New AMS-dates for the Upper Volga Mesolithic and the origin of microblade technology in Europe

Neue AMS-Daten zum Mesolithikum der oberen Wolga und das Aufkommen der Mikroklingentechnik in Europa

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Abstract - In the last 20 years several new peat bog sites have been detected in the Upper Volga area. The article presents a first series of AMS-dates for the Stanovoje 4 site. They assign the early Butovo Culture to the Preboreal and the middle Butovo Culture to the Boreal. In the second part of the article some new evidence for microblade technology and composite tools in the late Palaeolithic/early Butovo Culture is discussed. It is well possible that the introduction of microblade technology and slotted bone tools in the late Boreal/early Atlantic period in the western Baltic was stimulated by contacts to eastern hunter-gatherers.

Zusammenfassung - *In den letzten 20 Jahren wurden im oberen Wolgagebiet zahlreiche neue steinzeitliche Feuchtbodenplätze entdeckt. Der Artikel behandelt eine erste Serie von AMS-Datierungen für den mehrphasigen mesolithischen Fundplatz Stanovoje 4. Die Daten stellen die Schicht der frühen Butovo-Kultur in das Präboreal und die Schicht der mittleren Butovo-Kultur in das Boreal. Stanavoje 4 kann damit als Referenzfundplatz für die frühholozäne Kulturentwicklung im oberen Wolgagebiet gelten. Besondere Aufmerksamkeit verdient das Auftreten von Mikroklingen und Kompositgeräten wie Knochendolchen mit Flinteinsätzen in der frühen Butovo-Kultur, die im Spätpaläolithikum der Region ihre Vorläufer finden. Die Autoren diskutieren die Verbreitung und weitere Entwicklung dieser Innovation. Es ist gut möglich, dass das Aufkommen von Mikroklingen und Flintschneidendolchen im Ostseegebiet im ausgehenden Boreal/frühen Atlantikum auf einen Technologietransfer aus dem östlichen Europa zurückgeht.*

Keywords - Mesolithic, Upper Volga, Butovo Culture, microblade technology, cultural contacts, transfer of technology
Mesolithikum, Obere Wolga, Butovo Kultur, Mikroklingen-Technologie, Kulturkontakt, Technologietransfer

Introduction

Stone age research in the western Baltic has a long tradition and southern Scandinavian sites gave name to Mesolithic entities such as the Maglemose technocomplex. In the past investigations in the area further east were less noticed in western Central Europe. Political and language boundaries hampered the exchange of information. The last years saw increasing interest in the eastern Stone Age and it becomes clear that contacts in the Mesolithic and Neolithic between east and west have been underestimated.

Studies on the Stone Age of the eastern Baltic countries and northwestern Russia were mainly focused on important cemeteries such as Zvejnieki in Latvia and Olenii Ostrov in Russia (for example Larsson & Zagorska 2006; Oshibkina 2008). At the same time the research potential of peat bog sites was less noticed as was shown also for the Transural region (Savchenko 2003). In the 1980s M. Zhilin initiated surveys in the Upper Volga and Oka interfluve and discovered c. 50 new peatbog sites with favourable preservation conditions for organic materials (Fig. 1). The bogs developed in former glacial lakes, which were linked with the Upper Volga through the tributaries along its right bank. In the subsequent period large scale excavations were conducted at some of the locations (Fig. 1). Here we present first results of a project on systematic radiocarbon dating (AMS) of the Upper Volga Stone Age with a focus on the site Stanovoje 4.

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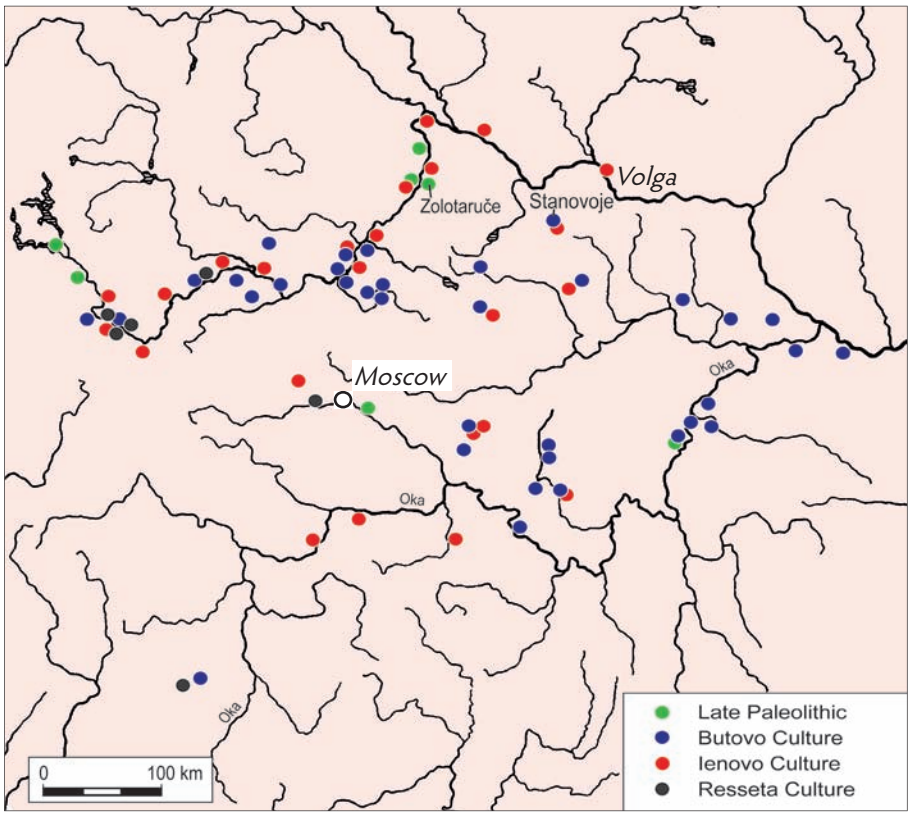

Fig. 1. Late Palaeolithic and Mesolithic sites in the Upper Volga area.
Abb. 1. *Spätpaläolithische und mesolithische Fundstellen im Gebiet der Oberen Wolga.*

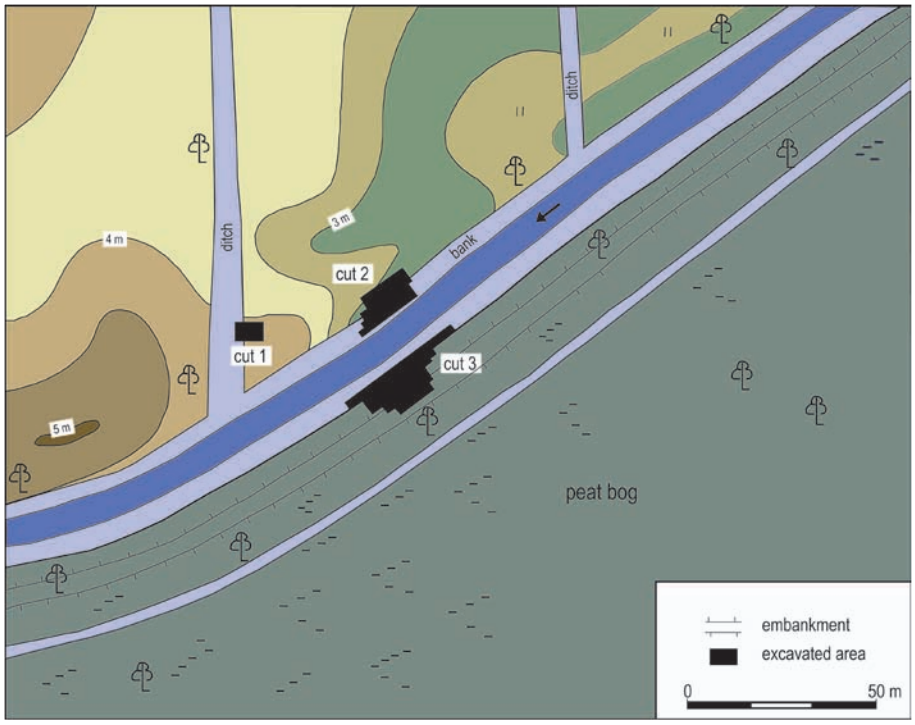

Fig. 2. Stanovoje 4. Plan of the excavated units.
Abb. 2. *Stanovoje 4. Plan der ausgegrabenen Flächen.*

From the Late Palaeolithic to the early Mesolithic - general remarks

The final phase of the Late Palaeolithic and the Mesolithic of the Upper Volga area is defined by three cultural entities. The Ienevo Culture is distributed in the western and central part of the Volga-Oka-region and is characterised by tanged points – including examples similar to Lyngby points – indicating contacts to the Ahrensburgian tradition. Trapezes and an elaborated macro and micro blade technique represent further typical elements (Žilin 2006). The site Zolotoruče 1 on Upper Volga represents the other, probably local tradition without tanged points but with regular microblades used as inserts for composite projectile heads (Žilin 2006; Zhilin 2007). During the early Holocene the Resseta Culture existed mostly in the western part of the Upper Volga Region and displays a similar flint inventory, but with different types of points. However, this technocomplex is as yet poorly studied (Žilin 2006). At the transition to the Holocene the Butovo Culture started and existed until the early Atlantic period. The (late) Butovo Culture developed parallel to the Kunda Culture of the eastern Baltic (Šturms 1970, 28 pp.; Jaanits & Jaanits 1978; Rimantiené 1995, 59 pp.; Žilin 2006). In the Atlantic period the appearance of pottery defines the start of the Upper Volga Culture of the "Forest Neolithic", but no use of domesticated animals or cereals is related to this period.

Results of pollen analyses and conventional radiocarbon dates – mostly obtained on sites of the Butovo Culture – provide a general outline of the Mesolithic chronology in the forest zone of Eastern Europe (Zaretskaya et al. 2005). Studies of Upper Volga peat bog sites contributed to a much better understanding of the Stone Age development and hunter-gatherer economy of this particular region. One of the most important peat bog sites is Stanovoje 4 (Komsomolsk district, Ivanovo region) located on a gentle slope on a promontory at the outflow of the river Lahost from the Podozerskoye peat bog (Figs. 1 & 2). From 1993 to 2002 c. 600 sqm of the former lake shore site were excavated on both sides of the modern river in trenches of c. 140 sqm and c. 460 sqm. In the deeper parts of the excavation a complex stratigraphy was documented and the excavation trenches (in the following: 'cuts' 2 and 3) together provided a sequence of four Mesolithic and one early "Neolithic" layer (Fig. 3).

The upper Stone Age layer of Stanovoje 4 (cut 2, layer II) contained thick walled pottery fragments of the early Forest-Neolithic. As expected the animal bones of this layer reflect a pure hunter-gatherer-fisher economy. The assemblage provides a *terminus ante quem* for the lower cultural layers. Typological analysis assigns the bottom layer to the early Butovo Culture (cut 2 and 3, layer IV) and the overlying layers to the Ienovo Culture (cut 2, layer III) and to the middle Butovo Culture (cut 2 and 3, layer III; Zaretskaya et al. 2005). Because isolated AMS-dates are only available for the Upper Volga Stone Age, the authors started systematic dating of layers and objects aimed at the better identification and timing of characteristic Stone Age elements and innovations such as micro blade technology, polished (slate) axes or pottery production in Central Russia. This paper focuses on AMS-dates for the site Stanovoje 4 and the site Zolotoruče 1 (Fig. 1).

AMS-dates for Stanovoje 4

The early Butovo Culture

The finds of the early Butovo Culture (cut 2 and 3, layer IV) consist of c. 154 stone artefacts and ca. 54 bone and antler tools. The fauna is characterized by dominance of elk and beaver; brown bear, badger,

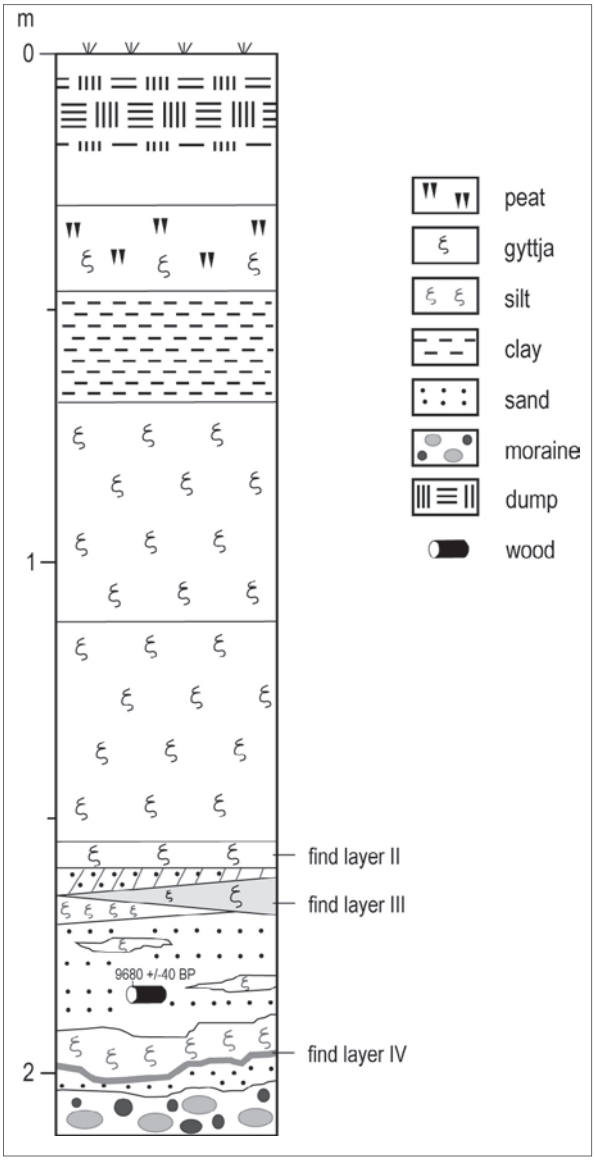

Fig. 3. Stanovoje 4. Stratigraphy of cut 2.
Abb. 3. *Stanovoje 4. Stratigraphie von Schnitt 2.*

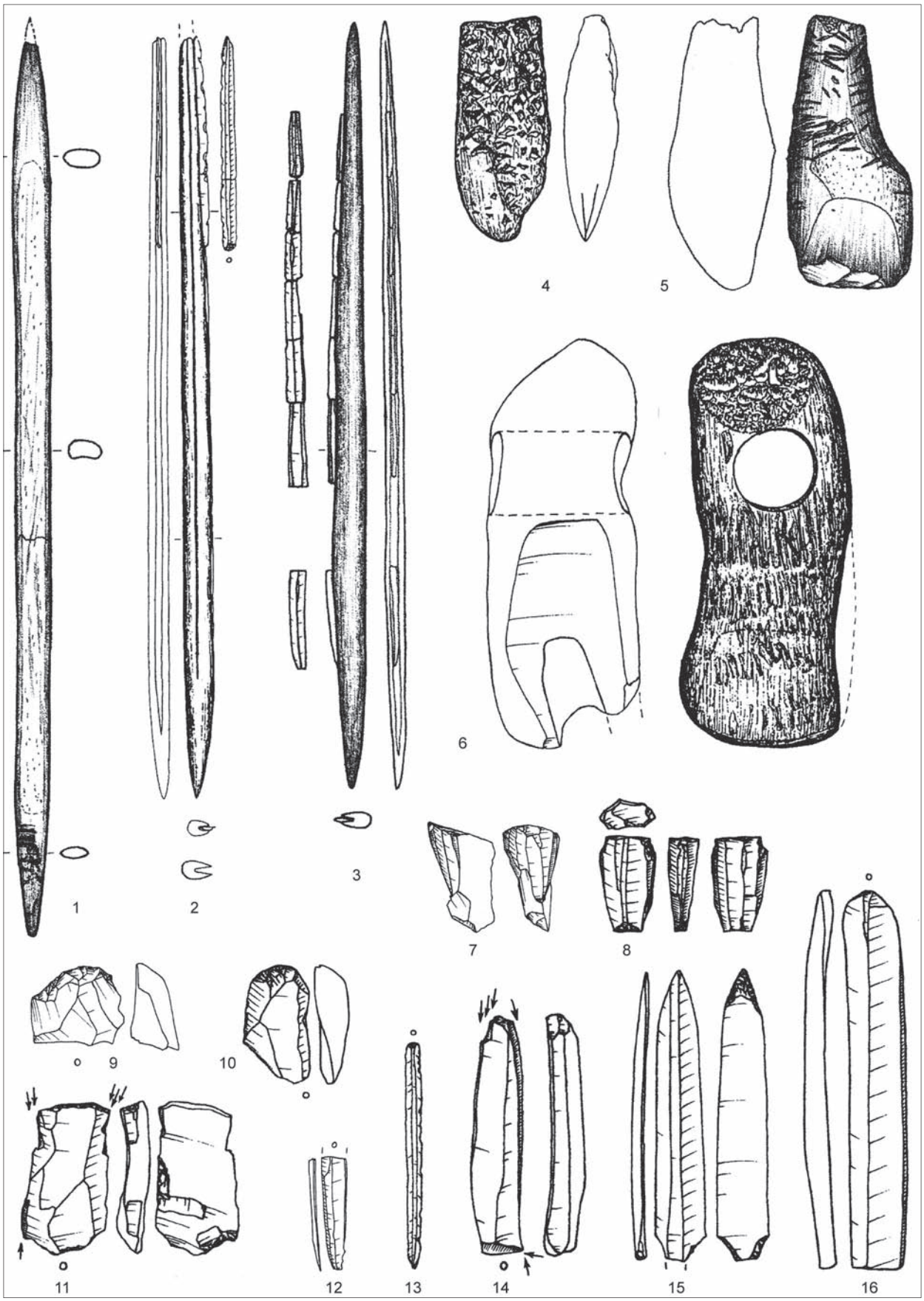

Fig. 4. Stanovoje 4. Selection of typical flint artefacts and bone/antler tools of the Early Butovo Culture. Scale 1-6: 2:3; 7-16: 3:4.
Abb. 4. *Stanovoje 4. Auswahl typischer Steinartefakte und Knochen-/Geweihgeräte der frühen Butovo-Kultur. Maßstab 1-6: 2:3; 7-16: 3:4.*

Fig. 5. Stanovoje 4, early Butovo Culture. Fragments of polished slate axes.
Abb. 5. *Stanovoje 4, frühe Butovo-Kultur. Fragmente geschliffener Schieferbeile.*

hare, pine marten, otter, musk rat and domestic dog are also present, and indicate a taiga forest landscape. The same kind of environment is indicated by pollen analyses with pine and birch trees and substantial presence of periglacial elements.

The stone artefacts were made of poor quality silex material from local sources and only a few imported blade tools exist. The stone tool assemblage

Fig. 6. Stanovoje 4, AMS samples. 1 point of a massive bone dagger (KIA 39316: 9 554 ±43 BP). – 2 elk shoulder blade ("broad knive") with sharpened edges (KIA 35152: 9 879 ±50 BP). –3 elk antler adze blade (KIA 39317: 9 741 ±40 BP). – 4 elk antler socket (KIA 35153: 9 505 ±47 BP). Scale 1, 3-4: 2:3; 2: 1:3.

Abb. 6. *Stanovoje 4, AMS-Proben. 1 Spitze eines massiven Knochendolches (KIA 39316: 9 554 ±43 BP). – 2 Elchschulterblatt ("broad knive") mit angeschärften Kanten (KIA 35152: 9 879 ±50 BP). –3 Beilklinge aus Elchgeweih (KIA 39317: 9 741 ±40 BP). – 4 Gerätefassung aus Elchgeweih (KIA 35153: 9 505 ±47 BP). Maßstab 1, 3-4: 2:3; 2: 1:3.*

Lab-Code	Sample	Material	Associated Tool Type or Feature	Extracted Collagen (mg)	^{14}C-age (BP)	Calibrated age (calBC)	∂^{13}C (‰)
KIA 39314	Zolotoruče 1 lower layer	bone *Bison priscus*	Unmodified (concentration 5)	27.95	10 240±37	10 122-9 885	-20.76
KIA 39315	Zolotoruče 1 lower layer	charcoal	Fire place (concentration 3)	28.82	9 990±62	9 658-9 366	-25.94
KIA 35152	Stanovoje 4 c3, layIV, 173	bone *Alces alces*	Shoulderblade scraper	19.75	9 879±50	9 455-9 249	-22.52
KIA 39317	Stanovoje 4 c2, layIV, square 95	antler *Alces alces*	Antler adze blade	29.74	9 741±40	9 272-9 218	-18,70
KIA 39316	Stanovoje 4 c3, layIV, square 191	bone *Alces alces*	Massive bone dagger	30.44	9 554±43	9 121-8 808	-21.1
KIA 35153	Stanovoje 4 c4, layIV, 302	wood	(handle) antler socket	-	9 505±47	8 930-8 702	-28.82
KIA 35154	Stanovoje 4 c3, layIII, 21	bone *Alces alces*	slotted bone point	28.07	9 413±50	8 811-8 562	-20.99
KIA 35156	Stanovoje 4 c3, layIII, 484	bone *Alces alces*	slotted bone dagger	23.86	9 383±42	8 764-8 557	-19.05
KIA 35157	Stanovoje 4 c3, layIII, 293	Wood	(handle) antler mattock	-	8 860±47	8 223-7 814	-28.23
KIA 35158	Stanovoje 4 ▪ c3, layIII, square 265	bone *Alces alces*	massive bone dagger	30.51	8 799±44	8 005-7 710	-18.87
KIA 35155	Stanovoje 4 c3, layIII, 290	bone *Alces alces*	bone point (Shigir type)	31.59	8 315±48	7 514-7 282	-22.03

Fig. 7. New AMS-dates on the terminal Palaeolithic site of Zolotoruče 1 and Mesolithic bone and antler tools from the Butovo Culture at Stanovoje 4. Radiocarbon dates given in one sigma range. Calibration of radiocarbon dates according to CALIB rev 5.01 (IntCal04, Reimer et al., Radiocarbon 46: 1029-1058).

Abb. 7. *Neue AMS-Daten zum spätpaläolithischen Fundplatz Zolotoruče 1 und zu mesolithischen Knochen- und Geweihgeräte der Butovo Culture des Fundplatzes Stanovoje 4. Radiokarbondaten werden im ein Sigmabereich angegeben. Die Kalibration der Daten erfolgte mit CALIB rev 5.01 (IntCal04, Reimer et al., Radiocarbon 46: 1029-1058).*

is dominated by scrapers and some burins. A 7.5 cm long tanged point deserves special attention. The tang was retouched on the ventral side and is broken, while the tip shows a ventral surface retouch (Fig. 4: 15). The point was manufactured on a long and very regular blade. There are further regular blade fragments and

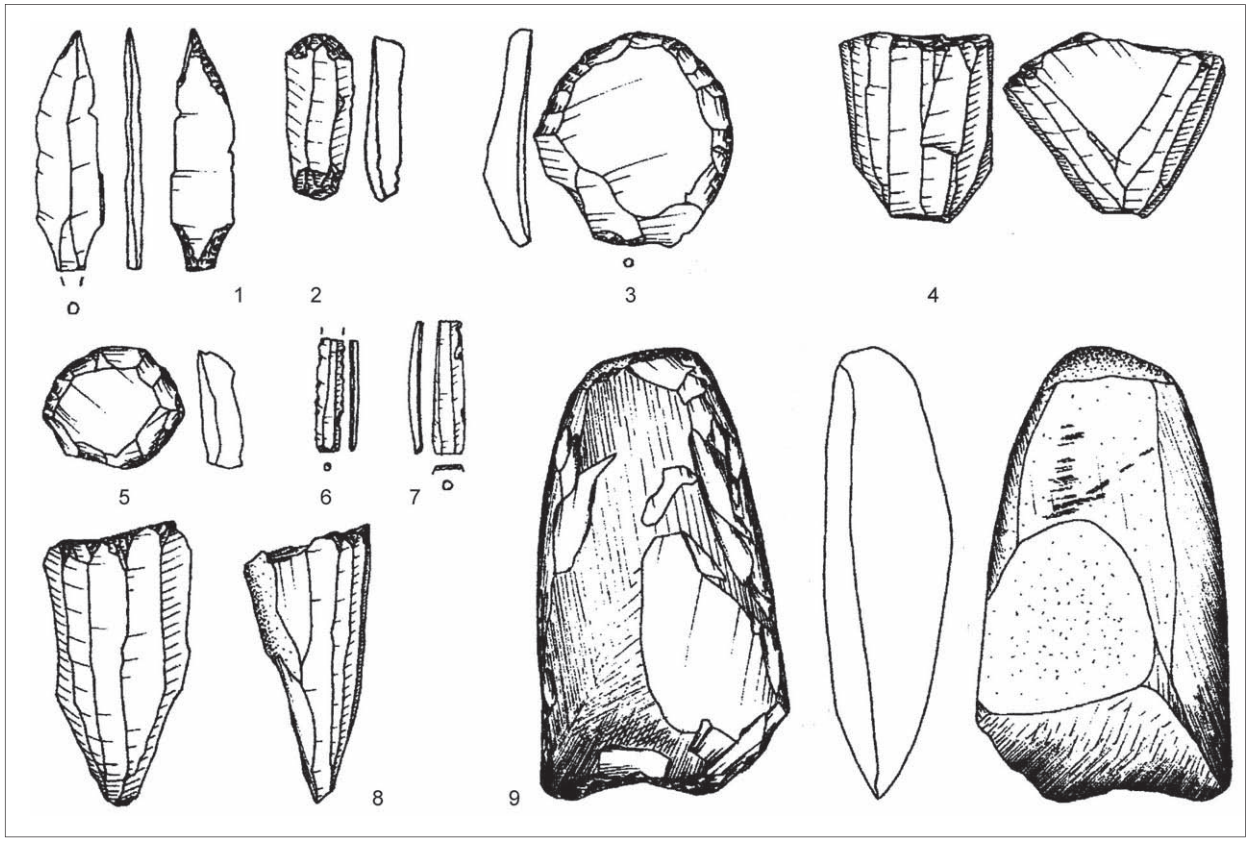

Fig. 8. Stanovoje 4. Typical flint artefacts of the Middle Butovo Culture. Scale 3:4.

Abb. 8. *Stanovoje 4. Typische Steinartefakte der mittleren Butovo-Kultur. Maßstab 3:4.*

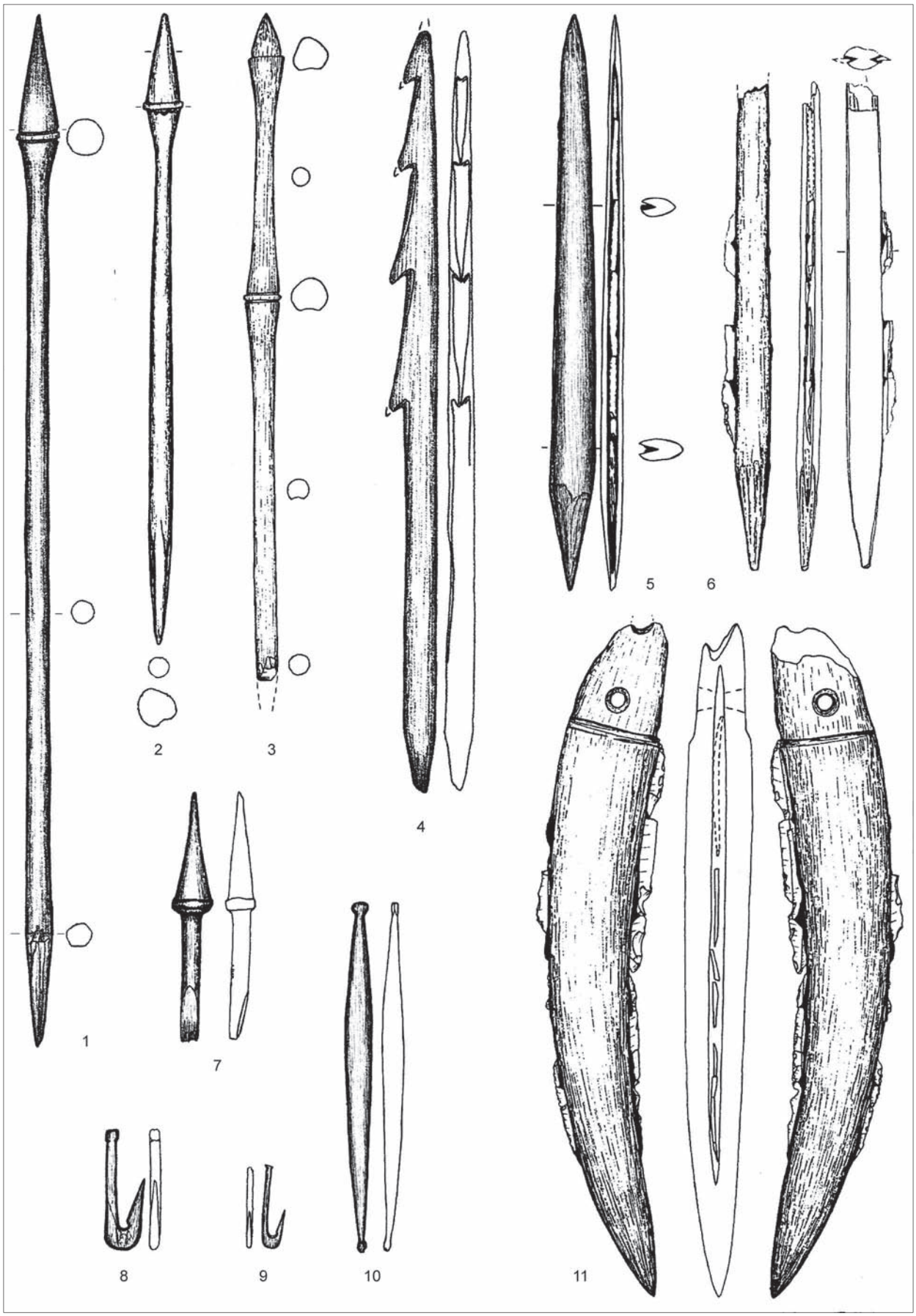

Fig. 9. Stanovoje 4. Typical bone tools of the Middle Butovo Culture. Scale 2:3.

Abb. 9. *Stanovoje 4. Typische Knochengeräte der mittleren Butovo-Kultur. Maßstab 2:3.*

some microblades/-fragments of highest quality (Fig. 4: 12, 13 & 16). Together they provide strong arguments for the use of pressure technique for blank production. Fragments of 6 slate and silicised limestone axes and adzes with polished cutting edges form a further remarkable element of the early Butovo Culture (Fig. 5).

The flint microblades correspond with slotted bone daggers and slotted points present in the organic tool assemblage. Some of the bone points show microblades still fixed in the slot (Fig. 4: 2 & 3) and leave no doubt as to the systematic use of such composite tools.

There are further tool types such as simple long bone points/arrowheads (Fig. 4: 1), antler sockets (Fig. 4: 6), antler blades (Fig. 4: 4 & 5) and elk shoulder blades with sharpened edges ("broad knives"). The latter piece (Fig. 6: 2) was sampled for AMS-dating and provided a ^{14}C-age of 9 879 ±50 BP (c. 9 350 calBC; Fig. 7). A sample from a piece of elk antler adze (Fig. 6: 3) from the same layer is only slightly younger (9 740 ± 40 BP/c. 9 250 calBC). Further samples from a point of a massive bone dagger (Fig. 6: 1) and a wooden handle of an antler socket (Fig. 6: 4) gave results of 9 555 ±43 BP (c. 8 950 calBC) and 9 505 ±47 BP (c. 8 900 calBC; Fig. 7).

The four AMS-results for layer IV date the assemblage to the Preboreal. They indicate a somewhat younger start of the settlement at the lake shore than expected from pollen analyses which were in favor of a start of settlement activities already in the terminal Younger Dryas. At the same time the date for the massive bone dagger and the wooden handle of the antler axe on first sight indicate a c. 200 radiocarbon years younger phase. But they are in some contradiction to a conventional radiocarbon date of 9 680 ±40 BP (c. 9 100 calBC; GIN-10128) obtained on a birch trunk found in the overlaying sediments (cut 2, layer IV) (Zhilin & Matiskainen 2003, 697; Zaretskaya et al. 2005). The birch sample (GIN-10128) was 12 cm in diameter and taken from a carefully controlled context (Zaretskaya et al. 2005). And also the two AMS-dates are in a contradiction with a conventional date of a worked wooden stake dated to c. 9 620 ±60 BP (GIN-8377) from the overlying layer of Ienevo Culture in cut 3. The AMS-dates assign the assemblage of the early Butovo Culture to the first half of the Preboreal c. 9 400 to 8 800 calBC, while conventional dates support an earlier dating to about 9 600-9 300 calBC (Zaretskaya et al. 2005, 128). In conclusion we suggest a dating of the layer to 9 600 to 9 100 calBC; the younger dates are unexplained at the moment.

AMS-dates for the middle Butovo Culture

The layer of the Ienovo Culture (IIIa) was limited to cut III. There were found typical one-edged and oblique points of Ienevo Culture, which are not present in the Butovo Culture. Few organic remains did not allow taking promising samples for AMS-dating. Stratigraphic information and conventional radiocarbon ages suggest a dating towards the middle of the Preboreal (Zaretskaya et al. 2005, 125).

Fig. 10. Stanovoje 4. AMS samples. 1 fragment of a slotted bone point (KIA 35154: 9 413 ± 50 BP). – 2 fragment of a slotted bone dagger (KIA 35156: 9 383 ± 42 BP). Scale 2:3.

Abb. 10. *Stanovoje 4. AMS-Proben. 1 Fragment einer Knochenspitze mit beidseitiger Nut (KIA 35154: 9 413 ± 50 BP). – 2 Fragment eines Knochendolches mit beidseitiger Nut (Flintschneidendolch) (KIA 35156: 9 383 ± 42 BP). Maßstab 2:3.*

Archaeological layer III was a well developed unit in cut 2 and 3 and provided a wide range of finds. The fauna is dominated by forest animals among which elk and beaver are the most numerous. The stone tool assemblage is again characterized by various types of scrapers, burins and axes (Fig. 8: 2, 3, 5 & 9). Tanged points are of the above mentioned type (ventral retouched tang and ventral surface retouched tip; Fig. 8: 1), but in this case made of common blades. The blades were produced from single platform cores of conical shape (Fig. 8: 4 & 8). Regular microblades (Fig. 8: 6 & 7) are still present and argue for the continuation of this specific technique of blank production; but typical wedged cores or handle cores similar to those of the younger Maglemose and Kongemose Culture in the western Baltic (Henriksen 1976; Sørensen 1996) are not represented in the assemblage. Polished slate axes are a further important find category.

Organic remains are frequent in layer III and bone points are documented by various types. Long pieces with a massive biconical and sometimes decorated tip belong to the so called Shigir type (Fig. 9: 1-3 & 7; Fig. 11: 1-5), which is already present in the layer of the Ienovo Culture (Žilin 2006, 12). Slotted bone points and daggers form an element of continuation from the early Butovo Culture (Fig. 9: 5, 6 & 11; Fig. 11: 6). Further tools such as bone mattocks, elk antler blades, axes, massive bone daggers, a bone rod (Fig. 9: 10) and fish hooks (Fig. 9: 8 & 9) were detected with several examples.

Five samples of layer III were taken for AMS-dating (Fig. 7). Fragments of a slotted bone point (Fig. 10: 1) and of a slotted bone dagger (Fig. 10: 2) provided similar results of 9 413 ±50 BP (c. 8 700 calBC) and 9 383 ±42 BP (c. 8 650 calBC). A younger phase is

Fig. 11. Shigir bone points (1-5) and slotted bone dagger (6) from the Upper Volga Butovo Culture. Scale 1-5: 1:1; 6: 2:3.
Abb. 11. *Shigir-Knochenspitzen (1-5) und Flintschneidendolch (6) der Butovo-Kultur im Oberen Wolgagebiet. Maßstab 1-5: 1:1; 6: 2:3.*

represented by a date of an elk antler mattock fragment (Fig. 12: 3; 8 860 ±47 BP/c. 8 050 calBC) and a fragment of a massive bone dagger (Fig. 12: 1; 8 799 ±44 BP/c. 7 900 calBC). The youngest date for the Middle Butovo Culture (layer III) was obtained on a Shigir point fragment (Fig. 12: 2; 8 315 ±48 BP/ c. 7 400 calBC).

The available dates indicate a longer use of the lake shore in the Boreal period and might suggest three settlement phases (early phase: c. 8 700 calBC,

Fig. 12. Stanovoje 4, AMS-samples. 1 point of a massive bone dagger (KIA 35158: 8 799 ±44 BP). – 2 fragment of a bone point (Shigir type; KIA 35155: 8 315 ±48 BP). – 3 fragment of an elk antler mattock (KIA 35157: 8 860 ±47 BP). Scale 1-2: 2:3; 3: 1:2.

Abb. 12. *Stanovoje 4, AMS-Proben. 1 Spitze eines massiven Knochendolches (KIA 35158: 8 799 ±44 BP). – 2 Fragment einer Knochenspitze (Shigir-Typ; KIA 35155: 8 315 ±48 BP). – 3 Fragment einer Elchgeweihhacke (KIA 35157: 8 860 ±47 BP). Maßstab 1-2: 2:3; 3: 1:2.*

middle phase: c. 8 000 calBC, final phase: c. 7 300 calBC). Marked plateaus in the ^{14}C-age calibration curve are not responsible for these clusters, but the picture needs further confirmation. In general the AMS-dates are in accordance with results based on pollen analysis and conventional radiocarbon dates.

The timing of innovations: the case of microblade technology

The new AMS-results make Stanovoje 4 the most reliable dated Stone Age sequence of the early Holocene in the Upper Volga area (Fig. 13). They assign the early Butovo Culture from c. 9 600 to 9 100 calBC. (first half of Preboreal or terminal Younger Dryas by pollen analyses, see above) and the developed Butovo Culture from c. 8 800 to 7 300 calBC (late Preboreal and Boreal, in accordance with pollen analyses). On stratigraphical grounds and three conventional dates from worked wooden stakes the layer of the Ienovo Culture can be dated to c. 8 800 calBC (younger Preboreal, in accordance with pollen analyses).

The results for Stanovoje 4 provide the opportunity to discuss the timing of specific tool types and innovations in a more general perspective. Important innovations in the period from Greenland Interstadial 1 to the late Atlantic (c. 12 700 – 4 000 calBC) in Central Europe were the introduction of bow and arrow, of flint axes, of microblade technology and of pottery production. The most prominent innovation was the introduction of farming with deep impact on the life style of Stone Age society. In this paper we will focus on the microblade technology.

The Stanovoje 4 site demonstrates the production of regular macro- and microblades and the use of slotted tools in the early Butovo Culture. The very regular blanks and the shape of single platform cores argue for a very controlled production by the use of pressure technique. The technology contributes to the manufacturing of standardized and efficient composite weapons and tool technology. "Microblades were a key component … that faciliated high mobility and efficient hunting" (Goebel et al. 2000, 574) and allowed a very effective use of high quality raw material (Stupak 2006, 114).

According to the Zolotaruče 1 site pressure technique was already in use during the terminal Palaeolithic in the Upper Volga area (Žilin 2006, 6; Zhilin 2007). Typical cores and microblades were identified in the lower layer of the site. Reindeer and Bison Priscus are present among the few faunal remains. The proposed Late Glacial context could be confirmed now by an AMS-date of a Bison bone (concentration 5) to 10 240 ±37 BP/c. 10 050 calBC (Fig. 7) which assigns the find layer to the Younger Dryas period. A somewhat younger result obtained on a charcoal sample from a fire place of concentration 3 indicates use of the site also at the transition to the Holocene (Fig. 7; 9 990 ±62 BP/c. 9 500 calBC).

However, the tanged point site of Rostislavl located c. 130 km southeast of Moscow (Trusov 2006) lacking microblades demonstrates that this specific technology was not applied on every Late Glacial site of the

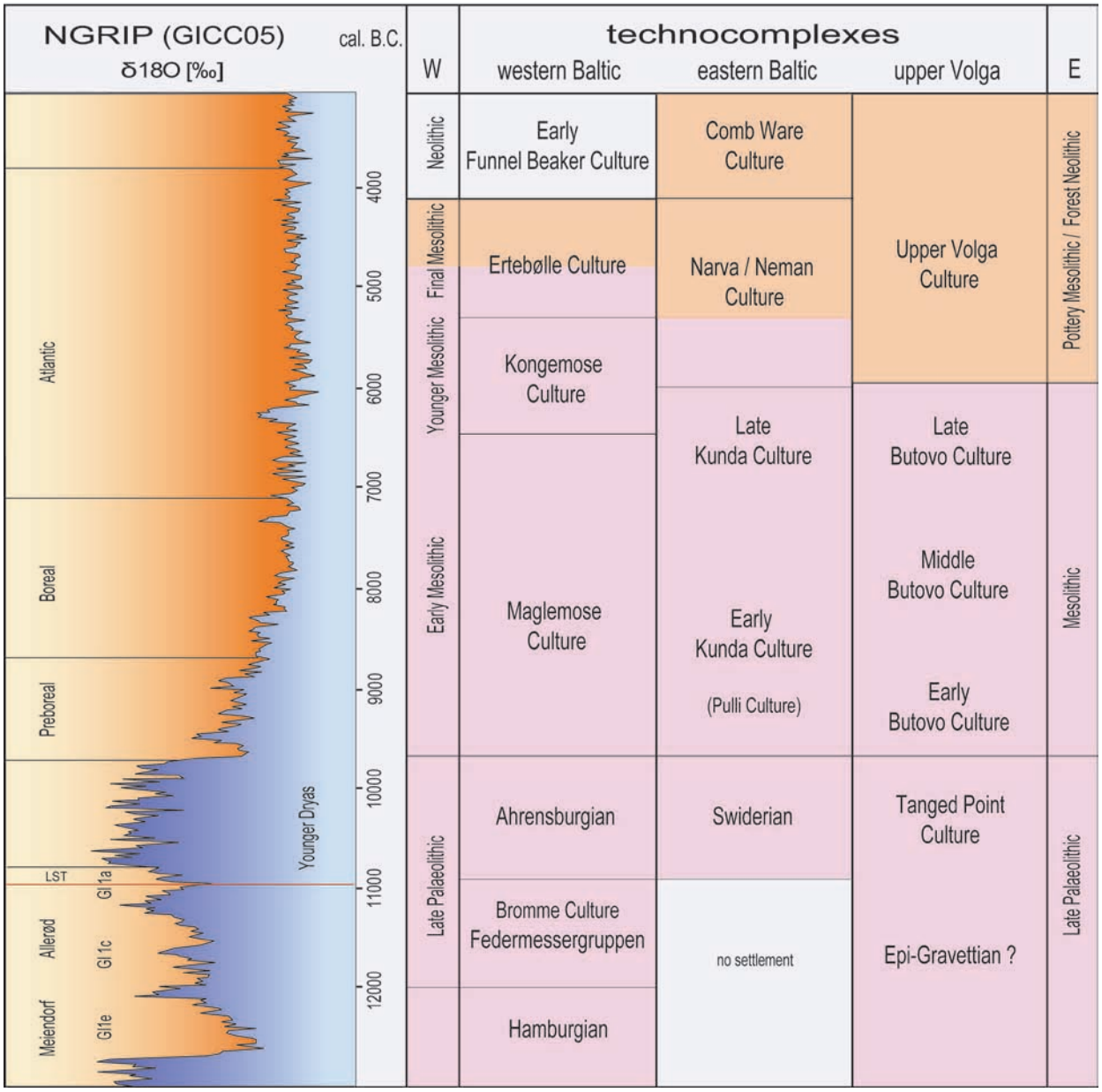

Fig. 13. Climatic development and chronology of the Lateglacial and early Holocene in the southern and eastern Baltic and the Upper Volga region. GI: Greenland Interstadial.

Abb. 13. *Chronologietabelle des Spätpaläolithikums und Mesolithikums im südlichen und östlichen Ostseegebiet und in der Oberen Wolgaregion. GI: Grönland Interstadial.*

Volga-Oka region. This phenomenon might be supported by the availability of high quality raw material, an idea which is supported by a single regular blade that was probably imported from elsewhere to the site (Trusov 2006, 150). Because only part of the Rostislavl assemblage was documented with reliable stratigraphic context we have to take this observation with some caution.

In a broader perspective the production of microblades can be traced back more than thousand years further east. In the southern Transbaikal area microblade production is proposed for the site Studenoye 2 and Ust'Menza 2 dated up to c. 17 000 BP (Fig. 14: 10 & 11; Goebel et al. 2000). In further regions of Siberia and in Japan the production of regular microblades and the use of pressure technology can be identified on Upper Palaeolithic sites dated after the Last Glacial maximum and before start of Greenland Interstadial 1 (Goebel et al. 2000, 572; Goebel 2002; Graf 2009, 496). It is not intended to discuss this evidence in more detail here. In general there is no doubt that specific microblade production was in use in eastern Eurasia earlier than further west and also spread over to North America (see Inizian et al. 1992; Olofsson 1995). But this does not necessarily mean that this technology was taken over in western Eurasia from the east.

In the early Holocene pressure technique was also in use for the processing of Obsidian in the Pre Pottery Neolithic of eastern Anatolia (Balkan-Atli &

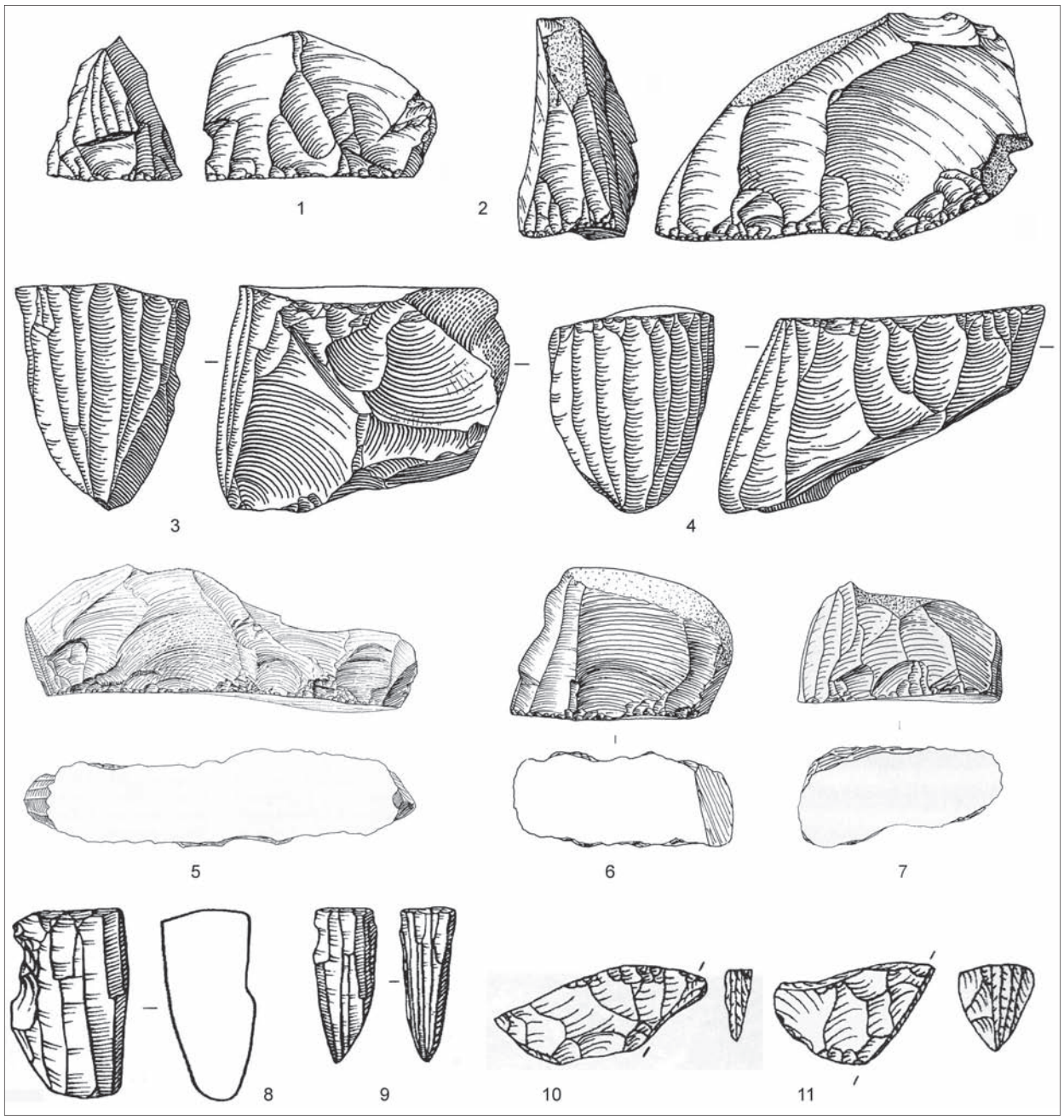

Fig. 14. Examples of microblade/handle cores from northern Germany (1-4), Denmark (5-7), the Upper Volga region (8-9) and the southern Transbaikal (10-11). 1-2. Stoltenberg LA 10. – 3-4 Dreggers LA 3; – 5 Holmegard I. – 6 Lundby I. – 7 Svaerdborg I. – 8-9 Butovo 1; – 10 Studenoe 2; – 11 Ust-Menza 2, layer 24 (>17 000 BP) (after Henriksen 1976; Goebel et al. 2000; Žilin 2006; Hartz 2009). Scale 2:3.

Abb. 14. *Beispiele von Mikroklingenkernen/sogenannten handle cores aus Norddeutschland (1-4), Dänemark (5-7), der Oberen Wolgaregion (8-9) und dem südlichen Transbaikal (10-11). 1-2. Stoltenberg LA 10. – 3-4 Dreggers LA 3; – 5 Holmegard I. – 6 Lundby I. – 7 Svaerdborg I. – 8-9 Butovo 1; – 10 Studenoe 2; – 11 Ust-Menza 2, layer 24 (>17 000 BP) (nach Henriksen 1976; Goebel et al. 2000; Žilin 2006; Hartz 2009). Maßstab 2:3.*

Cauvin 2007) and probably in the Levante and further east (Gronenborn 1997, 395). The introduction of regular blades probably produced by pressure technique and trapezes is a well established innovation in southern Europe (Clark 1958). Both elements characterise the Late Mesolithic in Central Europe and in southern Germany where the specific blade technology and trapezes started in the early Atlantic period probably soon after 7 000 calBC (Gronenborn 1997). For the moment it remains an open question whether all these were independent innovations or the follow of a trajectory from east to west.

Approximately 1 000 km to the west of the Upper Volga area the late Swiderian industry of the Baltic countries is characterized by a good quality blade technology, but blank production by pressure technique was not applied (Šatavičius 2005). In contrast, the early Mesolithic Kunda Culture (Fig. 13) demonstrates a highly regular blank production and the use of pressure technique can sometimes be

Fig. 15. Preliminary map of the spread of microblade technology and pressure technique/regular blade technique in northern Europe.

Abb. 15. *Entwurf einer Karte zur Ausbreitung der Mikroklingentechnologie und Drucktechnik/regelmäßigen Klingentechnik in Mittel und Osteuropa.*

identified at sites such as Pulli in Estonia (Fig. 15; Jaanits & Jaanits 1978). The Pulli assemblage also shows close similarities in the type of tanged points with ventral retouch of the tang and ventral surface retouch on the distal part (Pulli type) which is known from many Kunda sites in the Baltic (Ostrauskas 2002). At the Tłokowo site in Olsztyn district, north-eastern Poland, a slotted bone point of Kunda type was found with

typical microblade fragments still fixed in the grooves (Sulgostowska 1996). This site marks the western border of the Kunda Culture and the slotted bone point is probably dated to the late Boreal (c. 8 300-8 200 BP/c. 7 300 calBC; Schild et al. 2003, 154). The dating of the find might represent the phase of transition of the microblade technology further southwest.

In the western Baltic there has been a long debate as to the introduction of regular microblades and pressure technique with special focus on the introduction of handle cores (Callahan 1985). *Handle cores* are a specific type of elongated microblade core with a narrow front (Fig. 14: 1-7). A re-evaluation of the evidence by Olofsson (2002; 2003) argues for the start of an elaborated microblade technology and slotted bone tools in the younger Maglemose Culture in southern Scandinavia (Fig. 13; Henriksen 1976; Sørensen 1996). The same holds true for northern Germany where on sites such as Loop 1 and Lammershagen 10 an advanced macroblade production developed in the late Boreal parallel to a microblade technique with tiny regular microblades stuck from single platform conical cores (Hartz 2009). These sites are slightly older than Duvensee site 13 which existed somewhat around 7 500 calBC while handle cores were introduced at the transition to the Atlantic period (Bokelmann et al. 1985; Bokelmann 1991, 91). Unfortunately AMS-dated late Boreal and early Atlantic sites with microblades are lacking so far both for the Schleswig-Holstein and Mecklenburg-Vorpommern regions. As mentioned above, in the western Baltic the typical handle cores started during the late Maglemose, and developed further into the Kongemose Culture where it ends around the middle of the 6th millennium calBC (Vang Petersen 1984; Sørensen 1996).

The site of Högland in Lapland, northern Sweden, demonstrates the spread of this technology to the far North at c. 6 600 calBC (Olofsson 2003, 5). However, recent discoveries in Finnish Lappland provide new information on the question of early settlement and the introduction of microblades and pressure technique in northern Scandinavia. The Sujala site located at Lake Vetsijärvi is radiocarbon dated to c. 8 250 calBC and is characterized by a chert industry of extralocal raw material origin. Very regular blades and microblades indicate that a "considerable part of the blades were most likely produced by pressure" (Rankama & Kankaanpää 2008, 889). The presence of microblades and pressure technique as well as the type of tanged point with ventral surface retouch (Rankama & Kankaanpää 2008, Fig. 8) is explained by a colonisation of people from northern Russia of Butovo-Kunda Culture origin.

In conclusion it appears a reasonable scenario to propose the introduction of the microblade technology in the western Baltic from the east during the late Preboreal to Boreal period, when this technology still formed a typical element of the Kunda and Butovo Culture (Fig. 15). If this scenario is correct, contacts to eastern Baltic hunter-gatherers were very important for the exchange of information and introduction of technologies in the western Baltic Sea area long before pottery was introduced as an eastern innovation.

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