Eleven bone arrowheads and a dog coprolite – the Mesolithic site of Beregovaya 2, Urals region (Russia)

Elf Knochenspitzen und ein Hundekoprolith -Der mesolithische Fundplatz Beregovaya 2, Ural (Russland)

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Abstract - Beregovaya 2 is one of the rare bog sites in the Urals region providing a sequence of Stone Age layers with excellent preservation conditions. Ongoing excavations revealed numerous faunal remains and a remarkable number of tools made of stone, bone, antler as well as wooden and other plant materials. All in all three Mesolithic layers (Early, Middle and Late Mesolithic), one early Neolithic (pottery Mesolithic) layer and an uppermost Eneolithic layer were recorded. Pollen and C14-dates indicate occupation of the site from the Preboreal to the Subboreal period. The article provides general information on the finds and presents a unique bundle of bone arrowheads found together with a net sinker and a coprolite in the Middle Mesolithic layer. Results of aDNA-analysis assign the coprolite to dog. AMS-dates prove the high integrity of the sequence of cultural layers and the results obtained in this study underline the importance of Beregovaya 2 for the supra-regional understanding of the environmental and cultural development of the early Holocene in Eurasia.

Zusammenfassung - *Der Fundplatz Beregovaya 2 gehört zu einem der wenigen Fundplätzen im Gebiet des Urals, die eine Abfolge von steinzeitlichen Fundschichten mit ausgezeichneten Erhaltungsbedingungen aufweisen. Die fortlaufenden Ausgrabungen lieferten zahlreiche Faunenreste und eine große Vielfalt an Werkzeugen aus Stein, Knochen und Geweih sowie bearbeitete Hölzer. Insgesamt besteht die Abfolge aus drei mesolithischen Fundschichten aus dem frühen, mittleren und späten Mesolithikum sowie einer frühneolithischen („keramisches Mesolithikum") und einer zuoberst liegenden äneolithischen Kulturschicht. Mit Hilfe von pollenanalytischen Untersuchungen und Radiokarbondaten lässt sich die Abfolge vom Präboreal bis ins Subboreal datieren. Die Abhandlung gibt zunächst einen Überblick über die wichtigsten mesolithischen Funde und präsentiert dann ein außergewöhnliches Bündel von Knochenpfeilspitzen, das zusammen mit einem Netzsenker und einem Koprolith in der mittelmesolithischen Schicht entdeckt wurde. Die aDNA-Analysen weisen den Koprolith tierartlich dem Hund zu. Die hohe Integrität der mesolithischen Schichtensequenz wird durch AMS-Datierungen untermauert. Damit bestätigt sich die große Bedeutung des Fundplatzes Beregovaya 2 für die Kultur- und Umweltentwicklung des frühen Holozäns in Eurasien.*

Keywords - **Mesolithic, Urals region, bone point bundle, dog coprolite, radiocarbon dates, aDNA-analysis**
Mesolithikum, Ural, Knochenspitzenbündel, Hundekoprolith, Radiokarbondaten, aDNA-Untersuchungen

Introduction

About 15 years ago there was little information on the Mesolithic occupation in the Urals region and it was believed that the eastern Ural area was settled only during the Late Mesolithic (Serikov 2000). This was due to the fact that most of the Mesolithic sites were identified on mineral soils, a well known phenomenon from the northern European lowlands. Such sites are often a palimpsest of repeated visits during a longer period of time and because preservation of organic materials is missing or limited there are no reliable absolute dates available.

Few caves in the middle and northern Urals contain Mesolithic materials (Fig. 1: 1; Chairkin & Zhilin 2005). Additionally numerous artefacts made of bone and antler were collected during gold and peat mining in the eastern Urals area. The most prominent collection

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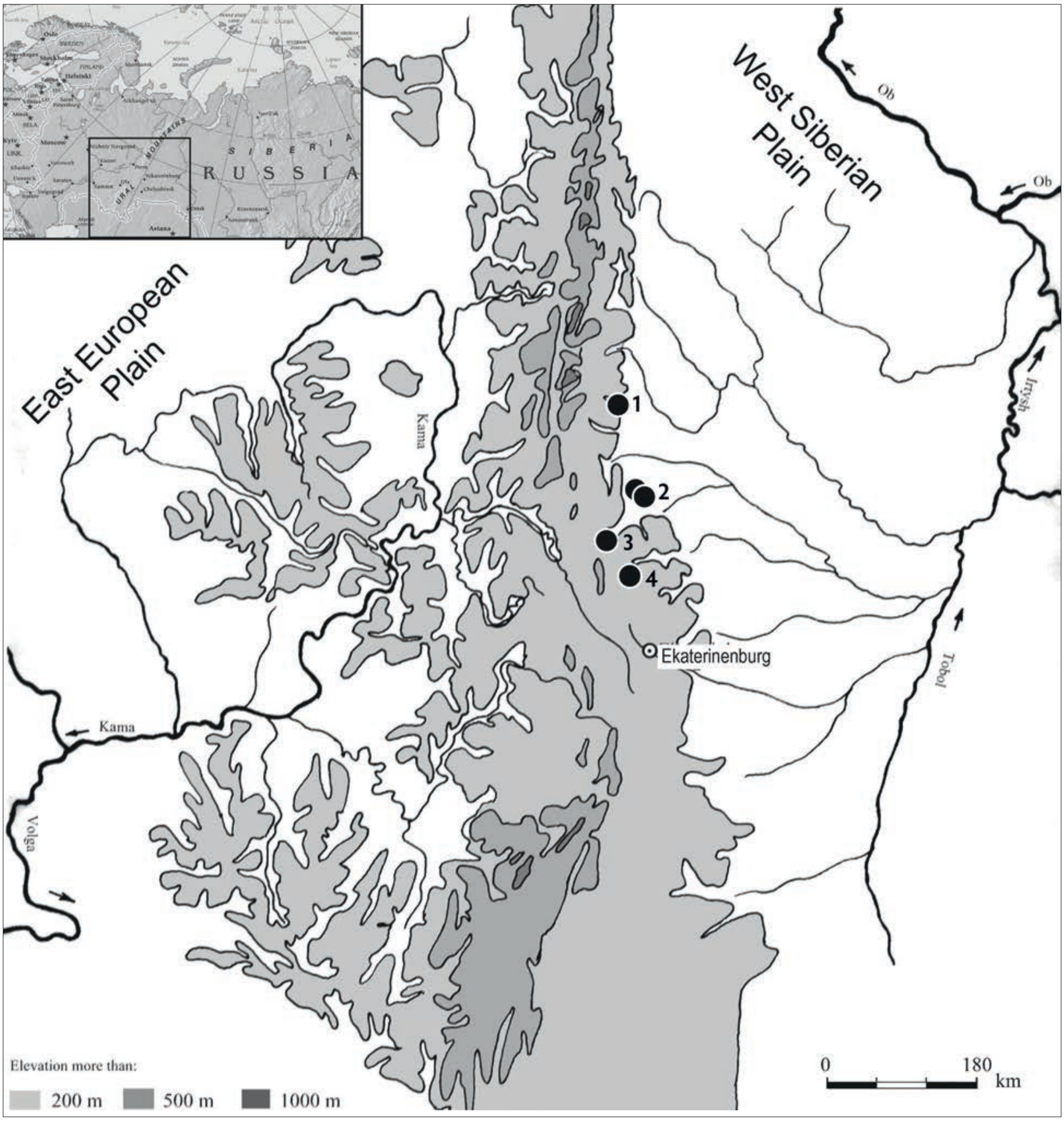

Fig. 1. Map of middle Urals with sites mentioned in the text (drawing: M. Zhilin). 1 – Lobvinskaya cave; 2 – Koksharovsko-Yurjinskaya 1 and 2; 3 – Beregovaya 1 and 2; 4 – Shigir peat bog.

Abb. 1. *Karte des mittleren Urals mit den im Text erwähnten Fundplätzen.*

is recorded from the Shigir peat bog (Fig. 1: 4; Chairkina et al. 2000) where among other finds hundreds of bone points were collected. Unfortunately no context information is available for these finds. In the last years sampling of more prominent finds for AMS-dating started to better explain their chronological context and in this way it was possible to prove a Mesolithic age for the famous wooden Shigir idol (Lillie et al. 2005).

In 2003 two of the authors (M.Z., S.S.) started systematic surveys in peat bogs of the middle Urals area. Mineral bottom layers of two sites at Koksharovsko-Yuriskaya peat bog (Fig. 1: 2) discovered by Yu. B. Serikov (Serikov 2000) produced Mesolithic stone and bone artefacts, but as excavations of 2007 showed these layers were disturbed by taphonomic processes (Zhilin et al. 2012). Later on, subsequent drilling and test excavations in the Gorbunovo peat bog (Fig. 1: 3) situated about 210 m a.s.l. at the eastern slope of the Urals Mountains c. 120 km north, northwest of Ekaterinburg provided *in situ* Stone Age layers with excellent preservational conditions in this region for the first time. The most prominent early Holocene sequence of Gorbunovo peat bog was identified at the Bergeovaya 2 site about five km south of the city of Nizhnii Tagil (Fig. 2).

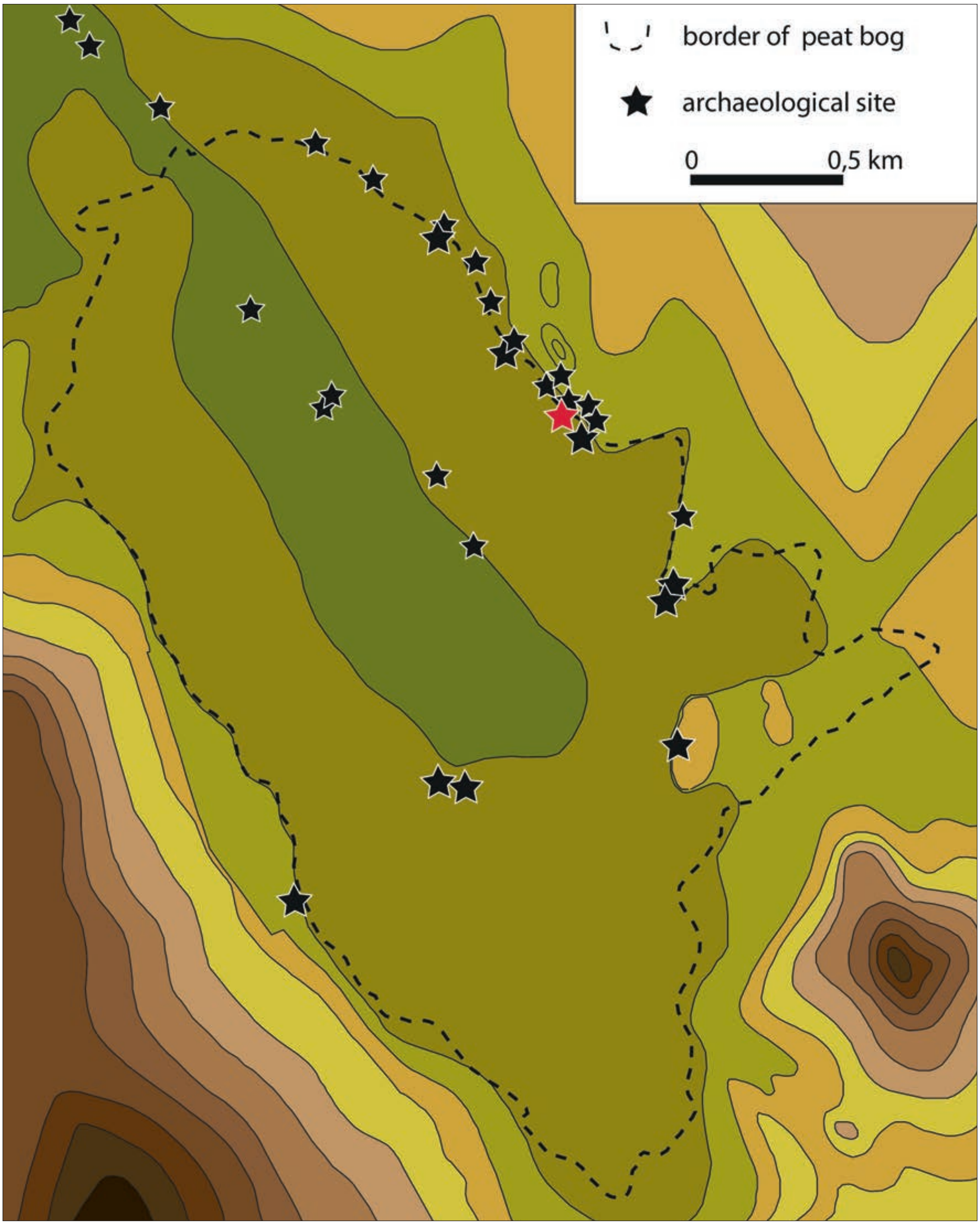

Fig. 2. Map of Gorbunovo peat bog with archaeological sites. Red star: site Beregovaya 2 (drawing: T. Terberger).
Abb. 2. *Karte vom Gorbunovo Moor mit archäologischen Fundplätzen. Rotes Sternchen: Beregovaya 2.*

Beregovaya 2 – an outstanding Stone Age sequence

The site Beregovaya 2 is situated at a rocky promontory of the north-eastern shore of the Gorbunovo peat bog at the right bank of a dried creek. In 1991-1992 excavations on 112 m² were conducted by O.V. Ryzhkova (2004) on the settlement site in the mineral soil (Figs. 2 & 3), where mixed materials from the Mesolithic, Neolithic, Eneolithic and early Iron Age was found. (The term Neolithic is here used according to the Russian terminology and is describing assemblages with pottery connected with a Mesolithic/hunter-gather-fisher economy.) Since 2008 M. G. Zhilin and S. N. Savchenko excavated 127 m² in the peat bog (Zhilin & Savchenko 2010) below the settlement area in front of the rocky promontory (Figs. 3 & 4). A first test trench (11 x 1 m) into the lake sediments showed a

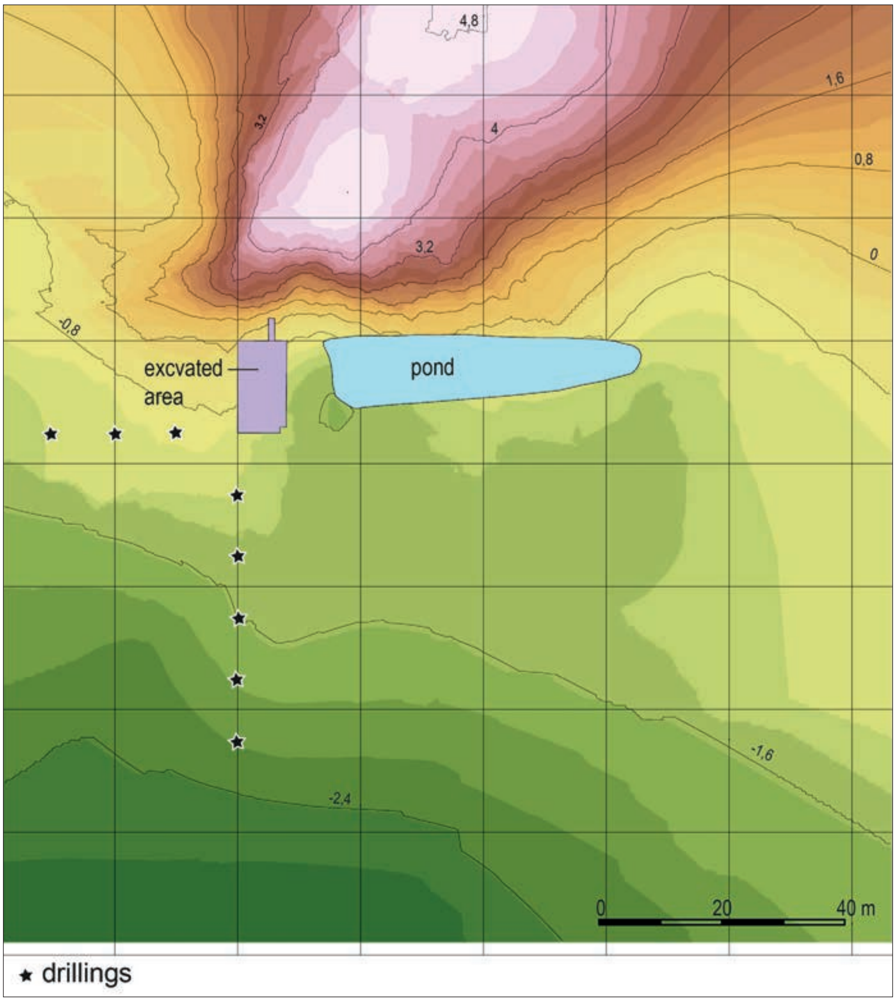

Fig. 3. Map of excavations at Beregovaya 2 (drawing: A. Kotula).
Abb. 3. *Grabungsplan von Beregovaya 2.*

sequence of five cultural layers in lake and bog sediments (Fig. 5). A pollen core from the middle part of the trench and first radiocarbon dates proved the early Holocene context of the layers.

The uppermost cultural layer (I) is embedded in dark brown, decomposed peat and revealed a small amount of bones, flint artefacts and Eneolithic pottery fragments. Pollen data indicate formation of this layer during the Subboreal period.

Cultural layer II was identified in the upper part of brown decomposed peat, separated from the upper layer by sterile peat with wood up to 1.2 m thick. The layer contains bones, lithic artefacts, bone and antler tools as well as ceramic sherds of the earliest stage of the Neolithic of Middle Eastern Urals area. Pollen data place the formation of this layer to the first half of the Atlantic period and three radiocarbon dates confirm occupation of the site between 6200-6100 calBC (AAR-14548; KIA-42074; AAR-14833; Fig. 6, Zaretskaya et al. 2012).

Cultural layer III (upper Mesolithic layer) is embedded in the bottom part of a brown decomposed peat separated from the second cultural layer by a sterile band of peat up to 0.4 m thick. It contained bones mostly of elk and beaver, waterfowls and fish as well as an organic tool industry made mainly on elk bones and antlers. A large number of lithic artefacts including macro- and microblade cores (with evidence of pressure technique) and blades, burins, endscrapers, and fragments of polished adzes and chisels were collected. A surprising feature in cultural layer III was a trackway made of split pine logs leading from former open water to the swampy lake shore (Fig. 7). The planks were up to 4.5 m long, 0.5 m wide and 0.12 m thick, and were carefully worked with a polished adze. The stratigraphy suggests that this layer is of Late Mesolithic age. Pollen data provide evidence for deposition during the late Boreal period, which is confirmed by a number of conventional radiocarbon dates falling into the interval between ca. 7100 to 6900 calBC (GIN-14085, 14086, 14087, 14133, 14134; AAR-14549; Fig. 6, Zaretskaya et al. 2012).

Cultural layer IV (Middle Mesolithic) is embedded in grey fine detritus gyttja and separated from the cultural layer III with a sterile streak of olive coarse detritus gyttja up to 20 cm thick. Finds include faunal

Fig. 4. View on the excavation from 2009 in the lake sediments (photo: M. Zhilin).
Abb. 4. *Blick auf die Grabungsfläche von 2009 in den verlandeten Seeablagerungen.*

remains, worked wood and various bone and lithic artefacts. The distribution of the finds (Fig. 8) shows a clear concentration regarding the wooden artefacts and the animal bones. The wood is concentrated as a semicircular grouping in the centre and the eastern part of the excavation trench in a distance of c. 10 m from the edge of the settlement site, which is consistent with the distribution of the animal bones. In contrast the stone artefacts are much more scattered over the whole excavation area and do not provide such a clear picture.

The fauna is characterized by various mammals like elk, red deer and beaver as well as waterfowl and fish, which indicate a rich aquatic environment in a taiga-forest landscape. The layer indicates a deposition of the finds at some meters distance from the lake shore and a number of stakes, driven down from the level of this cultural layer into the lake bottom reflect activity at a distance from 10 to 30 meters from the lake shore. We do not want to rule out that some floating platforms were attached to these stakes. Furthermore intact and fragmented wooden artefacts such as

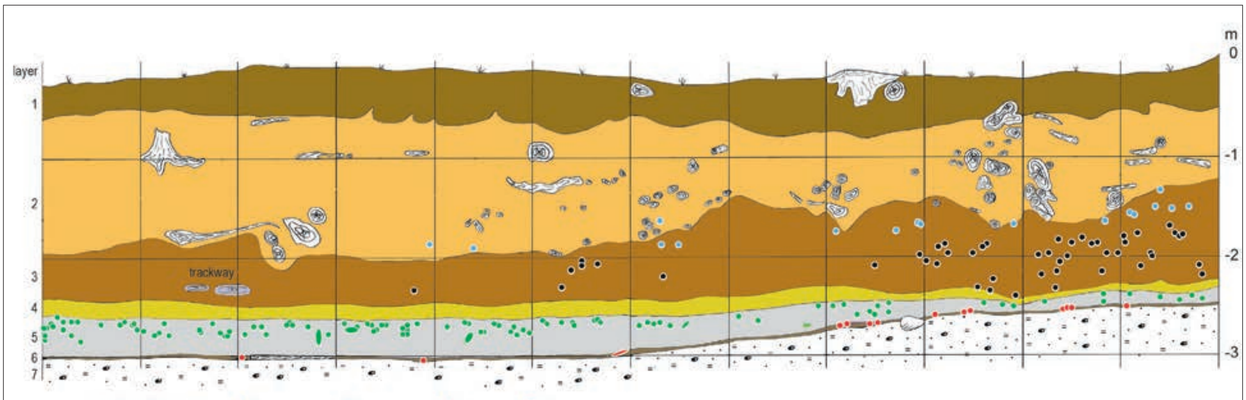

Fig. 5. Stratigraphy of Beregovaya 2 (drawing: M. Zhilin).
Abb. 5. *Stratigraphie von Beregovaya 2*

Lab. Number	Dated substance	Position of the sample	BP	calBC	Remarks
Between cultural layers I and II					
GIN -14124	sphagnum peat	Sect. 2, layer 2, depth.-2.61 m	6390 ±110	5478–5295	
GIN -14125	sphagnum peat	Sect. 2, layer 2, depth -2.81 m.	6990 ±40	5975–5950 5918–5837	
Cultural layer II, Early Neolithic					
AAR 14548	Antler (insert pick-axe)	Sqm 56, depth -2.78 m	7278 ±34	6211–6137 6110–6083	
AAR 14833	charred residue (sherd of Koshkino type)	Sqm 58, depth -284/-286 cm. Pit 2	7320 ± 38	6230–6100	
KIA42074	charred residue (sherd of Koshkino type)	Sqm 60, depth -2.88 m	7325 ±40	6232–6203 6146–6101	
Cultural layer III, Late Mesolithic					
GIN-14134	wood (plank no 3 trackway)	Sqm 32, depth. -3.22/-3.32 m	7960±30	7028–6930 6921–6877	
AAR 14549	bone (elk scapula knife)	Sqm 70, depth -2.94/ -3.00 m	7989 ± 36	6972–6911 6884–6829	
GIN -14133	wood (plank no 5 trackway)	Sqm 58, depth -3.21/ -3.25 m	7990±30	6971–6912 6884–6830	
GIN -14087	wood (plank fragment trackway)	Sqm. 40, depth -3.25/ -3.30 m.	7990±40	7042–6983 6973–6911 6885–6829	
GIN -14085	charred thin tree trunk	Sqm 5, depth -3.03/ -3.09 m	8120±50	7144–7057	
GIN -14086	burnt pine stake	Sqm 3-4, depth -3.09/ -3.13 m (bottom of cultural layer III)	8350±40	7490–7446 7414–7356	
GIN -14126	sedge peat	Sect. 2, , depth -3.23 m (level of trackway)	7990±40	7042–6983 6973–6911 6885–6829	
GIN-14080	sedge peat	Sec.1, layer 3, –330 cm, c.l.III, bottom, below trackway	8360 ± 40	7511–7449 7410–7362	
Between cultural layers III and IV					
GIN-14081	gyttja	Sec.1, layer 4, between c.l. III and IV, –338 cm	8620 ± 40	7654–7585	
GIN -14127	sedge peat	Sect. 2, below cultural layer III, depth -3.35 m (below trackway)	8190±40	7261–7225 7193–7128	
GIN -14128	cane peat	Sect. 2, between cultural layers III and IV, depth.-3.42 m	8200±40	7301–7219 7199–7139	
GIN -14129	gyttja	Sect. 2. between cultural layers III and IV, depth –3.45 m	8480±40	7575–7530	
Cultural layer IV, Middle Mesolithic					
AAR 14834	bark (binding of a net sinker)	Sqm 85. 35.20. depth -380 cm	8405 ± 40	7540–7460	
KIA42075	willow bark (binding of a net sinker)	Sqm 46, depth -3.64/ -3.73 m	8445 ±50	7569–7494	
POZ 46389	dog coprolite	Sqm. 46, depth -365 см	8480 ±40	7575–7530	
GIN -14137	wooden stake	Sqm 24, depth -3.40/ -3.46 m	8490 ±40	7578–7535	
GIN -14130	gyttja (top of layer)	Sect. 2, layer 5, depth -3.68 m	8520 ±100	7651–7474	
GIN -14089	worked wooden plank	Sqm 7, depth -3.68 m,	8670 ±40	7683–7601	
GIN -14207	elk antler	Sqm 48-49, depth -3.73/ -3.77 m	8840 ±70	8198–8110 8002–7821	
GIN-14082	gyttja	Sec.1, layer 5, c.l. IV, top	8970 ± 40	8275–8202	
GIN -14090	larch wood (worked branch)	Sqm 6, depth -3.58/ -362 m,	8970 ±60	8278–8183 8042–7994	
GIN -14136	larch stake,	Sqm 43, depth -3.78 m,	9010 ±40	8278–8234	
GIN -14208	elk bone (scapula)	Sqm 41, 86.32, depth -3.70 m	10200 ±100	10140–9754	contradicts dates of cultural layers IV-V
Between cultural layers IV and V					
GIN -14083	gyttja	Sect. 1, layer 5, lower part, depth -3.70/ -3.75 m	9140±40	8349–8285	
GIN -14131	gyttja	Sect. 2, layer 5, lower part, depth -3.80 m	9170 ±90	8475–8289	
Cultural layer V, Early Mesolithic					
GIN -14088	larch stake,	Sqm 7, sect. 1, depth -3.71/-3.79 m, (horizontally on lake bottom)	9800 ±40	9289–9253	
GIN -14210	two elk bones	Square meter 48, depth -3.85/ -3.96 m	9830 ±70	9356–9241	
KIA42076	elk bone (scapula knife)	Sqm 21, depth. -4.04 m,	9835 ± 50	9316–9255	

GIN -14135	pine planed and charred log	Sqm 42-43, -3.78/ -3.76 m	9850±40	9317–9266	
GIN -14209	preform of elk scapula knife	Sqm 60-72, depth -3.86/ -3.92 m	10060±80	9815–9446	
KIA42077	tubular bone (tool preform)	Sqm 20, depth -4.08 m, on lake bottom	9215 ± 40	8474–8337	
GIN -14251	larch stake (no 1)	Stake point driven into lake bottom: Sqm 76, depth -4.12/ -4.61 m	8980+-90	8285–8170	same construction as GIN 14249 und 4250
				8116–8053	
				8047–7981	
GIN -14249	larch stake (no 2)	Stake point driven into lake bottom: Sqm 76. depth -3.97/ -4.34 m	9230+-50	8489–8419	same construction as GIN 14248 und 4250
				8410–8346	
GIN -14250	larch stake (no 3)	Stake point driven into lake bottom: Sqm 76. depth -3.95/ -4.30 m	9230+-60	8491–8417	same construction as GIN 14248 und 4249
				8414–8344	
Lithological layer 6, incorporating or overlaying cultural layer V					
GIN -14140	gyttja with peat	Sqm. 35, layer 6, depth -3.71 m	9390±40	8724–8624	
GIN -14084	gyttja with peat	Sect. 1, layer 6, depth -3.77/ -3.80 m	9610±40	9011–8912	
				8904–8845	
GIN -14132	gyttja with peat	Sect. 2, layer 6, depth -4.03 m	9210±40	8469–8328	

Fig. 6. Radiocarbon dates of Beregovaya 2. Calibration was performed with Oxcal v4.1 (Aarhus, Poznan) and CALIB rev 5.01 (Kiel).

Abb. 6. *Radiokarbondaten von Beregovaya 2. Kalibration nach Oxcal v4.1 (Aarhus, Poznan) und CALIB rev 5.01 (Kiel).*

stakes, spears and an arrow shaft were recovered. The lithic inventory consists of debitage, several larger blades, a microblade (Fig. 9: 1) and a few flint tools like short scrapers (Fig. 9: 4-7), a burin (Fig. 9:3) and a retouched blade (Fig. 9: 8). Discarded cores are numerous (Fig. 9: 9-12) and exceed the number of blades. In addition, more than 20 preforms and some fragments of polished slate axes (Fig. 9: 13) and several broken hammerstones and polishing slabs were recovered, all produced from local rock. The stone artefact assemblage from this cultural layer reflects a typical waste or toss zone where mostly larger pieces like used cores or semi-products of low quality were discarded in the water. A lot of mammalian bones and a number of bone artefacts (Fig. 10), including arrowheads, daggers, fish hooks, various knives, perforators, beaver mandible tools and preforms were found there. In one case the glued microblades of a slotted point were still preserved (Fig. 10: 2). Among the worked bones a bundle of bone points and slotted arrowhead deserve special attention (see below). This cultural layer could be placed into the middle Mesolithic, and pollen data suggest formation during the first half of the Boreal period. This is confirmed by a series of conventional radiocarbon dates placing the settlement to the period from c. 8200 to 7500 calBC (AAR-14834; KIA-42075; GIN-14089, GIN-14090, GIN-14136, GIN-14137, GIN 14207, GIN-14208; Fig. 6,

Fig. 7. Beregovaya 2. Late Mesolithic track way at the former lake shore made of split pine logs dated to the late Boreal/early Atlantic period (photo: M. Zhilin).

Abb. 7. *Beregovaya 2. Spätmesolithischer hölzerner Weg am ehemaligen Seeufer. Die Konstruktion besteht aus gespaltenen Kieferbohlen und wird an den Übergang Spätboreal/ Frühatlantikum datiert.*

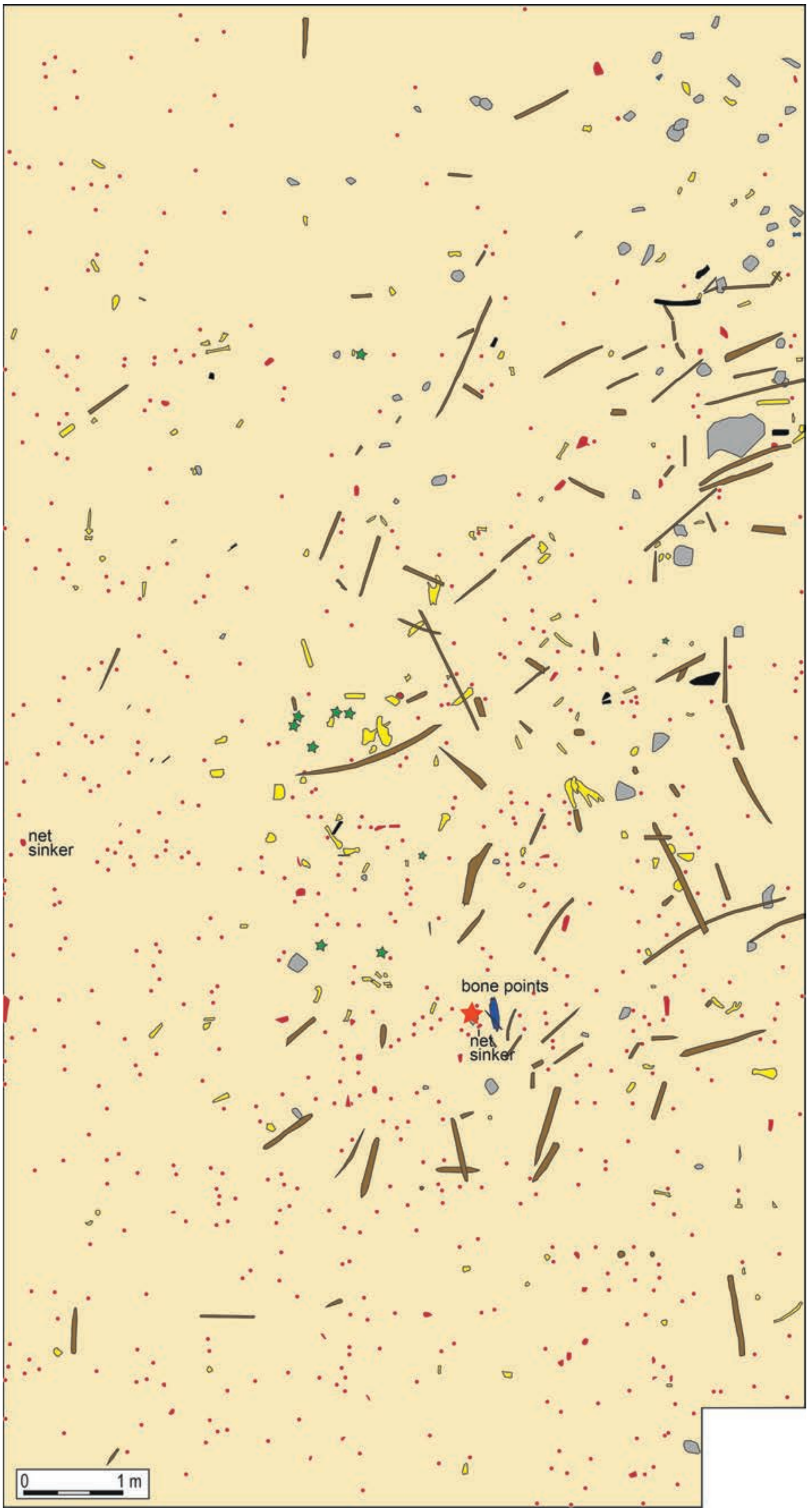

Fig. 8. Beregovaya 2. Distribution of finds in the Middle Mesolithic Layer (Layer IV). Red: stone artefacts; yellow: animal bones; grey: unmodified stones; brown: wood and wooden artefacts; green stars: coprolites; red star: coprolite used for DNA analysis; blue: bone point bundle (drawing: T. Terberger and M. G. Zhilin).

Abb. 8. *Beregovaya 2. Fundverteilung in der mittelmesolithischen Schicht (Schicht IV). Rot: Steinartefakte; gelb: Tierknochen; grau: unmodifizierte Steine; braun: Hölzer und Holzartefakte; grüne Sternchen: Koprolithen; rotes Sternchen: auf DNA untersuchter Koprolith; blau: Knochenspitzenbündel.*

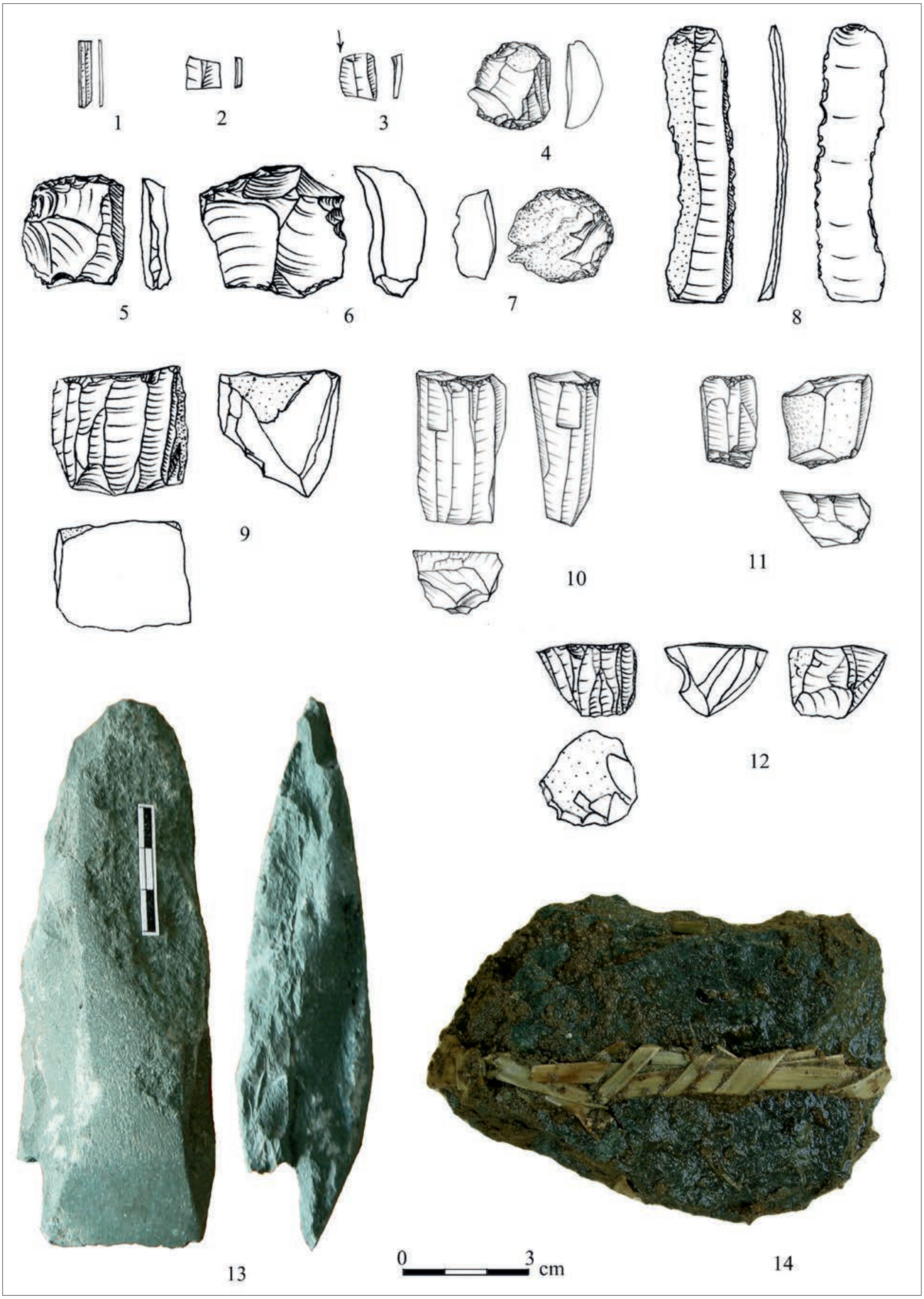

Fig. 9. Beregovaya 2. Middle Mesolithic (Layer IV) stone artefacts: 1 microblade; 2 blade fragment; 3 burin; 4-7 endscrapers; 8 retouched blade; 9-12 cores; 13 axe; 14 sinker from square meter 85 with preserved bark binding (drawing: M. Zhilin).

Abb. 9. *Beregovaya 2. Steinartefakte aus der mittelmesolithischen Schicht (Schicht IV): 1 Mikroklinge; 2 Klingenfragment; 3 Stichel; 4-7 Kratzer; 8 retuschierte Klinge; 9-12 Kernsteine; 13 Steinbeil; 14 Netzsenker aus Quadrat 85 mit erhaltener Umwicklung.*

Fig. 10. Beregovaya 2. Middle Mesolithic (layer IV) bone artefacts: 1-2 arrowheads; 3-5 awls; 6 tool of beaver incisor; 7 burin-scraper from beaver mandible; 8, 10-11 slotted knives; 9 dagger; 12 elk scapula knife (drawing and photo: M. Zhilin).

Abb. 10. *Beregovaya 2. Knochenartefakte aus der mittelmesolithischen Schicht (Schicht IV): 1-2 Pfeilspitzen; 3-5 Pfrieme; 6 Gerät aus Bieberzahn; 7 schaber-stichelartiges Gerät aus Bieberkiefer; 8, 10-11 Flintschneidenmesser; 9 Dolch; 12 Messer aus Elchschulterblatt.*

Fig. 11. Beregovaya 2, Middle Mesolithic. Bundle of eleven bone points in situ (photo: M. Zhilin).
Abb. 11. *Beregovaya 2, mittelmesolithische Schicht. Bündel aus elf Knochenspitzen in situ.*

Fig. 12. Beregovaya 2, Middle Mesolithic. Five two-winged bone points during excavation (photo: M. Zhilin).
Abb. 12. Beregovaya 2, mittelmesolithische Schicht. Fünf zweiflüglige Knochenspitzen in der Grabungsfläche.

Zaretskaya et al. 2012)

The lowermost cultural layer V (Early Mesolithic) rests upon the bottom of a glacial lake. This layer is separated from cultural layer 4 by a 0.10 - 0.20 m thick layer of reddish fine detritus gyttja. Bones of forest mammals, waterfowl and fish were detected accompanied by a lithic industry characterized by microblade technology (core, core preform) and core axes (several preforms). The bone industry includes fragments of harpoon heads, an intact fishing hook and several tools made of elk bones and antler and beaver mandibles. Besides thin stakes, driven into the lake bottom, two fragments of massive stakes and a massive plank were found. On the basis of the stratigraphy cultural layer V dates to the early Mesolithic. A Preboreal context is suggested by pollen data and two series of conventional radiocarbon date the sedimentation of the older phase between c. 9350 to 9250 calBC (GIN-14088, GIN-14135, GIN-14209, GIN-14210, KIA-42076; Fig. 6, Zaretskaya et al. 2012) and the younger phase between 8450 to 8300 calBC (GIN-14249, GIN-14250, GIN-14251; Fig. 6, Zaretskaya et al. 2012).

During excavation in 2009 the most prominent find assemblage was observed in the Middle Mesolithic layer (IV): adjacent to the unique hoard of bone points was found a net sinker with preserved binding and a coprolite (Figs. 8 & 13). These finds provided the opportunity for a detailed analysis of the finds and the integrity of the find layer.

The bundle of bone points (cultural layer IV)

In the central part of the middle Mesolithic layer a bundle of eleven bone arrowheads was recovered in the gyttja (Figs. 8, 11 & 12). Some stone flakes and fragments, a net sinker (Fig. 19), a cut branch, a wooden splinter with scars from whittling, a coprolite (Fig. 20) and a bone awl (Fig. 10: 4) were found close by at the same level.

The bone points were carefully uncovered and documented one by one in their exact position before removal from the gyttja. They were lying close together with the points in one direction and only the upper one was slightly turned (Fig. 11). The regular position of the bone points suggests that they were bound tightly together. Plant materials are well preserved in this cultural layer and the fact that no string was found let us assume that the points were bound with leather or sinew. Taking into consideration that gyttja is formed at a water depth from 1 to 3 m, this bundle was dropped into the lake and minor displacement of the upper arrowhead can be explained by wave activity.

Fig. 13. Bergovaya 2, Middle Mesolithic. Bone points, net sinker and coprolite in situ (photo: S. Hartz).

Abb. 13. *Beregovaya 2, mittelmesolithische Schicht. Knochenspitzen, Netzsenker und Koprolith in situ.*

Ten arrowheads are two-winged with a long blade and short stem (Figs. 14-16), and the last one represents a half-finished asymmetric composite point with the convex side prepared for a slot which was not cut (Fig. 16: 9). The two-winged arrowheads look rather uniform, probably made by one person. Their length varies between 17.1 and 24.0 cm, mostly 19.0 -22.8 cm; width between 1.4 and 1.8 cm, mostly 1.5 – 1.6 cm; and thickness between 0.5 and 0.7 cm, mostly 0.6 cm. The last one is 20.0 cm long, 1.0 cm wide and 0.6 cm thick, which also corresponds well with the general model, if we take into consideration that the width of asymmetric arrowheads is normally less than the width of two-winged ones. The points weigh between 10.7 g and 19.6 g (Fig. 17).

All of them were made from splinters removed from long bones most probably of elk. Technological analysis suggests the following manufacturing sequence for the two-winged points: 1. probably initial soaking of an elk long bone in water, 2. production of a blank by the groove and splinter technique, 3. coarse longitudinal scraping or whittling of the preform, 4. fine longitudinal whittling, 5. oblique grinding of the blade and stem of the arrowhead with a fine abrasive slab and 6. longitudinal whittling of the wedge-like bevel. However, no waste material of the manufacturing process was found in the cultural layer and production on site cannot be proven.

The manufacturing sequence for the asymmetric composite arrowhead (Fig. 16: 9) was similar, only the slot for inserts should have been cut along its convex side, but this final stage is missing. The broad and even surface of whittling scars at the bevel indicate that the

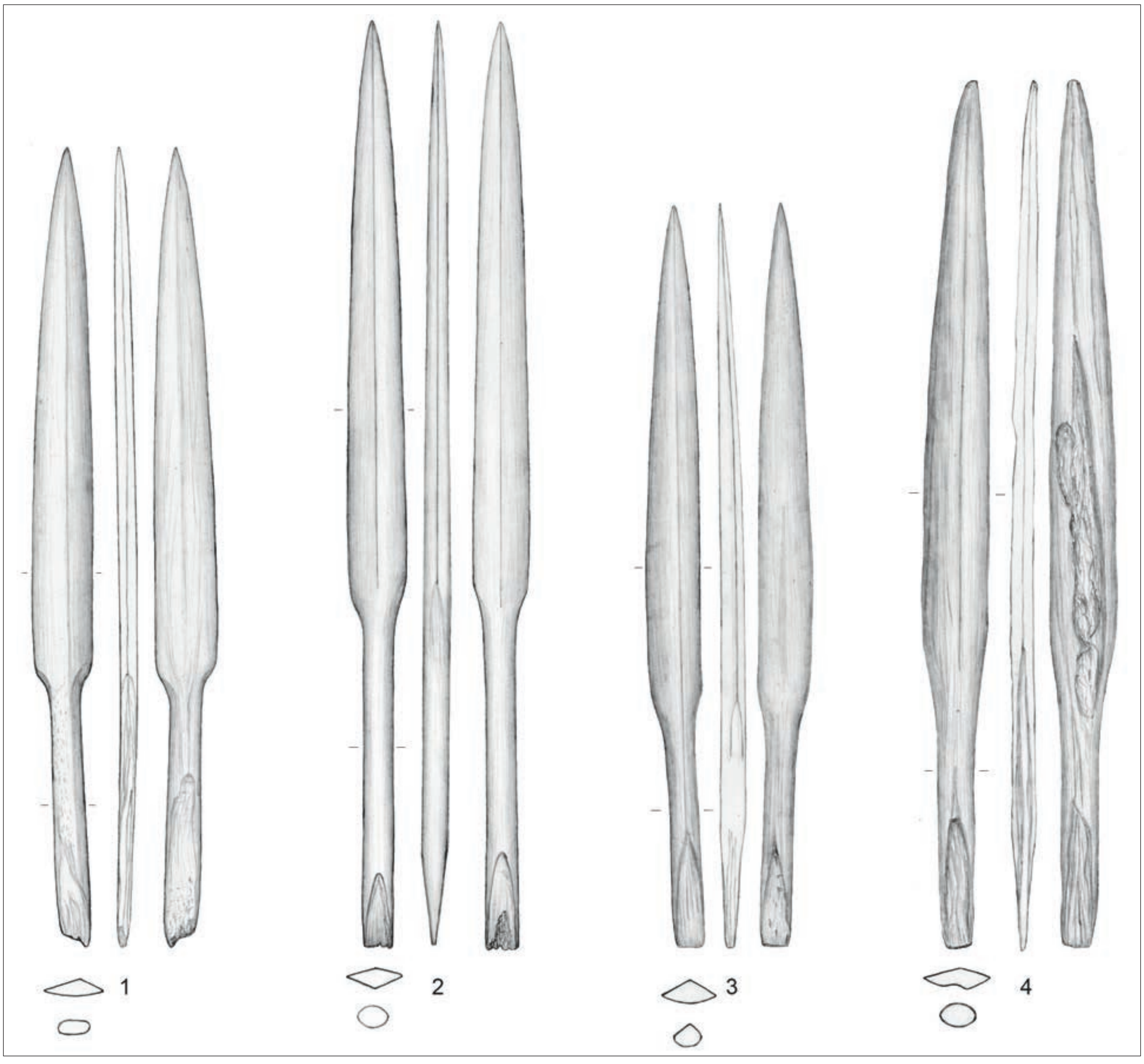

Fig. 14. Beregovaya 2, Middle Mesolithic. Bone points of bundle, no. 1-4 (drawings: M. Zhilin). Scale 1:2.
Abb. 14. *Beregovaya 2, mittelmesolithische Schicht. Knochenspitzen 1-4.*

bone was very soft during processing. The use-wear analyses with the help of a stereo microscope with magnifications up to 32 times showed that four arrowheads bear use traces as projectiles including impact fractures, polishing and thin short scratches (Figs. 14: 2; 15: 8; 16: 10-11), running from the tip along the axis of the arrowhead. Three others were finished, but not used (Figs. 14: ,3; 15,5.7); and the last four were unfinished (Figs. 14: 1 & 4; 15: 6; 16: 9). These points were probably produced for hunting big game, of which discarded faunal remains were recovered in large numbers in the outcast layers of the settlement (Fig. 18).

Long two-winged arrowheads with wedge-like base are known from Final Palaeolithic and Mesolithic sites as well as stray finds in Eastern Europe and the Urals areas. In the Eastern Urals region they are present in the stray find collection from the Shigir peat bog (Savchenko 2011) and in the cave from Kamen Dyrovatyi (Kalinina 2007). In Eastern Europe they are well known under the name Pentekinnen type in the Final Palaeolithic of the Baltic area (Clark 1936; Gross, 1940). Scarce finds of such arrowheads, but with conical base are known in the Mesolithic of the eastern Baltic (Zagorska & Zagorskis, 1989, fig. 4: 11), north of the Russian Plain and Upper Volga area (Zhilin 2001). Flat narrow asymmetric slotted arrowheads are well known in the Mesolithic of the Urals (Savchenko 2011) and represent a specific Urals type of arrowhead, which does not appear in other regions.

Net sinker (cultural layer IV)

Close to the bundle of bone arrowheads a net sinker with preserved binding was found (Figs. 8 & 19). The sinker was made of a coarse unworked fragment of a local rock (length: 8 cm, width: 6 cm, thickness: 3 cm) bound transversally four times. The binding material is a strip of bark probably willow (*Salix*). From the same Middle Mesolithic context a second sinker with a similar type of binding was recorded (Figs. 8 & 9: 14).

Net sinkers in gyttja deposits can easily be explained by accidents during fishing. They were lost during uplift of the net in a water depth of >1 meter or

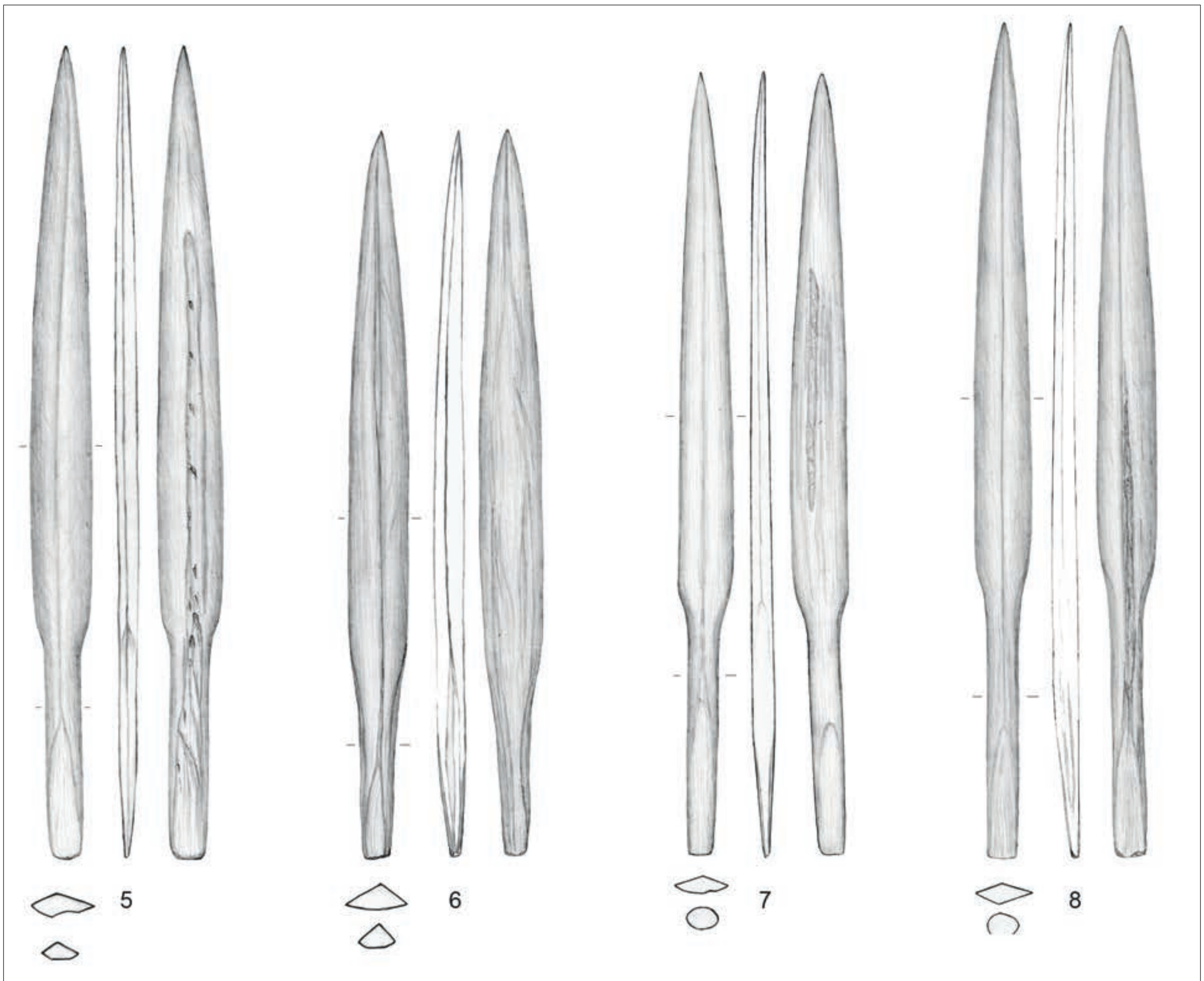

Fig. 15. Beregovaya 2, Middle Mesolithic. Bone points of bundle, no. 5-8 (drawings: M. Zhilin). Scale 1:2.

Abb. 15. *Beregovaya 2, mittelmesolithische Schicht. Knochenspitzen 5-8.*

they were discarded when the string was cracked or broken. Net sinkers appear in various forms and materials on the site and they indicate that aquatic resources played an important role for the Stone Age subsistence strategy.

The coprolite (cultural layer IV)

Excrements, preserved human or animal faecal matter, form a direct evidence of the substances consumed by animals or humans. They constitute a potentially vast source of information on animals and the ecology of the site in which they lived (Jouy-Avantin et al. 2003). Unfortunately, they are very fragile and susceptible to decomposition, and therefore rarely recovered in archaeological context. Well preserved palaeo-faeces could be used as a valuable source for identifying plant macro- and microremains (e.g. Delhon et al. 2008), the frequency of large herbivores in a landscape (Baker et al. 2013), in terms of palaeoparasitology (Kühn et al. 2013; Bouchet et al. 2003; Iñiguez et al. 2003), diet (van Geel et al. 2011) or even to get knowledge about viral diversity (Appelt et al. 2014). However, often the identification of such faecal matter to the species which produced it is debatable or not possible, but necessary before any further studies can be conducted. Therefore, during the past several years research on the species identification of excrements from archaeological context has been intensified (Linseele et al. 2013; Kühn et al. 2013).

The Beregovaya 2 coprolite was found as one large pellet (layer IV, square meter 49, -3.69 m below ground surface). It had a frustoconical, flat shape, a smooth texture and a dark brown to black colour (Figs. 8 & 20). After drying, it changed to a yellow-white, chalky mass showing few black pieces of charcoal (up to 5 mm).

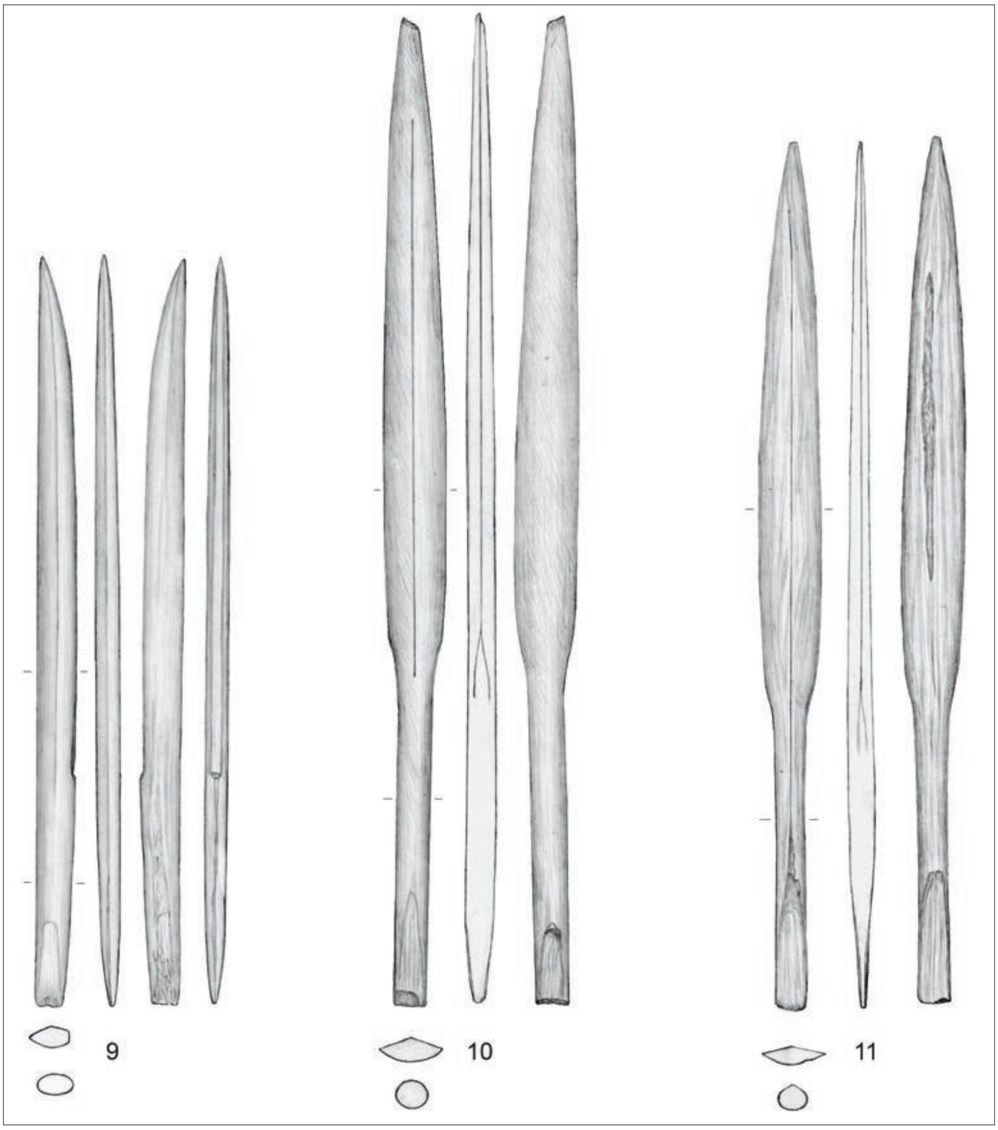

Fig. 16. Beregovaya 2, Middle Mesolithic. Bone points of bundle, no. 9-11 (drawings: M. Zhilin). Scale 1:2.

Abb. 16. *Beregovaya 2, mittelmesolithische Schicht. Knochenspitzen 9-11.*

No	type	Weight, gr.
1	Two-winged, unfinished	15.2
2	Two-winged, used	17.2
3	Two-winged, finished, unused	12.0
4	Two-winged, unfinished	16.9
5	Two-winged, finished, unused	10.7
6	Two-winged, unfinished	11.6
7	Two-winged, finished, unused	14.7
8	Two-winged, used	19.6
9	Narrow flat asymmetric slotted, unfinished	14.8
10	Two-winged, used	16.3
11	Two-winged, used	11.8

Fig. 17. Beregovaya 2, Middle Mesolithic (layer 4). Weights of the bone points from the cache.

Abb. 17. *Beregovaya 2, mittelmesolithische Schicht. Gewichte der Knochenspitzen.*

Species\ layers		II	III	IV	V
Elk	*Alces alces*	+	+	+	+
Beaver	*Castor fiber*	+	+	+	+
Wolf	*Canis lupus*	+	+	+	+
Brown bear	*Ursus arctos*	+	+	+	+
Reindeer	*Rangifer tarandus*	+	+		
Siberian red deer	*Cervus elaphus*			+	+
Fox	*Vulpes vulpes*		+		
Otter	*Lutra lutra*		+	+	
Hare	*Lepus sp.*	+	+	+	
Badger	*Meles meles*	+	+		
Sable	*Martes zibellina*		+	+	
Weasel	*Mustela erminea*	+			
Pine marten	*Martes martes*				+
Wolverine	*Gulo gulo*			+	
Polecat	*Mustela putorius*			+	
Domestic dog	*Canis lupus* f. *familiaris*	+		+	

Fig. 18. Beregovaya 2. Fauna represented in the find layers (identification by P.A. Kosintsev).

Abb. 18. *Beregovaya 2. Faunenspektrum in den einzelnen Fundschichten.*

Small fish bones, scales and tiny charcoal and stone particles were already visible within the coarse component. After recovering, it was carefully dried and kept sterile for a later attempt to determine the species of origin. For this reason, it was decided to test the preservation of aDNA (E.A. Nikulina) and to analyze faunal (U. Schmölcke) and botanical macro remains (S. Klooß).

aDNA-analysis

First approaches to analysis the ancient DNA of palaeo-faeces go back to the late 1990s (Poinar et al. 2001; Fricker et al. 1997), but to date it remains very difficult to extract the aDNA of the defecator due to the bad preservation of coporolith aDNA and – related to that fact – the high risk of recent contamination of the ancient samples. This is especially true for potential human palaeo-faeces (Gilbert et al. 2009). Therefore such investigations are rarely done (Kuch & Poinar 2012). In the case of the Beregovaya 2 coprolite it was necessary to create a bar-coding marker system, which allows the animal species identification of the defecator and not of the animal species consumed (cf. Poinar et al. 2001). In this case, it was obvious that the last meal was some kind of fish. Therefore, the genetic analyses were applied to test the assumption of origin of the coprolite from human vs. dog vs. wolf or fox. The aDNA study was conducted in the Archaeogenetic Laboratory of the Centre of Baltic and Scandinavian Archaeology (ZBSA) in Schleswig, Germany. All analyses were done following the strict criteria necessary in archaeogenetic to ensure the authenticity of the aDNA.

The faecal pellet was stored in a dried state at room temperature before analyses. Several relatively large (ca. 10 mm) intact fragments of the faecal pellet were selected to obtain 0.5 g material for DNA extraction. The fragments were irradiated for 60 minutes with UV light (254 nm) to reduce superficial contamination. The material was dissolved in 500 µl MagNA Pure DNA Tissue Lysis Buffer (Fa. Roche Diagnostics) with 20 µl Proteinase K (20 mg/ml). The mixture was incubated for 24 hours at 37 °C. 20 µl Proteinase was added every eight hours. Finally, the temperature was increased to 55 °C for two hours after addition of a fresh portion of Proteinase. The mixture was centrifuged at 3000 rpm for 1 minutes and 400 µl of supernatant was used for the automated silica-based extraction with MagnaPure Compact System and Nucleic Acid Isolation Kit I (Fa. Roche Diagnostics).

We designed two primers for the polymerase chain reaction (PCR), which are specific for Canidae (dog, wolf and fox): 5`-ATTATATCCTTACAT-AGGAC-3′ and 5`-TGATTAAGCCCTTATTGGAC-3′. The primer pair allows amplification of a 100 bp fragment (60 bp excluding primers) of the mitochondrial control region. 2 µl of the DNA extract were used for PCR. The final reaction volume was 10 µl. Each reaction consisted of Pfu-rekombinant, 0.06 mM KCl, 16 mM (NH_4) $2SO_4$, 2 mM $MgSO_4$, 1 mM dNTPs, 20 mM Tris-HCl (pH 8.8), 0.1 % Triton X-100, 0.1 mg/ml BSA, and 0.5 µM of each primer. Amplifications were performed in following cycling conditions: initial denaturation at 95 °C for three minutes, followed by 50 cycles of at 95 °C for 30 seconds, annealing at 45 °C

Fig. 19. Beregovaya 2, Middle Mesolithic. Netsinker in situ (photo: M. Zhilin)
Abb. 19. *Beregovaya 2, mittelmesolithische Schicht. Netzsenker in situ.*

for 30 seconds, extension at 72 °C for 40 seconds, and final extension at 72 °C for five minutes. PCR products were one time re-amplified in 20 µl reaction volumes with similar composition and cycling parameters, but the cycle's number was reduced to 30. Such obtained amplifications were gel-purified and cloned using *E. coli* JM107 and CloneJET PCR Cloning Kit (Fa. Fermentas) as well as Roti®-Transform (Fa. Carl Roth) to prepare calcium chloride competent bacterial cells.

Transformed *E. coli* were incubated at 37 °C for 18 hours on agar ampicillin plates. Eight to ten colonies per plate were transferred on a fresh selective plate and additionally incubated at 37 °C for eight to ten hours. We used these colonies to perform PCR with the primer pair pJET1.2 Forward and pJET1.2 Reverse (Fa. Fermentas).

The reaction mix was as follows: 1 U Taq DNA Polymerase, 0.8 mM dNTPs, 2 mM $MgSO_4$, 10 mM KCl, 8 mM $(NH_4)2SO_4$, 10 mM Tris-HCl (pH 8.8), and 0.25 µM of each primer. Cycling parameters were: 95°C for 3 minutes followed by 25 cycles at 94 °C for 30 seconds, 60°C for 30 seconds, and 72 °C for 30 seconds. PCR products were sequenced using Sanger method (Sanger et al. 1977) at the Institute of Clinical Molecular Biology, Kiel University. To test the reproducibility of results, all analyses were one (extraction) to at least four times (PCR, cloning, sequencing) repeated; negative extraction, PCR, cloning and sequencing controls were processed. The obtained sequences were analysed using DNASTAR (DNASTAR, Inc.) and the online Basic Local Alignment Search Tool (BLAST; Altschul et al. 1990).

Finally, a BLAST search of the cross-referenced nucleotide data bases revealed that the obtained sequence has the highest similarity (100 %) to the mitochondrial control region of dog. The sequence was submitted to the European Nucleotide Archive (ENA) and assigned the accession number LM993795. Because the faecal aDNA preservation was poor only very short fragments were amplifiable, in our case 100 bp. This is enough for species identification, but not enough for further implication or comparisons with DNA data of ancient dog teeth or bones (e.g. Druzhkova et al. 2013; Germonpré et al. 2009).

Fig. 20. Beregovaya 2, Middle Mesolithic. Coprolite after recovering (photo: S. Hartz).
Abb. 20. *Beregovaya 2, mittelmesolithische Schicht. Koprolith nach der Bergung.*

Faunal analysis
The coprolite from Beregovaya 2 contained fish remains, mostly scales of perch (*Perca fluviatilis*) and of one or more unknown cyprinid species. Only six bones of at least three specimens could be identified to species level. Four bones, one spina pinna, one ceratohyal and two precaudal vertebrae are from *P. fluviatilis*. Since the two vertebrae differ strongly in size – their length is 2.2 mm and 4.0 mm – they must derive from two individuals with total body length of about 14 cm and 26 cm, respectively. The second detectable species is the dace (*Leuciscus leuciscus*), represented with an operculum and a precaudal vertebra. Although laterally fragmented to a nearly quadratic piece, the operculum is the largest bone in the coprolite (15 x 15 mm). Comparisons to skeletons of modern dace show that the fish must have been of a total body length of about 25 cm, near to the maximum length of this species. The fragmented vertebra could be of the same specimen. While records of the ubiquitous perch give no specific information about the aquatic environment, the record of dace is typical for streams or large rivers with rock or gravel bottom.

Botanical macro remains
Only a few uncharred straws (2-3) and some remains of epidermises could be identified. Three uncharred seeds of large nettle (*Urtica dioica*), white goosefoot (*Chenopodium album*) and fig-leave goosefoot (*Chenopodium ficifolium*) indicate nitrogen-rich ruderal locations typical for the local environment of a (Mesolithic) settlement site (see Kloss 1987a; 1987b). The charcoal and the tiny stones probably formed accidental elements of the dog diet.

Radiocarbon dating cultural layer IV and the bundle of bone points

In order to obtain detailed insight into the age of the Middle Mesolithic assemblage (cultural layer IV) and to test the integrity of the gyttja layer a series of radiocarbon dates has been obtained (Fig. 6). Conventional radiocarbon dating was performed in Moscow (Russia) and AMS-dating in Kiel (Germany), Poznan (Poland), and Aarhus (Denmark).

From the cultural layer nine samples were taken from lacustrine deposits (gyttja), unworked and worked wood as well as elk bone and antler for conventional ^{14}C-dates. They assign two phases of settlement to the early and middle Boreal period (c. 8800 - 8300 calBC and 7600 - 7400 calBC; Fig. 6, Zaretskaya et.al. 2012). In order to gain more detailed information on the dating of the bundle of arrowheads without destroying the unique series of artefacts, we decided to sample the adjacent coprolite and net sinker (fibres) from the same layer. In addition, plant material from a second net sinker from the same layer was chosen for AMS dating.

Fine grained organic faecal matter from the coprolite was dated to c. 7575–7530 calBC (POZ 46389: 8480 ±40 BP), while the plant material from the adjacent net sinker gave almost the same age of

7569–7494 calBC (KIA 42075: 8445 ±50 BP). The second net sinker (Fig. 9: 14) which was found 5 m away (sqm 85) from the bone arrowheads was dated slightly younger to 7540–7460 calBC (AAR 14834: 8405 ±40 BP).

There is a striking accordance between the three AMS-dates, and statistically they can represent the same age. They date the assemblage from layer IV and the bone arrowheads to the middle part of the Boreal. The AMS results are in general accordance with the conventional dates, however, the conventional ones tend to be slightly older (early Boreal).

Discussion

Five cultural layers dating from the Early Mesolithic to the Eneolithic make Beregovaya 2 the most important peat bog site of the Stone Age in the Middle Trans Ural region and now there is no doubt that the middle Urals was settled during the entire early Holocene.

Systematic radiocarbon dating provides a reliably dated stratigraphy for the site (Fig. 6). AMS-dates of cultural layer IV from three different laboratories give an accurate dating for the find context of the bone point bundle and prove the integrity of the gyttja layers: The bone and stone objects of different stability and weight give statistically identical results and leave no doubt that we are dealing with reliable find layers with no indication for find mobility during deposition in the soft sediments or by later taphonomic processes.

Environment and subsistence

Pollen data indicate that during the Preboreal period sparse larch forests with pine and birch trees were widespread, but since the early Boreal period dense taiga forest was dominant around the Beregovaya 2 site. Larch, and birch were still the main tree species, but pine was also present. Since the late Boreal and during modern times pine and birch dominate in the forest with larch and some other species as admixture (Zaretskaya et al. 2014).

Regarding subsistence strategy, hunting was of major importance for the provision of meat and marrow. In the bone composition elk is the most frequent species, followed by beaver and other forest mammals.

Bird bones are numerous in all layers with various waterfowl the most important species. Regarding the location of the settlement at the lake shore it is no surprise that fish bones are present in all layers. Fishing seems to be most important during the Boreal period (layer III and IV) and perch and pike bones are the most numerous species. Fishing technology such as hooks and net sinkers support the idea that fish contributed considerably to the human diet. Stable isotope data on humans from Stone Age burials of Minino and Sakthysh, in Upper Volga (Wood et al. 2013; Piezonka et al. 2013) indicate that aquatic resources such as fish, waterfowl and probably also water chestnut played a very important role for Mesolithic and Neolithic (pottery Mesolithic) people. The data suggest increasing relevance of fish towards the Neolithic.

When it comes to the dog – unusually recorded at the Beregovaya 2 not only osteologically but also by the archaeogenetic analysis of faecal material – its presence at the site was to be expected. The process of domestication took place independently at different places in the Near East, in Siberia, China and in Europe between 30,000 and 12,000 calBC (Savolainen et al. 2002; Germonpré et al. 2009; Thalmann et al. 2013; Boudadi-Maligne & Escarguel 2014), and some recent studies indicate a very early domestication event 33,000 years ago in the Central Asian Altai region (Druzhkova et al. 2013; Ovodov et al. 2011). Obviously, certain dogs were known in Stone Age as "persons with 'souls'" and this applies to a special degree in the Lake Baikal region of Siberia (Losey et al. 2013; Losey et al. 2011). Nevertheless, dogs have also been part of the human diet for instance in Europe in times when food was scarce, quite regularly during the Mesolithic and Neolithic (e.g. Ewersen & Schmölcke 2013). Probably already in Mesolithic times humans and dogs hunted together (Schmölcke 2013), since dogs could not only help the hunters to find the prey, they also followed and killed wounded animals (Vang Petersen 2013).

Material culture

Hunting was also important for the acquisition of raw material (like skin, sinew, bone and antler). The rich bone and antler industry from all three Mesolithic layers appears to be rather homogenous: The tool assemblage consists of bone arrowheads, harpoon heads, daggers, knives, awls, hooks, shoulder blade knives, rib scrapers, long bone scrapers and beaver mandible tools. Most of these bone artefacts find analogies in the Mesolithic of Eastern Europe (Zhilin 2001). The needle shaped (Fig. 10: 1) and two-winged arrow heads also find their parallels there, though wedge-like bases are rare in Eastern Europe. Similar types of harpoon heads and straight daggers and knives (Figs. 10: 9 & 11) are known from Eastern and Northern Europe, as well as intact fishing hooks, awls shoulder blade and rib knives. On the other hand, narrow flat asymmetric slotted arrowheads (Fig. 10: 2) and curved knives (Fig. 10: 8 & 10) with a slot for inserts on the convex side are typical for the Urals area and are not met with in Eastern and Northern Europe. The Mesolithic bone industry of Western Siberia is practically unknown. Only one fragment of a burnt slotted arrowhead was reported from this region, but large series of microblade inserts from mineral soil sites suggest wide use of slotted weapons (Besprozvannyi 1997).

Among the bone tool industry slotted daggers and points deserve special attention. They correspond well with the presence in the stone artefact assemblage of layers III-V of very regular, narrow microblades produced by pressure technique (Fig. 9: 1) and cores for their production (Fig. 9: 9-12). Microblades require high quality raw material and pieces of such quality from local deposits were available at Beregovaya 2. This technology is directly associated with slotted composite tools and microblade fragments used as insets. The same type of blade concept with conical microblade cores is common in the Butovo Culture further West and could be identified in some Final Palaeolithic and various Mesolithic sites of the Upper Volga region (Zhilin 2001; 2006; 2007; 2011). In the late Boreal/early Atlantic period the microblade production by pressure technique becomes a frequent element in Mesolithic assemblages from the northern lowlands and southern Scandinavia. Some years ago we suggested an eastern origin for this innovation in northern Europe and the western Baltic (Hartz et al. 2010) and recently this was confirmed by further studies. Sørensen et al. (2013) identified in late Preboreal and early Boreal assemblages from the eastern Baltic and Fennoscandinavia *the conical core pressure blade concep*t. The findings from Beregovaya 2 prove the presence of this specific blade concept at the beginning of the Holocene further East to the Ural region. Two fragments of slotted bone daggers in the cave site Bobylek suggest its even earlier presence in the Late Glacial of the Southern Urals (14200 ±400 BP; Volokitin & Shirokov 1997). A dagger with slots on both lateral sides with microblades in situ, and a fragment of a similar weapon from the site Chernoozerye 2 in Western Siberia are also dated to the Late Glacial (14500 ±500 BP; Gening & Petrin 1985). This site also produced a number of small cores of microblade production probably manufactured by pressure technology. Further studies are necessary to better understand the wider Eurasian context of this technology and related composite tools on the basis of reliable dated contextual findings.

Polished stone axes and adzes (Fig. 9: 13) are another important element present in Beregovaya 2 since the Early Mesolithic. Waste products from all Mesolithic layers (III-V) demonstrate the production of such tools at the site. They find their counterparts in assemblages of the Butovo Culture such as Stanovoje 4 and similar sites in the Upper Volga region further West (Zhilin 2009). The polished axes were used for wood cutting and this technology is introduced here much earlier than in the Central European Stone Age, where regular use of polished rock stone adzes / axes does not appear before the Early Neolithic (Linienbandkeramik) in the 6th millennium calBC (e.g. Ramminger 2007). Further studies are necessary to evaluate the impact of the use of polished stone tools on the Mesolithic environment and to better understand the Eurasian origin and context of this technology.

A further important element to mention is the early presence of pottery in Beregovaya 2, layer II. Two charred remains from ornamented shards of the Koshkinskij type discovered in close connection to an organic tool (elk antler pick-axe) from the same layer were directly dated. The early use of pottery at the end of the 7th mill calBC in the Middle Trans Urals region is confirmed by three radiocarbon dates of 6232-6101calBC (KIA 42074), 6230-6100 calBC (AAR 14833) and 6211-6083 calBC (AAR 14548; Zaretskaya et al. 2012). The similarity of dates on charred remains from shards and the elk antler tool indicates an absence of reservoir effect in this case. Further west, in the European Forest Zone (Upper Volga Region), pottery was introduced somewhat later (Hartz et al. 2012; Dubovtseva et al. 2013). In view of a possible reservoir effect for charred crusts from potsherds, the question of diffusion and / or independent invention of pottery production in various parts of Eastern Europe and Eurasia cannot be clearly answered on the base of the present data.

The bone point bundle in context

The most prominent find of the Beregovaya 2 site is the unique bundle of eleven bone points from the Middle Mesolithic layer (IV). If all the pieces were unfinished, the motivation for the deposition of the points in the water near the lake shore could be explained rather easily by soaking before final processing. The presence of used and finished but also of unused and unfinished points of similar dimensions are not in favour of this interpretation and give the impression of a deposition or cache for further future use. However, it is not uncommon that finished and unfinished projectiles were kept together as we can learn from the equipment of the ice mummy from the Ötztal Alps, where most of the arrows were unfinished (e.g. Egg 1992; Fleckinger & Steiner 2000). In conclusion the bundle can be explained as a reserve which a hunter deposited or lost by accident.

Neighbouring finds such as stone flakes, a net sinker, a cut wooden branch and a coprolite seem to be ordinary waste randomly ending up in the sediment layer at the lake shore near the settlement. According to the topographical situation there was no real beach zone during occupation of layer IV.

The excavation plan shows that most of the recovered finds, including concentrations of fish scale and bones, otoliths, and a lot of flakes from flint and non-siliceous rock processing, as well as polishing slabs for the production of stone axes and various other tools, and the majority of the wooden stakes are concentrated not near the shoreline, but at a distance of about 10-18 meters from it, or 16-25 meters from the edge of the settlement site on top of the rocky promontory (Fig. 3). The reason for this is unclear and we do not want to disallow that some kind of platform was built to carry out work requiring water.

In the light of the prominent topographical situation we do not want to rule out a ritual offering of the points. It is well known from both the archaeological and ethnographic record that lake shores of settlements sometimes had a special status (Chairkina 2004).

At the Upper Volga Mesolithic site of Ivanovskoye 7 a perfectly polished and richly ornamented arrowhead was deeply embedded in the lake bottom near the habitation site. Moreover, the nearby site Ivanovskoye 3 yielded two long needle shaped arrowheads, one of which was ornamented, and also stuck vertically in the lake bottom near the habitation site. The prestigious character of those points and the fact that such arrowheads were normally used for terrestrial hunting argue for the interpretation of the finds as the result of ritual activities at the lake shore (Zhilin 2001; Zhilin et al. 2002).

At the same time we can mention finds of ritual character found in shallow water environments at northern Central European Mesolithic sites, such as the ornamented bone and antler artefacts from Friesack and Rosenhof (Gramsch 2000; Feulner & Hartz 2011) or prestigious items such as Danubian shaft hole axes (Hartz et al. 2011). During the European Bronze and Iron Age (2nd/1st millennium calBC) offerings of weapons in water are well known (e.g. Hansen 1994; Hansen et al. 2012) and similar observations can be reported from the eastern Urals area (Chairkina 2004, 139).

If we look for parallels we have to admit that in general Mesolithic bone points appear in large numbers in bogs, swampy lakes (e.g. Lubana Lake or Shigir peat bog: Chairkina et al. 2000; Bützsee: Cziesla & Pettitt 2003) and in multilayer bog sites such as Friesack (Gramsch 2010), Hohen Viecheln (Schuldt 1961) or the Danish Åmosen (Mathiassen 1943; Andersen 1983). Only in a few cases are there indications for an intentional deposition of series of points. Prominent examples are two complexes of barbed bone points from Friesack in north-eastern Germany (Gramsch 1987). The five points of complex II bear traces of hafting material and the finished weapons were embedded in the bottom of the layer. The second complex (III) consists of six barbed points in a bundle oriented parallel to the ground. This situation resembles the Beregovaya 2 find and an interpretation as a stored cache or ritual deposition in the shallow water seems plausible. Further Mesolithic caches from southern Sweden are discussed by Larsson (1978), but in no case were more than two barbed bone points found together and deposition of flint artefacts is more relevant. Recently four blade caches dating to the late Maglemose/early Kongemose were detected by systematic large scale investigations in Rönneholms mosse (Larsson & Sjöström 2010). They were found isolated and demonstrate that deposition of materials in the landscape was more common than perhaps expected.

A good parallel for the Beregovaya 2 finding can be mentioned from the Horne site in northern Jutland, Denmark, where five barbed bone points were found during early peat cutting (Andersen 1978). According to early reports they were tied together with plant material and there is little doubt that we are dealing with an intentional cache or votive offering.

In 2010 two bone harpoon heads were discovered in Beregovaja 2, again in cultural layer III at the greatest distance from the shore end of the trench. They were placed horizontally on the surface of the swamp at a distance of 2 m from the trackway. They were resting beside each other without any traces of hafting. The context of this find indicates that it might have been an offering.

In conclusion depositions are known from Mesolithic sites from time to time and can also be discussed for Upper Palaeolithic / Late Glacial contexts (e.g. Bosinski 1982; Terberger 1998). They reflect a considerable planning depth in the acquisition of raw materials / processing of tools and weapons and probably also demonstrate a long tradition of ritual activities at waterside locations.

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Literature cited

Altschul, S. F., Gish, W., Miller, W., Myers, E. W. & Lipman, D. J. (1990). Basic local alignment earch tool. *Journal of Molecular Biology* 215: 403-410.

Andersen, S. H. (1978). En 8000-årig pil fra fra Vendsyssel. *Vendsyssel nu og da* 2: 54-55.

Andersen, K. (1983). *Stenalderbebyggelsen i den vestsjællandske Åmose*. Fredeningsstyrelsen, København.

Appelt, S., Fancello, L., Le Bailly, M., Raoult, D., Drancourt, M. & Desnues, C. (2014). Viruses in a 14th-century coprolite. *Applied and Environmental Microbiology* AEM-03242, doi: 10.1128/AEM.03242-13.

Baker, A. G., Bhagwat, S. A. & Willis, K. J. (2013). Do dung fungal spores make a good proxy for past distribution of large herbivores? *Quaternary Science Reviews* 62: 21-31.

Besprozvannyi, E. M. (1997). The Mesolithic of the taiga zone of Southern Siberia. *In: Rescue archaeological investigations in Middle Urals*. Yekaterinburg, 26-38 (in Russian).

Bosinski, G., Braun, R., Turner, E. & Vaughan, P. (1982). Ein spätpaläolithisches Retuscheurdepot von Niederbieber/ Neuwieder Becken. *Archäologisches Korrespondenzblatt* 12: 295–311.

Bouchet, F., Harter, S. & Le Bailly, M. (2003). The state of the art of paleoparasitological research in the Old World. *Memorias do Instituto Oswaldo Cruz* 98: 95-101.

Boudadi-Maligne, M., & Escarguel, G. (2014). A biometric re-evaluation of recent claims for Early Upper Palaeolithic wolf domestication in Eurasia. *Journal of Archaeological Science* 45: 80-89.

Chairkina, N. M., Savchenko, S. N., Serikov, Y. B. & Litvyk, A. S. (2000). *Archaeological sites of the Shigir peat bog.* Yekaterinburg (in Russian).

Chairkin, S. E. & Zhilin, M. G. (2005). Mesolithic finds from cave sites of the forest zone of Eastern Urals. *In:* M. G. Zhilin (ed.) *The Stone Age of Eastern Europe and Trans Urals area.* Moscow, Academia (in Russian).

Chairkina, N. M. (2004). Mysteries of peat bogs. *In: Ritual sites of the mountain and forest Eastern Urals area.* Yekaterinburg (in Russian).

Clark, J. G. D. (1936). *The Earliest Stone Age Settlement of Scandinavia.* Cambridge.

Cziesla, E. & Pettitt, P. B. (2003). AMS-^{14}C-Datierungen von spätpaläolithischen und mesolithischen Funden aus dem Bützsee (Brandenburg). *Archäologisches Korrespondenzblatt* 33: 21-38.

Delhon, C., Martin, L., Argant, J. & Thiébault, S. (2008). Shepherds and plants in the Alps: multi-proxy archaeobotanical analysis of neolithic dung from "La Grande Rivoire" (Isère, France). *Journal of Archaeological Science* 35: 2937-2952.

Druzhkova, A. S., Thalmann, O., Trifonov, V. A., Leonard, J. A., Vorobieva, N. V., Ovodov, N. D., Graphodatsky, A. S. & Wayne, R. K. (2013). Ancient DNA analysis affirms the canid from Altai as a primitive dog. *PloS one* 8(3): e57754.

Dubovtseva, E., Kosinskaya, L., Panina, S., Piezonka, H. Savchenko, S., Terberger, T. & Zhilin, M. G. (in prep.). Early Pottery in the Urals region. New Results. *Presentation on the 7th International Symposium „Radiocarbon and Archaeology"*, Ghent 2013.

Egg, M. (1993). Die Gletschermumie vom Ende der Steinzeit aus den Ötztaler Alpen. *Jahrbuch Römisch-Germanisches Zentralmuseum* 39: 1-128.

Ewersen, J. & Schmölcke, U. (2013). Untersuchungen zur Haltung und Nutzung von Haushunden auf meso- und neolithischen Fundplätzen im nördlichen Deutschland. *Universitätsforschungen zur Prähistorischen Archäologie* 240. Bonn, p. 267-299.

Feulner, F. & Hartz, S. (2011). Ein Loch, 7 Ecken und 280 Kerben. Der Kultstab von Grube-Rosenhof in Ostholstein. *Archäologische Nachrichten aus Schleswig-Holstein* 17: 22-25.

Fleckinger, A. &, Steiner, H. (2000). *Der Mann aus dem Eis.* Bozen.

Fricker, E. J., Spigelman, M. & Fricker, C. R. (1997). The detection of Escherichia coli DNA in the ancient remains of Lindow Man using the polymerase chain reaction. *Letters in applied microbiology* 24: 351-354.

Gening, V. F. & Petrin, V. T. (1985). *Late Paleolithic epoch at the south of Western Siberia.* Novosibirsk. Nauka.

Germonpré, M., Sablin, M. V., Stevens, R. E., Hedges, R. E. M., Hofreiter, M., Stiller, M. & Despré, V. R. (2009). Fossil dogs and wolves from Palaeolithic sites in Belgium, the Ukraine and Russia: osteometry, ancient DNA and stable isotopes. *Journal of Archaeological Science* 36: 473-490.

Gilbert, M. T. P., Jenkins, D. L., Higham, T. F., Rasmussen, M., Malmström, H., Svensson, E. M., Sanchez, J. J., Scott Cummings, L., Yohe, R. M., Hofreiter, M., Götherström, A. & Willerslev, E. (2009). Response to comment by Poinar et al. on "DNA from pre-Clovis human coprolites in Oregon, North America". *Science* 325: 148-148.

Gramsch, B. (1987). Zwei mesolithische Knochenspitzen-Depots von Friesack, Kr. Nauen. *Ethnographisch-archäologische Zeitschrift* 28: 222-231.

Gramsch, B. (2000). Friesack: Letzte Jäger und Sammler in Brandenburg. *Jahrbuch des Römisch-Germanischen Zentralmuseums* 47: 51-96.

Gramsch, B. (2010). Die mesolithischen Knochenspitzen von Friesack, Fundplatz 4, Lkr. Havelland. *Veröffentlichungen zur brandenburgischen Landesarchäologie* 43/44: 7-84.

Gross, H. (1940). Die Renntierjäger-Kulturen Ostpreußens. *Prähistorische Zeitschrift* 30-31: 39-67.

Hansen, S. (1994). Studien zu den Metalldeponierungen während der älteren Urnenfelderzeit zwischen Rhônetal und Karpatenbecken. *Universitätsforschungen zur prähistorischen Archäologie* 21. Habelt Verlag. Bonn.

Hansen, S., Neumann, D. & Vachta, T. (eds.) (2012). Hort und Raum. *Aktuelle Forschungen zu bronzezeitlichen Deponierungen in Mitteleuropa.* Topoi 10. Berlin.

Hartz, S., Terberger, T. & Zhilin, M. G. (2010). New AMS-dates on the Upper Volga Mesolithic and the origin of Microblade Technology. *Quartär* 57: 155-169.

Hartz, S., Kalis, A. J., Klassen, L. & Meurers-Balke, J. (2011). Neue Ausgrabungen zur Ertebøllekultur in Ostholstein und der Fund von vier stratifizierten durchlochten donauländischen Äxten. *In*: J. Meurers-Balke & W. Schön (eds.) *Vergangene Zeiten… LIBER AMICORUM. Gedenkschrift Jürgen Hoika. Archäologische Berichte* 22. Kerpen-Loogh, 25-62.

Hartz, S., Kostyleva, E., Piezonka, H., Terberger, T., Tsydenova, N. & Zhilin, M. G (2012). Hunter-gatherer Pottery and charred Residue Dating: New Results on Early Ceramics in the North European Eurasian Forest Zone. *Radiocarbon* 54: 1033-1048.

Iñiguez, A. M., Reinhard, K. J., Araújo, A., Ferreira, L. F. & Vicente, A. C. P (2003). *Enterobius vermicularis*: ancient DNA from North and South American human coprolites. *Memórias do Instituto Oswaldo Cruz* 98: 67-69.

Jouy-Avantin, F., Debenath, A. Moigne, A. M. & Moné, H. (2003). A standardized method for the description and the study of coprolites. *Journal of Archaeological Science* 30: 367-372.

Kalinina, I. V. (2007). Mesolithic substrate in the ornamental tradition of the Ob Ugrian people. *In*: Myth, rite and ritual object in antiquity. Yekaterinburg (in Russian)

Kloss, K. (1987a). Pollenanalyse zur Vegetationsgeschichte, Moorentwicklung und mesolithisch-neolithischen Besiedlung im Unteren Rhinluch bei Friesack, Bezirk Potsdam. *Veröffentlichungen des Museums für Vor- und Frühgeschichte Potsdam* 21: 101-120.

Kloss, K. (1987b). Zur Umwelt mesolithischer Jäger und Sammler im Unteren Rhinluch bei Friesack. *Veröffentlichungen des Museums für Vor- und Frühgeschichte Potsdam* 21: 121-130.

Kuch, M. & Poinar, H. (2012). Extraction of DNA from Paleofeces. *Methods Molecular Biology* 840: 37-42.

Kühn, M., Maier, U., Herbig, C., Ismail-Meyer, K., Le Bailly, M. & Wick, L. (2013). Methods for the examination of cattle, sheep and goat dung in prehistoric wetland settlements with examples of the sites Alleshausen-Täschenwiesen and Alleshausen-Grundwiesen (around cal 2900 BC) at Lake Federsee, South-west Germany. *Environmental Archaeology* 18: 43-57.

Larsson, L. (1978). Ageröd IB – Ageröd ID: a study of the early Atlantic settlement in Scania. *Acta archaeological Lundensia* 12. Habelt Verlag, Bonn.

Larsson, L. & Sjöström, A. (2010). Mesolithic research in the bog Rönneholms mosse, southern Sweden. *Mesolithic Miscellany* 21: 2-9.

Lillie, M. C., Zhilin, G. M., Savchenko, S. & Taylor, M. (2005). Carpentry dates back to Mesolithic. *Antiquity* 79: 305.

Linseele, V., Riemer, H., Baeten, J., De Vos, D., Marinova, E. & Ottoni, C. (2013). Species identification of archaeological dung remains: A critical review of potential methods. *Environmental Archaeology* 18: 5-17.

Losey , R. J., Bazaliiskii, V. I., Garvie-Lok, S., Germonpré, M., Leonard, J. A., Allen, A. L., Katzenberg, M. A. & Sablin, M. V. (2011). Canids as persons: Early Neolithic dog and wolf burials, Cis-Baikal, Siberia. *Journal of Anthropological Archaeology* 30: 174-189.

Losey, R. J., Garvie-Lok, S., Leonard, J. A., Katzenberg, M. A., Germonpré, M., Nomokonova, T., Sablin, M. V., Goriunova, O. I., Berdnikova, N. E. & Savel'ev, N. A. (2013). Burying Dogs in Ancient Cis-Baikal, Siberia: Temporal Trends and Relationships with Human Diet and Subsistence Practices. *PLoS ONE* 8(5): e63740.

Mathiassen, T. (1943). *Stenalderbopladser i Åmosen.* Nordiske Fortidsminder III, 3. København.

Ovodov, N. D., Crockford, S. J., Kuzmin, Y. V., Higham, T. F. G., Hodgins, G. W. L. & van der Plicht, J. (2011). A 33,000-Year-Old Incipient Dog from the Altai Mountains of Siberia: Evidence of the Earliest Domestication Disrupted by the Last Glacial Maximum. *PLoS ONE* 6(7): 22821.

Piezonka, H., Kostyleva, E., Zhilin, M. G, Dobrovolskaya, M. & Terberger, T. (2013). Flesh or fish. First results of archaeometric research of prehistoric burials from Sakhtysh IIa, Upper Volga region, Russia. *Documenta Praehistorica* 40: 57-73.

Ramminger, B. (2007). *Wirtschaftsarchäologische Untersuchungen zu alt- und mittelneolithischen Felsgesteingeräten in Mittel- und Nordhessen.* Internationale Archäologie 102. Verlag M. Leidorf. Rahden/ Westf..

Poinar, H. N., Kuch, M., Sobolik, K. D., Barnes, I., Stankiewicz, A. B., Kuder, T., Spaulding, W. G., Bryant, V. M., Cooper, A. & Pääbo, S. (2001). A molecular analysis of dietary diversity for three archaic Native Americans. *Proceedings of the National Academy of Sciences* 98: 4317-4322.

Ryzhkova, O. V. (2004). The site Beregovaya II at Gorbunovo peat bog: results of 1991-1992 excavations. *In*: The fourth readings in memoria of Bers. Yekaterinburg, 59-75 (in Russian).

Sanger, F., Nicklen, S. & Coulson, A. R. (1977). DNA sequencing with chain-terminating inhibitors. *Proceedings of the National Academy of Sciences* 74: 5463-5467.

Savchenko, S. N. (2011). Bone arrowheads in the Mesolithic of the Urals. *In*: G. A. Khlopachev (ed.) *Proceedings in Memorium of Zamyatnin*. Vol. 2. Bone weapons and mobile art objects in ancient cultures of northern Eurasia. Saint Petersburg, 153-181 (in Russian).

Savolainen, P., Zhang, Y. P., Luo, J., Lundeberg, J. & Leitner, T. (2002). Genetic evidence for an East Asian origin of domestic dogs. *Science* 298: 1610-1613.

Schmölcke, U. (2013). The evidence of dogs for hunting from Mesolithic times up to the Viking Age from a zoological point of view – A survey. *In*: O. Grimm & U. Schmölcke (eds.) *Hunting in Northern Europe until 1500 AD – Old Traditions and Regional Developments, Continental Sources and Continental Influences.* Neumünster, 175-183.

Schuldt, E. (1961). Hohen Viecheln. Ein mittelsteinzeitlicher Wohnplatz in Mecklenburg. *Schriften der Sektion zur Vor- und Frühgeschichte* 10. Berlin.

Serikov, Y. B. (2000). *The Paleolithic and Mesolithic of the Middle Eastern Urals area.* Nizhnii Tagil (in Russian).

Sørensen, M., Rankama, T., Kankaanpää, J., Knutsson, K., Knutsson, H., Melvord, S., Eriksen, B. V. & Glörstadt, H. (2013). The First Eastern Migrations of people and Knowledge into Scandinavia: Evidence from Studies of Mesolithic Technology, 9th-8th Millenium BC. *Norwegian Archaeological Review* 2013: 1-38.

Terberger, T. (1998). Siedlungsspuren zwischen 20000 und 16000 B.P. am Mittelrhein? *Germania* 76: 403-437.

Thalmann, O., Shapiro, B., Cui, P., Schuenemann, V. J., Sawyer, S. K., Greenfield, D. L., Germonpré, M. B., Sablin, M. V., López-Giráldez, F., Domingo-Roura, X., Napierala, H., Uerpmann, H-P., Loponte, D. M., Acosta, A. A., Giemsch, L., Schmitz, R. W., Worthington, B., Buikstra, J. E., Druzhkova, A., Graphodatsky, A. S., Ovodov, N. D., Wahlberg, N., Freedman, A. H., Schweizer, R. M., Koepfli, K.-P., Leonard, J. A., Meyer, M., Krause, J., Pääbo, S., Green, R. E. & Wayne, R. K. (2013). Complete Mitochondrial Genomes of Ancient Canids Suggest a European Origin of Domestic Dogs. *Science* 342: 871-874.

Van Gee, B., Guthrie, R. D., Altmann, J. G., Broekens, P., Bull, I., Gill, F. L., Jansen, B., Nieman, A. M. & Gravendeel, B. (2011). Mycological evidence of coprophagy from the feces of an Alaskan Late Glacial mammoth. *Quaternary Science Reviews* 30: 2289-2303.

Vang Petersen, P. (2013). Mesolithic Dogs. *In*: O. Grimm & U. Schmölcke (eds.) *Hunting in Northern Europe until 1500 AD – Old Traditions and Regional Developments*, Continental *Sources and Continental Influences.* Neumünster, 147-162.

Volokitin, A. V., Shirokov, V. I. (1997). Upper Paleolithic site in rockshelter Bobyljok (Middle Urals). *In*: *Rescue archaeological investigations in Middle Urals*. Yekaterinburg, 8-15.

Wood, R. E., Higham, T. F. G., Buzilhova, A., Suvorov, A., Heinemeier, J. & Olsen, J. (2013). Freshwater Radiocarbon Reservoir Effects at the Burial Ground of Minnino, Northwest Russia. *Radiocarbon* 55: 163-177.

Zagorska, I. & Zagorskis, E. (1989). The bone and antler inventory from Zvejnieckі II, Latvian SSR. *In:* C. Bonsall (ed.) *The Mesolithic in Europe*. Proceedings of the 3rd International Symposium. Edinburgh, 414-423.

Zaretskaya, N. E., Hartz, S., Terberger, T., Savchenko, S. N. & Zhilin, M. G. (2012). Radiocarbon chronology of the Shigir and Gorbunovo archaeological bog sites, Middle Urals, Russia. *Radiocarbon*, 54 (3-4): 783-794.

Zaretskaya N. E., Panova, N. K., Zhilin, M. G., Antipina, T. G., Uspenskaya, O. N. & Savchenko, S. N. (2014). Geochronology, stratigraphy, and development history of peat bogs of the Middle Urals area during early Holocene (case study from Shigir and Gorbunovo peat bogs). Stratigraphy. Geological correlation (in print; in Russian).

Zhilin, M. G. (2001). *Mesolithic bone industry of the forest zone of Eastern Europe.* Moscow (in Russian).

Zhilin, M. G. (2006). Das Mesolithikum im Gebiet zwischen den Flüssen Wolga und Oka: einige Forschungsergebnisse der letzten Jahre. *Prähistorische Zeitschrift* 81/1: 1-48.

Zhilin, M. G. (2007). *The final Paleolithic of the Yaroslavl flow of the Volga.* Moscow (in Russian).

Zhilin, (2009). Chronology and evolution in the Mesolithic of the Upper Volga - Oka interfluve. *In*: P. Crombé, M. van Strydonck, J. Sergant, M. Boudin & M. Bats (eds.) *Radiocarbon chronology and evolution within the Mesolithic of North-West Europe*. Newcastle: Cambridge Scholars Publishing, 451-472.

Zhilin, M. G. (2011). Bone arrowheads in the Mesolithic of the forest zone of Eastern Europe. *In*: G. A. Khlopachev (ed.) *Proceedings in Memorium of Zamyatnin*. Vol. 2. Bone weapons and mobile art objects in ancient cultures of northern Eurasia. Saint Petersburg, Nauka (in Russian).

Zhilin, M. G., Kostyleva, E. L., Utkin, A. V. & Engovatova, A. V. (2002). Mesolithic and Neolithic Cultures of the Upper Volga (after materials of the site Ivanovskoye VII). Moscow, Nauka (in Russian).

Zhilin, M. G. & Savchenko, S. (2010). A "hoard" of bone arrowheads from the site Beregovaya II in Eastern Urals area. *In:* O.M. Davudov (ed.) *Problems of archaeology of Eurasia*. Makhachkala, 302-315 (in Russian).

Zhilin, M. G., Savchenko, S. N., Serikov, Y. B., Kosinskaya, L. L. & Kosintsev, P. A. (2012). Mesolithic sites of the Koksharovo peat bog. Moscow. Voskresensk Printing House (in Russian).

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