Eesti Arheoloogia Ajakiri, 2003, **7**, 2, 99–122
https://doi.org/10.3176/arch.2003.2.01

Eva David

THE MESOLITHIC ZVEJNIEKI SITE (LATVIA) IN ITS EUROPEAN CONTEXT: PRELIMINARY RESULTS DELIVERED BY A TECHNOLOGICAL STUDY OF THE BONE AND ANTLER INDUSTRY

A recent technological study of the bone and antler industry of the Zvejnieki site provides new insight into our understanding of the Mesolithic of northern Europe. As far as bone and antler industry is concerned, the Preboreal and Boreal horizons of Zvejnieki burials and settlement sites can be seen as belonging to the north-eastern technocomplex that may extend, for these chronozones, from Poland to western Russia including southern Sweden and the Baltic states. In fact, in this geographical area the archaeological assemblages such as Ageröd I: A-H-C, which was usually considered as Maglemosian, have delivered an industry mostly represented by points and edged tools made by the 'Z' Method (a method discovered first by the author at Zamostje, Russia) on metapodials of large ungulates. Pendants made of mammal teeth have been manufactured by either sawing or by grinding-drilling according to their designation for the living people or the dead, respectively. This method as well as the last two techniques can now be ascribed to the north-eastern technocomplex, while the Maglemose and the northern technocomplex used a different technology in order to produce, on similar blanks, weapons, tools and ornaments of the same kind.

Zvejnieki asulakoha luu- ja sarvesemete nüüdisaegne tehnoloogiline uurimine lisab uusi teadmisi Põhja-Euroopa kiviaja kohta. Nagu luu- ja sarvesemed osutavad, kuulub Zvejnieki asulakoha ja kalme preboreaalse ja boreaalse horisondi esemete tootmisviis kirde tehnokompleksi, mis eksisteeris neis kronotsoonides Poolast kuni Lääne-Venemaani, kaasa arvatud Lõuna-Rootsi ja Balti riigid. Sellel geograafilisel alal (arheoloogilistes kogumites nagu Ageröd I: A-H-C, mida tavaliselt on vaadeldud Maglemose kultuuri osana) on esindatud peamiselt otsikud ja lõiketeraga tööriistad, mis on suurimetajate põialuudest valmistatud Z-meetodil (seda meetodit täheldas autor esmakordselt Venemaa Zamostje materjali puhul). Imetajahammastest ripatsid on tehtud saagimise või lihvimise-puurimise abil olenevalt sellest, kas need olid mõeldud elavate või surnute tarbeks. Z-meetodit, nagu ka eeltoodud tehnikaid võib kirjeldada kui kirde tehnokompleksi. Maglemose ja põhja tehnokompleksis kasutati samade pooltoodete puhul teistsugust tehnoloogiat, kuigi tulemuseks olid üsna samasugused relvad, tööriistad ja ehted.

Eva David, UMR 7055 CNRS, Préhistoire et Technologie, Maison de l'Archéologie et de l'Ethnologie, 21, Allée de l'Université. F-92023 Nanterre Cedex, Paris, France; davide@mae.u-paris10.fr

The Zvejnieki site

The Zvejnieki site is located on a morainic ridge overhanging the Rūja river beside Lake Burtnieki in northern Latvia (Fig. 1). Discovered during the summer of 1872, the site has been extensively excavated by F. Zagorskis from 1964 to 1971 (Zagorskis 1987). It delivered more than 300 graves representing the biggest cemetery in northern Europe for the Mesolithic period, the oldest occupation being dated to 8240 ± 70 BP (Ua-3634, grave 305) and 8150 ± 80 BP (OxA-5969, grave 170), (Zagorska 2000, p. 91, Table 1). From 1971 to 1978 the excavation area has been enlarged to the settlement site (Zvejnieki I & II) covering 665 m^2, with occupations dating from the Mesolithic to the Neolithic periods. Concerning the Mesolithic, the earliest horizon is dated to the Preboreal (Zagorska 1992, p. 100) and is represented at the bottom of the stratigraphic sequence by an horizontal layer that was formed near the top of the morainic ridge when it was an island (Fig. 2).

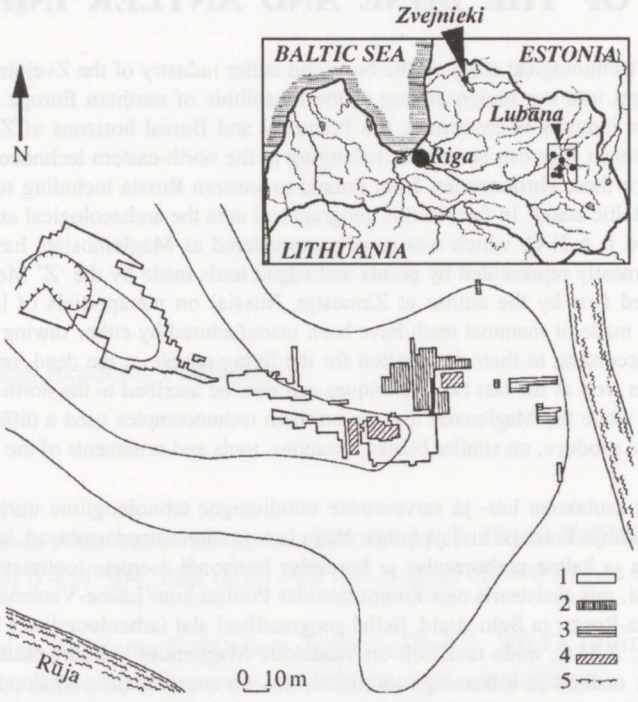

Fig. 1. Map of Latvia showing Zvejnieki and Lubāna and the location of the Zvejnieki sites (after Zagorska 1992, p. 110, Fig. 12, altitudes are not mentioned by the author). 1 Stone Age cemetery, 2 Mesolithic settlement site (Zvejnieki II), the line in bold shows the location of the stratigraphical section in sectors VI & XIII-East (see Fig. 2 below), 3 Neolithic site (Zvejnieki I), 4 modern buildings, 5 destroyed area.

Joon 1. Zvejnieki ja Lubāna Läti kaardil ning Zvejnieki kaevandite asendiplaan (Zagorska 1992, 110, joon 12 järgi, kõrgust ei ole autor märkinud). 1 kiviaegne kalmistu, 2 mesoliitiline asulakoht (Zvejnieki II), jämeda joonega on markeeritud stratigraafiline sektsioon sektorites VI ja XIII-ida (vt joon 2), 3 neoliitiline asulakoht (Zvejnieki I), 4 tänapäevased ehitised, 5 lõhutud ala.

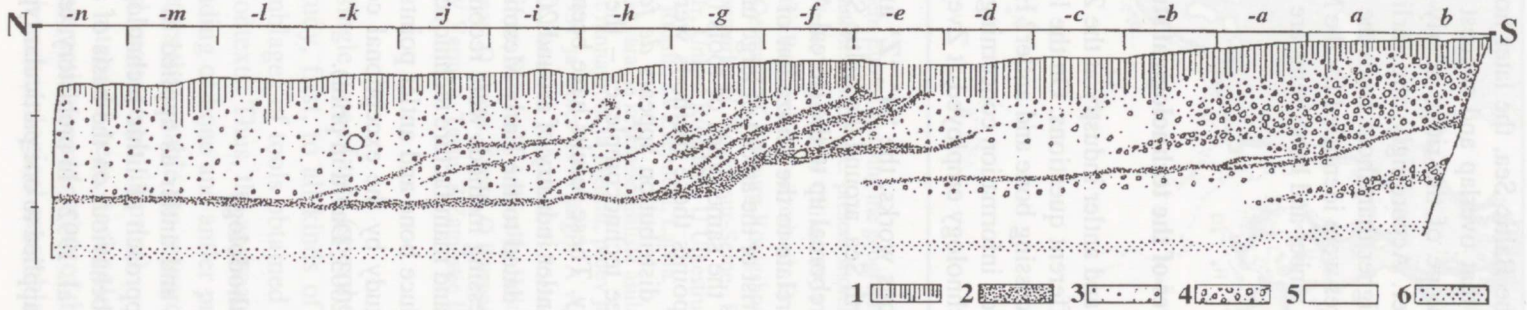

Fig. 2. Geological stratigraphy of the Zvejnieki II settlement site (after Zagorska 1992, p. 101, Fig. 3). The North-South section is located in sectors VI & XIII-East and comprises 16m from "-n" to "b". 1 humus, 2 thin sand and gravel, 3 fine gravel, 4 coarse gravel, 5 freshwater deposit, 6 steril sand.

Joon 2. Zvejnieki II asulakoha geoloogiline stratigraafia (Zagorska 1992, 101, joon 3 järgi). Põhja-lõuna sektsioon asub sektorites VI ja XIII-ida ja on "-n-ist" kuni "b-ni" 16 m pikk. 1 huumus, 2 õhuke liiv ja kruus, 3 peen kruus, 4 jäme kruus, 5 magevee setted, 6 steriilne liiv.

Due to the marine transgression of the Baltic Sea, the later horizons are represented by a series of oblique layers that overlap and suggest that occupations took place near the water, on the slope of the ridge nearly until its bottom actually surrounded by the Rūja river. Accordingly, the earliest artefacts can be found at the same level or even higher than those from the latest Mesolithic occupations. No archaeological features were identified for the Mesolithic period in the course of excavation, but stone, amber and bone items are numerous indeed (about 2500 flint artefacts).

The scope and objectives of the technological study

A technological study of the bone and antler industry at the Zvejnieki site can provide an opportunity to answer different questions. On the local scale: What was the technology employed for processing bone and antler? How can the bone and antler industry of Zvejnieki provide information concerning the nature of the site? On a broader level: Can the technology employed at Zvejnieki be seen as belonging to a wider cultural unit?

As has been established in previous works, the **'D', 'Z' and 'O' methods** were used respectively around the North Sea, around the Baltic Sea and in western Europe from the second half of the Preboreal up to the Boreal-Atlantic transition (David 1999a; 2000a; 2000b). They relate to the utilization of metapodials (the bone between the phalanges and the wrist or the ankle) of large ungulates (aurochs, elk, red deer) for the manufacture of the same types of tools (mainly projectile points). In relation to the types of points these methods were used for, their unexpectedly restricted geographical distribution appears *de facto* as a cultural indicator distinguishing between three technocomplexes – the northern, north-eastern and western ones, respectively. These results have been obtained from a technological study of the bone and antler industry of around 20 occupation sites (Fig. 3), representing ca 3000 pieces dated to the Early Mesolithic period (10th to the 8th millennium BC). The processing methods were reconstructed after the original identification of 21 debitage and manufacture techniques used by the last prehistoric hunters of Europe to produce bone and antler points and tools which have been made available for the study by the exceptional conditions of preservation related to wetlands (David 2003; David in print).

Methodology

The technological study of bone and antler as applied in archaeology is a recent development of the French approach of lithic technology (Julien 1992), which aims at characterising human behaviour on the basis of anthropic records (Leroi-Gourhan 1965; 1968; Inizan et al. 1992). In prehistory, technological study of bone and antler has generally been applied to one particular type of raw material

Fig. 3. Map of northern Europe showing the geographical location of the Early and Middle Mesolithic sites studied by the author. Dotted line: present shoreline and rivers; solid line: hypothetical shoreline during the Ancylus Lake stage (after Childe 1931 and Coles 1998). A Ageröd I: A-H-C, South Sweden; B Birsmatten-Basisgrotte, Switzerland; D Duvensee, Germany; F Friesack 4, Germany; H Hohen Viecheln, Germany; K Bedburg-Königshoven, Germany; L Lundby Holmen II, Denmark; M Mullerup 1, Denmark; N Noyen-sur-Seine, France; O Ogens, Switzerland; Ø Barmose, Denmark; S Star Carr, United Kingdom; U Ulkestrup Lyng Øst I, Denmark; V Verup-a, Denmark; Z Zamostje II-1991, Russia; Zv Zvejnieki, Latvia.

Joon 3. Autori uuritud vara- ja keskmesoliitiliste asulakohtade paiknemine Põhja-Euroopas. Katkendjoon näitab praegust rannajoont ja jõgesid, pidev joon märgib hüpoteetilist rannajoont Antsülusjärve ajal (Childe 1931 ja Coles 1998 järgi). A Ageröd I: A-H-C, Lõuna-Rootsi; B Birsmatten-Basisgrotte, Šveits; D Duvensee, Saksamaa; F Friesack 4, Saksamaa; H Hohen Viecheln, Saksamaa; K Bedburg-Königshoven, Saksamaa; L Lundby Holmen II, Taani; M Mullerup 1, Taani; N Noyen-sur-Seine, Prantsusmaa; O Ogens, Šveits; Ø Barmose, Taani; S Star Carr, Inglismaa; U Ulkestrup Lyng Øst I, Taani; V Verup-a, Taani; Z Zamostje II-1991, Venemaa; Zv Zvejnieki, Läti.

(antler), or to a single type of tool (spearheads, for example). It seemed essential to extend the study, first, to all kinds of bone and antler type of blanks and, second, to assemblages of tools obtained precisely from secure and well dated archaeological contexts. Thus, the approach has been developed in order to get a global understanding of bone and antler production, which permits to emphasise the recurrent factors that enable the researcher to characterise an industry in time and space (David, monograph, in print).

In the sense intended here, technological study of bone and antler thus necessitates an interactive combination of the typological, anatomical and technical analyses for each archaeological assemblage (Fig. 4). Thus, it cannot be limited

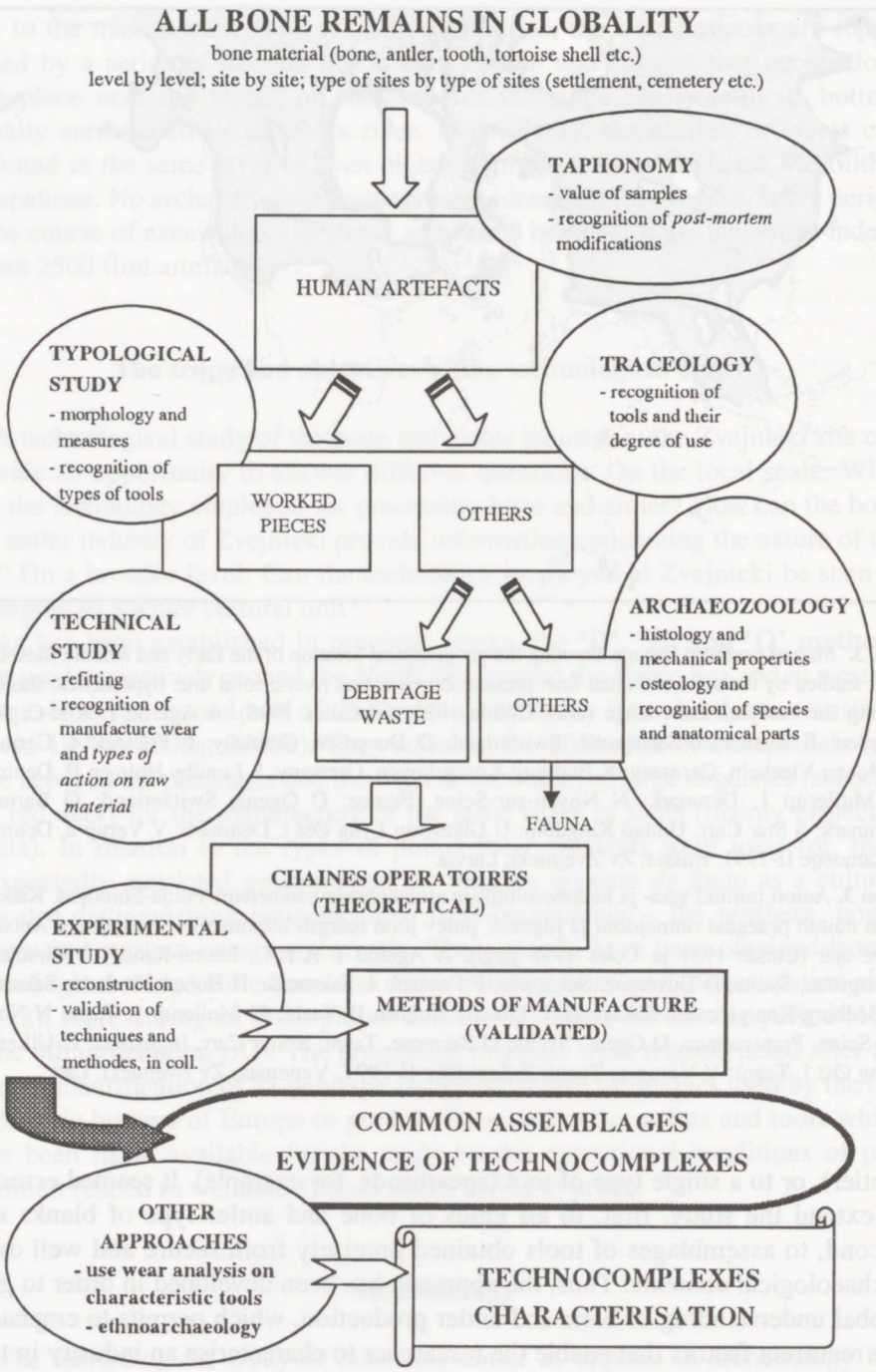

Fig. 4. Methodology. Bone and antler technology as a global approach applied to hard organic archaeological remains.

Joon 4. Metodoloogia. Luu- ja sarvesemete töötlemise tehnoloogia analüüs rakendatuna kogu orgaanilist päritolu kõvale arheoloogilisele materjalile.

solely to the study of the techniques which, being concerned with descriptions of traces, enables a typology of techniques, but it also includes other archaeological approaches such as taphonomy and archaeozoology. These last mentioned approaches enable us to recognise anthropic patterns on bone and antler and to evaluate the degree of transformation of the sample for the final reconstruction of the *chaînes opératoires* of manufacture and, further, for the evaluation of the importance of the bone and antler industry in the "technical system" of prehistoric hunters (Leroi-Gourhan 1945).

While the lithic technology requires geological knowledge, the bone and antler technology requires also that of other approaches referring to bone and antler, and even more than for lithic, since this raw material is, at first, organic and fragile. In becoming fossilised through the loss of collagen, bone and antler, after having been used, undergo some taphonomical modifications, which can be very important as their determination permits us to estimate the value of the archaeological sample. It is equally necessary to integrate into the study all archaeozoological results pertaining to hunting strategies, mode of exploitation and type of preferred game, in order to establish the range of possibilities and the choice of techniques applied by prehistoric populations.

Thus, the study begins with a separation of the osseous remains into two groups: the pieces of anthropic origin, i.e. pieces intentionally transformed by human action, and those showing other modifications (bone altered by chemical, mechanical and other factors). Unfortunately, it is common practice to separate, either during excavation or in the course of processing, worked pieces from general faunal remains. So, the study necessitates a review of the whole assemblage of excavated osseous material. This is done in order to eliminate, right from the start, numerous pieces that, prior to the study, have been wrongly identified as tools, and *vice versa.*

Secondly, the pieces of anthropic origin are divided into two groups: manufactured items (implements) and the rest. The implements are subjected to a typological study aimed at establishing the morphometrical and technical characteristics of all pieces belonging to tools, weapons and objects. In the rest of the material, the waste products (debitage) are then separated from food remains and other bone and antler material (non-archaeological deposits and intrusive animals/pieces). Pieces originating from fracturing connected with culinary activity, for example, but secondarily modified with the intention of using them are also considered relevant to the production of an industry.

Such sorting requires, on the one hand, a thorough acquaintance with the structure (histology) and mechanical properties of bone and antler, as well as with their morphology in its natural state (osteology). On the other hand, this implies some ability to recognise traces left by "action on the material" (Leroi-Gourhan 1943). In addition to a macroscopic (and sometimes also microscopic) analysis of the archaeological sample, this cannot be obtained without a corpus of reference (tools and techniques) elaborated through experimental work.

The manufacturing techniques can be then brought to light, conceptualised in the form of *chaînes opératoires* as a logical train of "sequences" of action on

the material beginning with the natural bone and ending with the finished tool (separately, a "cinematic" view inside each sequence can be developed, Semenov 1964). This way, the methods – as a succession of techniques linked together – that have been systematically applied by prehistoric hunters to process bone into specified implement(s) can be reconstructed, with respect to blanks made on different anatomical parts and using different species. Subsequently, the methods of manufacture are validated through experimental study (David 1999b).

One of the objectives of technological study is, through the identification of methods, to recognise technical traditions revealed in the form of "techno-complexes", which are, according to the original definition by D. L. Clarke (1968), "group[s] of cultures characterized by assemblages sharing a polythetic range but differing [in] specific types of the same general families of artefact-types, shared as a widely diffused and interlinked response to common factors in environment, economy and technology" (David 1999b, p. 357).

With regard to the Early Mesolithic of northern Europe (Preboreal and Boreal chronozones) it has been possible to demonstrate through technological study of bone and antler productions that the manufacturing methods have a cultural value (rather than chronological), because their spatial distribution has revealed distinct geographical areas around the 9th millennium BC (David 2003). The factors determining this distribution in technocomplexes (different from that proposed by Kozlowski et al., 1977) have not been identified yet, which suggests, on the one hand, that some additional approaches should be integrated into the study in order to characterise these entities. On the other hand, the analysis should be extended to other regions, notably those of the north-eastern technocomplex, where the criteria for cultural identification remain to be determined more precisely. Zvejnieki is the only site in Latvia that provides, for the late prehistoric bone industry, a well documented stratigraphic context with a firmly established chronology (Zagorskis 1987) and it has accordingly been included in the study.

Choice of assemblage and its composition

The assemblage derives from the archaeological layers of the Zvejnieki II settlement site, which belongs to the Preboreal and Boreal corresponding to the Early Mesolithic (based on relative chronology and faunal analysis, see Zagorska & Zagorskis 1989). For comparison, the grave inventory from the Zvejnieki cemetery, dated by radiocarbon to the Middle Mesolithic (Zagorska 1997), has also been examined. The material from the end of the Mesolithic (Atlantic chronozone) of these two contexts still remains to be studied.

As regards the horizon in the settlement site dated to the Preboreal, selected for study were the excavated areas I, VI, IX and XIII, because these lie at the summit of the morainic ridge (see Fig. 2, squares -e to b). These sectors cover a total area of 160 m^2 and represent, on the bottom of the archaeological sequence, at least one archaeological layer that is quite straight, extensive, rich and little disturbed.

The chosen bone material from the horizon dated to the Boreal comes from areas VII, X and XI, covering 142 m^2, which are lying slightly downhill from the summit of the ridge that has probably been eroded just after these occupations. This material probably corresponds to several successive phases of occupation, represented by several archaeological oblique layers in the form of palimpsests. Accordingly, the material has been studied as a single assemblage, excluding the peripheral areas that do not lie on the axis of the natural slope, in order to avoid material mixed with the other latest layers, which means excluding about half of the material from the original corpus. Thus, 174 pieces were excluded after checking their horizontal and stratigraphic distribution.

The studied bone and antler remains coming from the above-mentioned sectors of the site comprise 501 items of which only 327 artefacts are relevant to the industry (Table 1). Certain pieces that prior to the study had been attributed to the layers in question in view of their stratigraphic position, but in a "fresher" state (absence of patina, porous and very light-coloured material) were, as a precaution, considered to be intrusive and were accordingly excluded from the study. The industry is in the form of tools (whole or fragmented) and debitage waste that show use wear, but no sign of post-depositional patterns. The sample is in an excellent state of preservation, light to dark brown in colour, with a kind of patina (probably related to restoration). Most of these observations indicate that the sample is homogeneous and has been covered quite rapidly in the two horizons, and then preserved in an anaerobic environment on (Preboreal) and around (Boreal) the summit of the morainic ridge. Accordingly, the general character reveals that, on the one hand, the osseous implements have been made and used locally, and on the other hand, the sample comes from a refuse area or discard locations away from the zones of passage or living structures proper. These considerations enable a comparison between the material from Zvejnieki and that obtained from contemporaneous European sites where similar observations have been made.

The faunal remains were unfortunately destroyed after having been studied, in the 1980s. Data on the representation of anatomical parts and on the mode of utilization of the meaty parts are thus unavailable. In view of the absence of faunal remains technological study of the material was not possible in its entirety

Table 1. Zvejnieki II, composition of the whole bone and antler corpus from the Mesolithic horizons (in terms of number of finds)

Tabel 1. Zvejnieki II, luu- ja sarvleidude arvuline jaotus mesoliitilises kihis

Types of items	Preboreal	Boreal	Total
Implements	109	146	255
Waste products	39	33	72
Fauna	119	55	174
Total (No. of finds)	267	234	501

(see Methodology). The palaeozoological study conducted indicates that out of the 7981 faunal remains an overwhelming majority (91.7%) were of elk in the Preboreal (Early Mesolithic). Elk remains are also well represented, being twice as numerous as wild boar remains, in the Boreal (Middle Mesolithic). During this period, dog and beaver are well represented among the smaller mammals (Zagorska 1992, p. 114, Table 1). The absence of red deer, aurochs, horse, badger and dog, and the rarity of roe deer among the faunal remains dated to the Preboreal indicates that the study has not taken into consideration worked bones, because all these animals are represented in the industry. The significance of artefacts produced on bones of species that are not consumed (not represented in the fauna) will be the subject of a separate discussion in a forthcoming monograph on the site. Worthy of note is the presence of horse, a species quite rare in northern Europe in the Early Mesolithic (Degerbøl 1964) and, apart from elk, the poor representation of forest species utilized for toolmaking in the Preboreal, as compared with contemporaneous Scandinavian sites (David 1999a). The presence of domestic dog at Zvejnieki is in accord with the identification of this species on contemporaneous sites, as in Estonia (Lõugas 1997, p. 283 and ongoing research).

Implements

The implements, represented by tools, weapons and objects, include 255 pieces, 109 of which belong to the Preboreal horizon and 146 to the Boreal one (see David, monograph, in print, for definitions of the typological classes and tool types mentioned in the text).

The implements from the layers dated to the Boreal, as compared to those of the Preboreal, include a significant number of pointed pieces (*pièces appointées*) made of metapodials and other bones of large ungulates (aurochs, elk), as well as a smaller percentage of edged tools (*outils biseautés*), (Fig. 5). The other typological classes are represented in similar proportions for both periods: cutting tools (*outils tranchants*), tools with sleeves (*outils à douille*), rounded tip tools (*outils mousses*), flat surface tools (*outils plans*) and objects. In addition, Mesolithic assemblages always include a high proportion of typologically indeterminate pieces.

Tool function is not readily apparent from the archaeological material, since soft and fibrous tissues are not preserved. A comparison of archaeological points with those known from ethnographic sources has suggested to I. Zagorska (1983) that the projectile points were mostly hafted in the manner of equipment and weapons for fishing and hunting. However, a use-wear analysis on the bone and antler pieces, as well as experimental work, have not been undertaken yet.

As on contemporaneous European sites, the pointed pieces are bodkins and a great majority of projectile points with a basis that indicates a simple binding to the shaft. These armatures are represented by identical types in the two horizons, which suggests a cultural continuity between them (Fig. 6).

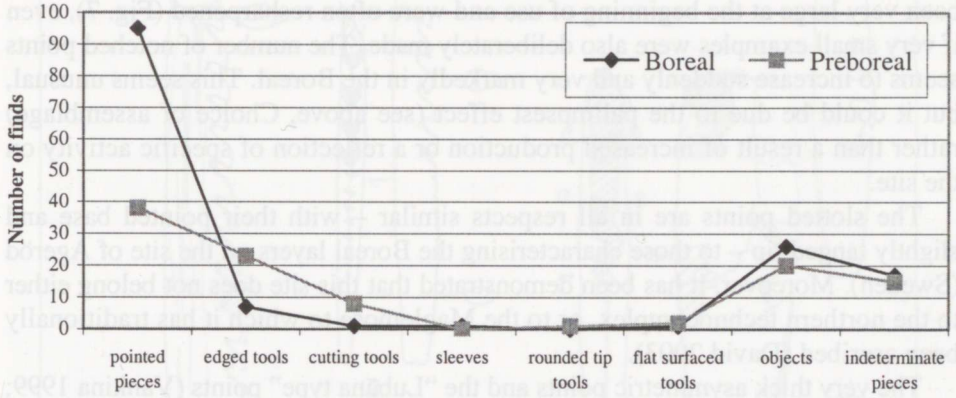

Fig. 5. Zvejnieki II, occurrence of the implements (tools, weapons and objects, as well as indeterminates) in the Mesolithic horizons (in terms of number of finds).

Joon 5. Zvejnieki II, luu- ja sarvriistade esinemus (tööriistad, relvad, objektid ja määramata leiud) mesoliitilises kihis.

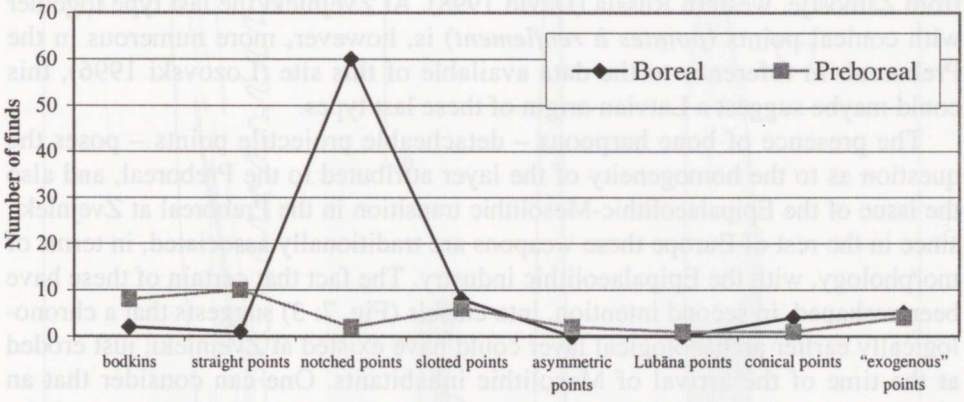

Fig. 6. Zvejnieki II, occurrence of projectile points with fixed hafting in the Mesolithic horizons (in terms of number of finds).

Joon 6. Zvejnieki II, viskoda otsikute esinemus mesoliitilises kihis.

While bodkins and straight points are the most frequent types on the site and the most common in the Mesolithic, it is the notched points that generally represent one of the criteria for identification of the early phases of the northern technocomplex (David 1999a). At Zvejnieki II a late tendency is observed, with attributes that are, however, identical in terms of morphology, spacing, layout and the technique of manufacture of the notches. Made on elk metapodials, the

dimensions of certain notched points indicate that these armatures would have been very large at the beginning of use and were often resharpened (Fig. 7), even if very small examples were also deliberately made. The number of notched points seems to increase suddenly and very markedly in the Boreal. This seems unusual, but it could be due to the palimpsest effect (see above, Choice of assemblage) rather than a result of increased production or a reflection of specific activity on the site.

The slotted points are in all respects similar – with their pointed base and slightly tanged tip – to those characterising the Boreal layers on the site of Ageröd (Sweden). Moreover, it has been demonstrated that this site does not belong either to the northern technocomplex, or to the Maglemose to which it has traditionally been ascribed (David 2003).

The very thick asymmetric points and the "Lubāna type" points (Vankina 1999; see location on Fig. 1) might represent regional manufactures from the Boreal onwards, since no parallels have been identified at the present state of research.

Grouped under the name "exogenous points" are all such types of armatures that never represent the same periods in northern and western Europe. Those include straight points with a stem showing a rhombic section (*pointes droites à section losangique*), winged points (*pointes à ailerons*) and tapered points (*pointes effilées*). In fact, they have more frequent parallels in contemporaneous material from Zamostje, western Russia (David 1998). At Zvejnieki the last type together with conical points (*pointes à renflement*) is, however, more numerous in the Preboreal. In reference to the data available of this site (Lozovski 1996), this could maybe suggest a Latvian origin of these last types.

The presence of bone harpoons – detacheable projectile points – poses the question as to the homogeneity of the layer attributed to the Preboreal, and also the issue of the Epipalaeolithic-Mesolithic transition in the Preboreal at Zvejnieki, since in the rest of Europe these weapons are traditionally associated, in terms of morphology, with the Epipalaeolithic industry. The fact that certain of these have been reshaped, in second intention, into chisels (Fig. 7: 3) suggests that a chronologically earlier archaeological layer could have existed at Zvejnieki, just eroded at the time of the arrival of Mesolithic inhabitants. One can consider that an absence of sedimentation between the expected Epipaleolithic layer and the Mesolithic one would have altered the mechanical properties of the bone left by the first inhabitants of the site and would thereby have hindered secondary working by the second wave of inhabitants unless there was continuous permafrost which has not been demonstrated, however, for that chronological stage. Thus, the Mesolithic population could indeed have used some tools from the stripped Epipalaeolithic layer (possibly even excavated by themselves), either by modifying them (harpoons into chisels), or again by integrating them directly (re-utilization of Epipalaeolithic harpoons in the Early Mesolithic), or again by re-appropriating them into their own technological system (production of harpoons of the Epipalaeolithic type manufactured with a Mesolithic technology). The hypothesis of the presence of a chronologically earlier archaeological layer, some vestiges of

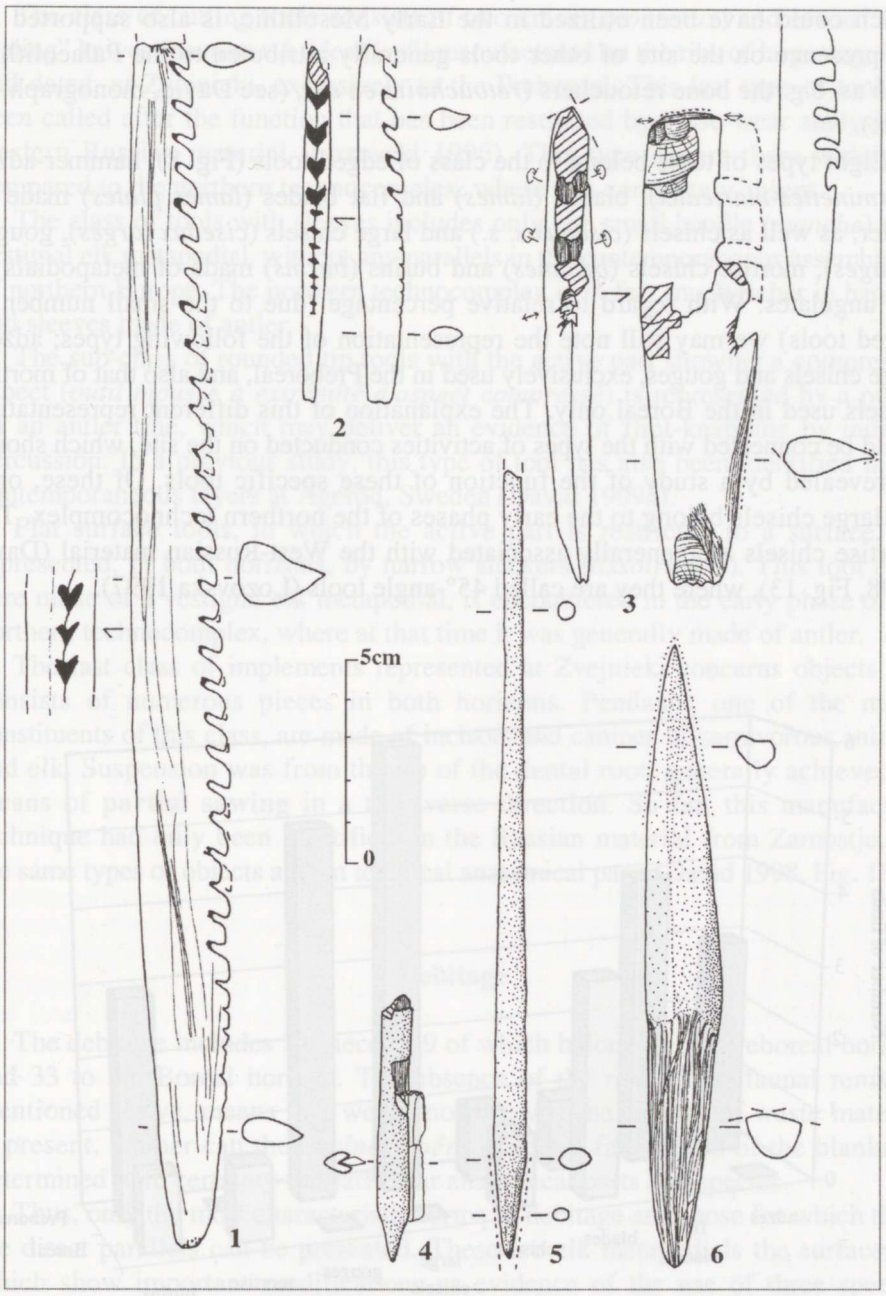

Fig. 7. Zvejnieki II, tools manufactured on long bones of large ungulates. 1 & 2 notched points (fragments), 3 harpoon reshaped, in second intention, into a chisel, 4 slotted point (fragment), 5 tapered point (fragment), 6 asymmetric point. Drawings by Eva David.

Joon 7. Zvejnieki II, suurimetajate pikkadest luudest valmistatud tööriistad. 1, 2 hambulised otsikud (katked), 3 talvaks ümber tehtud harpuuniots, 4 uurdega otsik (katke), 5 teravnev otsik (katke), 6 asümmeetriline otsik (katke). Joonised Eva David.

which could have been utilized in the Early Mesolithic, is also supported by the presence on the site of other tools generally attributed to the Palaeolithic, such as, e.g. the bone retouchers (*retouchoirs en os*), (see David, monograph, in print).

Eight types of tools belong to the class of edged tools (Fig. 8): hammer-adzes (*herminettes-marteaux*), blades (*lames*) and flat blades (*lames plates*) made of antler, as well as chisels (*ciseaux s. s.*) and large chisels (*ciseaux larges*), gouges (*gouges*), mortise chisels (*bédanes*) and burins (*burins*) made of metapodials of big ungulates. With regard to relative percentage (due to the small number of edged tools) we may still note the representation of the following types; adzes, large chisels and gouges, exclusively used in the Preboreal, and also that of mortise chisels used in the Boreal only. The explanation of this different representation could be connected with the types of activities conducted on the site, which should be revealed by a study of the function of these specific tools. Of these, only the large chisels belong to the early phases of the northern technocomplex. The mortise chisels are generally associated with the West-Russian material (David 1998, Fig. 13), where they are called 45°-angle tools (Lozovska 1997).

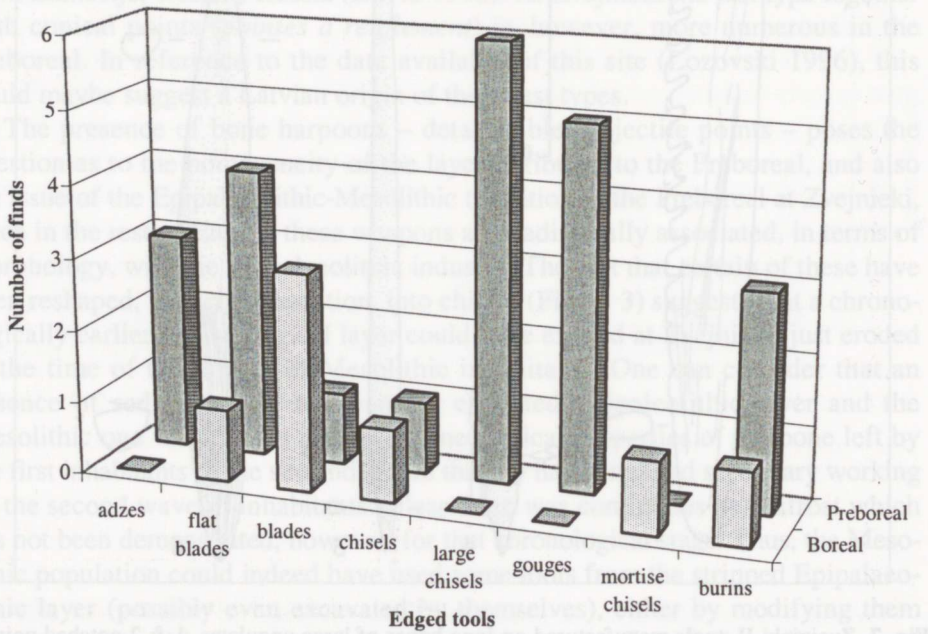

Fig. 8. Zvejnieki II, occurrence of edged tools in the Mesolithic horizons (in terms of number of finds).

Joon 8. Zvejnieki II, lõiketeraga tööriistade esinemus mesoliitilises kihis.

The class of cutting tools consists of two knives (*couteaux*) and seven "fish-scaling" knives (*couteaux à "écailler")* manufactured on the ribs of large ungulates and dated, at Zvejnieki, exclusively to the Preboreal. This last type of tool has been called after the function that has been restituted by a use-wear analysis on western Russian material (Lozovski 1996). This type occurs there widely as compared to the northern technocomplex, where it is completely absent.

The class of tools with sleeves includes only one small handle (*manche*) on a vestigial elk metapodial, without any parallels in the contemporaneous assemblages of northern Europe. The northern technocomplex is in fact much richer in handles and sleeves made of antler.

The sub-class of rounded tip tools with the active part showing a compressed aspect (*outil mousse à extrémité d'aspect compressé*) is represented by a punch on an antler tine, which may deliver an evidence of flint-knapping by indirect percussion. In a previous study, this type of tool has also been identified in the contemporaneous layers at Ageröd, Sweden (David 1999a).

Flat surface tools, in which the active part is restricted to a surface, are represented, in both horizons, by narrow sleekers (*lissoirs fins*). This tool type, here made of a vestigial elk metapodial, is encountered in the early phase of the northern technocomplex, where at that time it was generally made of antler.

The last class of implements represented at Zvejnieki concerns objects and consists of numerous pieces in both horizons. Pendants, one of the major constituents of this class, are made of incisors and canines of carnivorous animals and elk. Suspension was from the tip of the dental root, generally achieved by means of **partial sawing** in a transverse direction. So far, this manufacture technique had only been identified on the Russian material from Zamostje, for the same types of objects and on identical anatomical parts (David 1998, Fig. 18).

Debitage

The debitage includes 72 pieces, 39 of which belong to the Preboreal horizon and 33 to the Boreal horizon. The absence of the rest of the faunal remains, mentioned above, means that we do not know if the totality of waste material is present, neither can the *chaînes opératoires* for fabrication of the blanks be determined with certainty for particular anatomical parts and species.

Thus, only the most characteristic forms of debitage and those for which there are direct parallels can be presented. These are elk metapodials the surfaces of which show important modifications as evidence of the use of three specific fracturing techniques: **wedge-splinter** (*coin-éclat*), **shaft-wedge-splinter** (*coin-éclat-fente*) **and counterblow retouch** (*retouche par contrecoup*), (Fig. 9).

The technique of **wedge-splinter** leaves the negatives of removals very clearly visible on the exterior and proximal surfaces of metapodials (Fig. 10). This is an indirect percussion technique that permits a calibration (standard size) of the blanks by removing flakes from the proximal articular surface of the bone being

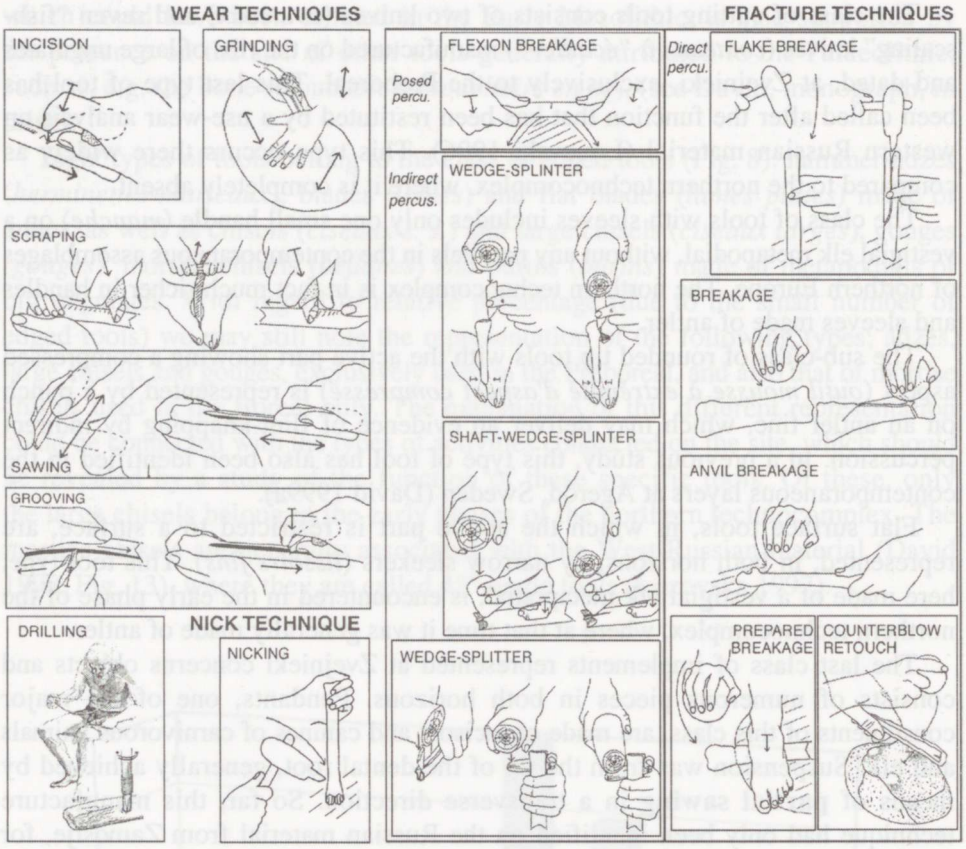

Fig. 9. Zvejnieki cemetery and Mesolithic settlement, 6 wear, 1 nick and 9 fracturing techniques identified with direct retouch (not shown here because it is a technique for processing not bone and antler, but flint tools) on the manufactured items and the wasters of debitage (16 techniques in all).

Joon 9. Zvejnieki kalmistu ja mesoliitiline asulakoht, 6 lihvimis-, 1 täkke- ja 9 lõhestustehnikat, mis on töödeldud esemetel ja jääkidel kindlaks tehtud otsese retuši kaudu (pole siin näidatud, kuna seda tehnikat ei kasutata tavaliselt luude ja sarvede töötlemisel, vaid tulekivist riistade juures) (kokku 16 tehnikat).

used as a striking platform. These very light flakes, which take off part of the anatomic articulation, occur very sparsely in the material. This might indicate selection after excavation, or else that such bone knapping took place outside the excavated area, or even that the archaeological assemblage has been subject to low post-depositional displacement (secondary deposit) affecting only the lightest pieces. Recovery of these flakes in the course of excavation would have thus provided important information on the deposition conditions of the archaeological material, and also on their possible use in the industry.

The **shaft-wedge-splinter** technique has been used to split elk limb bones longitudinally. It allows rectilinear blanks to be obtained, showing numerous negatives of removals along the edges testifying to indirect percussion (Fig. 11).

Fig. 10. Zvejnieki II, negatives of flake removals visible on the proximal part of an archaeological blank, produced by the wedge-splinter technique (external face of an elk metapodial). Scale in centimetres. Photos by Eva David.

Joon 10. Zvejnieki II, killu eemalduskoha negatiivpind arheoloogilise pooltoote proksimaalses osas, tehtud kiil-kild-tehnikas (põdra põialuu väliskülg). Skaala sentimeetrites. Fotod Eva David.

Fig. 11. Zvejnieki II, negatives of flake removals visible on the margins of a blank produced by the shaft-wedge-splinter and counterblow retouch techniques (internal face of an elk metapodial). Scale in centimetres.

Joon 11. Zvejnieki II, killu ja laastukeste eemalduskoha negatiivpind pooltoote serval, tehtud mõra-kiil-kild- ja vastulöök-retušš-tehnikas (põdra põialuu sisekülg). Skaala sentimeetrites.

The deep scars obtained while using this technique are transformed into more regular ones through the technique of **counterblow retouch** (see above, Fig. 9). One of the edges of the blank is placed on a convex surface and struck on the opposite edge, which takes off long and thin chips (large and very thin flakes). This action is repeated along both edges until the blank is perfectly rectilinear. Both techniques involve detachment of lateral removals (flakes and chips), in relation to the anatomical direction, certain examples of which have been found in the material.

These three techniques have generally been observed in association with one and the same blank. Their presence and the fact that they have been used to make blanks for projectile points and large edged tools which bear traces of manufacturing by means of such splintering indicate that they belong to the **'Z' Method** (Fig. 12). In fact, this is the only method in all of Europe that makes

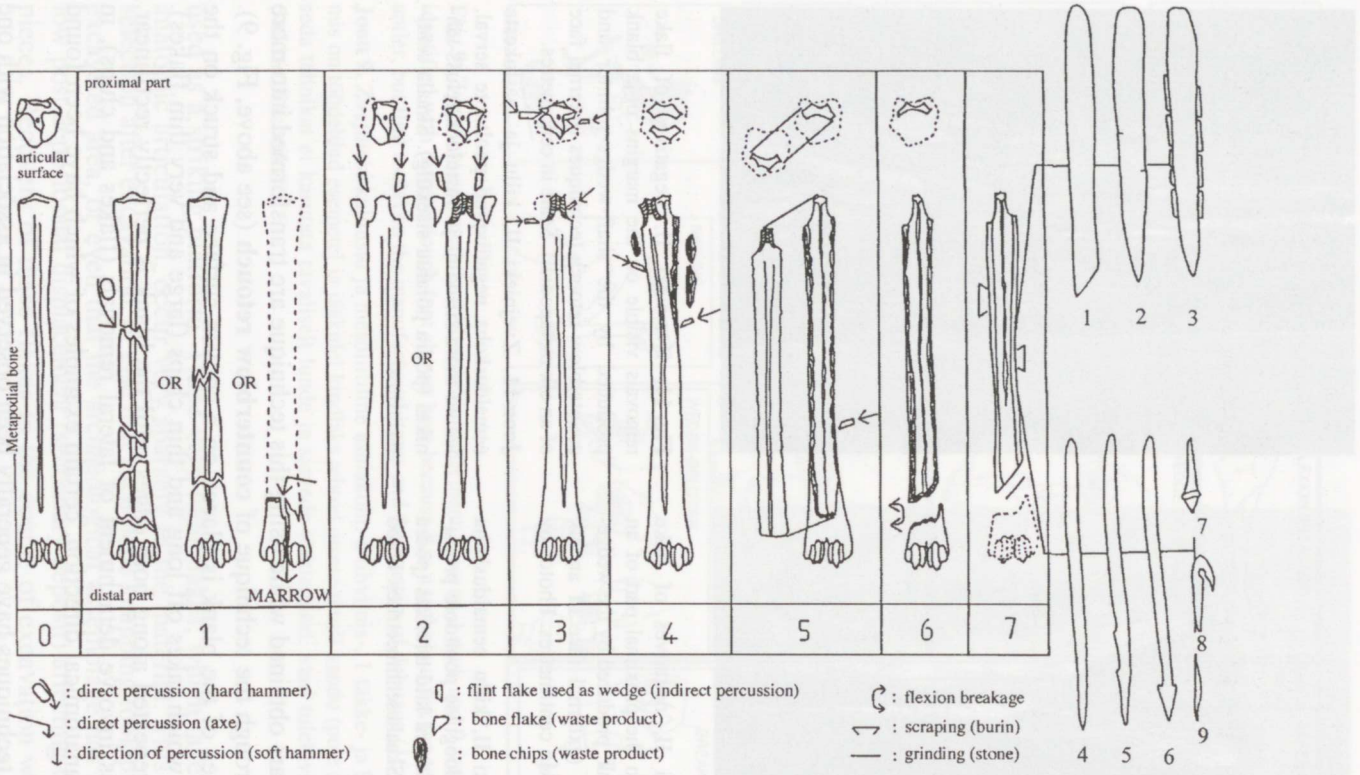

Fig. 12. The 'Z' Method (schematic representation of the sequences of debitage) with its Russian products (right) as used on an elk metapodial in north-eastern Europe (from David 1998, Fig. 20). 1 mortise chisel and gouge, 2 massive point, 3 slotted point, 4 straight point with a triangular tip, 5 barbed point, 6 winged point, 7 conical point, 8 hook, 9 awl.

Joon 12. Skeem põdra põialuu kasutamisest Z-meetodil Kirde-Euroopas (David 1998, joon 20 järgi). 1 talb ja õõnestalb, 2 massiivne otsik, 3 uurdega otsik, 4 kolmnurkse tipuga sirge otsik, 5 kiskudega otsik, 6 tiivuline otsik, 7 kooniline otsik, 8 õngekonks, 9 naaskel.

use of all these techniques in combination, on the same types of blanks (elk metapodials) and for making similar tools. The **'Z' Method** occurs in Russia (Zamostje) and in Sweden (Ageröd). The site of Zvejnieki thus provides another reference for the area of distribution of this method from the Preboreal to the Boreal in northern Europe.

Results and discussion

The study of the bone and antler material from Zvejnieki II reveals a relatively homogeneous assemblage from the early horizon, which belongs to the Preboreal up to the Middle Mesolithic related to the Boreal. Without discussing this chronological attribution, it can be seen that the assemblage of implements, consisting for the most part of projectile points and edged tools, first and foremost shows typological, anatomical and technological resemblances to the assemblage of implements from the early layers at the Swedish site of Ageröd I: A-H-C (layers BL, UT and VL) and from layer 2 at Zamostje II-1991 in Russia, regarded as dating from the Boreal to the Boreal-Atlantic transition.

In effect, the morphology and percentage of slotted points as well as the presence of chisels manufactured by fracturing techniques indicate a relationship in technological traditions between the Ageröd and Zvejnieki II sites. These fracturing techniques are likewise associated with the assemblage of implements from the Russian site of Zamostje, made on the same blanks (David 1998, Fig. 21). The presence of notched points probably reflects the influence of the northern technocomplex, as does the presence of large chisels (David 1999a). The closest similarities are observed in the series of tool types identical to those of the sites of the Early and Middle Mesolithic sites of western Russia (the Oka-Volga Plain): mortise chisels, "fish-scaling" knives, "exogenous points", tapered points and conical points (David 1998, p. 13), not forgetting the technique of **partial sawing** that permits the suspension of pendants made of mammal teeth. Only the narrow sleekers on vestigial metapodials of elk, the flat blades, the burins on fibulas of large ungulates and the gouges seem at present to be specific to the bone production from Zvejnieki II.

These preliminary results allow us to confirm the hypothesis, already advanced in earlier papers, of the presence of a **north-eastern technocomplex** in the Early and Middle Mesolithic, in contrast to the **northern technocomplex** centering around the North Sea and the **Maglemose**, which has been demonstrated to be localised strictly on Zealand (Denmark) during the Boreal (David 2003). A preliminary characterisation of this north-eastern technocomplex rests, in view of the technological study of the bone industry from Zvejnieki II, on the utilization of the **'Z' Method** for manufacturing, in similar percentages as on other sites, projectile points (slotted points, tapered and conical points) and edged tools on elk metapodials. Since such implements, manufactured by this method, have so far been observed only at the sites of Ageröd I: A-H-C (BL, UT, VL) and

Fig. 13. Zvejnieki cemetery (grave 170), pendants of elk, wild boar and aurochs teeth showing their suspension hole which has been manufactured, for each piece, by grinding the face and the extremity of the root and then, drilling the cortical part, followed by both techniques used jointly from the opposite direction.

Joon 13. Zvejnieki kalmistu (matus 170): põdra, metssea ja tarva hammastest ripatsid, millel on näha riputusaugud, mis on tehtud vastaskülgi ja juure osa lihvides ning seejärel puurides.

Zamostje II-1991 this technocomplex may be taken to extend geographically around the Baltic Sea, where it seems to be synchronous with the northern technocomplex. In anticipation of new data from the sites located in Poland and the other countries around Baltic, the latter may accordingly be delimited on its eastern side by an axis from the Öresund to the Oder, or even as far as the Vistula (Guminski, pers. comm.), since the characteristic bone production does not appear at all at Zvejnieki II, except in terms of certain elements (large chisel, notched point) present, then, in its early stage (Star Carr, England, and first horizon of Friesack-4, Germany – David 1999b). By contrast, the contemporaneous implements from the graves of the Zvejnieki cemetery do contribute to the technical characteristics of this northern technocomplex.

In effect, grave 170, which belongs to the Boreal (the only grave with worked bone material from the Mesolithic periods concerned – Zagorska & Lõugas 2000) has provided 177 pendants on mammal teeth (elk, red deer, aurochs, wild boar) for technological study. They reveal an utilization of the **grinding** and then **drilling** techniques used jointly to manufacture the suspension system of the pendants made by reducing/shaping and, thus, perforating the extremity (apex) of the root of labial teeth with opposite holes (Fig. 13). At Zvejnieki these two techniques occur to the exclusion of all others on such blanks and exclusively on pendants from the grave. Apart from the general considerations that this suggests – notably that a majority of these pendants as well as the throwing spear have been manu-

factured precisely for the dead –, these techniques, just like the **partial sawing** on the same blanks and for the same purpose used on the settlement site, have never been observed on pendants on identical blanks in the assemblages of the northern technocomplex (David, monograph, in print). Consequently, they appear as important markers for identifying social behaviour around death and, for our purposes, characterising material cultures of the last prehistoric hunters-gatherers in Europe by providing new insights to distinguish them in terms of technical traditions. This means that in future studies, the Mesolithic grave materials of Europe can be considered as well as those from settlement sites, as far as the archaeological context is secured and well dated.

From the perspective of technological study of the bone industry of Zvejnieki cemetery and Mesolithic settlement site, the utilization of the **'Z' Method** for making projectile points and edged tools, as described, on elk metapodials, as well as the use of **partial sawing** and **grinding-drilling** for the production of pendants, seem to be the major components of the **north-eastern technocomplex** (the so-called "Kunda Civilisation", cf. Kozlowski 1973).

Although additional data are needed on the Early and Middle Mesolithic of other Baltic sites (Pulli, Estonia), the technological study of the bone and antler material from the Zvejnieki sites discussed above, the preliminary results of which indicate some parallels with the Swedish site of Ageröd I: A-H-C (layers BL, UT and VL) and the Russian site of Zamostje II-1991 (layer 2), appears to be relevant to the characterisation of human groups in the Early Post-Glacial of north-eastern Europe.

Acknowledgements

I would like to express my sincere gratitude to all partners and specially to Ilga Zagorska for enabling my study of the Zvejnieki material in excellent conditions. The author is most obliged to the French Ministry of Foreign Affairs (Égide) and the Academy of Sciences for granting this research. Many thanks to Valdis Berzins for the original translation of the present paper, which derives from an article prepared in collaboration with Ilga Zagorska (forthcoming in Latvian, Latvian Journal of Archaeology).

References

Childe, V. G. 1931. The forest cultures of northern Europe. – Journal of the Royal Anthropological Institution, 61, 325–348.

Clarke, D. L. 1968. Analytical Archaeology. London.

Coles, B. J. 1998. Doggerland: A speculative survey. – Proceedings of the Prehistoric Society, 64, 45–81.

David, E. 1998. Étude technologique de l'industrie en matière dures animales du site mésolithique de Zamostje 2 – fouille 1991 – (Russie). – Archéo-Situla, 26 (1996), 5–62.

David, E. 1999a. L'industrie en matières dures animales du Mésolithique ancien et moyen en Europe du Nord: Contribution de l'analyse technologique à la définition du Maglemosien. PhD Dissertation. Nanterre-Paris X University (France).

David, E. 1999b. Approche technologique des industries en matières dures animales du Mésolithique danois d'après le matériel des gisements maglemosiens de Mullerup 1 (Sarauw's island – 1900) et Ulkestrup Lyng II (1946). – L'Europe des derniers chasseurs, Actes du V^{e} Colloque International Épipaléolithique et Mésolithique UISPP Commission XII, Grenoble, 18–23 Septembre 1995. Paris, 167–178.

David, E. 2000a. L'industrie en matières dures animales des sites mésolithiques de la Baume d'Ogens et de Birsmatten-Basisgrotte (Suisse): Résultats de l'étude technologique et comparaisons. – Table ronde épipaléolithique et Mésolithique, Lausanne, 21–23 Novembre 1997. (Cahiers d'Archéologie romande, 81.) Lausanne, 79–101.

David, E. 2000b. L'industrie en matières dures animales du "technocomplexe occidental": techniques et définition préliminaire. – Les derniers chasseurs-cueilleurs d'Europe occidentale (13000–5500 av. J.–C.), Actes du Colloque international de Besançon (Doubs, France), 23–25 Octobre 1998. (Presses Universitaires Franc-Comtoises, Collection Annales Littéraires de l'Université de Franche-Comté 699–2000, Série "Environnement, sociétés et archéologie", 1.) Besançon, 143–150.

David, E. 2003. The contribution of the technological study of bone and antler industry for the definition of the Early Maglemose culture. – Mesolithic on the Move. Papers presented at the 6th International Conference on the Mesolithic in Europe, Stockholm 2000. London, 649–657.

David, E. in print. L'industrie en matières dures animales du Mésolithique ancien et moyen en Europe du Nord: Contribution de l'analyse technologique à la définition du Maglemosien. Monograph.

David, E. in print. The debitage and manufacture techniques on bone and antler used during Early and Middle Mesolithic in northern Europe: Definitions and Experimental works. – Third International Meeting of the Worked Bone Research Group, Augst (Switzerland), 4–9 September 2001. (Internationale Archäologie. Arbeitsgemeinschaft, Symposium, Tagung, Kongress.) Rahden/Westf.

Degerból, M. 1964. Some Remarks on Late- and Postglacial Vertebrate Fauna and its Ecological Relations in Northern Europe. – Jubilee Symposium Supplement March 1964, British Ecological Society Jubilee Symposium. (A supplement to Journal of Ecology, 52 and Journal of Animal Ecology, 33.) Oxford, 71–85.

Inizan, M. L. & Roche, H. & Tixier, J. 1992. Technology of Knapped Stone. Meudon.

Julien, M. 1992. Du fossile directeur à la chaîne opératoire. – La Préhistoire dans le monde. Paris, 163–193.

Kozlowski, S. K. 1973. Introduction to the history of Europe in Early Holocene. – The Mesolithic in Europe. Warsaw, 331–366.

Kozlowski, J. K. & Kozlowski, S. K. 1977. Pointes, sagaies et harpons du Paléolithique et du Mésolithique en Europe du Centre-Est. – Colloques internationaux du C.N.R.S. 568 – Méthodologie appliquée à l'industrie de l'os préhistorique, Abbaye de Sénanque, 9–12 Juin 1976. Sénanque, 205–227.

Leroi-Gourhan, A. 1943. L'homme et la matière. Paris.

Leroi-Gourhan, A. 1945. Milieu et technique. Paris.

Leroi-Gourhan, A. 1965. Le geste et la parole: La mémoire et les rythmes. Paris.

Leroi-Gourhan, A. 1968. Le geste et la parole: Technique et langage. Paris.

Lozovska, O. 1997. On the function of the tools with working angle 45° from the Mesolithic layers of the Zamostje 2 site. – Ancient Zales'e Land: Materials for International Symposium. Sergiev-Posad, 74–86.

Lozovski, V. M. 1996. Zamostje 2. Les derniers chasseurs-pêcheurs préhistoriques de la plaine russe. – Exhibition catalogue "Du fond de l'eau, du fond des âges: chasseurs–pêcheurs préhistoriques de la Russie", Malgré–Tout Museum (Treignes, Belgium).

Lõugas, L. 1997. Post-Glacial Development of Vertebrate Fauna in Estonian Water Bodies. A Palaeozoological Study. (Dissertationes Biologicae Universitatis Tartuensis, 32). Tartu.

Semenov, S. A. 1964. Prehistoric Technology. London.
Vankina, L. 1999. The Collection of Stone Age Bone and Antler Artefacts From Lake Lubāna. (Latvijas Vēstures Muzeja Raksti 4 – Arheoloģija.) Rīga.
Zagorska, I. 1983. The Stone Age Hunting and Fishing Artefacts From the Territory of Latvia. PhD Dissertation, Vilnius University (Lithuania).
Zagorska, I. 1992. The Mesolithic in Latvia. – Acta Archaeologica, 63, 97–117.
Zagorska, I. 1997. The first radiocarbon datings from Zvejnieki Stone Age burial ground, Latvia. – Proceedings of the VIIth Nordic Conference on the Application of Scientific Methods in Archaeology, Savonlinna (Finland), 7–11 September 1996. (Iskos, II.) Helsinki, 42–46.
Zagorska, I. 2000. The Art from Zvejnieki Burial Ground, Latvia. – Acta Academiae Artium Vilnensis, 20, 79–92.
Zagorska, I. & Lõugas, L. 2000. The tooth pendant head-dresses of Zvejnieki cemetery. – De Temporibus antiquissimus ad honorem Lembit Jaanits. (Muinasaja teadus, 8.) Tallinn, 223–245.
Zagorska, I. & Zagorskis, F. 1989. The bone and antler inventory from Zvejnieki II, Latvian SSR. – The Mesolithic in Europe, Third International Symposium. Edinburgh, 414–423.
Zagorskis, F. 1987. Zvejnieku akmens laikmeta kapulauks. Rīga.

Eva David

ZVEJNIEKI (LÄTI) MESOLIITILINE ASULAKOHT EUROOPA KONTEKSTIS: LUU- JA SARVESEMETE VALMISTAMISE TEHNOLOOGILISE UURIMISE ESIALGSEID TULEMUSI

Resümee

Zvejnieki kiviaja asulakohad ja kalmistu asuvad Rūja jõe suudmes Burtnieki järve lähedal Põhja-Lätis (joon 1). Mesoliitiliste kihistustega (joon 2) asulakohta Zvejnieki II uuriti Francis Zagorskise juhtimisel aastatel 1971–1978. Vanim horisont on õietolmuanalüüsi ja esemetüpoloogia järgi dateeritud preboreaalsesse kliimaperioodi (Zagorska 1992, 100).

Zvejnieki luu- ja sarvesemete valmistamise tehnoloogiline uurimine annab võimaluse vastata kolmele küsimusele. Lokaalsel tasandil on oluline, kas nimetatud esemed annavad teadmisi asulakoha iseloomu kohta. Regionaalses perspektiivis on tähtis, missugust tehnoloogiat on kasutatud luu- ja sarvesemete valmistamiseks. Supraregionaalsel tasandil vajab aga selgitamist, millisesse suuremasse kultuuripiirkonda kuulub Zvejnieki tehnoloogiliselt. Hea põhja neile küsimustele vastamiseks annavad autori varasemad uuringud mitmel pool Põhja- ja Läänemere regioonis (David 1999a; 2000a; 2000b; 2003; joon 3).

Zvejniekist on kogutud rikkalik ja hästi säilinud luuaines. Kokku uuriti 501 luu- ja sarvjäänust, millest 327 on artefaktid ja ülejäänud töötlusjälgedeta luufragmendid. Tööriistu on analüüsitud materjali hulgas 255, neist 109 preboreaalse ja 146 boreaalse kronotsooni aegsest kihist. Peamiselt on tegu suurimetajate (ürgveis, põder) põialuudest tehtud otsikute, vähem lõiketeraga tööriistadega (joon. 5). Teistest tüüpidest on esindatud lõikeriistad, muhviga tööriistad, ümardatud otsaga

tööriistad ja muud esemed. Otsikute hulgas on naaskleid, mille ühistüübid mõlemas käsitletavas kultuurkihis osutavad kultuuri kontinuiteedile. Rohkesti esineb hambulisi otsikuid, mis on üks peamisi aluseid nn põhja tehnokompleksi määratlemisel (joon 7). Zvejniekis on need eriti iseloomulikud boreaalsele ajajärgule (joon 6). Muudest esemetest on lõiketeraga raieriistu (kaheksa esemetüüpi; joon 8), nuge, hammasripatseid, üks tulekivi töötlemisel kasutatud sarvest kärn jms.

Töötlemisjäägid osutavad kolme spetsiifilise lõhestustehnika – kiil-kild (joon 10), mõra-kiil-kild ja vastulöök-retušš (joon 11) – kasutamisele, mis seonduvad nn Z-meetodiga (joon 12). Viimase eristas autor Venemaa Zamostje asulakoha luuainese põhjal (David 1998).

Kokkuvõtlikult võib tõdeda, et Zvejnieki kalmistu I ja II asulakoha luu- ja sarvesemetel on head vasted Rootsi Agerödi I: A-H-C ja Venemaa Zamostje II teise kihi materjalis. Z-meetodi kasutamine otsikute ja lõiketeraga tööriistade valmistamiseks suurimetajate põialuudest ning saagimise ja lihvimise-puurimise tehnika kasutamine hammasripatsite tegemisel seob need kirde tehnokompleksiga. Viimane hõlmas Läänemere piirkonda ja oli ajaliselt paralleelne põhja tehnokompleksiga.