Panstwowe Museum Archeologiczne, Warszawa (PL)*, Warszawa (PL); Dr. M. Winiarska-Kabacińska (*National Archaeological Museum, Poznań (PL)*), Prof. Dr. S. Vencl, *National Archaeological Service, Praha (Cz)*; Dir. Dr. Z. Bagniewski & Dr. J. M. Burdukiewicz, Drs. M. Masojæ, *Dept. of Archaeology, University of Wrocław, Wrocław (PL)*; Dr. Marek Wróbel, *Państwowa Służba Ochrony Zabytków, Państwowa Służba Ochrony Zabytków, Trzebinia (PL)*; and Miss. J. Kračenińska and R. Van Ermen, Directors of International Relations respectively at the *University of Wrocław (PL)* and the *K.U.Leuven (B)*.

Our special thanks to Dr. J. M. Burdukiewicz, *Dept. of Archaeology, University of Wrocław* for the co-operation in the joint fieldwork in the Kopanica Valley (PL), and for his kind permission to study the lithics related to hunting of the Late Glacial sites of the Kopanica Valley.

Besides the Network's funds, additional financial support was provided both for fieldwork in the Kopanica Valley by the *University of Wrocław*, the *Government of the Voivodeship Łęsko*, and the *National Science Foundation-Flanders* and for research by the *National Bank of Belgium*.

Sincere thanks to Dr. J.-P. Caspar and Dr. M. De Bie for their comments on the first draft and to Drs. S. Bubel for the editing. Scientific responsibility is assumed by the authors.

BIBLIOGRAPHY

- BAALES M. & STREET M., 1996,
Hunter-gatherer behavior in a changing Late Glacial landscape: Allerød archaeology in the central Rhineland, Germany. *Journal of Anthropological research*, 52: 281-316.
- BAGNIEWSKI Z., 1976,
Wyniki wstępnych badań na stanowisku nr 6 w Siedlnicy, woj. łęsko (Ergebnisse der Aufklärungsforschungen auf der Fundstelle 6 in Siedlnica, Wojewodschaft Łęsko). *Łęskie Sprawozdania Archeologiczne*, 16: 9-12.
- BARTON N., ROBERTS A. J. & ROE D. A., 1991,
The late Glacial in North-West Europe: Human Adaptation and Environmental Change at the End of the Pleistocene. CBA Research Report, 77. Oxford: Council for British Archaeology.
- BOCHEŃSKI Z., GINTER B., KOZŁOWSKI J. K., MOOK W. G., MUSZYŃSKI M., NADACHOWSKI A., STWORZEWICZ E. & SZYNDLAR Z., 1985,
Badanie osadów schronisk podskalnych w Żalasio, K. Krakowa. *Folia Quaternaria*, 56: 3-56.
- BODU P., 1995,
Le site à Federmesser du "Closeau" à Rueil-Malmaison (Hauts-de-Seine). *Notae Praehistoricae*, 15: 45-49.
- BODU P. & VALENTIN B., 1997,
Groupes à Federmesser ou Aziliens dans le sud et l'ouest du Bassin Parisien. Propositions pour un nouveau modèle d'évolution. *Bulletin de la Société Préhistorique française*, 94 (3): 341-347.

- BOHMERS A., 1947,
Jong-Palaeolithicum en Vroeg-Mesolithicum, In: VAN GELDER H. E., GLAZEMA P., BONTEKOE G. A., HALBERTSMA H. & GLASBERGEN W. (eds.), *Oudheidkundig bodemonderzoek in Nederland. Gedenkboek A. E. van Giffen*. Meppel: J. A. Boom & Zoon: 129-201.
- BOHMERS A., 1960,
Statistiques et graphiques dans l'étude des industries lithiques préhistoriques. Considérations générales au sujet du Hambourgien, du Tjongerien, du Magdalenien et de L'Azilien. *Palaeohistoria*, 8: 15-37.
- BOKELMAN K., 1991,
Some new thoughts on old data on humans and reindeer in the Ahrensburgian tunnel valley in Schleswig-Holstein, Germany. In: BARTON N., ROBERTS A. J. & ROE D. A. (eds.), *The Late Glacial in North-West Europe: Human adaptation and environmental change at the end of the Pleistocene.*, CBA Research Report, 77. Oxford: Council for British Archaeology: 72-81.
- BOSINSKI G., STREET M. & BAALES M., 1995,
The Palaeolithic and Mesolithic of the Rhineland. In: SCHIRMER W. (ed.): *Quaternary Field Trips in Central Europe. Vol. 2.* Munchen: Verlag Dr. Friedrich Pfeil: 829-999.
- BRATLUND B., 1991,
A study of hunting lesions containing flint fragments on reindeer bones at Stellmoor, Schleswig-Holstein, Germany. In: BARTON N., ROBERTS A. J. & ROE D. A. (eds.), *The Late Glacial in North-West Europe: Human Adaptation and Environmental Change at the End of the Pleistocene.* CBA Research Report, 77. Oxford: Council for British Archaeology: 193-207.
- BRATLUND B., 1996a,
Archaeozoological comments on Final Palaeolithic frontiers in South Scandinavia, In: LARSSON L. (ed.), *The earliest settlement of Scandinavia and its relationship with neighbouring areas.* Acta Archaeologica Lundensia, 24. Stockholm: Almquist & Wiksell International: 23-33.
- BRATLUND B., 1996b,
Hunting strategies in the Late Glacial of Northern Europe: a survey of the faunal evidence. *Journal of World Archaeology*, 10 (1): 1-47.
- BRODZIKOWSKI K. & Van LOON A. J., 1987,
Palaeogeographic development of the Kopanica Valley (Southern Great-Polish Lowland) during the Late Pleistocene and the Holocene. In: BURDUKIEWICZ J. M. & KOBUSIEWICZ M. (eds.), *Late Glacial in Central Europe. Culture and Environment.* Prace Komisji Archeologicznej PAN - Oddzia3 we Wroc3awiu, 5. Wroc3aw: Ossolineum: 183-213.
- BURDUKIEWICZ J. M., 1975,
Z badañ sondażowych stanowisk paleolitycznych i mezolitycznych w dolinie Kopanicy (rejon Olbrachcic i Siedlnicy, pow. wschowski), *Œliskie Sprawozdania Archeologiczne*, 17: 5-12.
- BURDUKIEWICZ J. M., 1986b,
Siedlnica 17a - eine neue Fundstelle der Hamburger Kultur im Odergebiet. *Archäologisches Korrespondenzblatt*, 16: 399-406.
- BURDUKIEWICZ J. M., 1986b,
The Late Pleistocene Shouldered Point Assemblages in Western Europe. Leiden: E. J. Brill Publishing House.
- BURDUKIEWICZ J. M., 1987,
Zum Forschungsstand der Hamburger Kultur. *Jahrbuch des Römisch Germanischen Zentralmuseums Mainz*, 34: 143-167.
- BURDUKIEWICZ J. M., 1989,
Le Hambourgien: origine, évolution dans un contexte stratigraphique, paléoclimatique et paléogéographique, *L'Anthropologie (Paris)*, 93: 189-218.
- BURDUKIEWICZ J. M. & HERMAN C. F., In press a,
Recherche dans la partie orientale de l'aire d'extension hambourgiennne - le nouveau site de Siedlnica 17. In: BODU P. & VALENTIN B. (eds.), *L'Europe septentrionale au tardiglaciaire, Table Ronde, Nemours 14-16 mai 1997.*

- BURDUKIEWICZ J. M. & HERMAN C. F., In press b,
Siedlnica 74, gm. Wschowa, woj. leszczyńskie. *Informator Archeologiczny*, 1996.
- BURDUKIEWICZ J. M. & HERMAN C. F., In press c,
Siedlnica, gm. Wschowa, woj. Leszczyńskie Stanowiska 17 i 17a. *Informator Archeologiczny*, 1995.
- BURDUKIEWICZ J. M. & HERMAN C. F., In press d,
Stanowisko schyłkowe paleolityczne Siedlnica 74, gm. Wschowa. *Œllskie Sprawozdania Archeologiczne*, 39 (1997).
- BURDUKIEWICZ, J. M., HERMAN C. F. & VERMEERSCH, P. M., 1996,
Nowa krzemienica kultury hamburskiej z Siedlnicy 17, gm. Wschowa. *Œllskie Sprawozdania Archeologiczne*, 38: 35-54.
- BURDUKIEWICZ J. M., HERMAN C. F. & VERMEERSCH P. M., In press a,
Dalsze badania krzemienica kultury hamburskiej z Siedlnicy 17, gm. Wschowa. *Œllskie Sprawozdania Archeologiczne*, 39 (1998).
- BURDUKIEWICZ J. M., HERMAN C. F. & VERMEERSCH P. M., In press b,
Siedlnica 17, gm. Wschowa, woj. leszczyńskie. *Informator Archeologiczny*, 1996.
- BURDUKIEWICZ J. M., HERMAN C. F., HAESAERTS P., DAMBLON F., LANGOHR R., MIKKESEN J. H. & VERMEERSCH P. M., 1996,
A new Hamburgian concentration at Siedlnica 17 in the Kopanica Valley (SW Poland), *Anthropologie et Préhistoire*, 107: 13-36.
- BURDUKIEWICZ J. M. & Van LOON A. J., 1988,
Le Hambourgien dans le bassin de l'Oder. In: OTTE M. (ed.), *De la Loire à l'Oder. Les civilisations du Paléolithique final dans le nord-ouest européen*. Oxford: B. A. R. Int. S. 444I, Vol. 2: 567-582.
- CASPAR J.-P. & DE BIE M., 1996,
Preparing for the hunt in the Late Palaeolithic camp at Rekem, Belgium. *Journal of Field Archaeology*, 23 (4): 437-460.
- CHARLES R., 1996,
Back into the North: the radiocarbon evidence for the human recolonisation of the north-western Ardennes after the last Glacial Maximum. *Proceedings of the Prehistoric Society*.
- CHMIELEWSKA M., 1978,
PóŸny Paleolit Pradoliny Warszawsko-Berlińskiej. Wroc3aw: Ossolineum.
- CYREK K., 1986,
Magdaleńskie obozowisko w Górach _wiêtokrzyskich (mosty, Stanowisko B). *Acta Archaeologica Carpathica*, 25: 11-55.
- COUDRET P. & FAGNART J.-P., 1997,
Les industries à Federmesser ou Aziliens dans le sud et l'ouest du Bassin parisien. Propositions pour un nouveau modèle d'évolution. *Bulletin de la Société Préhistorique Française*, 94 (3): 349-360.
- CUNDY B. J., 1989,
Formal variation in Australian Spear and Spearthrower Technology. Oxford: B.A.R. Int. S., 546.
- DAMBLON F., 1996,
Palaeobotany. In: KONINKLIJK BELGISCH INSTITUUT VOOR NATUURWETENSCHAPPEN: *Prehistory and Evolution of the Environment during the last 100,00 Years in the Great European Plain*. Unpublished Report. Brussels: Federal Office for Scientific, Technical, and Cultural Affairs. Vol. IB, Appendix A.4.: 1-17.
- DAMBLON F., HAESAERTS P. & VAN DER PLICHT J., 1996,
New datings and considerations on the chronology of Upper Palaeolithic sites in the Great Eurasiatic plain. *Préhistoire Européenne*, 9: 177-231.

- DE BIE M. & CASPAR J.-P., 1997,
La signification des outillages lithiques dans les industries à *Federmesser*. Observations sur la variabilité des burins et des pièces laminaires ou lamellaires à modification latérale dans le gisement de Rekem (Belgique). *Bulletin de la Société Préhistorique Française*, 94 (3): 361-372.
- DE BIE M. & VERMEERSCH P. M., In press,
Pleistocene-Holocene transition in Benelux. In: STRAUS L. G. & ERIKSEN B. V. (eds.): *As the World Warmed: Human Adaptations Across the Pleistocene-Holocene Boundary*. *Quaternary International*, 48 (1998).
- DOCKALL, J. Z., 1997,
Wear traces and projectile Impact: a review of the experimental and archaeological evidence. *Journal of Field Archaeology*, 34,3: 321-331.
- ERIKSEN B. V., 1996a,
Regional variation in Late Pleistocene subsistence Strategies. Southern Scandinavian reindeer hunters in a European context. In: LARSSON L. (ed.), *The Earliest Settlement of Scandinavia and its Relationship with Neighbouring Areas*. *Acta Archaeologica Lundensia*, 24. Stockholm: Almquist & Wiksell International: 7-21.
- ERIKSEN B. V., 1996b,
Resource exploitation, subsistence strategies, and adaptiveness in Late Pleistocene-Early Holocene Northwest Europe. In: STRAUS L. G., ERIKSEN B. V., ERLANDSON J. M. & YESNER D. R. (eds.), *Humans at the End of the Ice Age. The Archeology of the Pleistocene-Holocene Transition*. New York - London: Plenum Press: 101-128.
- FAGNART J.-P., 1993,
Le Paléolithique supérieur récent et final du Nord de la France dans son cadre paléoclimatique. Thèse de Doctorat. Lille: Université de Sciences et Technologie de Lille.
- FAGNART J.-P., 1997,
La fin des temps glaciaires dans le Nord de la France. Approche archéologique et environnementale des occupations humaines au cours du tardiglaciaire. Mémoires de la Société Préhistorique Française, 24. Paris: Société Préhistorique Française.
- FIEDORCZUK J., 1995,
Mesolithic finds at Dudka 1, Great Masurian Lakeland, and their chronological-taxonomic relations. *Przeegląd Archeologiczny*, 43: 47-59.
- FISHER A., 1996,
At the border of human habitat. The Late Palaeolithic and Early Mesolithic in Norway. In: Larsson L. (ed.), *The Earliest Settlement of Scandinavia and its Relationship with Neighbouring Areas*. *Acta Archaeologica Lundensia*, 24. Stockholm: Almquist & Wiksell International: 157-176.
- FISHER A., HANSEN P. V. & RASMUSSEN, P., 1984,
Macro and micro wear traces on lithic projectile points. *Journal of Danish Archaeology*, 3: 19-46.
- FISCHER A. & TAUBER H., 1986,
New C14-datings of Late Palaeolithic cultures from northwestern Europe. *Journal of Danish Archaeology*, 5: 7-13.
- GALIŃSKI T., 1987,
An investigation into Palaeolithic settlement of the Pomerian territories. In: BURDUKIEWICZ J. M. & KOBUSIEWICZ M. (eds.), *Late Glacial in Central Europe. Culture and Environment*. Prace Komisji Archeologicznej PAN - Oddział we Wrocławiu, 5. Wrocław: Ossolineum: 143-163.
- GENESTE, J. M. & PLISSON H., 1990,
Technologie fonctionnelle des pointes à cran Solutréennes: l'apport des nouvelles données de la grotte de Combe Saunière (Dordogne). In: KOZŁOWSKI J. K. (ed.), *Les industries à pointes foliacées du Paléolithique supérieur européen, Kraków 1989*. E.R.A.U.L., 42. Liège: Université de Liège: 293-320.

- GRØNNOW B., 1987,
Meiendorf and Stellmoor revisited. An analysis of late palaeolithic reindeer exploitation. *Acta Archaeologica*, 56: 131-166.
- GUMIŃSKI W., 1995,
Environment, economy and habitation during the Mesolithic at Dudka, Great Masurian Lakeland, NE-Poland. *Przeegl1d Archeologiczny*, 43: 5-46.
- GUMIŃSKI W. & FIEDORCZUK J., 1990,
Dudka 1. A stone age peat-bog site in North-Eastern Poland. *Acta Archaeologica*, 60 (1989): 51-70.
- HAYDEN B. (ed.), 1979,
Lithic Use-wear Analysis. Lithic Use-wear Conference, Simon Fraser University, Vancouver, March 1977. New York: Academic Press.
- HERMAN, C. F., 1997,
Indications of hunting at the ABP concentration of Siedlnica 17 Cut II/73, a Late Glacial site in the Kopanica Valley (SW-Poland): some preliminary thoughts. *CELlskie Sprawozdania Archeologiczne*, 39 : 325-336.
- HERMAN C. F., VERMEERSCH P. M. & BURDUKIEWICZ J. M., 1997,
The Hamburgian Occupation in the Kopanica Valley (SW-Poland): Some Insights after the Second Season. Leuven. Unpublished excavation report. Leuven: K.U.Leuven.
- HERRE W. & REQUATE H., 1958,
Die Tierreste der paläolithischen Siedlungen Poggenwisch, Hasewich, Borneck und Hoppenbach bei Ahrensburg. In: RUST A., *Die Jungpaleolithischen Zeltanlagen von Ahrensburg*. Offa-Bücher, 15. Neumünster: Karl Wachholtz Verlag: 23-27.
- HOLM J., 1996,
The earliest settlement of Denmark. In: LARSSON L. (ed.), *The Earliest Settlement of Scandinavia and its Relationship with Neighbouring Areas*. *Acta Archaeologica Lundensia*, 24. Stockholm: Almqvist & Wiksell International: 43-59.
- HOLM J. & RIECK F., 1987,
Die Hamburger Kultur in Dänemark. *Archäologisches Korrespondenzblatt*, 7: 151-168.
- KOBUSIEWICZ M., 1973,
Problems concerning Hamburgian culture in Central Europe. *Przeegl1d Archeologiczny*, 21: 65-92.
- KOBUSIEWICZ M., 1983,
Le problème des contacts des peuples du Paléolithique final de la plaine européenne avec le territoire français, *Bulletin de la Société Préhistorique Française*, 80: 308-321.
- KOBUSIEWICZ M. & KABACIŃSKI J. (eds.), 1993,
Chwalim, Subboreal Hunter-Gatherers of the Polish Plain. Poznan: Institute of Archaeology and Ethnology, Polish Academy of Sciences.
- KOWALKOWSKI A. & DOWGIAŁŁO-MYCIELSKA E., 1983,
The stratigraphy of fluvial and eolian deposits in the Kopanica Valley based on sedimentological and pedological investigations. *Geologisches Jahrbuch*, 71: 119-148.
- KOZŁOWSKI J. K. & KOZŁOWSKI S. K., 1996,
Le Paléolithique en Pologne. Préhistoire d'Europe, 2. Grenoble: Editions Jérôme Millon.
- KOZŁOWSKI J. K., Van VLIET B., SACHSE-KOZŁOWSKA E., KUBIAK H. & ZAKRZEWSKA G., 1974,
Upper Paleolithic site with dwellings of mammoth bones - Krakow-Spadzista Street B. *Folia Quaternaria*, 44: 1-110.
- LANGOHR R., 1993,
Types of tree windthrow, their impact on the environment and their importance for the understanding of archaeological excavation data, *Helinium*, 33(1): 36-49.
- LUND M., 1993,
Vorshäfte für Kerbspitzen der Hamburger Kultur. *Archäologisches Korrespondenzblatt*, 23: 405-411.

- MASOJÆ M., 1997,
Obozowisko kultury Federmesser z Siedlnica 17, gmina Wschowa (Wykop II/77+I/78). Unpublished magister paper. Wroc3aw: University of Wroc3aw.
- MOSS E. H., 1988,
 Techno-functional studies of the Hamburgian from Oldeholtwolde, Friesland, the Netherlands. In: OTTE M. (ed.), *De la Loire à l'Oder. Les civilisations du Paléolithique final dans le nord-ouest européen.*: B. A. R. Int. S. 444I. Oxford: Vol. 2: 395-412.
- NUZHNYI D., 1990,
 Projectile damage on Upper Palaeolithic microliths. Use of bow and arrow among Pleistocene hunters of the Ukraine. In: *The Interpretative Possibilities of Microwear Studies. Proceedings of the International Conference on Lithic Use-wear Analysis, 15th-17th February in Uppsala, Sweden*. Uppsala: Societa Archaeologica Upsaliensis: 113-134.
- ODELL G. H. & COWAN F., 1986,
 Experiments with spears and arrows on animal targets. *Journal of Field Archaeology*, 13: 195-212.
- ODELL G., 1988,
 Addressing Prehistoric hunting practices through stone tool analysis. *American Anthropologist*, 90: 335-356.
- RUST A., 1937,
Die Altsteinzeitliche Renntierjägerlager Meiendorf. Neumünster: Karl Wacholtz Verlag.
- RUST A., 1943,
Die alt- und mittelsteinzeitlichen Fund von Stellmoor. Neumünster: Karl Wacholtz Verlag.
- RUST A., 1958,
Die Jungpalaolithischen Zeltanlagen von Ahrensburg. Offa-Bücher, 15. Neumünster: Karl Wacholtz Verlag.
- SCHILD R., 1976,
 The Final Palaeolithic settlements of the European Plain. *Scientific American*, 234 (2): 88-99.
- SCHILD R., 1984,
 Terminal Paleolithic of the North European Plain. A review of lost chances, potential and hopes. *Advances in World Archaeology*, 3: 193-274.
- SCHILD R., 1996a,
 Radiochronology of the early Mesolithic in Poland. In: LARSSON L. (ed.), *The Earliest Settlement of Scandinavia and its Relationship with Neighbouring Areas*, Acta Archaeologica Lundensia, 24. Stockholm: Almquist & Wiksell International: 23-33.
- SCHILD R., 1996b,
 The North European Plain and Eastern Sub-Balticum between 12,700 and 8,000 BP. In: STRAUS L. G., ERIKSEN B. V., ERLANDSON J. M. & YESNER D. R. (eds.), *Humans at the End of the Ice Age. The Archaeology of the Pleistocene-Holocene Transition*. New York - London: Plenum Press: 129-157.
- SCHILD R. & KRÓLICK H., 1981,
 Rydno - a Final Palaeolithic ochre mining complex. *Przełłd Archeologiczny*, 29: 53-100.
- SCHWABEDISSEN H., 1954,
Die Federmesser-Gruppen des nordwesteuropäischen Flachlandes, zur Ausbreitung des Spät-Magdalénien. Neumunster: Karl Wacholtz Verlag.
- STAPERT D. & KRIST J., 1990,
 The Hamburgian site of Oldeholtwolde (NL): some results of the refitting analysis. In: CZIESLA E., EICKHOFF S., ARTS N. & WINTER D. (eds.), *The Big Puzzle. International Symposium on Refitting Stone Artefacts. Monrepos 1987*. Bonn: Holos: 371-404.
- STODIEK U., 1993,
Zur Technologie der jungpaläolithischen Speerschleuder. Eine Studie auf der Basis archäologischer, ethnologischer und experimenteller Erkenntnisse. Tübinger Monographien zur Urgeschichte, 9. Tübingen: Verlag Archaeologica Venatoria, Institut für Ur- und Frühgeschichte der Universität Tübingen.

- STREET M., BAALES M. & WENINGER B., 1994,
 Absolute Chronologie des Späten Paläolithikums und des Frühmesolithikums im Nördlichen Rheinland. *Archäologisches Korrespondenzblatt*, 24: 1-28.
- STURDY D. A., 1975,
 Some Reindeer economies in Prehistoric Europe. In: HIGGS E. D. (ed.): *Palaeoeconomy*. Cambridge: Cambridge University Press: 55-95.
- SULGOSTOWSKA Z., 1996,
 The earliest Mesolithic settlement of North-Eastern Poland. In: LARSSON L. (ed.), *The Earliest Settlement of Scandinavia and Its Relationship with Neighbouring Areas*. Acta Archaeologica Lundensia, 24. Stockholm: Almqvist & Wiksell International: 297-304.
- TROMNAU G., 1975a,
Die Fundplätze der Hamburger Kultur von Heber und Deimern, Kreis Soltau, Materialhefte zur Ur- und Frühgeschichte Niedersachsens, 9. Hildesheim: Verlag August Lax.
- TROMNAU G., 1975b,
Neue Ausgrabungen im Ahrensburger Tunneltal. Ein Beitrag zur Erforschung des Jungpaläolithikums im nordwesteuropäischen Flachland. Neumünster: Karl Wachholz Verlag.
- VERMEERSCH P. M., 1984,
 Du Paléolithique final au Mésolithique dans le Nord de la Belgique. In: CAHEN D. & HAESAERTS P. (eds.), *Peuples chasseurs de la Belgique préhistorique dans leur cadre naturel*. Bruxelles: Institut royal des Sciences naturelles de Belgique: 181-193.
- VERMEERSCH P. M., In press,
 La fin du Paléolithique et le Mésolithique en Flandre. In: *4ième Congrès de l'Association des Cercles Francophones d'Histoire et d'Archéologie de Belgique / 11e Congrès de la Fédération des Cercles d'Archéologie et d'Histoire de Belgique*. Institut Archéologique Liégeois.
- VERMEERSCH P. M. & MAES M., 1996,
 Chronostratigraphy of the Magdalenian at Orp. *Notae Praehistoricae*, 16: 87-90.
- VERMEERSCH P. M., SYMENS N., VYNCKIER P., GIJSELINGS G. & LAUWERS R., 1987,
 Orp, Site Magdalénien de plein air (comm. de Orp-Jauche). *Archaeologica Belgica*, 3: 7-56.
- ZHILIN M. G., 1996,
 The western part of Russia in the Late Paleolithic - early Mesolithic. In: LARSSON L. (ed.), *The Earliest Settlement of Scandinavia and its Relationship with Neighbouring Areas*. Acta Archaeologica Lundensia, 24. Stockholm: Almqvist & Wiksell International: 273-284.

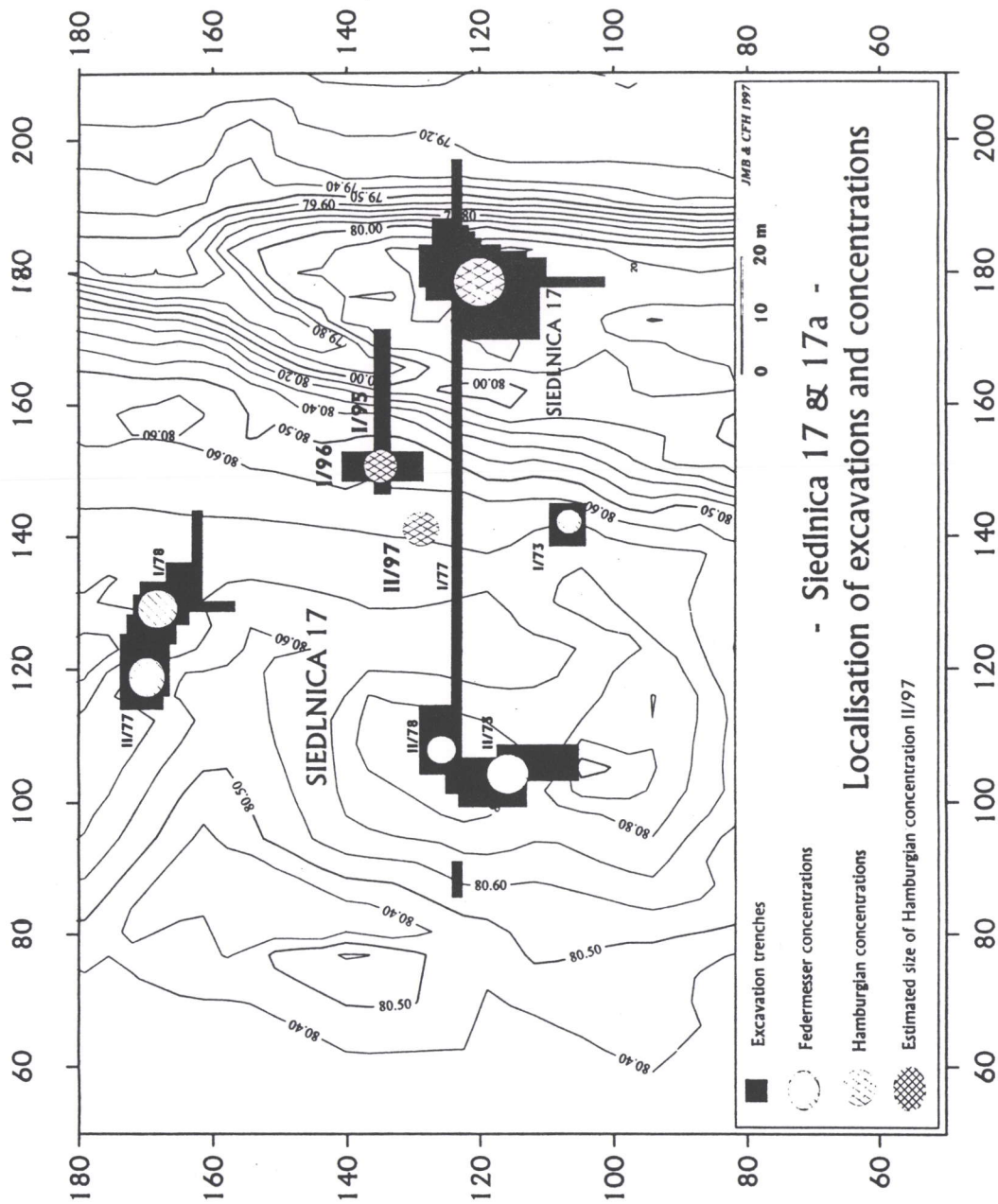


Fig. 1. Localisation of Hamburgian and Federmesser concentrations at Siedlnica 17, Kopanica Valley (W-Poland) and discoveries during recent joint fieldwork of the Dept. of Archaeology, University of Wrocław (PL) and Laboratorium voor Prehistorie, K.U.Leuven (B): trenches I/95; I/96; I/97.

1. excavation unit,
2. Federmesser concentration,
3. Hamburgian concentration,
4. Estimated location of recently discovered Hamburgian Concentration II/97.

Hamburgian Siedlnica 17 I/95 + I/96: excavated flint assemblage

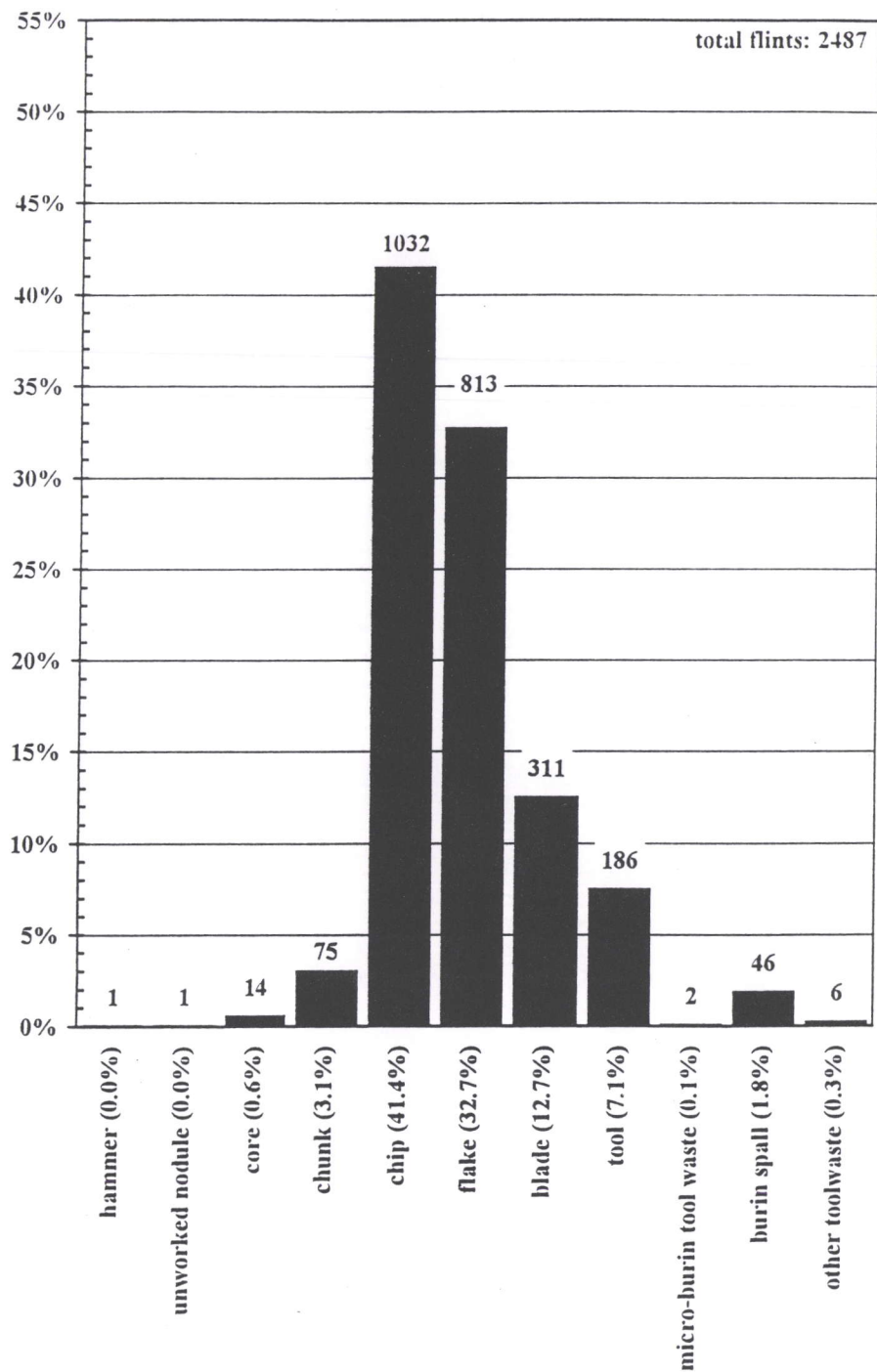


Fig. 2. Hamburgian Siedlnica 17 I/95+I/96: partly excavated flint assemblage (estimated 85% of total flints).

Hamburgian Siedlnica 17- I/95 +I/96: partly excavated tool assemblage

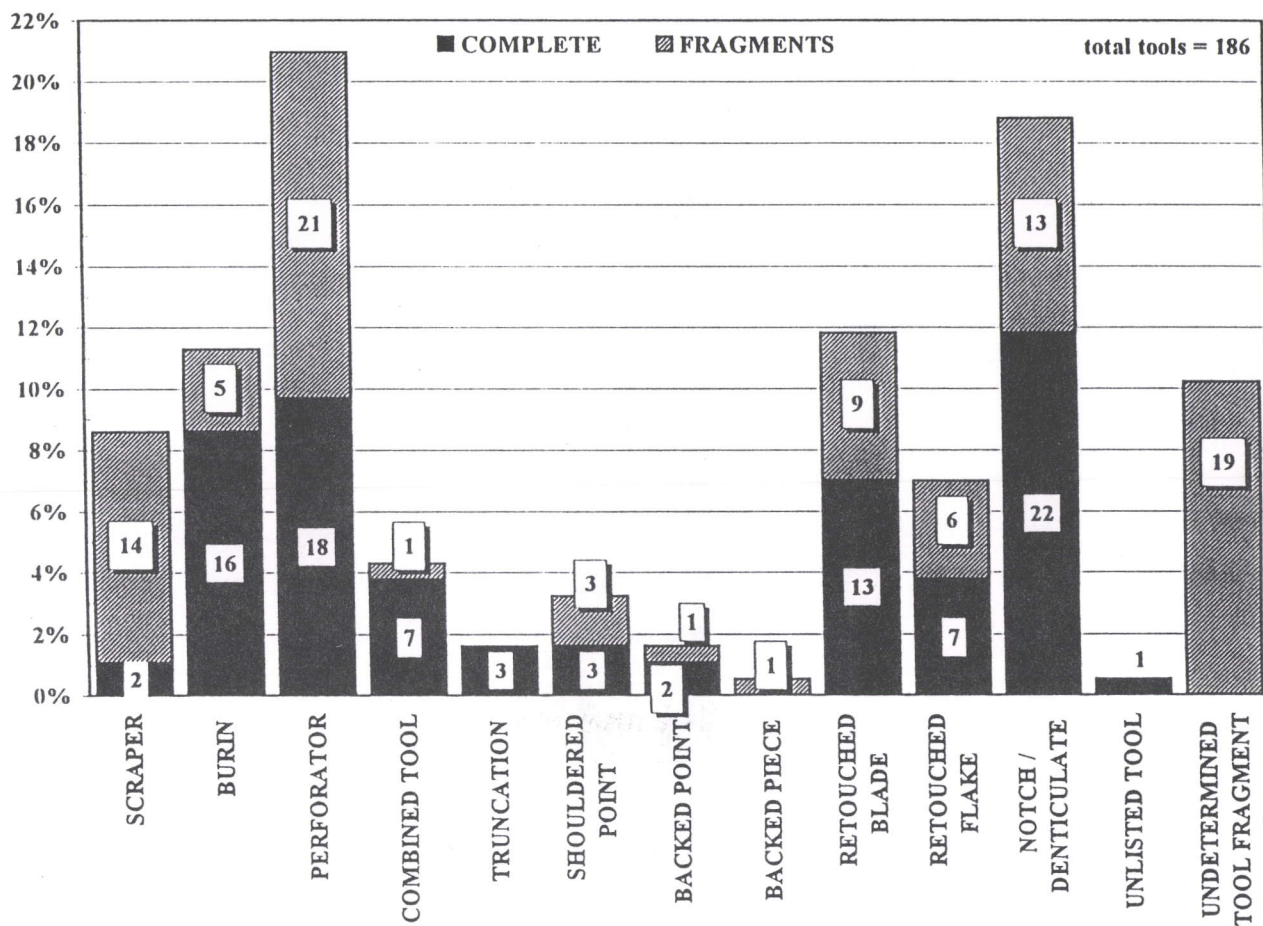
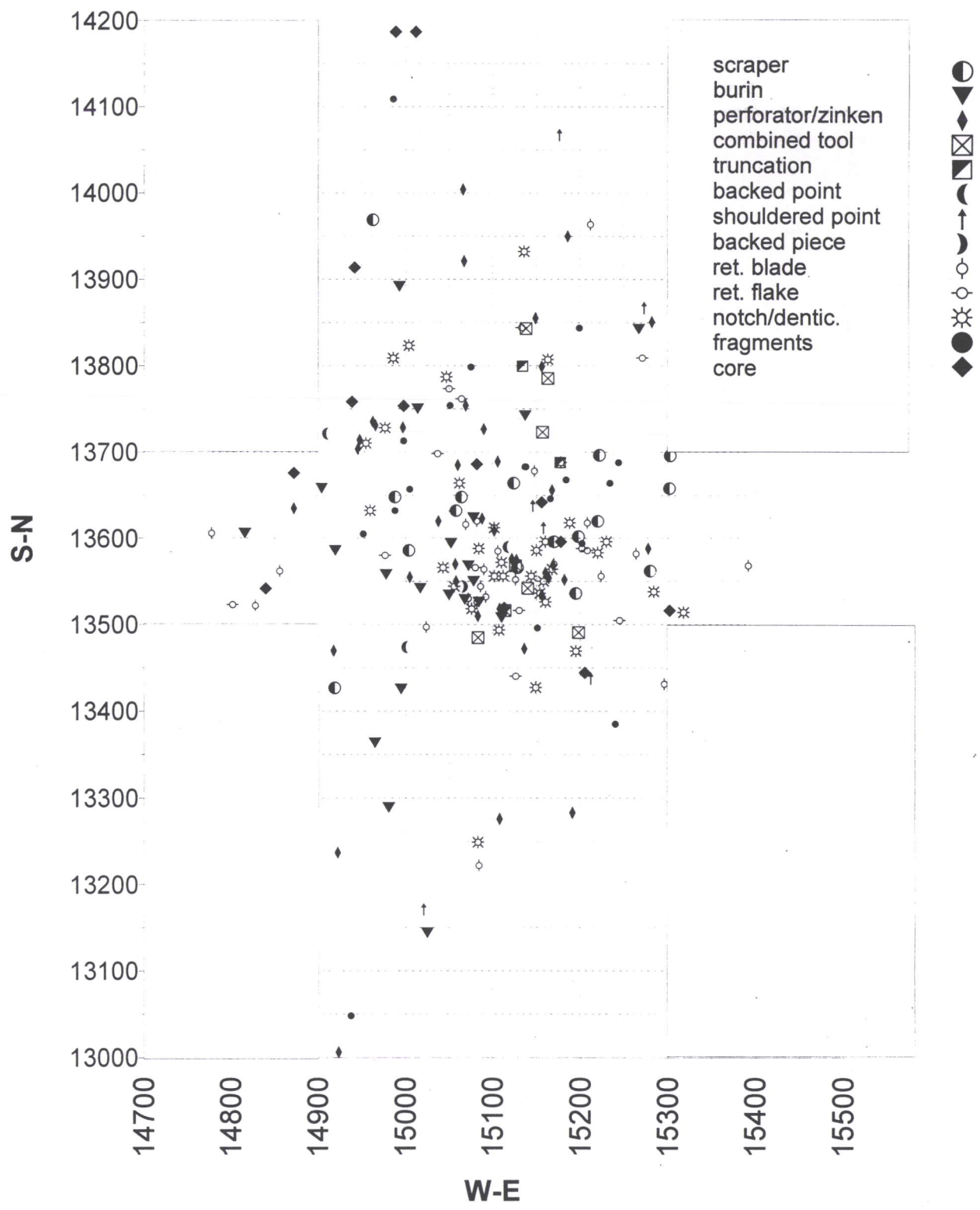
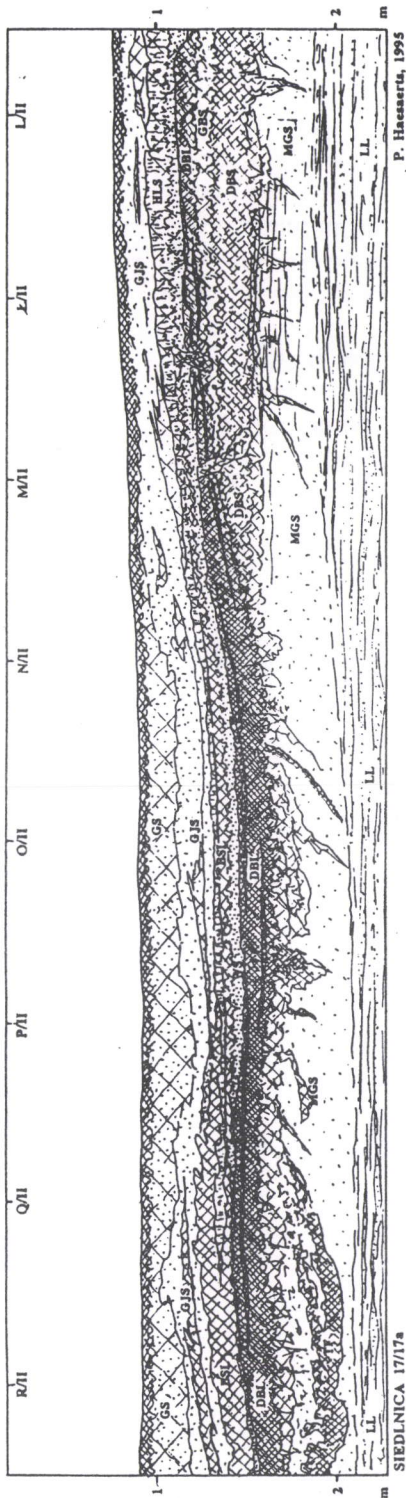


Fig. 3. Hamburgian Siedlnica 17 I/95+I/96: partly excavated tool assemblage (estimated 85% of total flints).

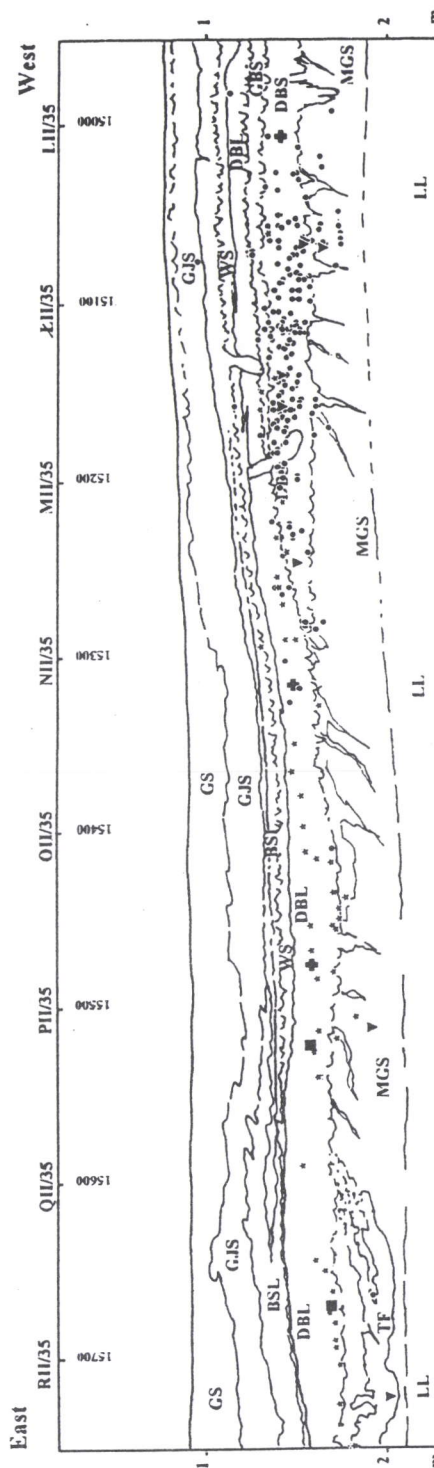


SIEDLNICA 17 I/95+I/96: Tools & Retouched Pieces

Fig. 4. Hamburgian Siedlnica 17 I/95+I/96: Planification of tools and retouched pieces.



P. Haesaerts, 1995



P. Haesaerts / C. F. Herman 1995 - 1996

Hamburgian Siedlnica 17-1/95: flints and charcoal & wood bits finds located 0 to + 50 cm N of South wall (13500-13550)

- unburned flints (205)
- ▼ burned flints (9)
- unidentified charcoal and wood bits (50)
- Beech (*Fagus*) (2)
- ◆ Oak (*Quercus*) (3)

Fig. 5. Hamburgian Siedlnica 17 I/95-1/96: West Part of South profile of trench I/95:

Top: lithostratigraphy (by P. Haesaerts)

Bottom: flints, charcoal and wood bit finds located in the respective geomorphologic layers between 0 to + 50 cm North of the South Wall (13500-13550).

Legend: (Geomorphologic interpretation by P. Haesaerts (R.B.I.N.S.); pedological interpretation by R. Langohr (L.G.))

GS: (geomorphologic horizon): Slightly humiferous surface horizon. Recent plough layer.

GJS: (± 20 cm) Grey yellowish fine sand with lenses of brown loamy sand in the lower part. = H2: Old plough layer.

HLS: (± 10 cm) Loamy sand with abundant iron staining along rootlets = H3: Probably aeolian deposition on wet meadow; and = H4: Wet meadow.

BSL: (± 20 cm) Brown homogeneous loamy sand, mainly developed in the eastern part of the section.

WS: (± 3 to 10 cm) Undulated layer of coarse white sand = H5: Horizon with the lowest amount of iron. Wind blown sand.

DBL: (0 to ± 25 cm) Dark brown to dark grey loam containing several fine layers of peaty material with small pieces of wood and charcoal = H6: Thin (max. 1 cm) black layer rich in organic matter. Peaty layer or a forest (or shrub-) litter layer; and = H7: Greyish horizon composed of bleached sand grains and black pellets of organic matter. A humiferous surface A-Horizon under forest or heathland, unrelated to the truncated B-Horizon below. Oldest plough layer.

TF: (0 to ± 40 cm) Asymmetric pocket-like structure of ± 3 m long and a few meters large, filled with light grey to yellowish sand and dark brown loamy sand in its lower part.

GBS: (± 15 cm) Light grey to yellowish sand with brown tongues along root casts = H8: Patchy horizon composed of about 20% of E-Horizon.

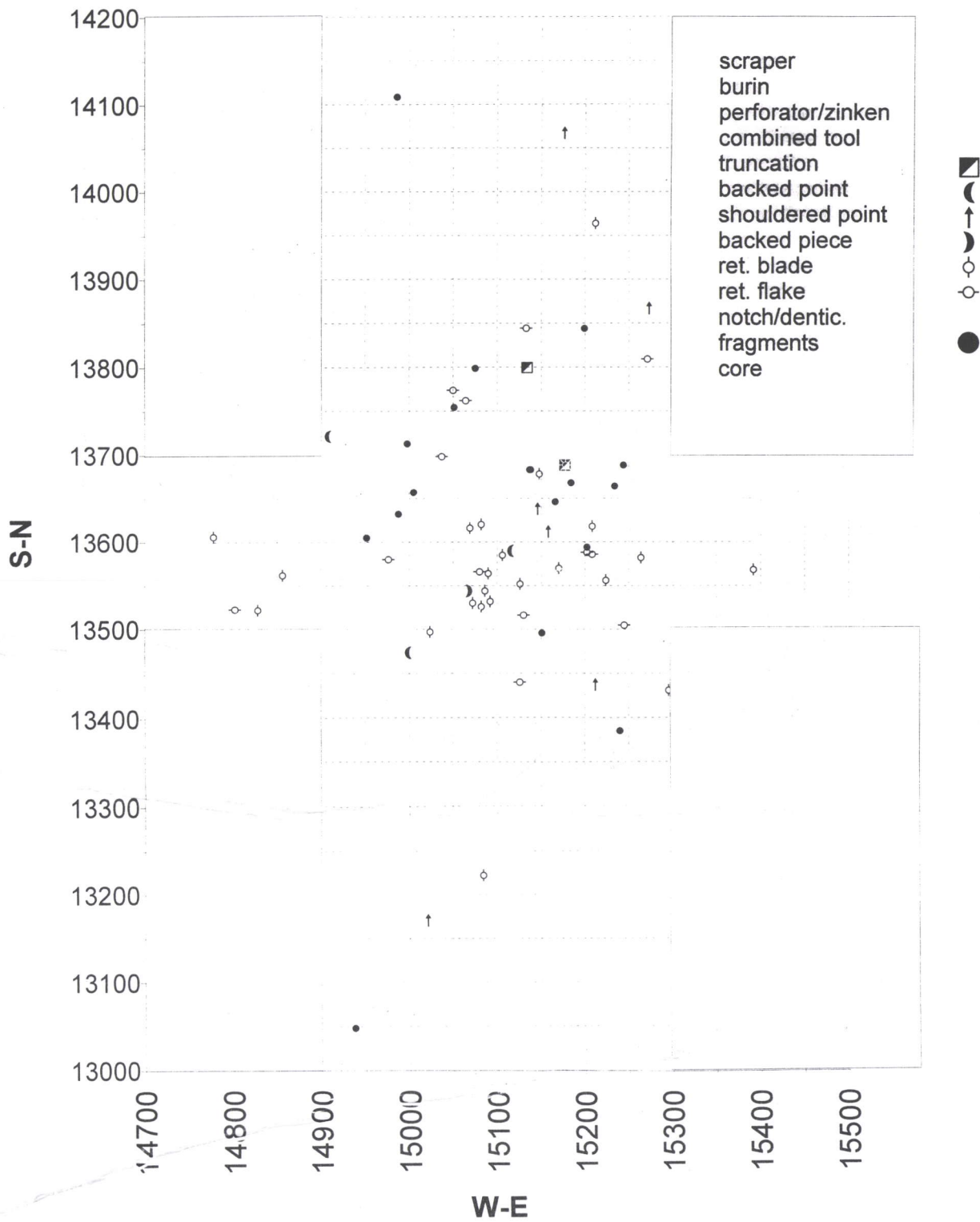
DBS: (± 30 cm) Brown to dark brown sand with diffuse sub-horizontal upper and lower boundary = H9, H10, H11, H12, and H13: Brown Bh horizon of a "groundwater" Podzol under heathland or under a forest vegetation typical for very acid soils, becoming slightly lighter in colour with depth.

MGS: (± 40 cm) Homogeneous mottled grey yellowish sand penetrated by brown tongues along root casts related to the overlaying units = H14: Tongues of slightly humiferous material along old root galleries; and = H15: Very light coloured soil, without stratification. Sediments accumulated on an at least slightly vegetated soil surface.

LL: (min. 30 cm) Laminated yellowish grey silt with many fine sandy layers more or less horizontally stratified = H16 and H17.

Siedlnica 17-II/73: Tabulation of lithics with diagnostic macro-wear projectile traces															
STATE OF PRESERVATION	DIAG. POINTS	Non-DIAG. POINTS	DIAG. BACKED PIECES	Non-DIAG. BACKED PIECES	DIAG. TRUNCATIONS	Non-DIAG. TRUNCATIONS	DIAG. NOTCHED PIECES	Non-DIAG. NOTCHED PIECES	DIAG. RETOUCHE PIECES	Non-DIAG. RETOUCHE PIECES	DIAG. SCAR PIECES	Non-DIAG. SCAR PIECES	DIAG. UNCERTAIN PIECES	Non-DIAG. UNCERTAIN PIECES	Grand Total
entire		3		3		4			2		4				
entire except for tiny apical (point)/ distal end fracture	1	3		1		2			1						
entire except for tiny basal (point)/ proximal end fracture	1				1										
entire except for tiny fracture at both ends	1			1											
distal part (pointed part)			3	2					1	3				1	
distal part (pointed part), with tiny apical fragment	2	4	1	1		1			2	2	1				
central part			4	11			1	1	1	3		1			
proximal part (basal part of point)		1*	5	4		1			4	3	1	2			
proximal part (basal part) with tiny basal fragments			4			1			1	3					
Subtotals	5	11	17	23	1	9	1	1	7	17	3	8	0	1	
GRAND TOTALS		16		40		10		2		24		11		1	104
* shouldered piece															
Diagnostic Pieces	34														
Non-Diagnostic Pieces	70														

Fig. 6. Federmesser Siedlnica 17 II/73: tabulation of lithics with diagnostic macro-wear 'projectile' traces.



HAMBURGIAN SIEDLNICA 17 I/95 + I/96:
Planification of Maximum Population of Possible Functional Projectiles

Fig. 7. Hamburgian Siedlnica 17 I/95+I/96: Planification of maximum population of possible functional projectiles.

Some Hamburgian assemblages: maximum population of tools that are to be investigated for projectile damage.

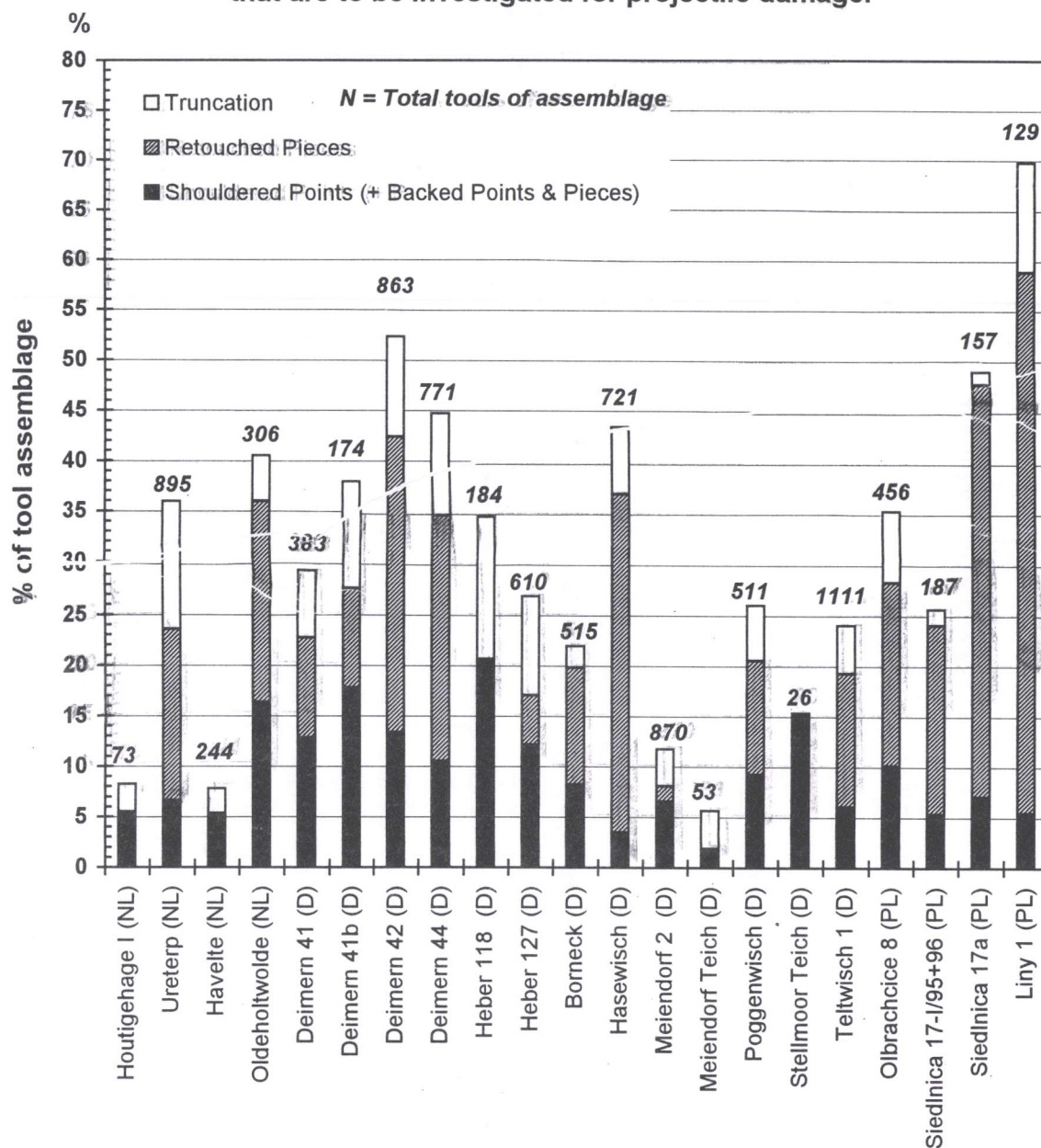


Fig. 8. Some Hamburgian (SPT) assemblages: percentages of the main morpho-metric lithic tool categories that contain the maximum population of tools to be investigated for projectile identifications (counts based on BURDUKIEWICZ, 1986; STAPERT & KRIST, 1990; BURDUKIEWICZ & HERMAN, In press).

Federmesser concentrations: maximum population of tools that were investigated for projectile damage.

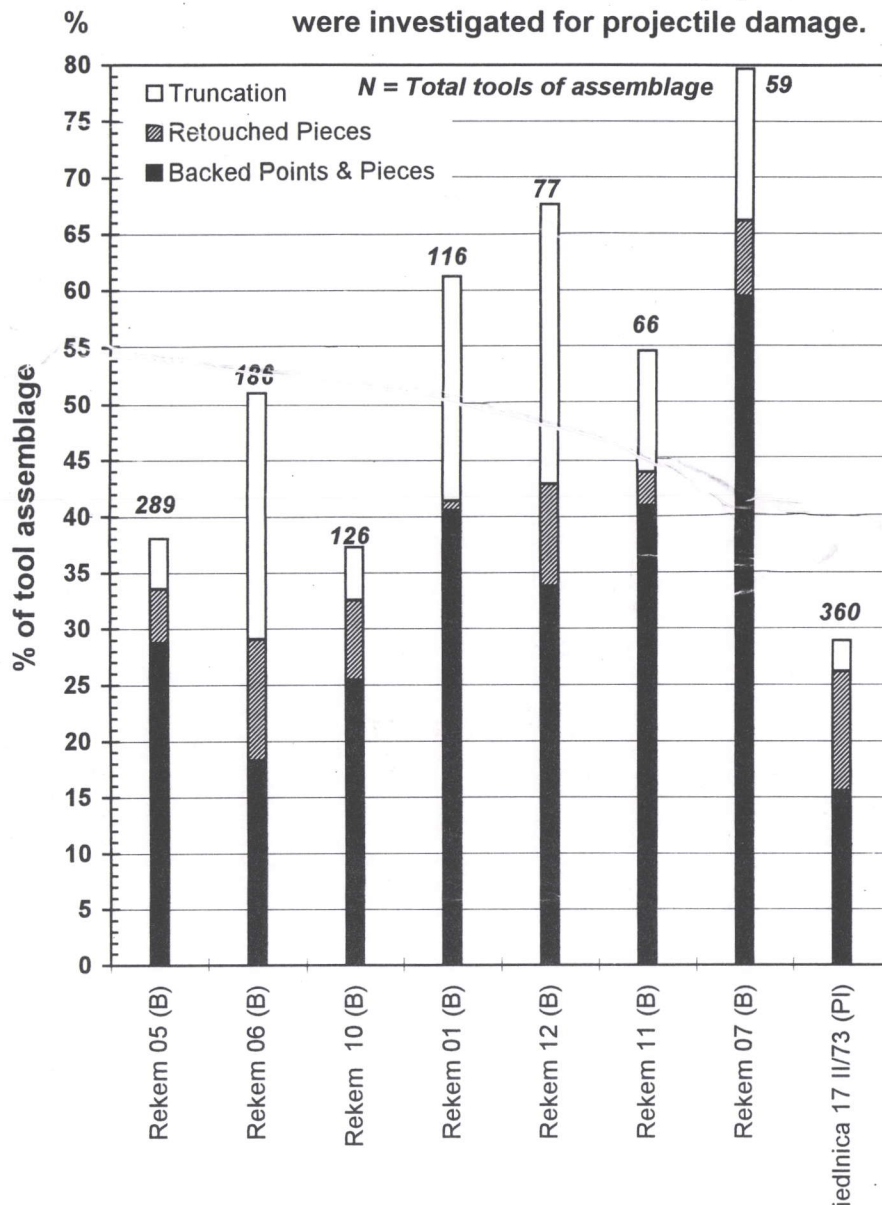


Fig. 9. Some Federmesser (ABPT) assemblages having been submitted to a functional projectile analysis (Siedlnica 17 II/73 (PL) and Rekem (B)): percentages of the main morpho-metric lithic tool categories in which functional projectile points have been identified (counts based on CASPAR & DE BIE, 1996: Table 1; DE BIE & CASPAR, 1997: Table 1; HERMAN, 1997: Table 2).

<i>HAMBURGIAN</i>	<i>Shouldered, Tanged, Backed Points, & Backed Pieces %</i>	<i>Retouched Pieces %</i>	<i>Truncations %</i>	<i>Total average %</i>
<i>MAX.</i>	20.65	53.49	14.13	
<i>AVERAGE</i>	9.50	15.10	6.18	30.78
<i>MIN</i>	1.89	0.00	0.00	
<i>FEDERMESSER</i>	<i>Shouldered, Tanged, Backed Points, & Backed Pieces %</i>	<i>Retouched Pieces %</i>	<i>Truncations %</i>	<i>Total average %</i>
<i>MAX.</i>	59.32	10.75	24.68	
<i>AVERAGE</i>	32.81	6.63	12.84	52.28
<i>MIN</i>	15.56	0.86	2.78	

Fig. 10. Total averages, Minima, Maxima of considered tool categories belonging to the maximum population of tools with possible projectile identification in the selected Hamburgian (Fig. 8) and Federmesser (Fig. 9) concentrations.

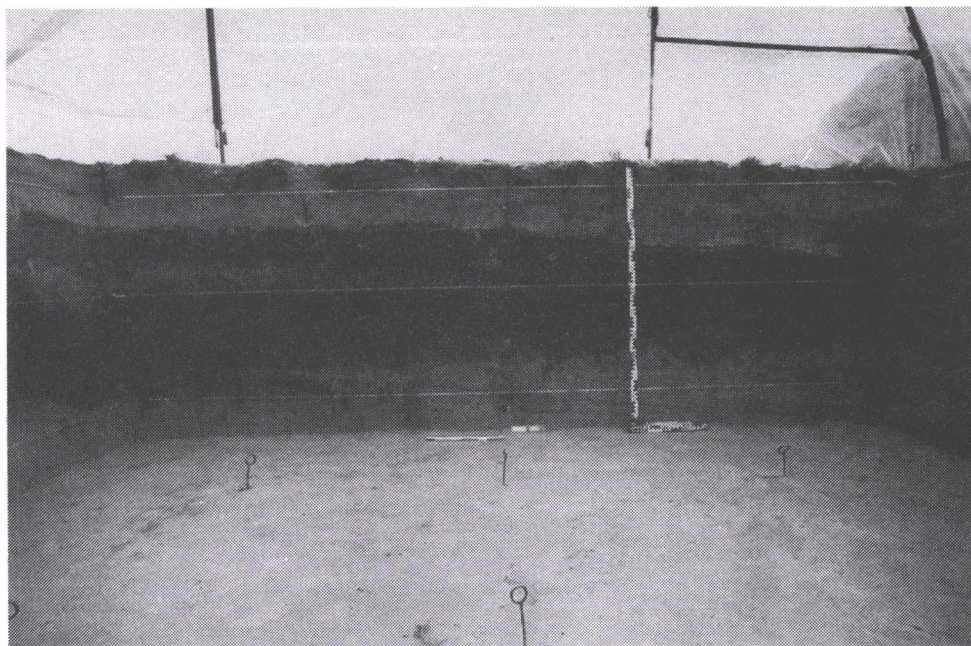


Plate I: Hamburgian Siedlnica 17 I/95+I/96: view to the NNE on the north block of the 1996 excavations and the north profile of trench I/95. The surface on the north block reveals the ploughing traces of Iron Age time (DBL-Horizon 7) which truncates into the greyish GBS-H7 (E Horizon) and brown to dark brown DBS-H9&10 (Bh Horizon). The Hamburgian concentration is located in the DBS-layer on top of the greyish yellow sands (MGS).



Plate II: Hamburgian Siedlnica 17 I/96: view on the North profile at 14200 North, from 14900 East to 15300 East. Complete profile of the excavations, similar to the south profile (reversed) from L/II (1500 East) to N/II (15400 East) described in Fig. 5.