Daniel Groß · Harald Lübke · John Meadows · Detlef Jantzen (eds.)

Working at the Sharp End: From Bone and Antler to Early Mesolithic Life in Northern Europe

10

Untersuchungen und Materialien
zur Steinzeit in Schleswig-Holstein
und im Ostseeraum

Untersuchungen und Materialien zur Steinzeit
in Schleswig-Holstein und im Ostseeraum

Band 10

Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum
aus dem Museum für Archäologie Schloss Gottorf und dem Zentrum für Baltische und Skandinavische Archäologie
in der Stiftung Schleswig-Holsteinische Landesmuseen Schloss Gottorf
Band 10

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Working at the Sharp End: From Bone and Antler to Early Mesolithic Life in Northern Europe

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Laserscan of the wooden sign that was attached to the excavation hut during the Hohen Viecheln excavations ('To the sharp harpoon'; Laserscan: J. Nowotny, ZBSA).

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Vorwort der Herausgeber

Die Schriftenreihe „Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein“ wurde von dem ursprünglichen Herausgeber Jürgen Hoika vor mittlerweile 25 Jahren im Jahre 1994 begründet, um am damaligen Archäologischen Landesmuseum Schleswig (ALM) und heutigem Museum für Archäologie Schloss Gottorf (MfA) ein Publikationsorgan für die Veröffentlichung von Forschungsergebnissen zur Steinzeit Schleswig-Holsteins zu schaffen. Dabei sollte es sich zum einen um Sammelwerke mit Beiträgen von vorzugsweise auf Schloss Gottorf veranstalteten Symposien, Workshops und Tagungen mit steinzeitlicher Thematik und zum anderen um zumeist in Dissertationen zusammengestellte ausführliche Materialvorlagen handeln. Entsprechend enthielt der 1994 vorgelegte erste Band der Reihe die Beiträge zum 1. Internationalen Trichterbechersymposium, welches, von Jürgen Hoika gemeinsam mit Jutta Meurers-Balke initiiert, 1984 am Archäologischen Landesmuseum in Schleswig stattgefunden hatte. In der Folge wurden dann aber beginnend mit den Arbeiten der beiden heutigen Herausgeber nunmehr acht überwiegend am Institut für Ur- und Frühgeschichte der Christian-Albrechts-Universität zu Kiel fertiggestellte Dissertationen veröffentlicht, die ganz wesentlich mit der wissenschaftlichen Vorlage und Auswertung von Forschungsgrabungen in Schleswig-Holstein und – seit der Beteiligung des Zentrums für Baltische und Skandinavische Archäologie an der Herausgeberschaft – aus dem gesamten Ostseeraum befasst sind.

Deshalb ist es eine besondere Freude für die Herausgeber, mit dem vorliegenden Band 10 „Working at the Sharp End: From Bone and Antler to Early Mesolithic Life in Northern Europe“ der Schriftenreihe „Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum“ wiederum einen Sammelband mit den Beiträgen eines Workshops vorlegen zu können, der vom 14. bis 16. März 2016 auf Schloss Gottorf stattgefunden hat. Dabei handelt es sich um den Abschlussworkshop des von der Deutschen Forschungsgemeinschaft geförderten Projektes „Neubewertung von Chronologie und Stratigraphie des frühholozänen Fundplatzes Hohen Viecheln (Mecklenburg-Vorpommern) unter besonderer Berücksichtigung der diagnostischen Knochenartefakte“ (DFG-Projektnummer 271652103) unter Leitung von Daniel Groß, Harald Lübke, John Meadows (alle ZBSA) und Detlef Jantzen (Landesamt für Kultur und Denkmalpflege Mecklenburg-Vorpommern; Landesarchäologie). Entsprechend enthält dieser Band neben dem Abschlussbericht des Forschungsprojektes insgesamt 17 Beiträge der eingeladenen Workshop-Teilnehmer, die entweder ergänzende Studien zum Fundplatz Hohen Viecheln enthalten oder sich grundsätzlich mit verwandten Themen zur Erforschung des frühholozänen Mesolithikums im nördlichen Europa befassen.

Alle Beiträge wurden nach internationalem Standard von jeweils zwei anonymen Gutachtern in einem Peer-review-Verfahren bewertet und danach den Autoren zur erneuten Überarbeitung übergeben, bevor die abschließende redaktionelle Bearbeitung der Manuskripte erfolgte. Die Textredaktion für alle Beiträge wurde von Gundula Lidke durchgeführt, Jana Elisa Freigang und Jorna Titel leisteten dabei unterstützende Arbeiten. Das Layout übernahm Daniel Groß, Titelbild und Umschlag entwarf Jürgen Schüller. Die meisten Karten und Zeichnungen wurden von den Autoren selbst bereitgestellt. In einzelnen Fällen erfolgte eine Überarbeitung durch Daniel Groß. Allen sei dafür an dieser Stelle herzlich gedankt.

Neu im Rahmen der Schriftenreihe ist, dass die Beiträge unmittelbar nach Fertigstellung und Freigabe der Autoren in einem „online-first“-Verfahren auf der Homepage des Verlages im Open Access zum freien Download bereitgestellt wurden. Für die Umsetzung dieser Forderung der Herausgeber danken wir dem Wachholtz Verlag, insbesondere Herrn Henner Wachholtz, sehr.

Besonderer Dank gilt dem Vorstand des Zentrums für Baltische und Skandinavische Archäologie Schleswig, besonders dem Direktor, Claus von Carnap-Bornheim, und der Forschungsleiterin, Berit Valentin Eriksen, die die Veröffentlichung dieses Bandes durch die Bereitstellung der erforderlichen Mittel für den Druck der Arbeit maßgeblich unterstützten.

Sönke Hartz und Harald Lübke
Schleswig, im Oktober 2019

Editors' Preface

The series 'Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein' was founded by its first editor, Jürgen Hoika, in 1994, 25 years ago, in order to establish a possibilty to publish Stone Age research results from Schleswig-Holstein at the then Archaeological State Museum (Archäologisches Landesmuseum [ALM]), today's Museum for Archaeology (Museum für Archäologie, Schloss Gottorf [MfA]). Publications should, on the one hand, reflect proceedings of symposia, conferences and workshops with Stone Age topics primarily held at Gottorf Castle, on the other hand, dissertations presenting comprehensive material. According to that, the first volume, published in 1994, contained the contributions to the 1st International Funnelbeaker Symposium, which, initiated by Jürgen Hoika and Jutta Meurers-Balke, had taken place at the Archaeological State Museum in 1984. Following that, eight dissertations, mainly accomplished at the Institute for Pre- and early History at the Christian-Abrechts-University Kiel, were published, starting with those by today's editors. All these volumes contributed substantially to the scientific presentation and analysis of excavation materials from Schleswig-Holstein and – since 2012, when the Centre for Baltic and Scandinavian Archaeology (ZBSA) also became involved in editig the series – the whole of the Baltic Sea area.

Therefore the editors are especially happy to once more present conference proceedings with volume 10 of the series 'Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum': 'Working at the Sharp End: From Bone and Antler to Early Mesolithic Life in Northern Europe' collects contributions to a workshop held at Gottorf Castle on 14th–16th March, 2016. This represented the closing workshop of the DFG-funded project 'Neubewertung von Chronologie und Stratigraphie des frühholozänen Fundplatzes Hohen Viecheln (Mecklenburg-Vorpommern) unter besonderer Berücksichtigung der diagnostischen Knochenartefakte' (DFG project no. 271652103), directed by Daniel Groß, Harald Lübke, John Meadows (all ZBSA) und Detlef Jantzen (Landesamt für Kultur und Denkmalpflege Mecklenburg-Vorpommern; Landesarchäologie). In addition to the project's final report the volume contains 17 papers by researchers invited to participate in the workshop, representing either additional studies on material from the site Hohen Viecheln or related topics in research of the early Holocene Mesolithic in northern Europe.

Each paper was, according to international standards, peer-reviewed by two anonymous reviewers and then returned to the author for reworking before final editorial work. Copy-editing was performed by Gundula Lide, supported by Jana Elisa Freigang and Jorna Titel. Daniel Groß realised the layout; cover and cover illustration were designed by Jürgen Schüller. Most maps and figures were provided by the authors themselves, some were reworked by Daniel Groß. We express our sincere thanks to all involved!

It is a novelty for the series to have papers published online first immediately after completion and authors' approval in open access for free download on the website of Wachholtz Publishers. We would like to thank Henner Wachholtz, Wachholtz Publishers, very much for making this possible!

Special thanks are due to the board of the Centre for Baltic and Scandinavian Archaeology (ZBSA) Schleswig, particularly to the director, Claus von Carnap-Bornheim, and the head-of-research, Berit Valentin Eriksen, who substantially supported this publication by providing financial means for its printing.

Sönke Hartz and Harald Lübke
Schleswig, October 2019

Grusswort des Landesarchäologen von Mecklenburg-Vorpommern

Mit seinen großflächigen, oft noch weitgehend unberührten Niederungen und Binnengewässern bietet Mecklenburg-Vorpommern beste Voraussetzungen, um die gewässeraffinen Kulturen des Mesolithikums zu erforschen. Die Überreste ihrer Wohn- und Jagdstationen sind im feuchten Milieu hervorragend erhalten geblieben. Störungen durch Torfabbau, Begradigung von Gewässern oder Meliorationsmaßnahmen blieben im Wesentlichen auf das 19. und 20. Jahrhundert beschränkt. Sie haben zwar einen gewissen Schaden angerichtet, aber, weil sie zumindest im 20. Jahrhundert oft von aufmerksamen ehrenamtlichen Bodendenkmalpflegern beobachtet wurden, überhaupt erst zur Entdeckung vieler Fundstellen geführt.

Welche Fundstellen eingehender erforscht werden und damit das Bild einer Epoche besonders prägen, unterliegt oft dem Zufall. Hohen Viecheln rückte in den Fokus der Forschung, weil die Entdeckung mehrerer Knochenharpunen zu Beginn der 1950er Jahre auf eine günstige Konstellation traf: 1953 war aus der Vorgeschichtlichen Abteilung des Staatlichen Museums das Museum für Ur- und Frühgeschichte Schwerin entstanden, das auch für die Bodendenkmalpflege in den drei Nordbezirken der DDR zuständig war. Der ehrgeizige Direktor des Museums, Ewald Schuldt, hatte sich durch Ausgrabungen auf der Burgwallinsel Teterow einen Namen gemacht und war nun auf der Suche nach einem geeigneten Fundplatz für ein eigenes Forschungsprojekt.

Wegen der sehr guten Erhaltungsbedingungen versprach Hohen Viecheln, zusätzlich zu dem bekannten Spektrum an Steinartefakten auch ein umfangreiches Geräteinventar aus organischen Materialien bergen zu können. Die ebenfalls ausgezeichnet erhaltenen Tierknochen sollten Aufschluss über das Jagdwild geben. Hinzu kam die Aussicht, aus der Stratigraphie neue Erkenntnisse zur Chronologie und zu den Veränderungen der naturräumlichen Verhältnisse zu gewinnen. Diese Erwartungen wurden nicht enttäuscht: Hohen Viecheln entwickelte sich zu einem der bedeutendsten Plätze mesolithischer Forschung, gleichrangig mit Duvensee, und inspirierte weitere Forschungen, u. a. in Friesack und Rothenklempenow.

Hohen Viecheln gehört nach wie vor zu den legendären archäologischen Fundstellen in Mecklenburg-Vorpommern, auch wenn es aus heutiger Sicht nicht mehr so einzigartig dasteht. Dank einer intensiv betriebenen ehrenamtlichen Bodendenkmalpflege ist die Zahl der bekannten mesolithischen Fundplätze im Land deutlich gestiegen, von denen vermutlich mehrere ein ähnliches Potenzial wie Hohen Viecheln aufweisen. Verändert haben sich aber nicht nur die Verbreitungskarten, sondern auch die Möglichkeiten archäologischer Forschung. Es drängte sich deshalb geradezu auf, Hohen Viecheln noch einmal unter die Lupe zu nehmen, bisherige Erkenntnisse kritisch zu prüfen und neue hinzuzufügen. Der DFG und allen Projektpartnern gebührt herzlicher Dank dafür, dass sie das ermöglicht haben.

So wird Hohen Viecheln auch weiterhin als exemplarischer Fundplatz für das Mesolithikum in der norddeutschen Tiefebene stehen – eine hochinteressante Umbruchszeit, in der Klimawandel, Anstieg des Meeresspiegels und andere Veränderungen eine ständige Anpassung der Menschen an ihre Umwelt erzwangen.

Detlef Jantzen
Schwerin, im September 2019

Welcome address by the State Archaeologist of Mecklenburg-Western Pomerania

Mecklenburg-Western Pomerania with its large, often unspoiled lowlands and inland waters offers outstanding possibilities for research into the water-oriented cultural groups of the Mesolithic. Remains of their settlement and hunting sites are often well preserved in wet conditions. Disturbances by peat extraction, straightening of watercourses or melioration measures mainly took place during the 19th and 20th centuries. They did some damage, but – as at least during the 20th century they were often supervised by vigilant amateur archaeologists – many sites were discovered this way in the first place.

But often it is left to chance which sites can be thoroughly investigated to largely characterise the picture of a whole timespan. Hohen Viecheln became the focal point of research interest under favourable circumstances: the discovery of several bone points there at the beginning of the 1950s fell together with the establishment of the Museum of Pre- and Early History in Schwerin (out of the former Department of Prehistory at the State Museum) which was also responsible for the preservation and care of field monuments in the three northern districts of the GDR.

The ambitious museum director, Ewald Schuldt, had already gained reputation through his excavations of the Slavic ring wall island near Teterow, and he was looking for a suitable site for another research project. Due to the very good preservation conditions at the site, Hohen Viecheln promised, in addition to the spectrum of artefacts known from other places, a substantial organic inventory. The well-preserved animal bones were expected to shed light on game species and hunting strategies. Furthermore, important results were expected concerning chronology and environmental changes. These hopes were not disappointed: Hohen Viecheln has become, alongside Duvensee, one of the most important sites for Mesolithic research, and research there has inspired further excavations, e.g. at Friesack or Rothenklempenow.

Hohen Viecheln is still one of the legendary archaeological sites in Mecklenburg-Western Pomerania, even if it no longer stands alone. Thanks to intensive voluntary archaeological surveys the number of Mesolithic sites has increased significantly; and several of these may have a potential similar to that of Hohen Viecheln. But not only distribution maps have changed during the last years, but also the possibilities of archaeological research. Therefore, the idea to have another look at Hohen Viecheln, to challenge old results and add new ones, suggested itself. I want to thank the German Research Foundation (DFG) and all project contributors for having made this possible. In this way, Hohen Viecheln will continue to be an exemplary North German Lowland site of the Mesolithic – a highly interesting time when climate change, sea-level rise and other changes enforced constant human adaptions to the environment.

Detlef Jantzen
Schwerin, September 2019

Acknowledgements

This volume of the series 'Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum' represents the proceedings of a workshop held at the Centre for Baltic and Scandinavian Archaeology (ZBSA) in Schleswig in March 2016. It is a part of the editors' project 'Neubewertung von Chronologie und Stratigraphie des frühholozänen Fundplatzes Hohen Viecheln (Mecklenburg-Vorpommern) unter besonderer Berücksichtigung der diagnostischen Knochenartefakte', funded by the German Research Foundation (DFG) under the project number 271652103.

While the project was dealing with the re-evaluation of the site Hohen Viecheln 1 for chronological and stratigraphical aspects, this volume does not only cover its final publication but comprises additional modern studies about the site by different scholars. These are furthermore embedded into the international research landscape by adjacent studies covering an area from modern day Britain in the west to the Urals in the east.

All contributions are representing the authors' point of view and respective terminologies. Therefore differences in the vocabulary may appear to the careful reader. While a homogenisation of terms and data recording is relevant for comparative studies, it was beyond the scope and means of this project. As a consequence, terminologies may differ between the contributions, as exemplified by the terms 'uni-serial' and 'uni-lateral' bone points: both are characterised by barbs or notches on one lateral side. At the British site Star Carr those have ever since been named uni-serial, whereas uni-lateral is a more common term in other parts of Europe.

We, as editors, would like to thank all contributors for being part of this volume and their interesting and high-quality articles; also we are grateful for the voluntary support of all anonymous peer-reviewers and their help in improving the articles. Furthermore, we thank the German Research Foundation (DFG) for funding our research and the workshop as well as the Centre for Baltic and Scandinavian Archaeology represented by its director, Claus von Carnap-Bornheim, and the head-of-research, Berit Valentin Eriksen, for support of the project and its presentation in the current form. A tremendous help in the course of making this book was Gundula Lidke who was responsible for text editing, proof-reading, and correspondence with the authors and publishers. Thank you very much! Further editorial support was provided by Jana Elisa Freigang, Jorna Titel, Matthias Bolte, Isabel Sonnenschein and Jürgen Schüller. The latter is also responsible for the cover drawing. Much help and support was provided by Peter Teichert-Köster with respect to handling the finds and accessing them in the depot of the Landesamt für Kultur und Denkmalpflege Mecklenburg-Vorpommern; Landesarchäologie in Schwerin. Close collaboration with Mathieu Boudin of the Royal Institute for Cultural Heritage, Brussels, improved our radiocarbon measurements and the analysis of the consolidant.

We thank all people, mentioned and unmentioned here, who were involved in this book and the different research projects, who helped by further pushing the boundaries of our understanding of the cultural remains and chronologies of the past.

Daniel Groß, Harald Lübke, John Meadows, Detlef Jantzen
Schleswig, October 2019

Early Mesolithic bone projectile points of the Urals

Svetlana Savchenko

Abstract
During excavations of peat bog and cave sites various Early Mesolithic projectile points of the Urals were obtained. Nowadays these artefacts include bone arrowheads and harpoons. Stone projectile points of this period have not been found yet. Early Mesolithic bone arrowheads were found at the site Syun II in the southeastern Urals, the bottom layers of the Beregovaya I and II sites in the Gorbunovo peat bog, and in Lobvinskaya cave in the middle Trans-Urals as well as in Shaitanskaya cave in the northern Trans-Urals. 55 Early Mesolithic arrowheads are known. They comprise three typological groups – needle-shaped, narrow flat, and one-winged projectile points. Massive needle-shaped arrowheads obviously emerge first.
Needle-shaped arrowheads with one long slot and short ones without slots are dated to the early to middle Preboreal period. In the second half of this period narrow flat symmetric and asymmetric arrowheads with and without slots were used together with needle-shaped ones. Asymmetric slotted arrowheads are a specific Urals type not known in other areas. One-winged arrowheads with a barb or without it also emerge at that time.
Harpoons were also used during the Early Mesolithic in the Urals. Uni-lateral harpoons with a widened base with a notch were found in the bottom find level of the Beregovaya II site. The technological scheme of the manufacture of bone arrowheads was already established during the Early Mesolithic in the Urals. It could be traced here also during the Middle and Late Mesolithic and the Early Neolithic. Many types of Early Mesolithic arrowheads in the Urals are similar even in detail to Mesolithic arrowheads from Eastern Europe. This is evident not only in the shape of arrowheads, but also in the technology of their manufacture. It indicates population contacts across the Urals and Eastern Europe since the Early Mesolithic. At the same time specific types of artefacts such as narrow flat asymmetric arrowheads indicate different traditions among population of these territories, too. Comparable differences are observed between several regions of Eastern Europe, indicating that several groups comprising a cultural unity existed in this territory – including the Urals – during the Mesolithic.

1 Introduction

Several decades ago there were no Early Mesolithic sites known in the middle Trans-Urals. Recent excavations of stratified Mesolithic sites and cave sanctuaries (Chairkin/Zhilin 2005; Zhilin et al. 2012; 2014) showed that bone – together with stone – was one of the major raw materials for the production of various artefacts including projectile points. The role of the bone industry was especially important

Fig. 1. Early Mesolithic sites of the Urals. 1 – Syun' II; 2 – Shigir peat bog; 3 – Gorbunovo peat bog (Beregovaya I and II); 4 – Lobvinskaya cave; 5 – Shaitanskaya cave.

in areas where good flint was scarce, as in the middle Trans-Urals. Unfortunately, due to soil conditions only lithic artefacts are preserved at the majority of Stone Age sites in the Urals, which are situated on dry river banks and lake shores. Finds of bone artefacts are mainly connected with caves and peat bogs, and more rarely with alluvial deposits. Despite the small number of such sites these finds indicate that bone and antler tools were likely widespread in the Urals once. The typological diversity of bone artefacts is much greater than that of stone tools.

When people colonised new territories, they could not always find suit-able stone raw material.This often led to changes in the shape of stone tools and the technology of their manufacture, which had to be adapted to new raw materials. In contrast to stone, bone as a raw material was abundant in hunters' societies, always had similar physical characteristics, did not depend upon the morphology of the territory and did not demand serious changes in the technology of treatment and in the morphology of artefacts.

Scarce finds of bone projectile points are known from the Urals already from the Late Palaeolithic. The rock shelter Bezymyannyi on the river Pyzhma in the middle Urals preserved a fragment of a dagger or a spearhead made from a large long bone. The find level was ^{14}C-dated on mammalian bones: 19240 ± 265 uncal. BP (21872–20597 cal. BC [SOAN-2212, see Table 1]; Petrin 1992, 84; Serikov 2000, 48). A massive projectile, a spearhead with two slots found at the Talitskyi site, was dated to 18700 ± 200 uncal. BP (21132–20178 cal. BC [GIN-1907]; Gvozdover 1952). Evidently spears and javelins with large heads were used as hunting weapons. No other projectile points of that period have been found yet in the Urals.

During the Final Palaeolithic/Early Mesolithic bone arrowheads became the main group of projectile points in the Urals. Early Mesolithic sites there yielded specimens dated to the end of the Younger Dryas and the Preboreal period, about 10200–9000 uncal. BP (9600–8400 cal. BC; Khotinskiĭ 1977; Zaretskaya et al. 2012; 2014). Only a few of them were actually excavated, but they include sites with bone projectile points used during these periods. All arrowheads known up to now are made of bone,

some with flint inserts, but intact stone arrowheads have not been found yet. Bone arrowheads played the main role in furnishing projectiles in the Mesolithic of the forest zone of the Urals as in the Mesolithic of the forest zone of Eastern Europe (Zhilin 2001), which distinguishes these territories from Western and Central Europe.

2 Palaeoecological situation

Pollen and faunal data indicate the existence of mosaic landscapes at that time. Preboreal period pollen spectra compared with those of the previous Younger Dryas show a dominance of forest plants pollen. Pollen spectra of the first part of the Preboreal period reflect a vegetation of sparse larch forests with an admixture of birch and spruce. The grass pollen complex is substantial and various. Due to the climatic conditions the prevailing vegetation was a forest tundra. The climate became warmer in the second half of the Preboreal period, the number of birch pollen increased, and pine pollen appeared (Khotinskiĭ 1977; Panova et al. 2008; Zaretskaya et al. 2014).

Elk bones dominate the faunal remains at Early Mesolithic sites; bones of beaver, reindeer, Siberian red deer, brown bear, wolf, fox, arctic fox, Don hare, squirrel, pine marten, and sable are also common. Bones of waterfowl as well as forest and meadow birds are numerous. The composition of bird bones again indicates mosaic landscapes with large open areas (Nekrasov 1995, 128–129). Concerning fish, bones of pike, crucian carp, perch, roach, and cyprinids were found at Beregovaya II (Zhilin et al. 2014). All these data indicate an initial period of forest zone formation in the Urals at that time with a large share of open areas. The fauna then included all main forest species, but some elements of the late Pleistocene complex of open landscapes were still present then – woolly rhinoceros, reindeer, saiga, polar fox, Don hare –, which later disappeared (Kosintsev 1995).

3 Description of the material

Early Mesolithic bone arrowheads were found during excavations at Syun' II in the southern Cis-Urals area and at the bottom find level (V) of the peat bog parts of the Beregovaya I and II sites in Gorbunovo peat bog, in Lobvinskaya cave in the middle Trans-Urals, and in Shaitanskaya cave in the northern Trans-Urals (Fig. 1). Nowadays 56 Early Mesolithic bone arrowheads are known from the Urals. They belong to three typological groups – needle-shaped, narrow flat, and one-winged ones.

Needle-shaped arrowheads used for hunting various mammals and probably also birds and fish emerged first. Composite stabbing-cutting arrowheads with inserted flint microblades caused deep broad wounds, which led to a huge loss of blood and made killing a weakened animal easy. Stabbing needle-shaped arrowheads without slots deeply pierced the prey, going through skin and flat bones, sometimes through its whole body. A fragment of an elk skull from the Mesolithic find level III of site Sakhtysh 14 in the Volga-Oka interfluve with a diagnostic lesion caused by a needle-shaped arrowhead with a round cross-section (Zhilin 2004, 40) indicates their use for hunting large mammals.

3.1 Arrowheads of the Younger Dryas/early Preboreal period

The earliest arrowhead found in the Urals comes from the site Syun' II in the southern Cis-Urals (see Fig. 1,1), dated by pollen data to the Younger Dryas (Matyushin 1976, 133). It is a massive needle shaped one with a round cross-section and two long slots with some preserved microblade inserts. The point's tip is conical, its lower part is not preserved (Fig. 2,2). A fragment of an arrowhead with

one slot was found in the Early Mesolithic (V) find level of site Beregovaya II in 2017. It was found near the mineral lake shore, and clay and sand from the lake bottom were discovered in the slot. This means that it was deposited on the lake bottom before sedimentation of peaty gyttja started in this area about 9610 ± 40 BP (9011–8845 cal. BC). This indicates a dating of this arrowhead to the early phase of the bottom find level about 9850 ± 40 to 9800 ± 40 BP (9400–9200 cal. BC). This arrowhead represents a transitional form, from flattened needle-shaped arrowheads to narrow flat asymmetric ones. Its ratio of thickness to width is characteristic for flattened needle-shaped arrowheads, but its point is asymmetric. This find makes it possible to suppose that the specific Urals type of arrowheads – narrow flat asymmetric ones – emerged already during the first half of the Preboreal period, and not only in the second half, as considered earlier.

Arrowheads from Shaitanskaya cave in the northern Trans-Urals (see Fig. 1,5) are dated to the first half of the Preboreal period. These are massive composite needle-shaped ones with round cross-sections, or flattened ones with oval cross-sections with one long slot, a conical point and base. The ratio of thickness to width of these flattened arrowheads is 1:1.2–1:1.4.

Only the upper part is preserved of an arrowhead with a round cross-section of 7 mm in diameter. This point is conical, a slot with a trapezoidal cross-section 2 mm wide and 4 mm deep starts at a distance of 10 mm from the tip of the point. Residues of dark glue are visible on the slot walls. The tip of the point is smashed and chipped, the opposite end is split as a result of hitting a hard surface, likely the cave wall (Fig. 2,3). A massive flattened arrowhead, 220 mm long, 8 mm wide and 6 mm thick, with a slot running from the tip almost to the end of the base, is preserved intact. The slot is 1.5 mm wide and 5 mm deep; it has a V-shaped cross-section (Fig. 2,6). Small fragments of the middle part and a tip of two other flattened needle-shaped arrowheads were found. The U-shaped slot of the last one starts at the tip of the point, which was reshaped by longitudinal whittling, evidently after breakage. The point displays no smashing and chipping, but traces of piercing the ground are visible under a microscope (Fig. 2,1). Furthermore, a short massive arrowhead with a round cross-section without slots was found. The maximal diameter of the stem is 7 mm. The point is conical, the base is shaped wedge-like and 25 mm long (Fig. 2,4). The tip of the point is smashed and chipped as a result of hitting hard material (Chairkin/Zhilin 2005, 265–269).

3.2 Arrowheads of the middle Preboreal period

A needle-shaped arrowhead with one long slot and a conical base (Fig. 2,7) from the Shigir (see Fig. 1,2) collection of stray finds is dated to the middle of the Preboreal period. The artefact represents a transitional form between massive needle-shaped arrowheads with round cross-sections to flattened ones. It has a round cross-section in its lower part and an oval one in its upper part. The tip of the point is smashed as a result of hitting some hard material. A long slot with a trapezoidal cross-section 2 mm wide and 4 mm deep runs along one side of the artefact. It ends in the middle of the conical base of medium length. This arrowhead was AMS-dated to 9470 ± 45 uncal. BP (9119–8628 cal. BC [OxA-22282], see Table 1; Savchenko et al. 2015, 270).

A short massive needle-shaped arrowhead without slots and with a flattened widened tip and a pyramidal base with a quadrangular cross-section from the bottom find level (V) of the peat bog part of the Beregovaya I site in the Gorbunovo peat bog in the middle Trans-Urals is dated to the middle or the beginning of the second half of the Preboreal period. Two dates – 9590 ± 70 uncal. BP (9224–8774 cal. BC [GIN-14776]) and 9320 ± 60 BP uncal. BP (8743–8349 cal. BC [GIN-14774]) – were obtained for this find level on charcoal and unworked wood.

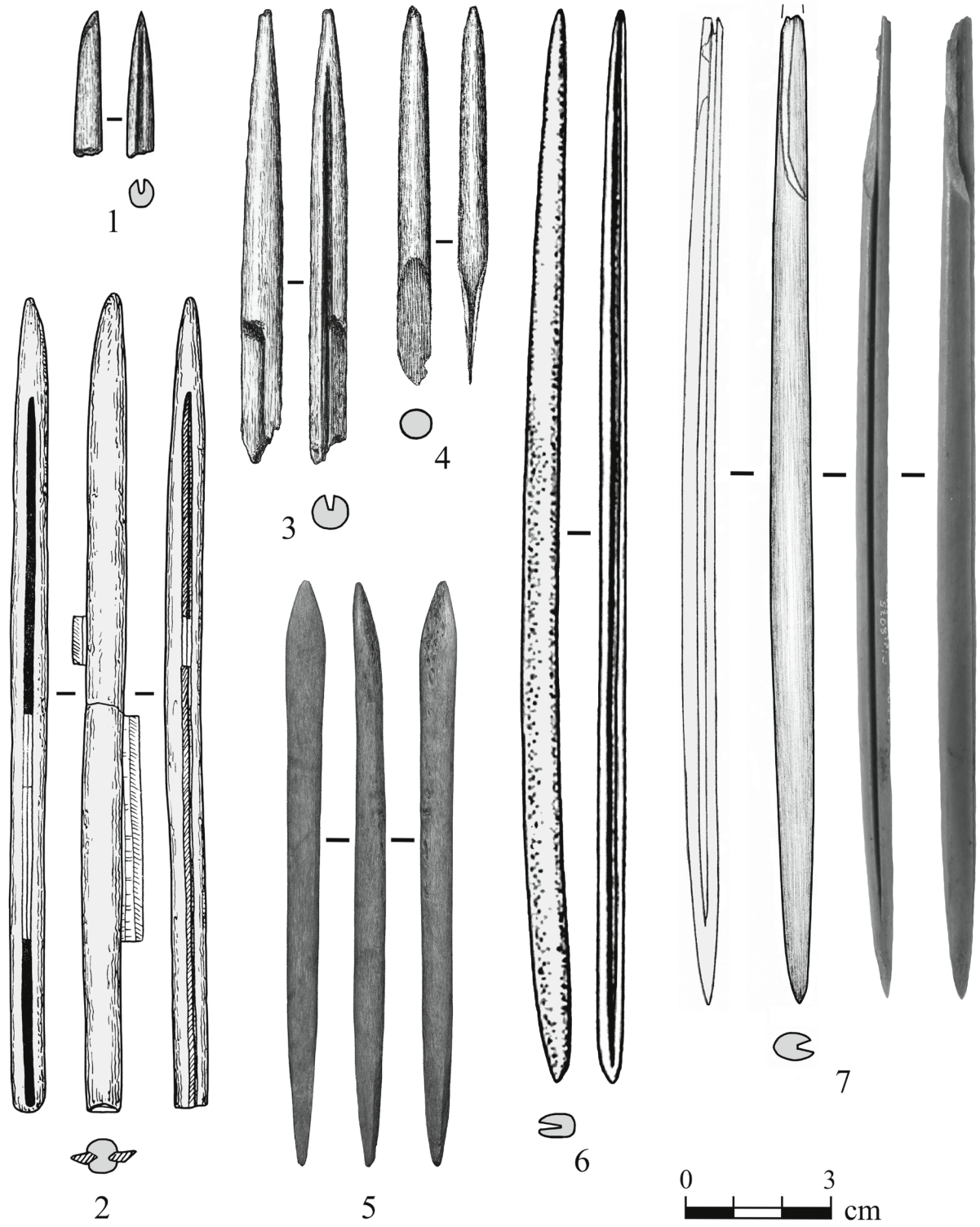

Fig. 2. Needle-shaped bone projectile points from the end of the Younger Dryas, and/or the first half of the Preboreal period: 1.3–4.6 – Shaitanskaya cave; 2 – Syun' II; 5 – Beregovaya I, find level V; 7 – Shigir peat bog.

3.3 Arrowheads of the second half of the Preboreal period

During the second half of the Preboreal period types of arrowheads become more various. Besides needle-shaped narrow flat symmetric arrowheads and asymmetric ones, one-winged arrowheads emerge. Artefacts from this period were obtained from excavations of a sanctuary in Lobvinskaya cave in the middle Trans-Urals (see Fig. 1,4).

Cave sanctuaries where shooting arrows into the cave from the outside took place emerged during the Early Mesolithic in the Urals. This rite survived till the late Iron Age. Several such sites are known in the Urals. The cave sanctuary in the rock wall Kamen Dyrovatyi is the largest one known. The cave is situated in a vertical rock wall at a height of 20 m from the rock bottom, and one can get there only with the help of special equipment. The cave was excavated in the 1930s by N. A. Prokoshev from the State Hermitage. Over 7000 arrowheads made from bone, stone, bronze, and iron were found in the cave. In the 1980s–1990s several thousand arrowheads more were discovered at the foot of the rock (Prokoshev 1935, 183–185; Serikov 2000, 93–96). The collection includes large amounts of arrowheads, among them slotted ones which can be attributed to the Mesolithic due to their typology. The tips of most arrowheads are smashed as a result of hitting cave walls or a rock. Probably shooting took place from the opposite low river bank, or from the water.

Lobvinskaya cave belongs to the same type of Urals cave sanctuaries. Compared with Kamen Dyrovatyi this cave is easy to access. Artefacts from different periods – ceramic sherds, metal ornaments, and a large number of arrowheads – were found there. Traceological analysis showed that arrowheads were broken as a result of hitting hard material, evidently the walls of the cave (Chairkin/Zhilin 2005, 260). Similar traces were observed on arrowheads from Shaitanskaya cave described above. Lobvinskaya cave was used by ancient hunters for short stops, but traces on arrowheads indicate that some rituals, part of which was shooting with bow and arrows into the cave, took place there, too (Chairkin/Zhilin 2005, 269). Pollen data relate the Mesolithic find level of Lobvinskaya cave to the second half of the Preboreal or the early Boreal period, which is confirmed by a ^{14}C-date on split elk bones of 9265 ± 255 uncal. BP (9255–7826 cal. BC [IERZh-92]; Chairkin/Zhilin 2005, 259). 62 fragments from 47 arrowheads were found in the Mesolithic find level of the cave.

There are 14 fragments of long massive needle-shaped slotted arrowheads. Two of them have round cross-sections. The first one is a fragment of the upper part of an arrowhead with a triangular cross-section of the tip of the point, which is smashed and cracked from the blow; the slot begins at 25 mm from the tip of the point (Fig. 3,1). A fragment of the lower part with a conical base is preserved from the second point. Its slot ends at a distance of about 60 mm from the beginning of the base (Fig. 3,2). Twelve fragments belong to flattened arrowheads with one long slot (Fig. 3,3–7). Their tips were not found. Four of them have short flattened conical bases (Fig. 3,3–4.6); one has a short wedge-like base with a rectangular cross-section (Fig. 3,5). Slots end at a distance of 30–70 mm from the base.

Besides needle-shaped arrowheads, symmetric and asymmetric narrow flat ones were also found in Lobvinskaya cave. The first type is represented by two fragments of slotted artefacts with lens-like cross-sections and with slots at both sides (Fig. 3,8–9), and a fragment of an arrowhead without slots with an amorphous sub-oval cross-section.

Fragments of narrow flat asymmetric slotted arrowheads with one straight blunt side and the opposite one the slotted cutting edge, convex near the tip (Fig. 3,10–14), are most numerous (≥ 26 arrowheads). They are asymmetric only in the upper part and symmetric in the lower one (Fig. 3,11). The cross-section is lens-like, rarely oval; single items have rhombic cross-sections (Fig. 3,14). The ratio of thickness to width is from 1:1.5 to 1:2. A long slot runs either directly from the tip of the point or starts at a small distance from the tip, it ends at the stem at a distance about 20–70 mm from the base. The cross-section of slots is mostly U-shaped, rarely V-shaped. Bases are short, mostly wedge-like (Fig. 3,12–14),

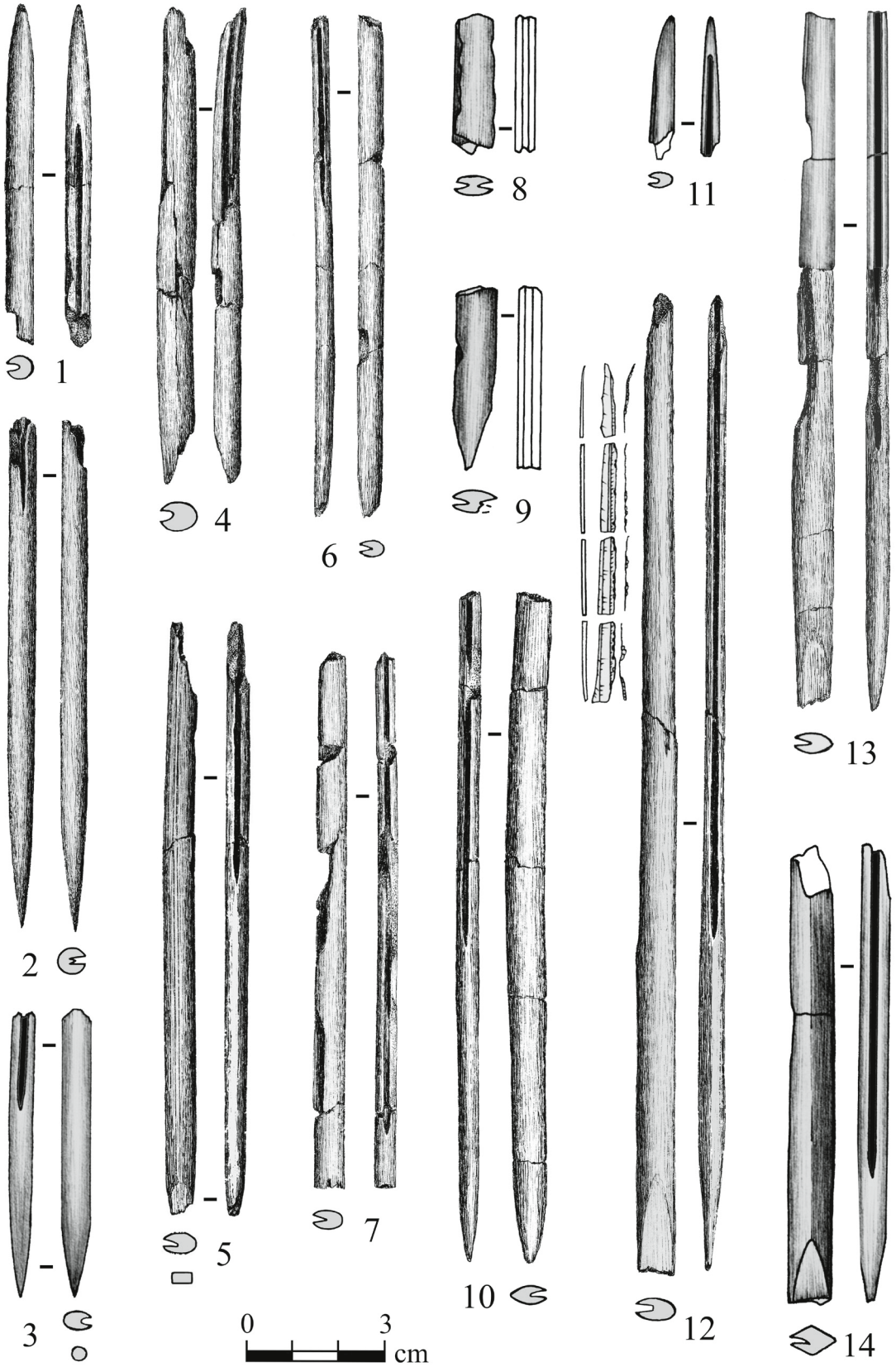

Fig. 3. Bone projectile points from the end of the second half of the Preboreal period: 1–7 – needle-shaped arrowheads; 8–9 – narrow flat symmetric arrowheads; 10–14 – narrow flat asymmetric arrowheads (Lobvinskaya cave, Mesolithic find level).

but some have flattened conical bases (Fig. 3,10). Narrow flat asymmetric arrowheads with one long slot are a specific local type of arrowheads, they are not found outside the Urals.

Some needle-shaped and narrow flat arrowheads are ornamented on both the dorsal and ventral faces with longitudinal straight engraved lines – single, double, or triple (Fig. 3,5). Red paint (ochre?) is clearly visible in these lines under the microscope (Chairkin/Zhilin 2005, 260).

Four one-winged arrowheads without slots were found in the same find level of Lobvinskaya cave. One arrowhead without a barb at the end of the wing has a blade of medium length, slightly less than half the whole length of the artefact, and a pronounced stem between the blade and the base. The end of the blade terminates into a well-pronounced step. Its blade has a lens-like cross-section, the stem with an oval cross-section is flattened, and the short base is conically flattened (Fig. 4,2).

Three fragments come from arrowheads with a barb at the end of the wing. The first one has a narrow blade with a drop-like cross-section, the low wing terminates into a short barb. The long flattened stem with oval cross-section is broken at the transition into the base (Fig. 4,3). A small fragment of the middle part, where the blade turns into the stem, is preserved of the second arrowhead. The barb at the end of the blade is broken, but it is evident that it went from the stem at an acute angle (Fig. 4,1). A flattened stem with an oval cross-section and a conical base is preserved in the case of the third arrowhead. The blade is broken off at the base of the barb, which is clearly visible (Fig. 4,4) (Chairkin/Zhilin 2005, 261).

3.4 Harpoons of the Preboreal period

Besides arrowheads massive uni-laterally barbed projectile points designed for hafting in shafts about 20 mm and more in diameter emerged during the Preboreal period. Four such artefacts were found in find level V of the peat bog area of the Beregovaya II site in Gorbunovo peat bog in the middle Trans-Urals (Fig. 1,3). The pollen spectrum from find level V of this site corresponds to the Preboreal period. A series of twelve ^{14}C-dates is divided into two groups. Earlier dates obtained from bone and wooden artefacts found closer to the shore fall into the interval 10060 ± 80 BP to 9800 ± 40 BP (9400–9200 cal. BC). Later dates obtained from samples found rather far from the shore, mainly wooden stakes driven into the lake bottom, fall into the interval 9230 ± 60 BP to 8980 ± 90 BP (8600–8200 cal. BC; Zaretskaya et al. 2012). This indicates two episodes of occupation at the site during the Early Mesolithic.

On the basis of their function the barbed projectile points can be divided into two categories. One of four barbed projectile points is a fragment of the upper part of a uni-lateral projectile with dense beak-shaped barbs (Fig. 4,7). Its base is broken off, and it could be a fragment of either a harpoon, or a leister or javelin head.

Three artefacts are fragments of harpoons (Fig. 4,5–6.8). All are uni-lateral ones with a base widened at the side with barbs, supplied with a transversal notch. The blade directly changes into the base, there is no stem between the blade and the base. The first one is rather short, it once had two barbs. Only the base of the first barb remains. The second, large elongated beak-shaped barb is close to the first one. A broad notch was transversally sawn at the widened side of the artefact's base (Fig. 4,8). The second item is a fragment of the lower part of a harpoon with an M-shaped notch at its base. The fragment preserves the base of the last barb (Fig. 4,5). The third harpoon had three barbs. The upper one was low-triangular, the two others were high and beak-shaped. A narrow transverse notch was sawn into the upper part of the widened side of the base (Fig. 4,6).

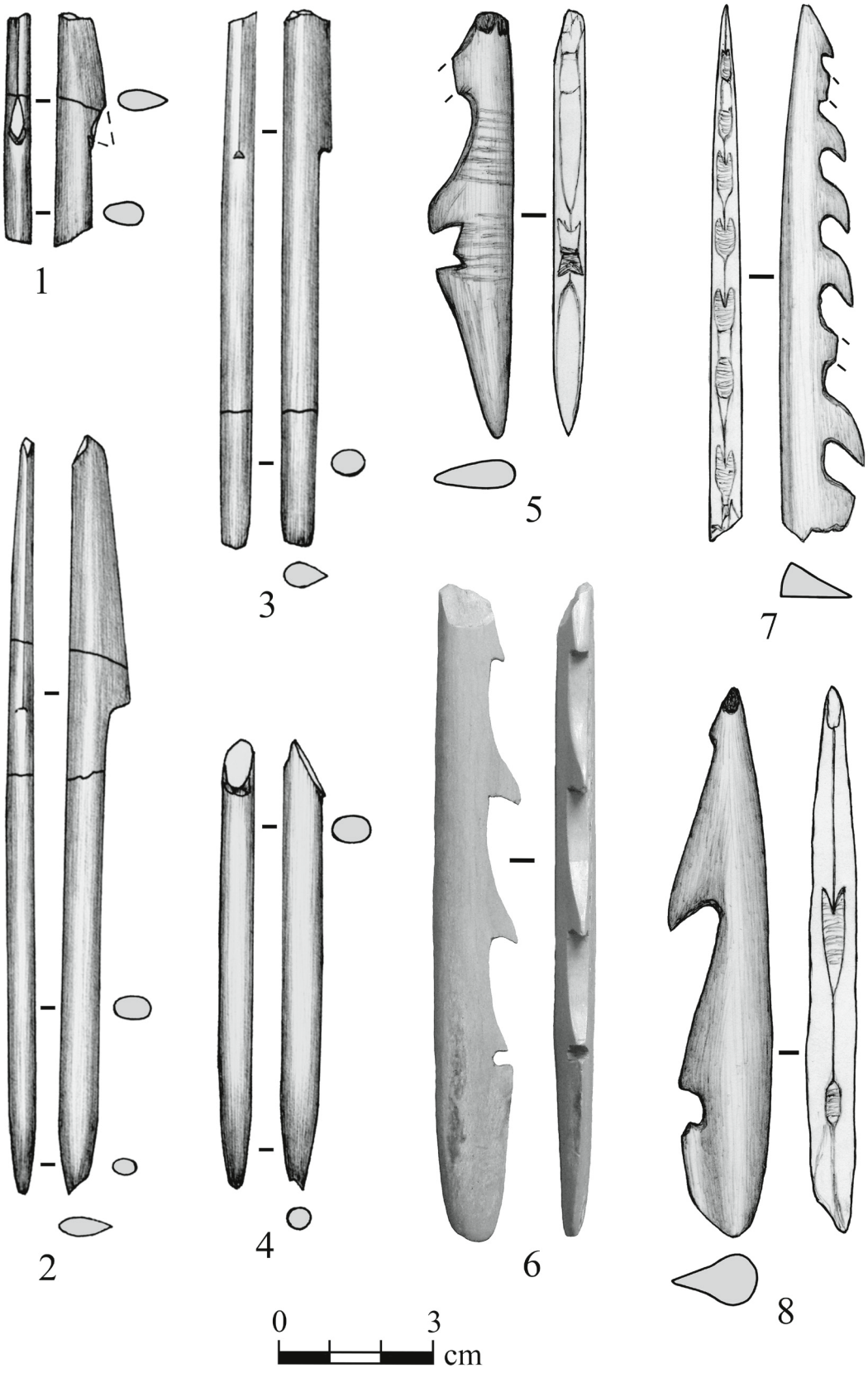

Fig. 4. Bone projectile points: 1–4 – one-winged arrowheads (Lobvinskaya cave, Mesolithic find level, from the end of the second half of the Preboreal period); 5–8 – barbed points (Beregovaya II, find level V, Preboreal period).

3.5 Functional diversification of barbed points

The first group includes leisters and fishing spearheads as well as projectile points of javelins for inland hunting. The second group includes harpoons used for hunting in the waterscape. Both categories of projectile points are suited for keeping in the body of hit prey. The main difference between them is in the shaping of the base which defines their functional purpose. With the base broken off, it is very hard to divide artefacts into the typological categories of harpoons and leister points (fishing spears) or heads of javelins.

Bases of leister points, fishing spearheads, and javelin heads are designed for a permanent hafting in shafts. Harpoons, in contrast, have a flexible connection with the shaft with the help of a line. Their bases were supplied with notches, dents, perforations, etc. for this purpose. One end of the line was attached to the harpoon, the other one to the shaft. The harpoon base was inserted into a hollow at the end of the shaft, or connected with the shaft via a foreshaft. When hitting the target, the harpoon detached from the shaft, and the line made it possible to recover the prey which tried to dive into the water.

Harpoons in the Urals were used most probably for hunting beavers, the bones of which occupy second place in quantity after those of elk, though we can't exclude hunting otter and big fish with harpoons, too. Fish bones and scales from Early Mesolithic find levels were met in small numbers only, and belong to rather small specimens (pike – minimum of nine individuals, 30, 45 and 50 cm long; crucian – three individuals, 15 and 45 cm long; perch – 29 individuals, 12, 15 and 20 cm long; roach – six individuals, 12 cm long). Massive harpoons were not needed for catching them. An intact bone fishing hook of 3.7 cm length was found in the bottom find level at Beregovaya II. It was suitable for catching such fish (Savchenko 2013, 218; 220).

A beaver skull with the first barb of a bone harpoon stuck in it was found in the Neolithic find level of the site Sakhtysh I in the Volga-Oka interfluve (Zhilin 2004, 44), which is direct evidence for hunting beavers with a harpoon.

4 Technology of manufacture

The technology of the manufacture of arrowheads was reconstructed with the help of traceological analysis. It is worth noting that all modes of bone treatment – percussion retouch, scraping, whittling, grinding, sawing, grooving, engraving, and polishing have been known in the Urals since the Late Palaeolithic (Serikov 2000, 44–46; Volkov et al. 2007). But because of the lack of stratified and well-dated Final Palaeolithic sites the question of the origin of the Mesolithic manufacturing technologies in the Trans-Urals and their comparison with objects from preceding late Palaeolithic sites remains open.

Long bones of ungulates, first of all elk and reindeer, were used as raw material for the production of arrowheads. They were longitudinally cut at a depth of 1/2 to 2/3 of their wall thickness, and then split along the grooves into long splinters with the help of a wedge. Remains of such grooves are partly preserved on some artefacts. Harpoons were made from blanks obtained from the most massive part of the diaphysis with its longitudinal ridge.

Scraping and whittling were the main modes of the crude treatment of preforms; crude grinding was more rarely used. Crude scraping, usually longitudinal, was most often used first, but traces of scraping in various directions before longitudinal whittling were observed on the surface of one harpoon (Fig. 4,6). Scraping removed redundant bone mass effectively and quickly. Longitudinal whittling and crude grinding were the next modes of treatment. Whittling was used for shaping preforms as well as the final smoothing of the artefact surface. The use of crude grinding for shaping bone artefacts is a specific feature of the bone industry of the Urals.

Only scraping was used for the crude treatment of artefacts from Lobvinskaya cave, whittling was used there only for final treatment. After whittling, one one-winged arrowhead (Fig. 4,2) was treated by crude grinding on a coarse-grained slab, afterwards by fine transverse grinding, and finally by polishing (Chairkin/Zhilin 2005, 261). Experiments showed that unretouched flakes and blades with suitable sharp edges could be used as scrapers and whittling knives (Savchenko 2010).

Details were refined after the general shape of an artefact had been produced. Slots for inserts were cut into composite items. A flat surface about 2–3 mm wide was created by longitudinal whittling along the side. Our experiment showed that most probably the axis of the slot was engraved first by moving the sharp angle of a broken blade forward, and afterwards the slot was deepened to 1–1.5 mm by sawing with a fragment of an unretouched blade. This operation straightened any unevenness of the slot after the initial engraving. Then the slot was grooved with a burin to the necessary depth (Savchenko 2010). Cross-sections of grooves have different shapes depending on the shape of the working edge of the burin used for grooving. Fragments of unretouched bladelets were used as burins, a fracture angle served as a cutting edge, as indicated by use-wear analysis of burins from the Mesolithic find level of the Koksharovsko-Yuryinskaya II site in the middle Trans-Urals (Zhilin et al. 2012, 76). This was also confirmed during the experimental production of a slotted bone arrowhead (Savchenko 2010). If the bone was strongly softened before work the edge of the burin remained sharp, and the cross-section of the slot was V-shaped (Fig. 2,6; 3,6–9.13–14). Because the cross-section of a blade is asymmetric, the cross-section of a slot is also asymmetric. A V-shaped cross-section indicates movement of a burin in one direction. If the direction was changed into the opposite, the cross-section of the slot became W-shaped (Fig. 3,2).

Slots with U-shaped cross-sections were grooved with a tool with a dull working edge (Fig. 2,1; 3,1.3–4.10–11). If the slot was grooved with a burin with its working edge shaped by a burin scar, the slot finally had a trapeze-like cross-section (Fig. 2,3.7; 3,12; see Chairkin/Zhilin 2005, 261–262). Slots with U-shaped cross-sections prevail, slots with V-shaped and trapezoidal cross section are less numerous, and slots with W-shaped cross-sections occur only in single cases.

Barbs on harpoons were shaped by longitudinal whittling in the direction of the point, with removing chips by whittling in the opposite direction, or by transverse and oblique sawing. Notches on the bases of harpoons were made by transverse sawing. Barbs on the upper part of a barbed projectile point (Fig. 4,7) were made by sawing, and afterwards their edges were made oblique by grinding, which turned them from rhombic into beak-shaped.

Barbs and steps of one-winged arrowheads were made by different modes. The base of the step of one arrowhead was smoothed by polishing with a fine-grained abrasive instrument after treatment by coarse grinding (Fig. 4,2). The base of a barb at an acute angle to the stem of another one (Fig. 4,1) was obliquely cut from both the ventral and dorsal surfaces. It was transversally cut in the case of one arrowhead with a low wing (Fig. 4,3). The barb on a fragment of an arrowhead where only the base of the barb was preserved (Fig. 4,4) was shaped by several cuts around its perimeter (Chairkin/Zhilin 2005, 262). The final smoothing of the surface of artefacts was carried out with the help of a whittling knife. Afterwards the surface was treated by grinding on a fine-grained abrasive slab, and in some cases polished. The engraved ornamentation seen on several slotted arrowheads from Lobvinskaya cave (Fig. 3,5) was cut with a broken blade, after fine whittling, before fine grinding and polishing. This is confirmed by a characteristic smoothing of the edges of ornamental lines. Wedge-shaped bevels of arrowheads from Lobvinskaya cave were shaped by whittling in the very end. Traces of fine grinding removed by whittling of flat sides of bevels are visible on their lateral edges (Chairkin/Zhilin 2005, 262). Inserts were mounted into the finished bone arrowhead after fine whittling. Remains of dark glue are preserved in slots of several arrowheads. The same mode of fixing inserts was used during the Mesolithic of the forest zone of Eastern Europe (Zhilin 2001, 63).

5 Analogies

Most Early Mesolithic bone projectile points from the Urals find analogies among the find material from Mesolithic sites of Eastern Europe. Needle-shaped massive arrowheads, both slotted and without slots, with round cross-section or flattened, were widely spread during the Final Palaeolithic and Mesolithic in the forest zone of Eurasia. Intact projectile points with wedge-shaped bevels (Gumbinen type) made of reindeer antler were spread over the Eastern Baltic (Gross 1940). Long massive needle-shaped arrowheads, both slotted and without slots, with round cross-section or flattened, were spread during the Early Mesolithic in the forest zone of Eastern Europe (Zhilin 2001, 225–226), but those with two slots are absent here.

Narrow flat symmetric arrowheads without slots or with two slots find analogies among finds from Early Mesolithic sites of Eastern Europe. The earliest of them, discovered in find level IV of Stanovoye 4 in the Upper Volga-Oka interfluve, are dated to the end of the Younger Dryas/beginning of the Preboreal period (Zhilin 2001, 228).

One-winged arrowheads with a barb at the end of the wing find analogies among East European finds from the Middle Mesolithic/Early Neolithic. Rare one-winged arrowheads without barbs come from Late Mesolithic sites (Zhilin 2001, 230). In the Urals both types of one-winged arrowheads emerge earlier.

Harpoons emerge in the forest zone of Eurasia during the Upper Palaeolithic. Nevertheless it was rather difficult to find close analogies for the Urals' Early Mesolithic harpoons. Some similar uni-lateral harpoons, with sparse or dense teeth, with the widened base at the denticulate side, and with a transversal notch, were found in Estonia in Kunda Lammasmägi, a site containing mixed Mesolithic and Neolithic finds (Indreko 1948; Zhilin 2001, 100–101). They are also present in the Lubana collection of stray finds (Vankina 1999, 53). Narrow flat asymmetric slotted arrowheads represent a specific Urals type and are not known outside the Urals.

It is worth noting that the manufacturing technology of arrowheads from the Urals and East European types is also similar (Zhilin 2001); observed both in the employment of the same techniques and the same operational sequence. A wide use of abrasive treatment is a specific feature of the Urals area, where many outcrops of abrasive rocks are available.

6 Conclusion

A highly developed bone industry was present in the Urals during the Early Mesolithic. The set of artefacts was rather various and included all main functional groups of tools. All known modes of secondary treatment of bone and antler were employed for their manufacture. Bone artefacts, and particularly projectile points, were widespread and played an important role in the life of Early Mesolithic populations. It is worth noting that lithic arrowheads from that period have not been found yet.

During the Final Palaeolithic/Early Mesolithic forests gradually replaced open landscapes, and bow and arrows became the main hunting weapon. Needle-shaped arrowheads emerged first (Fig. 5). Massive slotted needle-shaped arrowheads with round cross-section, such as an artefact from Syun' II, were used during the Final Palaeolithic in the southern Cis-Urals.

Needle-shaped arrowheads were still used during the first half of the Preboreal period. Artefacts with two slots were not found at sites of that time, but new types of needle-shaped arrowheads emerged – short ones without slots and with a wedge-like base, and slotted ones with round cross-section as well as flattened ones with one long slot. The latter are present among finds from Shaitanskaya cave in the northern Trans-Urals and from the Shigir collection in the middle Trans-Urals. The specific Urals type of arrowheads – narrow flat asymmetric ones – emerged as a further development of needle-shaped

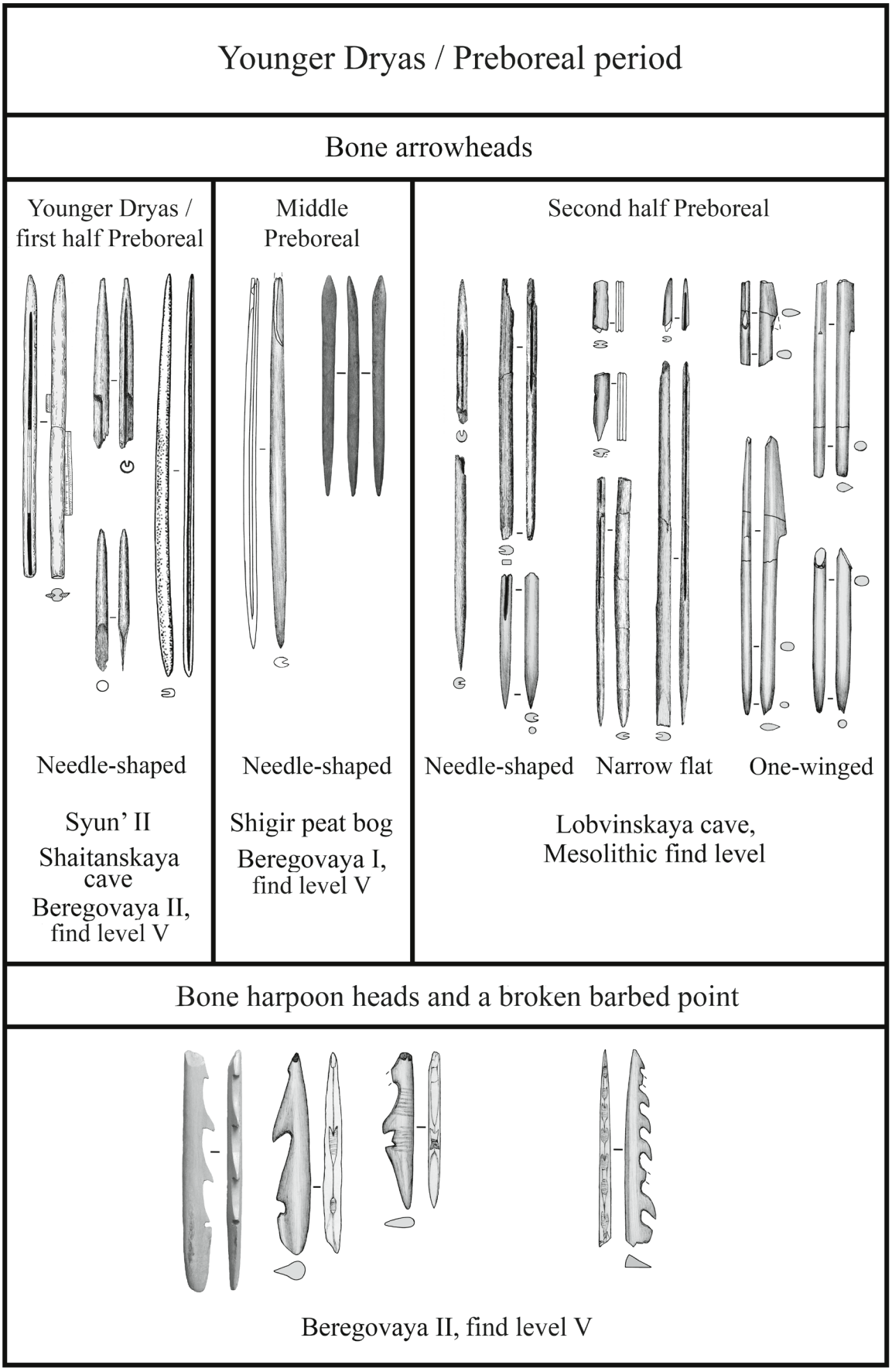

Fig. 5. Scheme of development of Early Mesolithic bone projectile points from the Trans-Urals.

flattened arrowheads, as indicated by a fragment of a transitional arrowhead found in the bottom find level of Beregovaya II in 2017. In the middle of the Preboreal period arrowheads with a widened point and pyramid-shaped bevel emerged, as indicated by a find from find level V of the Beregovaya I site in the middle Trans-Urals.

During the second half of the Preboreal period arrowhead types became more varied. Parallel to needle-shaped narrows now flat symmetric and asymmetric arrowheads with and without slots were used. One-winged arrowheads with and without a barb emerged, these were found in Lobvinskaya cave in the Middle Trans-Urals. It is worth noting that needle shaped arrowheads and flat ones represent one typological row. During the Early Mesolithic harpoons, and probably barbed leister points and spearheads, were spread across the Urals parallel to arrowheads. They were found in find level V of the Beregovaya II site.

A definite technological scheme of manufacture of bone projectile points was already established during the Early Mesolithic in the Urals. It developed further during the Middle and Late Mesolithic and Early Neolithic. Many types of Early Mesolithic arrowheads in the Urals are similar even in details to Mesolithic arrowheads from Eastern Europe. This could be traced not only in the shape of arrowheads, but also in the technology of their manufacture. It indicates contacts of populations of the Urals and Eastern Europe from the Early Mesolithic onwards. At the same time specific types of artefacts, such as narrow flat asymmetric arrowheads, indicate different traditions besides common ones among the populations of these territories. Similar differences are observed between several regions of Eastern Europe. It indicates that several cultures, each comprising a cultural unity, existed in this territory, including the Urals during the Mesolithic (Savchenko 2017, 224).

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Table 1. ^{14}C-dates of Late Palaeolithic and Early Mesolithic sites with barbed points in the Urals (calibration with OxCal v.3.10.; OxCal v.4.3.2. [Bronk Ramsey 2009]); r: 5; intcal 13 atmospheric curve (Reimer et al. 2013; Calib v.611).

Site/find level	Dated material	Lab. Index	BP uncal.	Cal. BC
Grotto Bezymyannyi/ Palaeolithic find level	Mammalian bones	SOAN-2212	19240 ± 265	21872–20597
Talitskyi site/ Palaeolithic find level	Mammalian bones	IGN-1907	18700 ± 200	21132–20178
Shigir peat bog/stray find	Bone arrowhead	OxA-22282	9470 ± 45	9119–8628
Beregovaya I/early Mesolithic (V) find level	Wood charcoal	GIN-14776	9590 ± 70	9224–8774
Beregovaya I/early Mesolithic find level (V)	Worked wood	GIN-14774	9320 ± 60	8743–8349
Lobvinskaya cave/Mesolithic find level	Elk bones	IERZh-92	9265 ± 255	9255–7826
Beregovaya II / early Mesolithic find level (V)	Larch stake	GIN-14088	9800 ± 40	9289–9253
Beregovaya II/early Mesolithic find level (V)	Elk vertebrae	GIN-14210	9830 ± 70	9356–9241
Beregovaya II/early Mesolithic find level (V)	Elk scapula knife	KIA-42076	9835 ± 50	9316–9255
Beregovaya II/early Mesolithic (V) find level	Worked pine log	GIN-14135	9850 ± 40	9317–9266
Beregovaya II/early Mesolithic (V) find level	Worked red deer shoulder blade	GIN-14209	10060 ± 80	9815-9446
Beregovaya II/early Mesolithic find level (V)	Worked elk long bone	KIA-42077	9215 ± 40	8474–8337
Beregovaya II/early Mesolithic find level (V)	Stake, larch	GIN-14251	8980 ± 90	8285–8170; 8116–8053; 8047–7981
Beregovaya II/early Mesolithic find level (V)	Stake, larch	GIN-14249	9230 ± 50	8489–8419; 8410–8346
Beregovaya II/early Mesolithic find level (V)	Stake, larch	GIN-14250	9230 ± 60	8491–8417; 8414–8344
Beregovaya II/early Mesolithic find level (V)	Peaty gyttja	GIN-14132	9210 ± 40	8469–8328
Beregovaya II/early Mesolithic find level (V)	Peaty gyttja	GIN-14140	9390 ± 40	8724–8624
Beregovaya II/early Mesolithic find level (V)	Peaty gyttja	GIN-14084	9610 ± 40	9011–8912; 8904–8845