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A New Hamburgian Concentration at Siedlnica 17 in the Kopanica Valley (SW Poland)

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Abstract

Renewed excavations (1995) at the Late Palaeolithic site complex of Siedlnica 17-17a (Kopanica valley, SW Poland) brought about the discovery on Polish territory of another rare Hamburgian concentration (SIE17-I/95). Preliminary results of archaeological, pedological, geological, and anthracological research are presented. The first discovery of Gyttja-layers within the valley, to which prehistoric artifacts are associated (Siedlnica 74), is briefly touched upon. Such find opens new venues in the reconstruction of the palaeoenvironment of the Kopanica valley.

Résumé

Des nouvelles fouilles en 1995 sur le complexe des sites Siedlnica 17-17a (vallée de la Kopanica, sud-ouest de la Pologne) ont conduit à la découverte d'une nouvelle concentration de la tradition Hambourgienne — rare en Pologne — (SIE17-I/95). Les résultats préliminaires des recherches archéologiques, pédologiques, géologiques et anthracologiques sont présentés ici. La découverte importante des couches de Gyttja dans la vallée de la Kopanica propre (Siedlnica 74), avec lesquelles des artefacts préhistoriques étaient associés, est brièvement exposée. Ceci ouvre de nouvelles perspectives pour la reconstruction du paléoenvironnnement de la vallée de la Kopanica.

1. INTRODUCTION

During the month of August 1995 renewed archaeological activities took place at the Late Palaeolithic site complex of Siedlnica 17 and 17a (Township of Wschowa, SW Poland; fig. 1 and 2). The *Department of Archaeology, University of Wrocław* (Poland) in collaboration with the *Laboratorium voor Prehistorie, Katholieke Universiteit Leuven* (Belgium), under the directorship of Dr. Jan Michał Burdukiewicz and Charles Frank Herman, excavated a new geological trench. This research aimed for more Late Glacial palaeoecological data for the time period in which the Shouldered Point Technocomplex (*SPT*) and Arched Backed Pieces Technocomplex (*ABPT*) existed. Because the Hamburgian (*SPT*) settlement of Siedlnica 17a and the Federmesser (*ABPT*) assemblages of Siedlnica 17 are located closely, this place was selected for re-investigation.

On this occasion a new Hamburgian lithic assemblage was discovered in the flat sand dune of Siedlnica 17 (fig. 3). This new discovery strengthens the notion that at present the Kopanica valley is the most important settlement aggregation of the Hamburgian Culture in Poland, in distance 400 km from the nearest site aggregation in Northern Germany. The excavated sites of Olbrachcice 8 and Siedlnica 17a bring the number of Hamburgian concentrations in the valley to three and possibly several more (surface finds of Olbrachcice 14, Olbrachcice 25, and maybe Siedlnica 33) [fig. 2]. Outside this area, finds remain rare on Polish territory: Nowy Młyn 3 and conceivably some of the Rydno sites in Central Poland (Holy Cross Mountains) [Schild & Królik, 1981]; Liny (Middle Odra Basin) [Kobusiewicz, 1973, Kobusiewicz *et al.*, 1987], Rogów Opolski 9 (Upper Odra Basin) [Burdukiewicz, 1975: 251], Tanowo (near Szczecin) [Galiński, 1987] and recently discovered Markowice (NE of Poznań) in Western Poland (pers. comm. Dr. Jacek Kabaciński).

2. THE ISSUES IN THE CONTEXT OF THE PREVIOUS RESEARCHES

The Kopanica valley is an important micro-region for the Late Glacial and Holocene periods (fig. 1). The valley is located in the zone just outside the maximal range of Weichselian Glaciers and shows series of complicated geomorphologic features (Brodzikowski & van Loon, 1987). Witness of the rich occupation history are the attested presence of the three main Late Palaeolithic archaeological units: Hamburgian (*SPT*), Federmesser (*ABPT*) and Tanged Point (*TPT*) Technocomplex, as well as Mesolithic occupations.

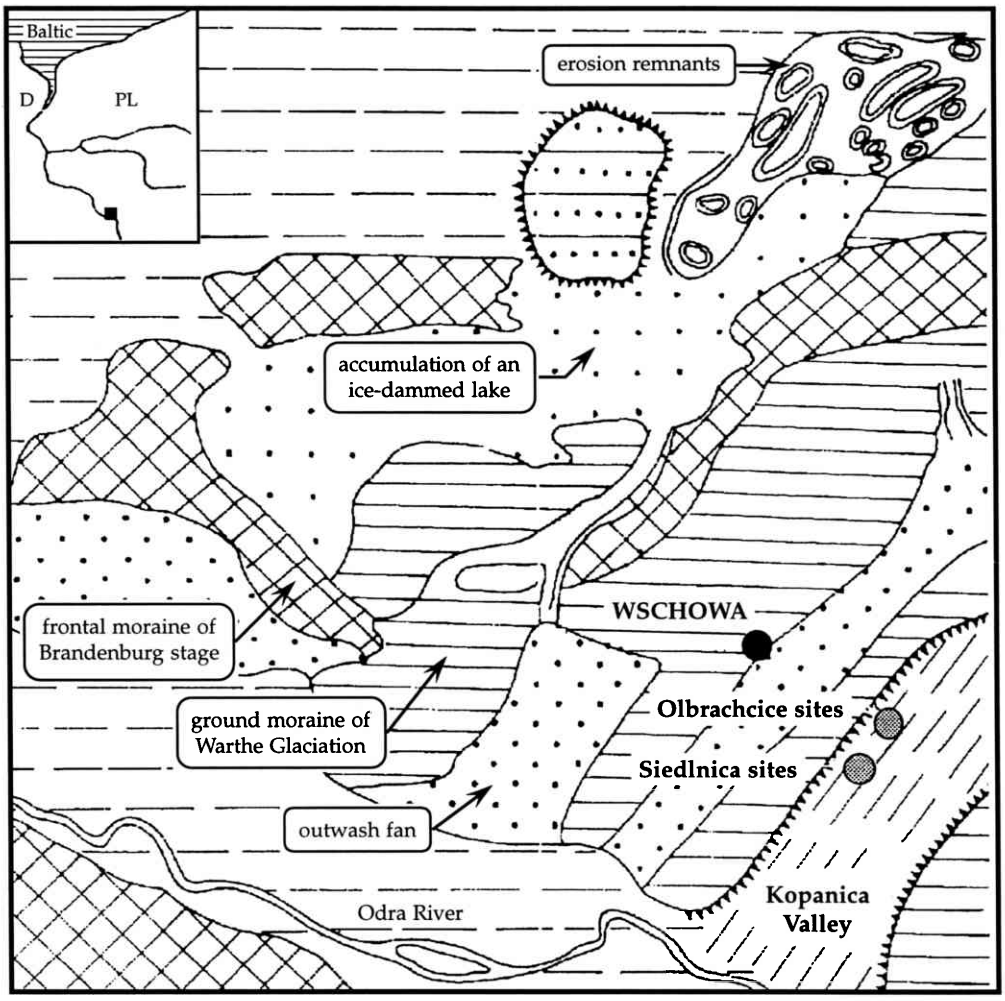


Fig. 1 — Geomorphologic map of Wschowa region and late Palaeolithic sites in the Kopanica Valley (Odra basin, S-W Poland).

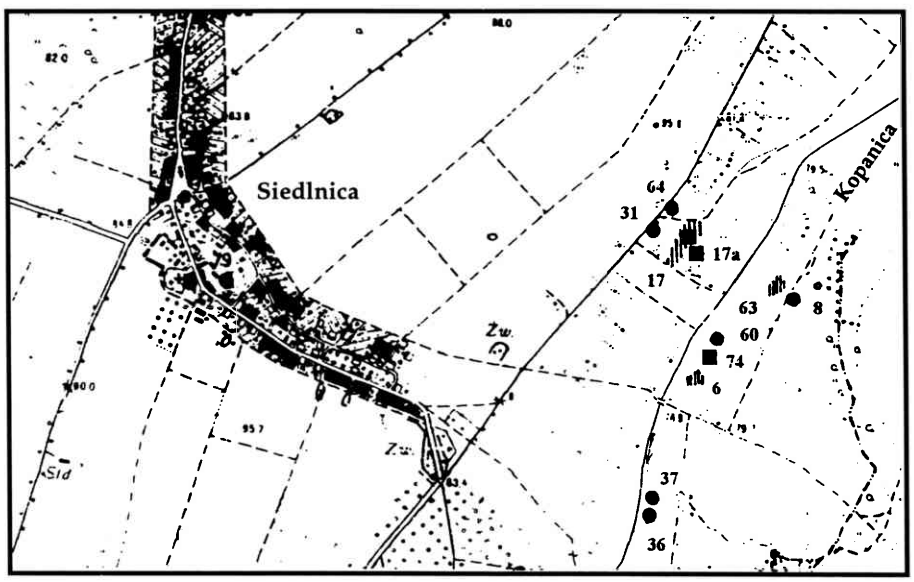


Fig. 2 — Location of the Palaeolithic sites in the Kopanica Valley around Siedlnica:
■ Hamburgian and possible Hamburgian sites;
▥ Federmesser sites with several artifact concentrations;
● Federmesser sites.

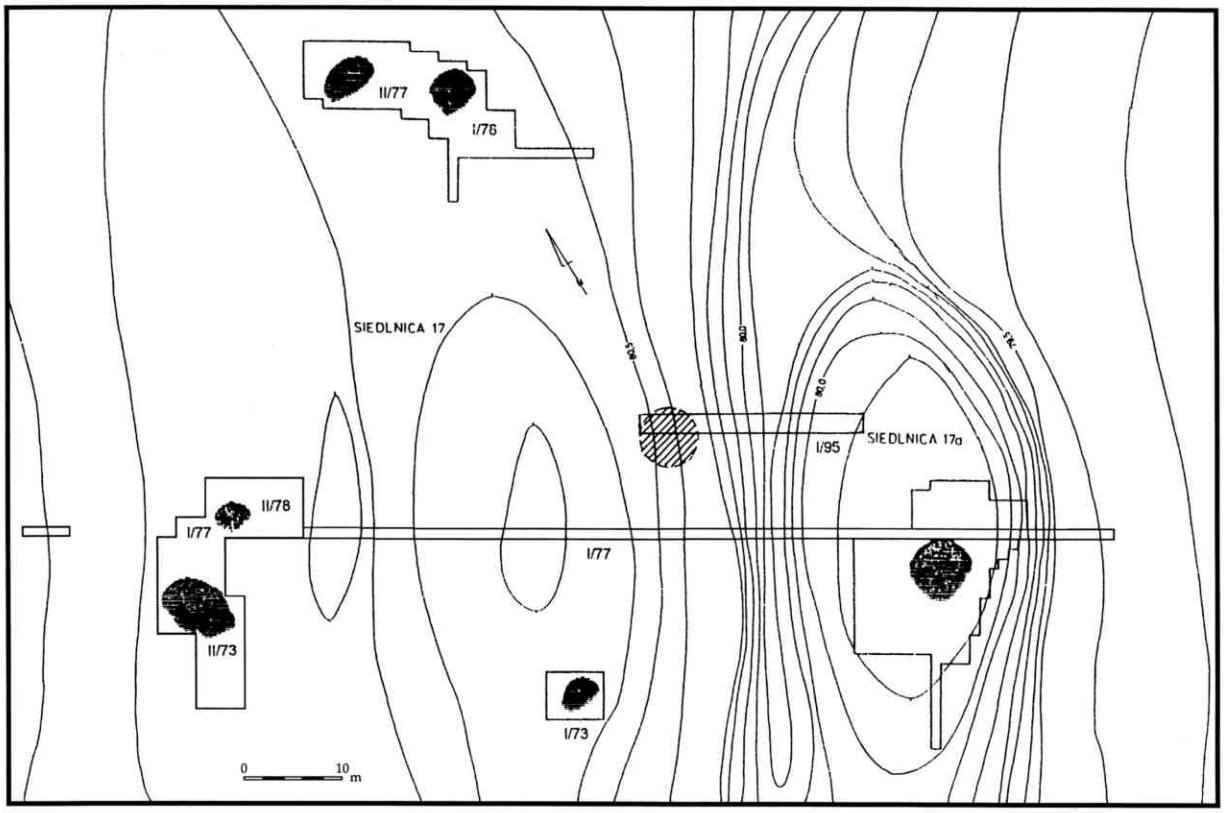


Fig. 3 — Siedlnica 17 & 17a: Location of the excavation units and artifact concentrations.
Hamburgian concentration;
Possible range of new Hamburgian concentration (SIE17-I/95);
3. Federmesser concentrations.

Our interest in the changing living conditions during Late Glacial period instigated us to build further on the multiple investigations during the seventies and begin eighties done by the senior author (Burdukiewicz, 1974, 1975, 1976, 1979a and b, 1980a and b, 1981, 1983, 1985, 1986, 1987a).

The presence in the Kopanica valley of the three mentioned Hamburgian concentrations and of at least six Federmesser concentrations (Siedlnica 17: *SIE17-II/77*, *SIE17-II/77+I/78*, *SIE17-I/77+II/78*, *SIE17-II/73*; *SIE17-I/73*; and Siedlnica 33) provided an excellent opportunity to investigate further the presumed associated environmental changes (e.g., fluvial, aeolian, and organogenic sedimentation; the Late Glacial soil formation). Earlier, a complex sequence of fossil soil horizons was distinguished and investigated by palaeopedologist A. Kowalkowski and geologist E. Mycielska-Dowgiałło (1983). Especially the adjacent location of Hamburgian Siedlnica 17a to the Federmesser concentrations of Siedlnica 17 was an occasion to check the palaeo-ecological history of this place and to seek new pollen profiles. Previous samples suffered from bad preservation [Wasylikowa manuscript (1977)].

Already in 1977 a 1 m × 120 m NW-SE long trench had been dug with similar purposes (Burdukiewicz, 1979a) [fig. 3]. Starting from the western *ABPT* Siedlnica 17 *SIE17-I/77+II/78* and *SIE17-II/73* concentrations the old trench was laid out perpendicular to the roughly NE-SW direction of the valley. Then, during the digging of this long trench, first traces of the Hamburgian Siedlnica 17a concentration were discovered east of the *ABPT* concentrations, between a narrow depression and the Holocene bedding of the Kopanica-river (for profile see Burdukiewicz, 1986: 100, fig. 29).

Based on these researches and the excavations at the other Late Glacial and Holocene Kopanica valley sites, K. Brodzikowski and A.J. van Loon (1987: 219, fig. 3) proposed a preliminary reconstruction of the palaeogeographic development of the Kopanica valley (fig. 3). They produced in a first attempt a schematic model of the valley stratigraphy based on various data observations at many distinct places in the valley and surrounding. The bottom of the Weichselian sedimentation started from Post-Brandenburgian fluvial sediments with indications of a fossil *"multistage soil development dating from the Oldest*

Dryas" (Kowalkowski & Mycielska-Dowgiałło, 1983: 142). Between the palaeosoils a formation of dune and coversands were situated, while the latter palaeosoil was capped by a sand matrix deposited during the main dune phase. Holocene developments were of Atlantic and Post-Atlantic times with the formation of channels and late Holocene aeolisation deposits and a Holocene period soil (Brodzikowski & van Loon, 1987).

It proved necessary to test the concepts concerning the general palaeogeography of the valley taking into account the chronological indices and the archaeological finds.

In first instance, the exact geomorphological relationship between the Hamburgian Siedlnica 17a and the Federmesser Siedlnica 17 sites needed further clarifications. Both sites are only separated by a narrow depression (an abandoned channel). However, exactly at this depression, stratigraphic information was lacking, because, in the seventies, digging could not go beyond the high water table. At that time ground water started to appear at *ca.* –30 cm below the surface of the faint narrow depression. In the absence of any pumping facilities, this crucial section had to remain unexplored. It was thought that the depression was the result of a deep erosion between Siedlnica 17 and 17a (Brodzikowski *et al.*, 1984: 83; fig. 3).

Both sites were believed to show distinct sedimentological formation histories. In general, according to Kowalkowski the *ABPT* concentrations were assumed to connect with a cryic brown soil (*reBv* and *reBvcn*) of middle deposit series, while the Hamburgian concentrations were joined with the humic gley soil (*kA/E/gg*-Horizon) of the lower deposit series (Kowalkowski & Mycielska-Dowgiałło, 1983: 144). Because Siedlnica 17 has an additional sand layer, it was postulated that further aeolian accumulation possibly took place at Siedlnica 17, after the Hamburgian settlement and before the *ABPT* settlements (Burdukiewicz, 1986: 104). Indeed, the *ABPT* concentration of trench *SIE17- I/73* is at a level of *ca.* 50 cm above both Hamburgian concentrations. The west-central part of the Kopanica valley was supposed to have been finally eroded away by the river to a depth of 4 to 5 m during the early Holocene (Brodzikowski & van Loon, 1987: 231).

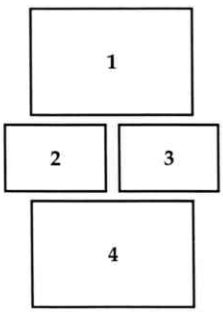
Another important question about the Late Glacial period in Central Europe remains the phylogenetic relation between the Hamburgian and Federmesser archaeological 'traditions'. Are they quite separate and in consequence, do they show only *"biological succession"* (Schild, 1984: 254)—the Hamburgian being rooted in the Western and Central European late Magdalenian (Burdukiewicz, 1993) and the Federmesser to the Central European Magdalenian *sensu lato* (Schild, in press; Eriksen, 1996: 10)—; or is the Hamburgian influence on the Federmesser much stronger (Burdukiewicz, 1986, 1989; Burdukiewicz & van Loon, 1988; Andersen, 1988). Similarly, the association of the Hamburgian with the Bölling interstadial (Stapert & Krist, 1987) and Federmesser with Alleröd interstadial asks for further refinement in view of the ongoing discussions whether the Dryas II climatic retreat—dry but warmer than Bölling (Berglund, 1987)—is traceable in Central Europe or even southern Scandinavia. In Britain a Late Glacial Interstadial, without any further distinctions between Bölling, Dryas II or Alleröd, is now generally accepted [Eriksen, 1996: 9; Barton *et al.* (eds.), 1991; De Bie & Vermeersch, in press].

3. THE EXCAVATIONS

3.1. The August 1995 archaeological excavations

A new long trench (*SIE17/17a-I/95*) was opened for full stratigraphic control (plate 1). Scant but sufficient prehistoric finds were expected to be found. In the seventies, a number of artifacts were recovered in the old *SIE17/17a-I/77* long trench:

PLATE 1 →

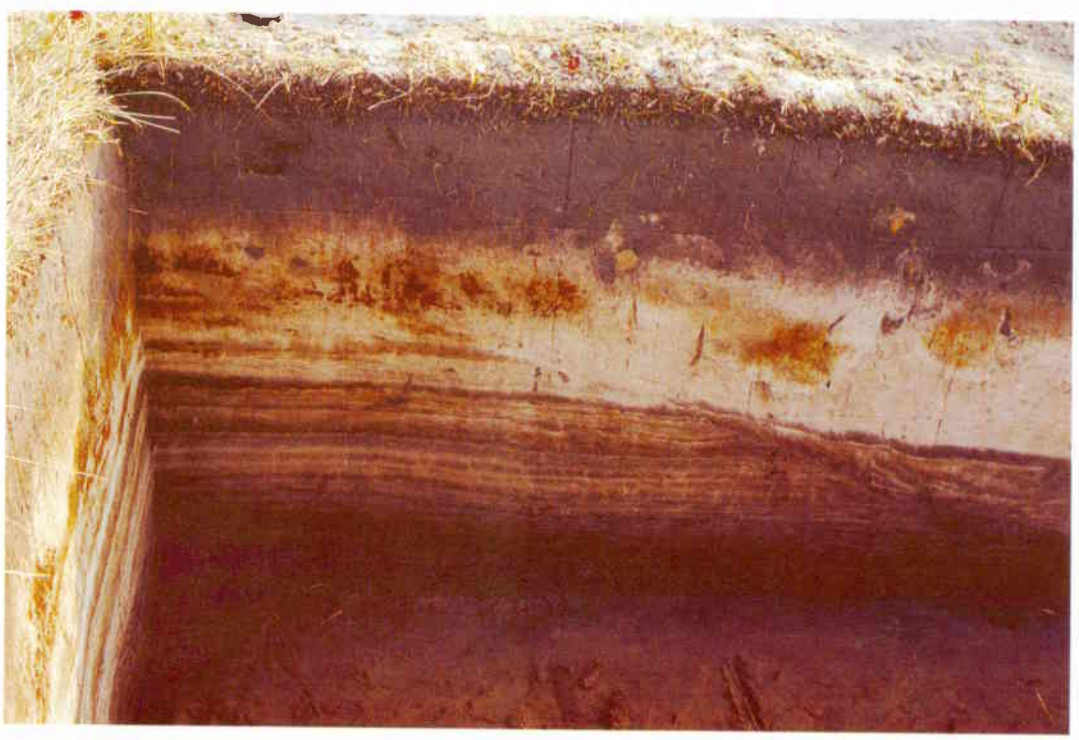


1: Siedlnica 17 & Siedlnica 17a (Kopanica Valley, SW Poland): General view on Trench SIE17/17a-I/95 looking South-West on South profile. Left under: Hamburgian Siedlnica 17a; beyond shallow depression towards the west: the newly discovered Hamburgian Siedlnica 17-I/95 concentration.

2: Siedlnica 17 (Kopanica Valley, SW Poland): Closer view on Trench SIE17/17a-I/95 looking South-West on South profile. Hamburgian Siedlnica 17-I/95 concentration.

3: Siedlnica 17 (Kopanica Valley, SW Poland): Detailed view on Trench SIE17/17a-I/95 looking North-West on West and North profile Hamburgian Siedlnica 17-I/95 concentration.

4: Siedlnica 17a (Kopanica Valley, SW Poland): General view on Trench SIE17/17a-I/95 looking South on South profile. Indication of truncation.



on the extreme west an *ABPT* concentration was hit and on the western slope of the shallow narrow depression a few lithic artifacts had appeared. Because these non-diagnostic flints were found on the Siedlnica 17 flat dune, they were logically associated with the nearby *ABPT SIE17-I/73* concentration (fig. 3). On the east flank of the narrow dip, plenty of Hamburgian debitage materials were recovered from the deposits on the flat Siedlnica 17a elevation. Consequently, in the new *SIE17/17a-I/95* trench, cutting both areas, similar finds belonging to the edges of the known concentrations were expected.

Excavations started on the Siedlnica 17 dune transsecting the subdued depression up to the Siedlnica 17a elevation. It resulted in a 2 m by 25 m trench, 10 m North of, and parallel to the old *SIE17-I/77* trench (NW-EW oriented). A maximum depth of −170 cm below surface was reached (fig. 4 and 5). The actual excavation was greatly enhanced thanks to an exceptional dry summer. The water table had lowered to −110 cm below the lowest point of the depression surface.

Excavation quadrants (1 m × 1 m) were numbered from Southwest $I_{II}/35$ and Northwest $I_{II}/36$ to Southeast $F_{III}/35$ and Northeast $F_{III}/36$. All lithic artifacts were spatially measured in three dimensions. Soil matrix was screened in units of 1 square meter through a 4 mm mesh. Procedure was to scrape the soil matrix and to follow the stratigraphic layers. However excavation layers were never thicker than 5 cm. Except for the small chips recovered from the screen, all finds were individually bagged.

3.2. A new Hamburgian concentration: Siedlnica 17-I/95

The omnipresence of debitage material (1934 flints) in the western Siedlnica 17 deposits made obvious that part of another and new concentration was tapped (fig. 3). Diagnostic tools, e.g. an intact Hamburgian shouldered point, some long blade scrapers (mostly with side retouch on both sides), numerous perforators on blades, including a few zinken, and the near absence of backed pieces in association with well-prepared, thin blade-flake debitage products, left no doubt that this concentration could be assigned to the Hamburgian Culture (fig. 7 and 8).

On the other, East side of the trench, that is, in the Siedlnica 17a elevation, only few Hamburgian lithics (34) were recorded, ... as expected. They indeed connect to the previously excavated Hamburgian Siedlnica 17a concentration. Instead of recovering traces of two distinct cultural facies, respectively Federmesser and Hamburgian, the finds were essentially limited to the Hamburgian only. Based on the characterisation of raw material, a few diagnostic pieces and the spatial data, a small number of flints (62) could tentatively be considered as Federmesser and Mesolithic intrusions (fig. 9 and 10).

3.3. The re-opening of the August 1995-excavation: environmental research

After the close down of the archaeological investigation, the I/95 trench was mechanically re-opened during the last week of September. This was done in function of the palaeogeomorphological, palynological investigations, respectively by Dr. Paul Haesaerts and Dr. Freddy Damblon, *Royal Institute of Natural Sciences of Belgium, Brussels*, and pedologic research by Dr. Roger Langohr assisted by Drs. Jari Mikkelsen, *University of Gent, Belgium* (Research Units of the *Belgian Research Network Sc-004*).

Also major parts of the old *SIE17/17a-I/77* trench and profiles of the units at the *ABPT* Siedlnica 17 *SIE17-I/77+II/78* and *SIE17-II/73* concentrations were exposed anew. Dr. Haesaerts took up the interpretation of the palaeostratigraphy of the trenches. Dr. Damblon took additional punctuated pollen profiles from the south and north wall of the *SIE17a-17 I/95* trench. And Dr. Langohr collected multiple soil block samples on all major parts of the exposed walls for the purpose of micro-morphological soil laboratory research.

4. STRATIGRAPHY OF TRENCH SIE17/17A-I/95: SOUTHERN SECTION (BY P. HAESAERTS AND F. DAMBLON)

4.1. Situation of the South-section

The East-West oriented trench cuts into Hamburgian Siedlnica 17a and Federmesser Siedlnica 17 in which the new Hamburgian concentration was found as well. Located on the western slope of the Kopanica Valley, the microtopography shows a small depression developed to the East and connected to a sandy ridge along the western slope. Fig. 4 and fig. 5 illustrate the distribution of the main units and the stratigraphy of Siedlnica 17, that is, the western part of the south section where the sequence is the most complete.

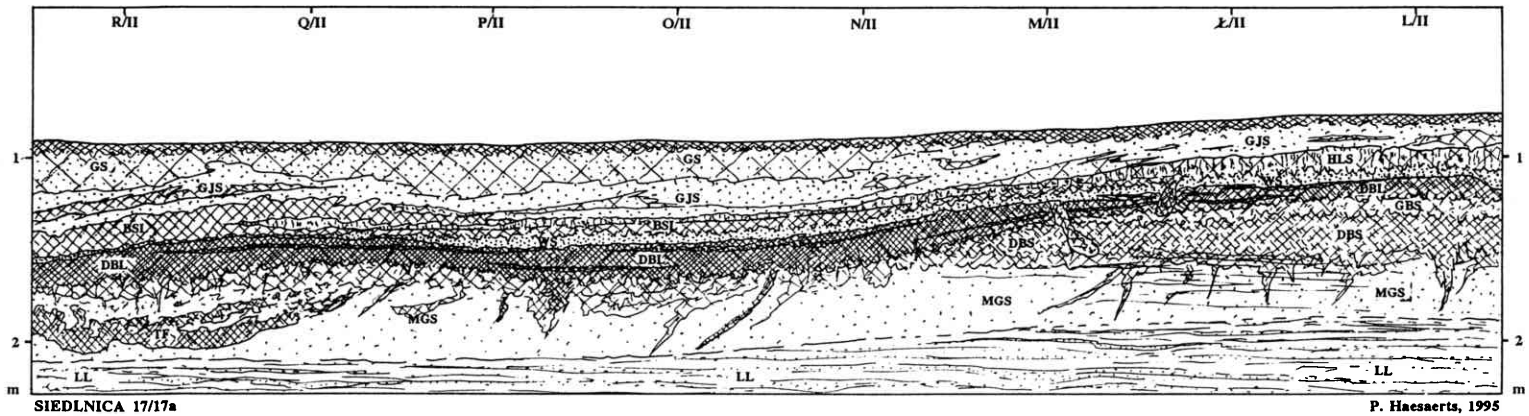


Fig. 4 — Siedlnica 17. Trench SIE 17/17a-I/95: Summary stratigraphy of West part of South profile, with indication of organic finds and Hamburgian artifacts.

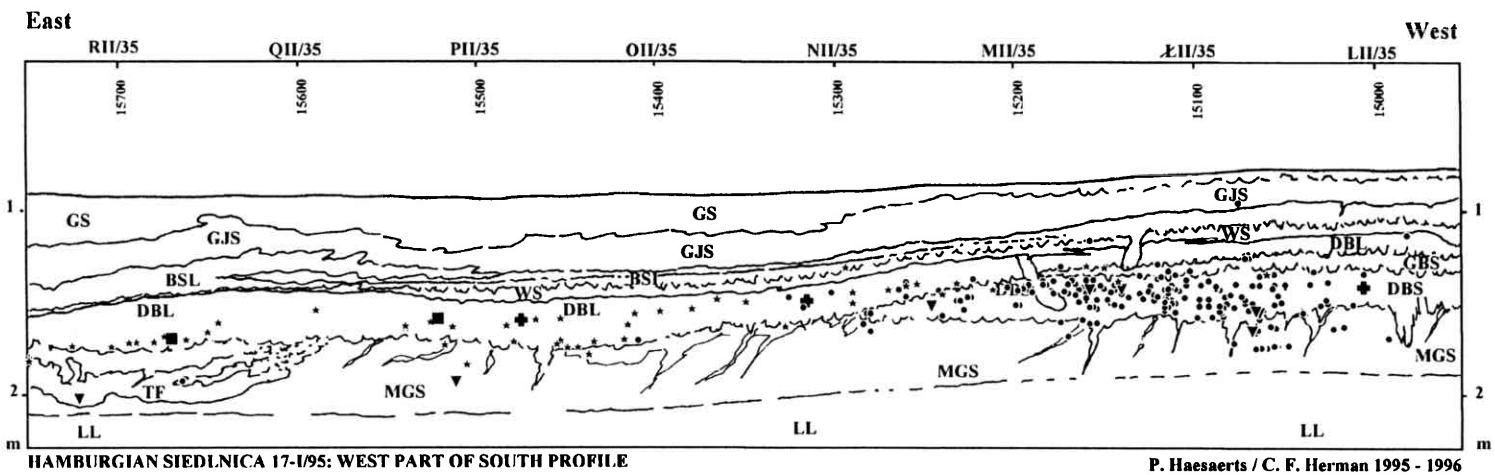


Fig. 5 — Siedlnica 17. Trench SIE 17/17a-I/95: Detailed stratigraphy of West part of South profile.

Hamburgian Siedlnica 17-I/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)

4.2. Lithostratigraphic sequence (from top to bottom): fig. 4 and fig. 5

Unit GS (± 30 cm)

Light grey sand following the surface of the top soil.

Unit GJS (± 20 cm)

Grey yellowish fine sand incorporating lenses of brown loamy sand in the lower part.

Unit HLS (± 10 cm)

Loamy sand with abundant iron staining along rootlets.

Unit BSL (± 20 cm)

Brown homogeneous loamy sand, mainly developed in the eastern part of the section.

Unit WS (± 3 to 10 cm)

Undulated layer of coarse white sand, reaching its main thickness in the western part of the section.

Unit DBL (0 to ± 25 cm)

Dark brown to dark grey loam containing several fine layers of peaty material as well as small pieces of wood and small charcoal fragments; from the lower one start many brown tongues along rootcasts penetrating the underlying units.

Unit 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. Present in the western part of the section, in between $T_{II}/35$ and $Q_{II}/35$ (fig. 4), this structure seems to be connected with a set of large shaped flat bottom pockets developed in the eastern part of the trench where they seem to follow the present day topography (fig. 5).

Unit GBS (± 15 cm)

Light grey to yellowish sand with brown tongues along root casts; only present in the west part of the trench, below the hydromorphic loamy sand (Unit HLS); gradual sub-horizontal boundary with the underlying unit DBS.

Unit DBS (± 30 cm)

Brown to dark brown sand with diffuse sub-horizontal upper and lower boundary; only recorded in the western part of the trench where an important concentration of Hamburgian lithics was present in the middle-lower part of the unit.

Unit MGS (± 40 cm)

Homogeneous mottled grey yellowish sand penetrated by brown tongues along root casts related to the overlaying units; iron staining distributed in patches is rather abundant east of quadrant $O_{II}/35$ (fig. 4). In quadrants $Ł_{II}/35$ and $M_{II}/35$ a strong platy structure with pale yellowish coatings developed in the upper part of the yellowish grey sands as well as in the lower part of the dark brown sands.

Unit LL (min. 30 cm)

Laminated yellowish grey silt with many fine sandy layers more or less horizontally stratified; present everywhere at the base of the section with an upper boundary following a gentle slope to the east, where it is cut obliquely by the base of the unit MGS (in quadrants $F_{III}/35$ to $D_{III}/35$).

4.3. Geometry of the system

Three sets of lithostratigraphic units separated by geometrical breaks could be distinguished in the *SIE 17/17a-I/95* trench (fig. 5). A first system is represented by the laminated sandy silts (unit LL) resting sub-horizontally at the bottom of the section. The second group of deposits consists of Units MGS, DBS, and GBS; it shows also a sub-horizontal distribution but is separated form the laminated sandy silts by an erosional gap in the eastern part of the section. Finally, the main geometrical break is recorded at the base of units TF and DBL which is cutting through the underlying deposits and shows a distinct slope dipping to the East more or less parallel to the present day topography.

4.4. Preliminary interpretation

Considering the regional geological background (Brodzikowski & van Loon, 1987), the laminated sandy silt (Unit LL) are ascribed to glacio-lacustrine deposits and related to one of the late glacial advances of the Weichselian in Poland.

The overlying homogeneous yellowish grey sands (Unit MGS) and the dark brown sands (unit DBS) are most probably of eolian origin; these sands fill in a large shaped depression developed in the upper part of the glacio-lacustrine deposits and can be related to an early phase of the late Glacial (Oldest Dryas) as they incorporate lithics of a Hamburgian occupation in their upper third. The dark brown sands (Units DBS) show all characteristics of a Bh-Horizon belonging to a podzolic soil development in the eolian deposits after the Hamburgian occupation, from a higher sub-horizontal surface. The presence of a well developed platy structure in the lower part of the Bh-Horizon could be indicative of ice segregation posterior to the soil development during a very cold climatic phase, for instance the Latest Dryas. If this interpretation

is correct, than the podzolic soil belongs most probably to the Alleröd.

A major break in the sequence, related to a new geometry of the system, is recorded at the base of the units TF and DBL which follows a distinct slope dipping to the East, parallel to the present-day topography. This could be confirmed by the preliminary botanical analysis of charcoal and wood fragments preserved in the lower part of Unit DBL which all belong to deciduous trees, mainly oak (*Quercus*) and beech (*Fagus*). This data demonstrate that the upper part of the sequence (Units TF to GS) has been deposited during a fairly recent period, most probably during the Sub-Atlantic (Huntley & Birks, 1983). The pocket-like structures related with Unit TF show in some places the typical characteristics of pits initiated by tree fall, mainly an asymmetric shape associated with heterogeneous filling, although in some cases erosional features could not be excluded (fig. 5). Nevertheless, all these structures are related to a similar topography as overlying Unit DBL and therefore, most probably also belong to the Sub-Atlantic. At that time, a wet depression did develop to the East of Square $L_{II}/35$, where the dark brown loam with peaty layers (Units DBL) were deposited. Later on, after a short eolian episode recorded by the thin white coarse sandy layer, this depression has been filled with humic colluvial sandy loam and with grey yellowish sands which show distinct anthrophic disturbances in the upper part.

5. Preliminary pedological interpretation of the Siedlnica site 17 (by R. Langohr and J. Mikkelsen)

5.1. Introduction

The pedological prospection, executed in September 1995 at Siedlnica 17/17a included the study of the freshly dug trench *SIE17/17a-I/95*, two re-opened sections of the previously dug trench *SIE17/17a-I/77*, and another re-opened section of trench *SIE17-I/78*. The study of the latter three sections aimed at a better overview of the general pedostratigraphy of the site. Procedure was to record and sample in detail 2–3 m wide profiles.

Trench SIE17/17a-I/95

P1 to ***P6***: In the new 25 × 2 m long trench all four walls were studied. Six profiles were recorded and sampled both in detail and in function of the global pedostratigraphy.

Trench SIE17/17a-I/77

P7: Profile of the northern wall in a central, 10 m long section of this 120 m long trench (Siedlnica 17). The pedostratigraphy shows a very similar trend to what was observed in the western part of the new trench except for locally, a more complete stratigraphy.

P8: Profile in the extreme western part (3 m long) of trench *SIE17/17a-I/77 (Siedlnica 17)*. The pedostratigraphy with an "Iron-" or "Forest" Podzol was completely different from the observations on all above mentioned profiles.

Trench SIE17-II/78

P9: Profile at the eastern edge (3 m long) of the trench (10 to 13 m to the east of *P8*). The soil characteristics are relatively close to those of *P8*.

Both bulk samples and undisturbed clods were collected from most horizons of the nine profiles. Chemical, physico-chemical, mineralogical, and micro-morphological study of these profiles is foreseen for the winter period 1996–1997. However, numerous field observations and a first global overview of the collected samples allows us to propose already a series of preliminary hypotheses.

5.2. Reference profile *P3* (Hamburgian Siedlnica 17-I/95: $Ł_{II}/35$-$M_{II}/35$ section on South wall)

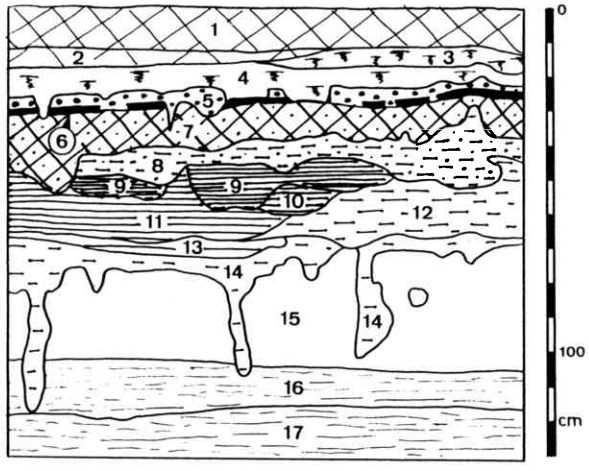


Fig. 6 — Siedlnica 17. Profile P3 in Trench SIE17/17a-I/95: South wall at $M_{II}/35$ to $Ł_{II}/35$. The numbers 1,2,3, ... 17 refer to Horizons H1, H2, H3, ... H17 as described in the text.

As the main point of interest is situated at the spot of the newly discovered Hamburgian concentration in the western part of trench *SIE17/17a-I/95*, attention goes mainly to the pedostratigraphic interpretation at this location. Fig. 6 gives the soil horizonation as recorded in *P3*, on the south wall

between levels $Ł_{II}/35$ and $M_{II}/35$. This level is also indicated in the sketch of the lithostratigraphy (fig. 4 and 5).

The soil horizons are labelled successively ***H1***, ***H2***, ..., along a pedostratigraphic sequence starting at the level of the present-day soil surface. *"Corr."* stands for the correlation with the lithographic sequence. The first sentence after the ***H***-label indicates the main reason(s) why that particular horizon has been distinguished in the pedostratigraphic sequence. *"Int."* stands for the preliminary interpretation of the soil horizon.

A Horizon	*B* O.M.	*C* Fe	*D* Clay + Silt	*E* Colour
H3	2.0 %	xxx	10 %	10YR 3/3
H4	0.0 %	xx	3 %	10YR 3.5/1
H5	0.5 %	(x)	2 %	10YR 5/2
H6	4.5 %	x	3–5 %	10YR 2/1
H7	3.5 %	x	3–5 %	10YR 3/1
H8	1.0 %	(x)	8–10 %	10YR 2/2
H9	2.0 %	x(x)	5–8 %	10YR 2/2
H10	0.5 %	x(x)	5 %	10YR 2/2
H11	2.0 %	x	8 %	10YR 2.5/2
H12	0.5 %	xx	5 %	10YR 3/1
H15	0.0 %	xx(x)	3 %	10YR 5/3

Table 1 — Siedlnica 17. Trench SIE17/17a-I/95, profile P3: preliminary pedological analytical data.

A: Horizon label.
B: Organic matter (O.M.) content determined by heating method.
C: Relative iron content by color after destruction of the organic matter by heating.
(x) = extremely poor; x = very poor; xx = poor; xx(x) = poor to moderate; xxx = moderate.
D: Clay + silt content by finger test.
E: Color of moist rubbed sample.

Table 1 gives some preliminary analytical data of this profile. The *organic matter content (O.M.)* has been estimated by burning the samples at 550°C during 24 hours. *Relative iron content* (Fe) is approximated by comparing soil colour after the organic matter content heating experiment. *Clay + silt* content has been appraised by the finger test and the colour has been measured on a rubbed moist sample with the *Munsel* colour chart.

H1. *Slightly humiferous surface horizon.*
(*Corr.*: H1 – unit GS)
Sharp lower boundary.
Int.: Recent plow layer. Most probably aeolian sand, gradually accumulating on a weakly developed grass vegetation or crop land.

H2. *Lighter colour than above, few redoximorphic features.* (*Corr.*: H2 – unit GJS)
Int.: Possibly old plow layer; same type of deposition as *H1*.

H3. *Abundant redoximorphic features.*
(*Corr.*: H3 – unit HLS)
Dark brown. Numerous traces of root rust (iron) linings.
Int.: Most probably traces of a wet meadow, not forest, nor heathland. Probably aeolian deposition on wet meadow.

H4. *Lighter coloured than above.*
(*Corr.*: H4 – unit HLS)
Very dark grey to dark grey. Still common traces of root rust linings.
Int.: Transition between *H3* and *H5*. Wet meadow. To the west of *P3*, on the somewhat higher landscape position, the lower boundary of this horizon shows numerous traces of what is possibly puddling by animals (cattle, sheep...?). The transition to this area is rather abrupt, on both the north and south walls of the trench and could correspond to a former parcel limit. Another possibility is that this area belongs to a former animal track (passage of animals from one area to another).

H5. *Very light coloured sand.*
(*Corr.*: H5 – unit WS)
Greyish brown horizon with the lowest amount of iron.
Int.: Deposition of wind blown sand coming from a bare soil surface which was originally under forest or heathland and that has undergone the impact of splash (strong impact of rain drops on a bare soil surface which separated the mineral from the organic fraction of the soil). The area of deflation was most probably situated west from the profile. This layer has not undergone any ploughing nor trampling or puddling by animals.

H6. *Thin (max. 1 cm thick) black layer rich in organic matter.* (*Corr.*: H6 – unit DBL)
Black horizon with the highest organic matter content.
Int.: Possibly remnant of an originally thicker peaty layer, or of a forest (or shrub-) litter layer. This layer becomes markedly thicker towards the eastern depression position. The lower boundary cuts the underlying horizon towards the depression (see *H7*).

H7. *Greyish horizon composed of bleached sand grains and black pellets of organic matter.* (*Corr.*: H7 – unit DBL)
Very dark grey when rubbed.
Int.: Typical composition for an humiferous surface A-Horizon under forest or heathland. The relative uniform thickness of 10–15 cm, the sharp lower boundary, and the uniform colour seems to indicate a possible homogenisation by occasional plowing. To the east side of *P3* (towards the depression), this horizon is clearly truncated by erosion. Considering the wetter conditions in this lower landscape position, the erosion was most probably by runoff. The complete pedostratigraphy of trenches *SIE17/17a-I/95* and *SIE17-I/77* shows evidences that this A-Horizon is in fact not the original A-Horizon of the underlying Podzol B-Horizon. Such A-Horizon should be much more rich in organic matter and darker in colour.

H8. *Patchy horizon, somewhat lighter coloured than* H7 *and* H9. (*Corr.*: H8 – unit GBS)
Average colour very dark brown. Patchy horizon composed of about 20 % of E-Horizon (= lighter coloured humus and iron depleted horizon) and pockets transitional to the underlying humus accumulation horizon (Bh). A few charcoal fragments. This horizon has probably the highest content of silt and clay.

H9. *Brown horizon of a Podzol profile.*
(*Corr.*: H9 – unit DBS)
Relatively uniform very dark brown colour, non-cemented, slightly firm when moist.
Int.: Typical brown humus accumulation horizon of a "groundwater" Podzol under heathland or under a forest vegetation typical for very acid soils. The brown colour is mainly due to organic matter. This horizon has a relatively low iron content. The iron depletion is probably due to the combination of the podzolization process, leaching iron downwards in the profile, and a reduction due to the fluctuating groundwater table. As this groundwater has a lateral movement towards the eastern depression position, the iron gradually becomes depleted from the profile.

H10. *In the field slightly more brown and more friable than* H9. (*Corr.*: H10 – unit DBS)
Int.: See *H9*.

H11, H12, and ***H13.*** *Still brown horizons, but becoming slightly lighter in colour with depth.* (*Corr.*: H11, H12, H13 – unit DBS)
Int..: All these horizons still belong to the Podzol Bh-Horizon.

H14. *Tongues of slightly humiferous material along old root galleries.* (*Corr.*: H14 penetrations of DBS down into the underlying MGS)

H15. *Very light coloured soil, without stratification.* (*Corr.*: H15 – unit MGS)
Brown, very little amount of silt and clay.
Int.: Sediments accumulated on an at least slightly vegetated soil surface.

H16 and ***H17.*** *Stratified sediments, sands with thin more clayey bands.* (*Corr.*: H16, H17 – unit LL)

There is a rather good correlation between the litho- and the pedostratigraphy of *P3*. There is agreement on a break in the stratigraphy at the bottom of *H7* (base of *DBL*). According to the pedostratigraphy however, there seems also to be a break between *H6* and *H7*, which are included in the same lithostratigraphic unit *DBL*.

5.3. Preliminary interpretation of the artifact distribution

The area with abundant artifacts coincides with *H9*, *H10*, *H11*, *H13*, and *H14*. This set of horizons shows at the location of the artifact concentration a lower boundary with a slight "pocket" morphology. It is not excluded that the Podzol B-Horizon follows here an earlier disturbance by an uprooted tree, but this remains hypothetical (Langohr, 1993). Several of such structures can be observed towards the small depression position along the trench (to the East of *P3*). In such case, following chronosequence can tentatively be proposed.

1. Accumulation of the artifacts at the surface of a soil which has not yet a Podzol profile (possibly a colour and/or structure B-Horizon with good biological activity).
2. Due to an uprooted tree (?) the artifact concentration becomes disturbed and penetrates deeper into the soil (Langohr, 1993).
3. Later development of the Podzol soil as a result of further acidification of the soil, and possibly a change in vegetation, which could partly or even largely be due to human activities (frequent fire for hunting, or forest clearing for agriculture ...).
4. At some moment freeze-thaw cycles down to some −50 to −60 cm from the original soil surface result in some ice segregation blades as observed at the level of the Bh-Horizon on the north facing wall $K_{II}/36$–$Ł_{II}/36$ of the trench. These cycles can also be responsible for the soil capping observed on the artifacts. Such

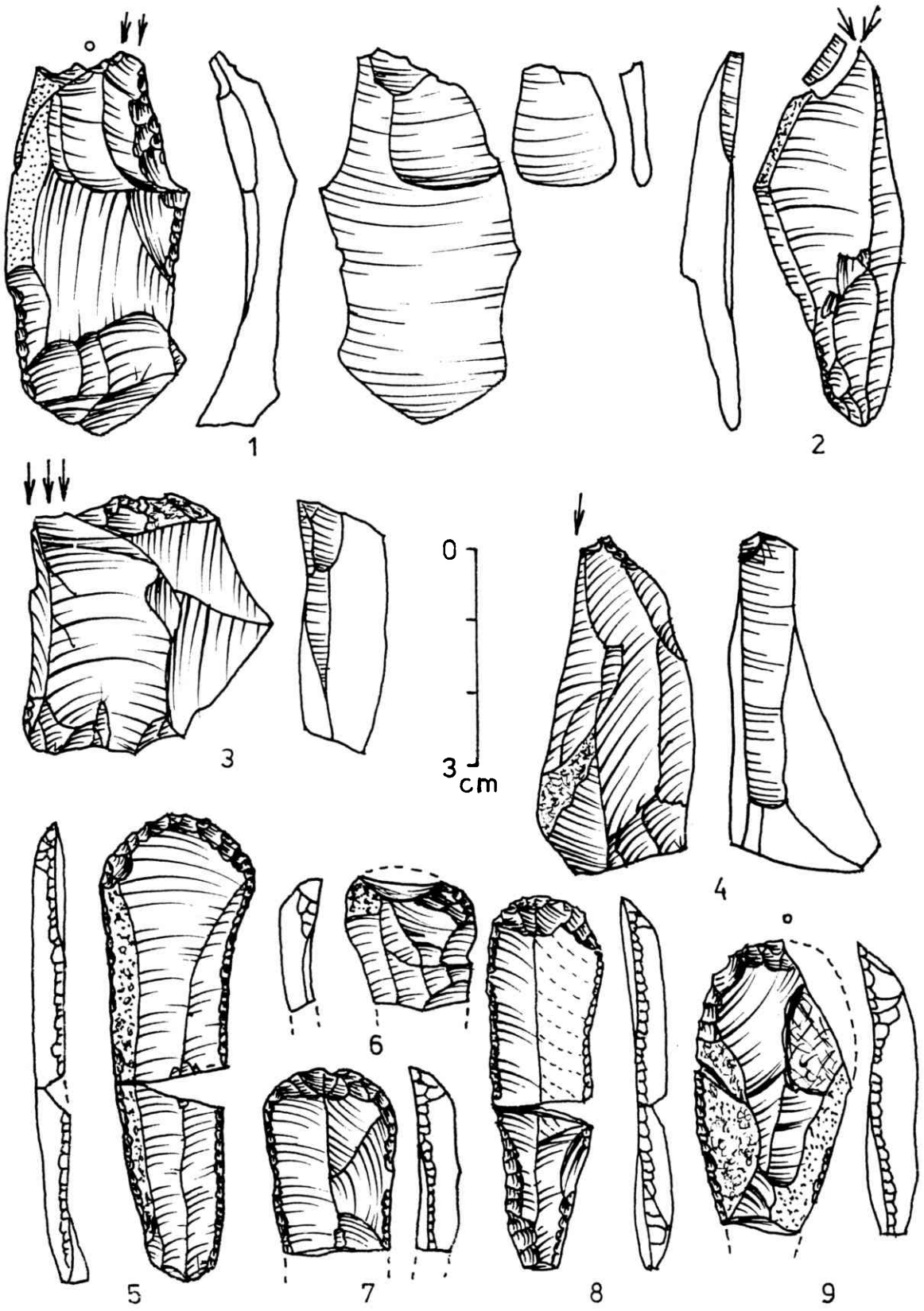


Fig. 7 — Hamburgian Siedlnica 17-I/95. Selected tools: 1. refitting of burin and burin spall; 2–4. burins; 5–9. end-scrapers.

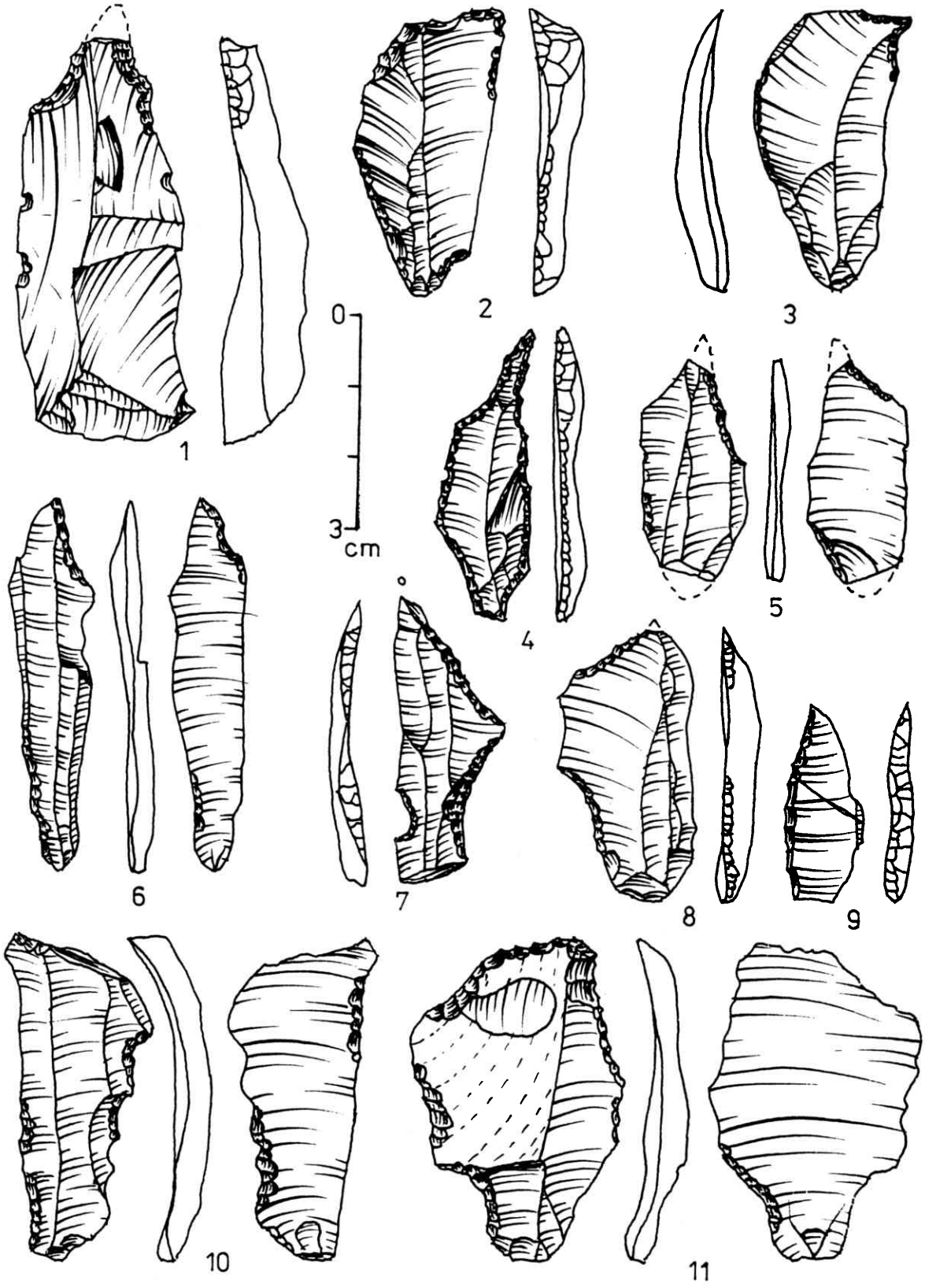


Fig. 8 — Hamburgian Siedlnica 17-I/95. Selected tools: 1–2. zinken; 3–4. perforators; 5–6. borers; 7–8. shouldered points; 9. backed point; 10. notched piece; 11. combined tool.

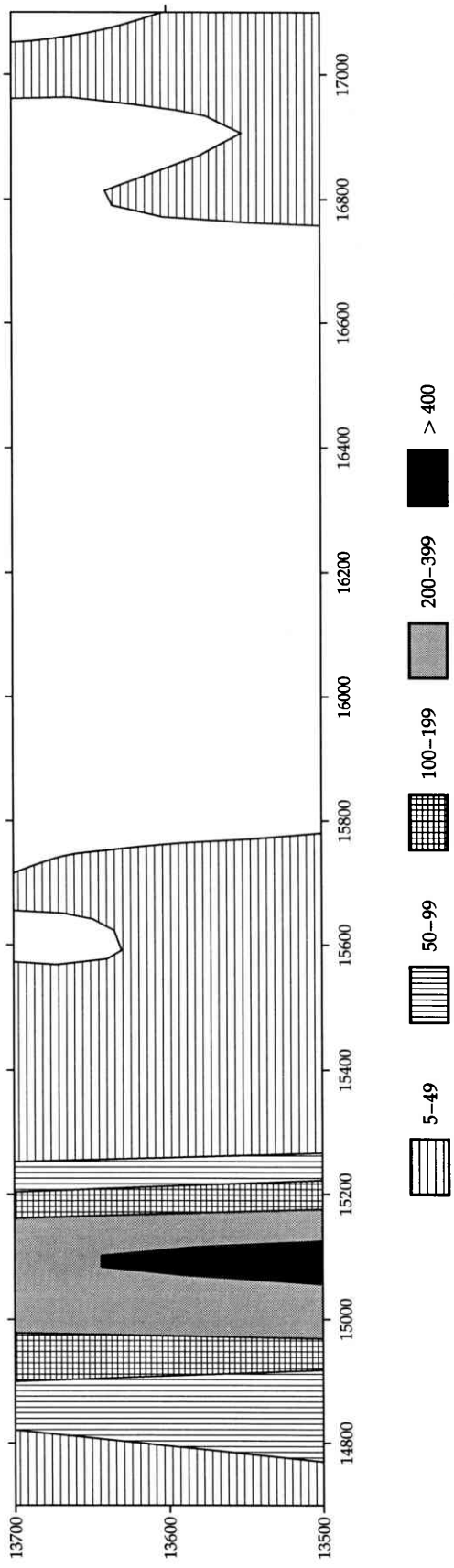


Fig. 9 — Siedlnica 17/17a-I/95: Density of flint artifact finds.

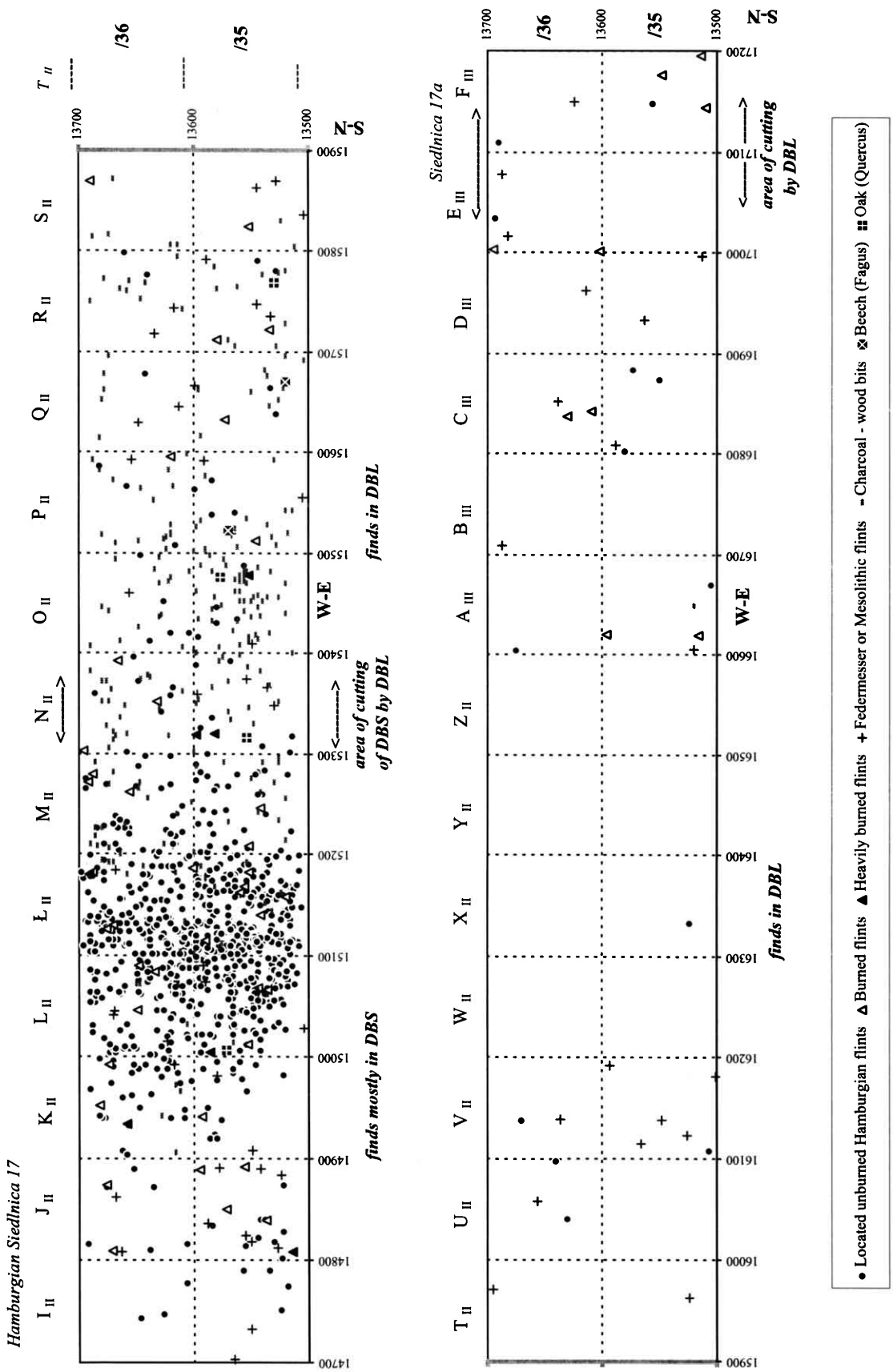


Fig. 10 — Hamburgian Siedlnica 17-I/95: Distribution of flint artifacts without chips and charcoal/wood bits.

frost can occur preferentially at a moment when dense forest vegetation is lacking or when a thick litter layer on the soil is absent. These cryogenic processes however cannot explain the spreading of the artifact concentration as they do not create a particular turbation.

A similar sequence as the three first steps has been described in the sandy area of Flanders (Belgium) in order to explain the particular spatial distribution of numerous Mesolithic artifact concentrations (Crombez, 1993).

6. ARCHAEOLOGICAL FINDS

6.1. Lithic artifact location of Hamburgian Siedlnica 17-I/95

Based on the limited sounding, it seems that the trench tapped the northern-central part of the new Hamburgian concentration (fig. 3). The outer limits of the lithic finds (so far 1934 flints) are situated at a distance of *ca.* 6 m from the centre of the concentration which is estimated to be bound to an area of *ca.* 3 to 6 m in diameter (K_{II}, L_{II}, $Ł_{II}$, M_{II} /35-36) [fig. 9 and 10], based on the Olbrachcice 8 or Siedlnica 17a concentrations (Burdukiewicz, 1986).

The Hamburgian Siedlnica 17-I/95 concentration was stratigraphically recovered mainly in the middle to lower part of the Unit *DBS* of the second group of deposits (fig. 4 and 5). Although in the horizontal plane major disturbances seem absent, a non-negligible vertical scatter was recorded. This is mainly due to animal and root bioturbation. According to Langohr and Mikkelsen (see above), the cryoturbation impact of the observed ice segregation near the lithic concentration would be minimal if not non-existent, although this should not *a priori* be excluded. The finds, limited to lithics and a number of quartz pebbles and sandstone slabs, were found mostly within a range of −45 cm and −100 cm below surface. The highest density is observed in the lower-middle *DBS* stratigraphic unit between −70 cm and −100 cm (fig. 4 and 5). These Hamburgian artifacts were found much deeper than the artifacts of the ABPT concentration *SIE17-I/73* or than the single *ABPT* artifacts from the old trench *SIE17-I/77* lying in the same zone of the site (fig. 3). There, *ABPT* lithics were recorded mostly between −20 cm and −40 cm below surface (Burdukiewicz, 1974). In general, the absolute height of the Hamburgian concentration of Siedlnica 17-I/95 (*ca.* 80 m above sea level) is just like Siedlnica 17a, where vertical scatter of artifacts was recorded down to −50 cm below surface (Burdukiewicz, 1986: 103).The difference between the vertical position of Hamburgian and *ABPT* artifact can be explained as a result of a local aeolian accumulation which happened after the Hamburgian settlement at Siedlnica 17.

6.2. Raw material and its preservation: Hamburgian Siedlnica 17-I/95

The lithics proper are made of mostly fine to medium grained olive green to brown-reddish Baltic flint. The flint of brownish colour is relatively rare, but widely dispersed in the Central European Plain. It was collected by several Late Palaeolithic groups. Similar raw material was used in the Kopanica Valley at Hamburgian Siedlnica 17a and the Late Palaeolithic concentration of Siedlnica 33 (Burdukiewicz, 1987); at the Tanged Point Technocomplex site Strumienno 1 (Burdukiewicz, 1988); and at numerous sites in the Ahrensburg Valley in Northern Germany (Rust, 1958). Some think this to be an erratic Jurassic flint (Balcer, 1983: 49).

Raw materials of the rare *ABPT* and Mesolithic admixture in trench *SIE17/17a-I/95* and of the single artifacts of *ABPT* found in the parallel long trench *SIE17-I/77* is of respectively, greyish and cream-greyish erratic Cretaceous flint. This material was used for the nearby *ABPT* concentrations. However, similar, but presently patinated, grey flint was worked as well by the Hamburgian people at Olbrachcice 8 in the Kopanica Valley, located *ca.* 1 km to the North of Siedlnica 17 (Burdukiewicz, 1986). The nature of the observed colour variation in the Hamburgian lithics is a point of interest and requires further investigation.

More than one third of the tools and debitage were slightly to heavily patinated (fig. 11). Pieces showing traces of frost or glance are limited. A maximum of 5 % of flints, showed distinct traces of heat stress (fig. 12). These were dispersed over the whole unit and so far do not indicate an actual hearth. However, the rather high percentage of burned burin spall tool waste might be an indication that a hearth is still to be uncovered. The fact that 3 out of the 5 identified burned burin spalls and 4 out of the 6 burned tools were found in quadrants L_{II}/35 and $Ł_{II}$/35 might be indications for such feature, although a dump is also not excluded.

But in general, the low number of burned flint stands in contrast with the observations made at the later *ABPT* concentrations at the same Siedlnica 17 site where almost half of the lithics are

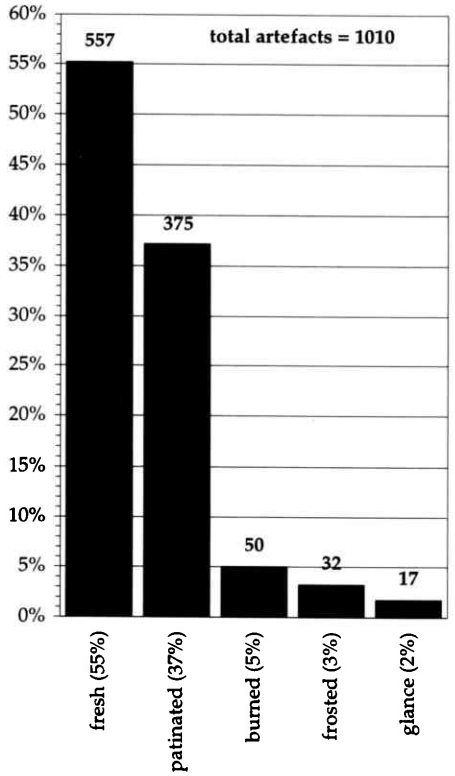


Fig. 11 — Hamburgian Siedlnica 17-I/95: state of preservation of flint artifacts (except chips).

burned. Most of the *ABPT* concentrations seem to have been exposed to a widespread fire as can be derived from the Siedlnica 17 concentrations. Moreover the grey Baltic *ABPT* flint, show much less impact of patination alterations, but more of frost.

6.3. Lithic tools and assemblage

Since the concentration is only partly excavated, the discussion will be brief (fig. 13 and 14). The distribution numbers in the taxonomic identifications should be considered preliminary. There is no doubt that the *SIE17-I/95* tool-set will be richer in number than that of nearby Siedlnica 17a. At the latter, *ca.* 117 tools were recorded—to which 5 other tools can be added from the present excavations. At Siedlnica 17-I/95 already 118 flint tools and tool fragments, besides a flint stone hammer and some rare tools made from quartz pebbles have been unearthed. Tools constitute 6.1 % of the whole flint assemblage or 11.7 % of the assemblage without chips. These latter (less than 1 cm) make up 47.8 % of the partly excavated assemblage. For what is known about Hamburgian assemblages, the partly excavated

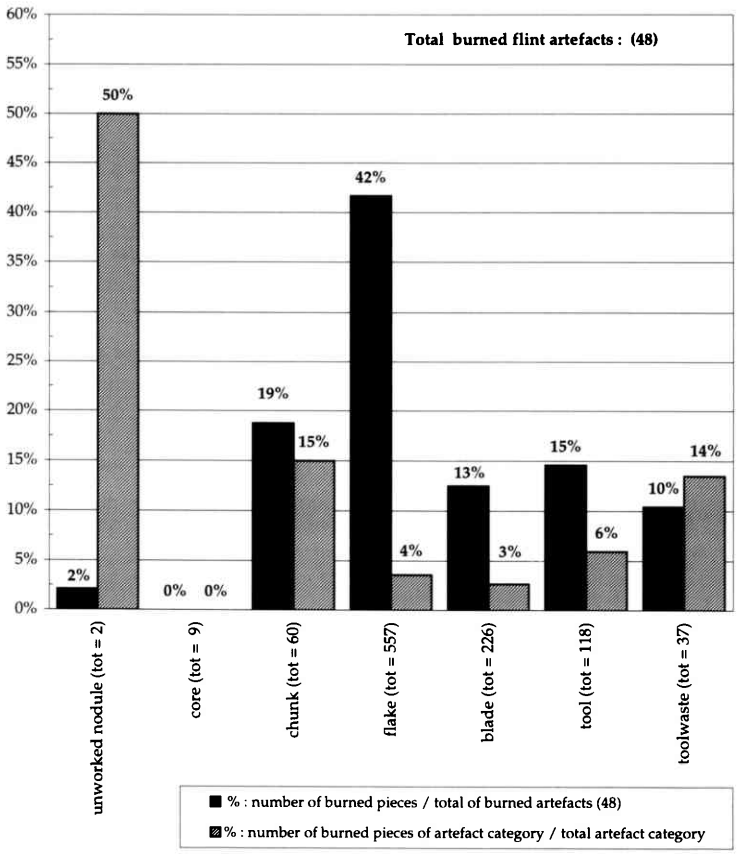


Fig. 12 — Hamburgian Siedlnica 17-I/95: distribution of burned flint artifacts (except chips).

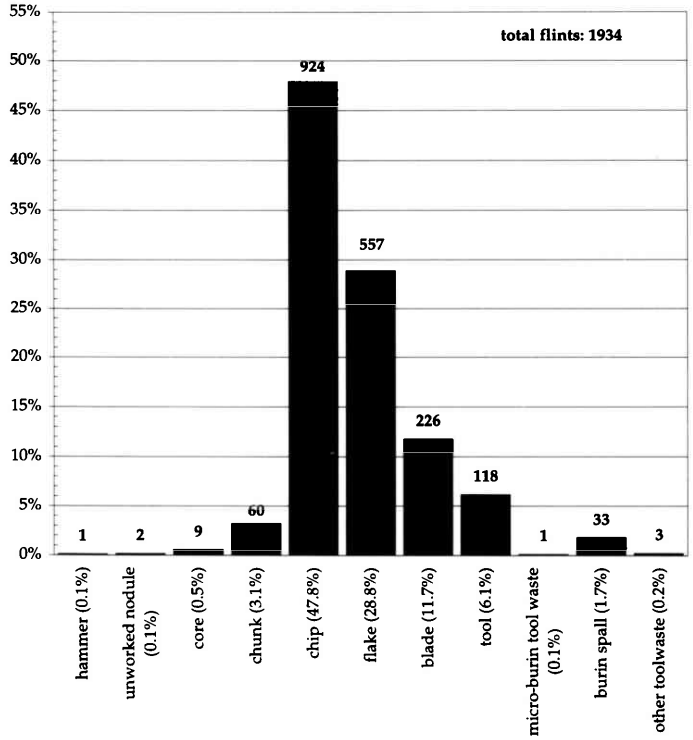


Fig. 13 — Hamburgian Siedlnica 17-I/95: partly excavated flint assemblage.

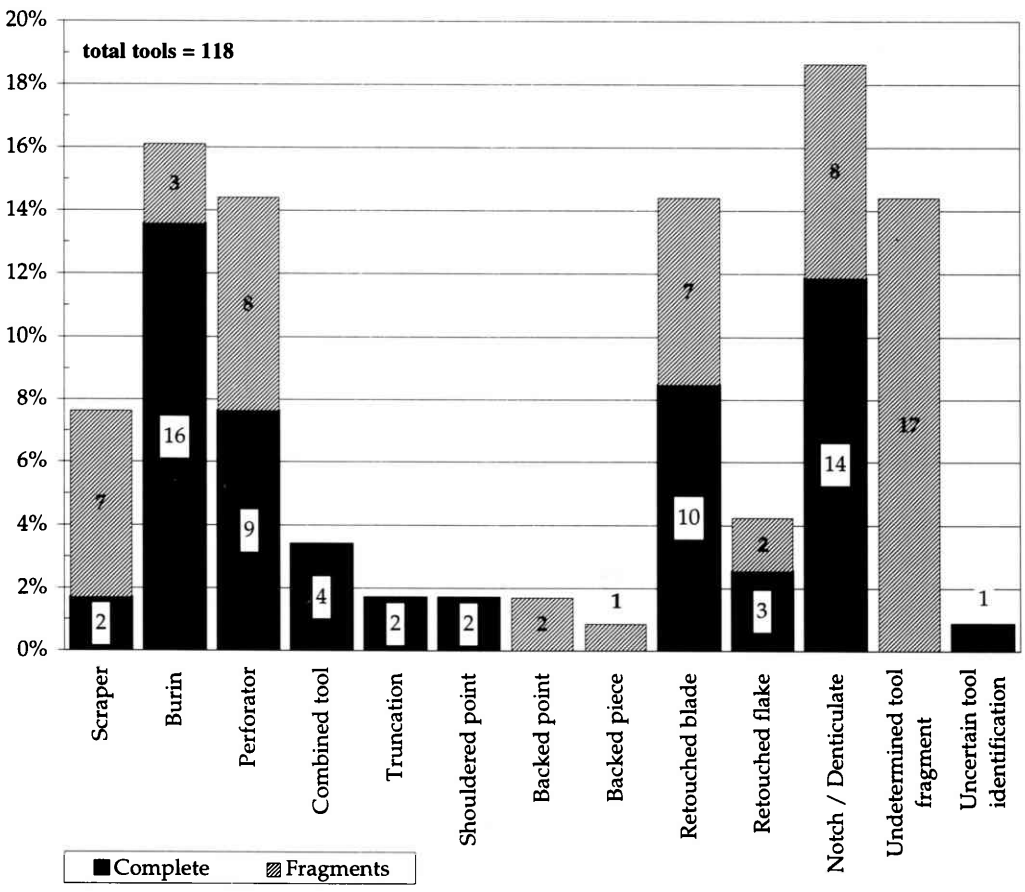


Fig. 14 — Hamburgian Siedlnica 17-I/95: preliminary tool distribution.

Siedlnica 17-I/95 tool-kit can so far be considered to be medium rich to restricted compared to the debitage remains.

In composition, the new concentration reveals some differences with Siedlnica 17a (fig. 14) in the emphasis on notched/denticulated pieces (22 or *19 %*), burins (19 or *16 %*) and perforators (17 or *14 %*). At Siedlnica 17a these tools amount respectively to 4 (*3 %*), 10 (*9 %*), and 9 (*8 %*) only. On the other hand scrapers (7 or *8 %*) are so far much less than at Siedlnica 17a (27 or *23 %*). A difference in function of both sites is a possible explanation that asks for further substantiation.

The ratio between flakes and blades (28.8 %/11.7 %) shows the Hamburgian stone worker's emphasis on flakes. This notion is strengthened by the observation that half of the flakes do not bear traces of cortex or natural surface anymore (fig. 15), an indication that they are not early stage products in the *'chaîne opératoire'*. Moreover, 15 % of complete and proximal fragments of flakes bear cortex on the butt only. A similar percentage is approximated for the blades and reveals that butt preparation was not a focal point in the debitage preparation. The comparison between the percentage (35 %)

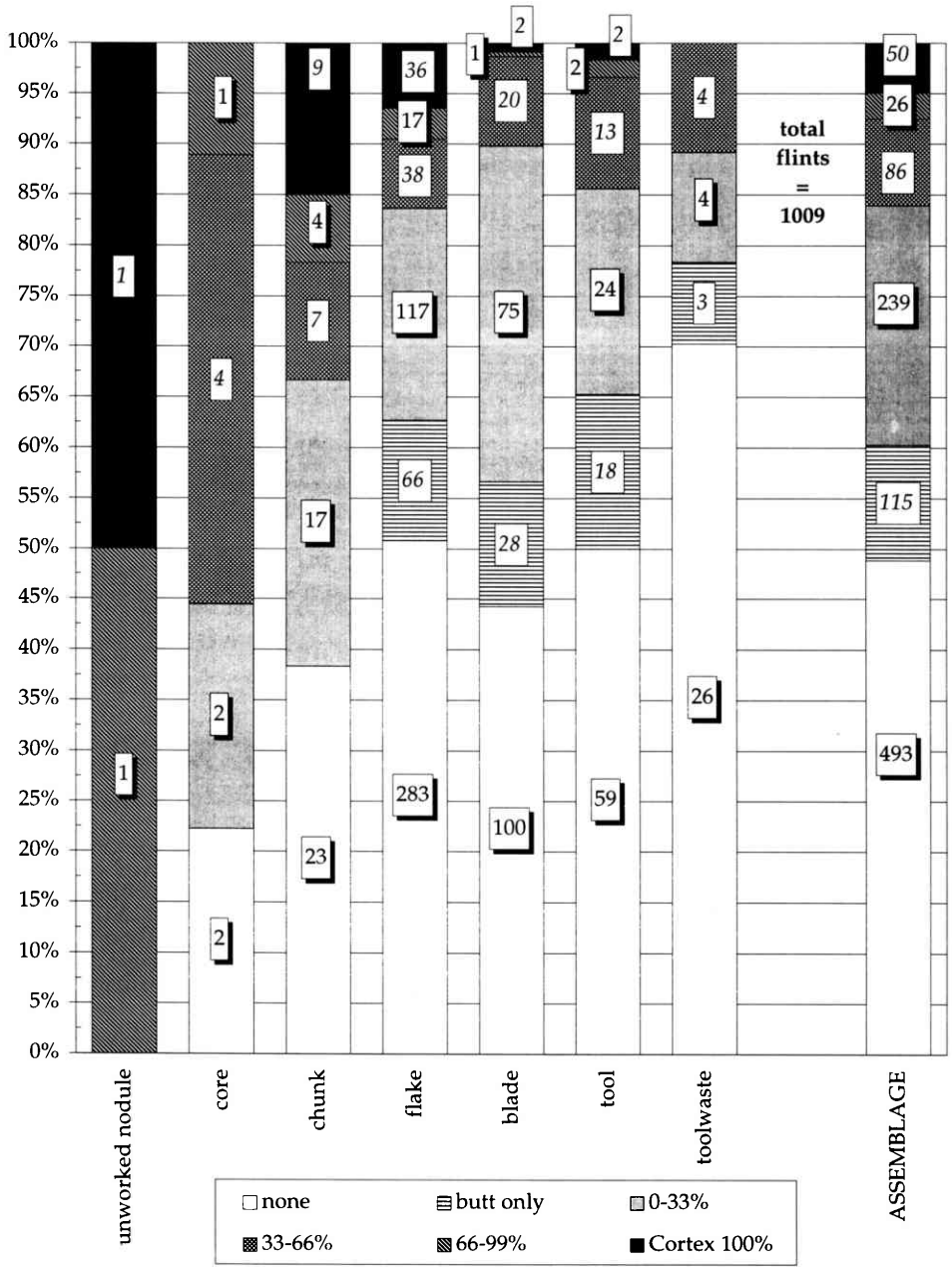


Fig. 15 — Hamburgian Siedlnica 17-I/95: presence of cortex or natural surface according to artifact categories.

of tools with traces of cortex on the dorsal surface and the percentages of flakes (37 %) and blades (43 %) with similar remnants, suggests that generally speaking, this aspect did not play a major role—if at all?—in the selection of the flakes or blades for tool production. The foreseen refitting and tool analysis will show at Siedlnica 17-I/95 to what extent flakes or blades were preferred for tool-production.

6.4. Burned wood and charcoal

Besides the plenty of lithics, a large number of wood and charcoal bits, more than 270, were collected. Spread over a distance of approx. 11 m, from K_{II}/35-36 to S_{II}/35-36 quadrants, a high density was recorded to the East of the flint concentration (L_{II}/35-36, $Ł_{II}$/35-36, M_{II}/35): quadrants O_{II}/35, P_{II}/35-36, Q_{II}/35 (fig. 4, 5 and 10). Especially a shallow depression, in Unit O_{II}/35, contained a large number of charcoal pieces (54), twice more than in any other unit. Also in the old *SIE17/17a-I/77* long trench, in the west flank of the small depression, traces of charcoal, a large, partly burned piece of tree root, and organic black deposits were observed (pulverised charcoal or turf?).

The presence of charcoal bits, located very close to lithic artifacts raises the question

(a) whether these burned wood traces stand in relation to the Hamburgian occupation;
(b) whether they are much younger and belong e.g. to the Holocene period; and/or
(c) at the intra-site level, whether they can be linked to the observed burning of a very high number of flint artifacts in the nearby ABPT-concentrations.

The preliminary and few anthracological identifications (6 samples) by Dr. Damblon produced oak (*Quercus*) and beech (*Fagus*). They suggest that the examined burned wood pieces came from Sub-Atlantic period or later (Huntley & Birks, 1983). So far, litho- and pedostratigraphic observations do not contradict such periodisation. Some burned wood and charcoal bits have been found just above the flint concentration. Obviously these must be younger than the Hamburgian occupation. Many more charcoal pieces, East of the concentration, came from the same depth as the flint artifacts, but the lithostratigraphy suggests a later date as well (fig. 4 and 5). However, the first author does not exclude the possibility that the charcoal remains, are a dump of a cleaned out prehistoric hearth, a so-called "satellite hearth" connected with the flint artifact concentration. Such concept scenario has been proposed at Pincevent (Paris Basin, France), where they are located some 5–10 m from the dwelling centre (Julian, 1984, Leroi-Gourhan, 1984: 23–24; Binford, 1983: 157). But, so far, the excavation produced—just like the Scandinavian Hamburgian sites of Jels 1, Jels 2, Slotsing a and c sites, and Holtsing—only rare lithics with clear traces of heat stress. They are scattered and are nearly absent in and around the O_{II}/35 charcoal concentration.

Another more likely interpretation is a natural wood fire of dried forests. Such event is attested at numerous Late Alleröd sites (Schild, 1975: 181). However, based on the few wood identifications this could have happened during Sub-Atlantic period as well. A late Alleröd periodisation would assume that charcoal and wood amassed during two or three different periods and got mixed. As yet, this is not supported by the preliminary stratigraphic and anthracological data.

Obviously, above statements should still be considered exploratory venues of interpretation and as such preliminary, since the charcoal concentration and the flint concentration are only partly excavated and full results of anthracological and ^{14}C analysis are awaited.

7. NEW LATE GLACIAL OCCUPATIONAL TRACES ON TOP OF GYTTJA LAYERS: SIEDLNICA 77

In September, at the close of the environmental investigation, new traces of a prehistoric occupation were found on the east bank of the Kopanica river (fig. 2). This new site, named ***Siedlnica 74***, is attested, by 3 surface finds and by 3 lithic pieces from a small test pit. As yet, the limited traces do not allow to identify as yet the exact cultural facies. Based on the metric-morphological characteristics of the flakes and blades, the patination and the red-brown colour of the Baltic flint a late glacial periodisation seems most probable. Of importance, however is the first attestation of Gyttja deposits within the Kopanica valley itself, and this in association with archaeological material. The small test-pit revealed a *ca.* 50 cm thick gyttja layer *ca.* 54–58 cm below surface. At the interface of the humic upper deposits and the Gyttja layer, flints were recorded. The narrow 50 cm × 2 m long test pit revealed as well that Gyttja deposits preceded the important erosion of the main Kopanica bedding during the Holocene. The cut into the edge of the East flank of the old Kopanica bedding shows a steep oblique downwards truncation of this layer in east-west direction.

The potential of this find is considerable. The upper level of the Gyttja is situated at a height of *ca.* 79 to 80 m above sea level, that means at the same height or slightly below the findspots of the Hamburgian concentrations on the west bank. Possibly, this Gyttja layer stands in relation with the lower series of sediments that were observed at the bottom of the I/95 unit. It may strengthen the interpretations proposed by Dr. Haesaerts and Dr. Langhor that these lower gley deposits are rather lacustrine in nature. With such interpretation the Kopanica valley could be reconstructed as rather being the result of a dead-ice lake. Such interpretation would be consistent with the Hamburgian preference for such environment. However these are still very preliminary thoughts and ask for substantiation.

8. Conclusions

The investigations during this year in the Kopanica valley might be an important breakthrough for the early part of Late Glacial of Poland. On a preliminary basis a few points can be made.

First of all, the Kopanica valley seems to have harboured more than some isolated Hamburgian groups. Although this valley belongs presently to the eastern periphery of the Hamburgian roaming region, and we don't have any idea of the contemporaneity of the Hamburgian concentrations, the find of a fourth concentration in the valley provides us the first hints that this valley might have functioned as an aggregation zone for specific subsistence or social activities. The fact that two out of the four concentrations of the Kopanica valley were found "accidentally", strongly suggests that more Hamburgian assemblages wait to be discovered: e.g., except for Olbrachcice 8, no indications of such material were observed on the surface, notwithstanding the relatively undeep occurrence of the finds. A concerted program with 30 cm wide drillings in Siedlnica 17 and 17a, at regular distances, might be the way to proceed for the recovery of more Hamburgian concentrations. Also outside the Kopanica valley, a similar "accidental" discovery history is repeated at Markowice (Pers. Comm. Dr. Jacek Kabaciński, P.A.N. Poznań).

Secondly, the presence in the valley of archaeological finds in association with Gyttja offers for the first time the prospect that prey remains in the form of bone or antlers, might be preserved. Although at Olbrachcice 8 *ca.* 400 small bone bits were found, only few could be identified as reindeer (Burdukiewicz, 1987: 185). An extended identification data set on fauna in association with the Polish Hamburgian is still absent. In fact such data in association with Hamburgian settlements are for the whole "territory" of this "culture" very limited and restricted to the Ahrensburg valley (Meiendorf, Stellmoor AbH, Poggenwisch in Schleswig-Holstein, Germany) [Rust, 1937, 1943, 1958], and possibly in Havelland (?), Northeast Germany (Gramsch, 1987: 107-108) or in Slotseng's "Kettlehole" in Denmark (Holm, 1996).

Thirdly, there are indications that the interpretations of the palaeogeography of the Kopanica valley and the Siedlnica 17a-Siedlnica 17 findspots proper, have to be adjusted according to the new finds. A further substantiation of the idea of a dead ice lake presents itself. At Siedlnica 17, preliminary observations by R. Langohr and J. Mikkelsen, show that only traces of a truncated, A-Horizon and an unrelated truncated Podzol B-Horizon were recorded. The fact that the new Hamburgian concentration was found in the Podzol B-Horizon suggests that the formation of both horizons happened posterior to the occupation. In the present absence of a pollen profile, ^{14}C-dates, faunal data, and micro-morphological soil analysis the exact periodisation remains open. Additionally, the preliminary observations by P. Haesaerts and R. Langhor indicate that the presumed Bölling soil at Siedlnica 17a was not visible anymore due to hydrocyclical impact (Brodzikowski & van Loon, 1987). According to R. Langohr and J. Mikkelsen there are indications of a "slightly vegetated soil surface" between H15 and H16 Horizons, that is, below the Hamburgian occupation of Siedlnica 17-I/95.

Finally, the new Hamburgian find might offer on a larger geographical scale new clues on how to look at the cultural variability within the Hamburgian. 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. The recent progress made in Southern Scandinavia with the discoveries of Hamburgian sites of Jels, Slotseng en Sølbjerg is also made on Polish territory. Six excavated sites, Olbrachcice 8, Siedlnica 17a, Siedlnica 17-I/95, Rogów Opolski, Liny, and Markowice mark the Polish, eastern periphery of the Hamburgian exploration zone. They finally offer a required minimum on data to discern the functional, cultural and/or chronological variation. Although indications of the presence of the Hamburgian in the Eastern part of Germany are still limited (Terberger, 1996) and a *quasi* void in occupation in the area between the Ahrensburg valley and the Polish sites is still

apparent, it well may be that this is but a reflection of the degree in intensity of archaeological investigations. The Hamburgian occupation in Central Europe might have been much more substantial than assumed. Moreover, the question of the taxonomic relationship between the Hamburgian and the often a-typical Late Magdalenian scant occupations in the southern en South Eastern highlands of Poland might be put forward again. (Desbrosse & Kozłowski, 1985). The recurrent propositions to regard the Hamburgian as the lowland counter part of the Late Magdalenian deserve further investigations (Valentin, 1995; Schild, in press).

Obviously, the recent new discoveries ask for continuation of the fieldwork. The collaboration of the *Katholieke Universiteit Leuven* and the *University of Wrocław* will be carried through. In the summer of 1996 new excavations should further uncover the Hamburgian Siedlnica 17-I/95 concentration. At the same time the potential of Siedlnica 74 will be further explored.

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