

EARLY MESOLITHIC BARBED BONE POINTS IN THE VOLGA-OKA INTERFLUVE

Mikhail G. Zhilin

Abstract

Complex research on various barbed points from early Mesolithic sites in the Volga-Oka interfluvium showed that they were the heads of different categories of hunting weapons, mostly projectiles. Analyses of their shape, size and use-wear traces made it possible to single out arrowheads, javelin or leister points, throwing and thrusting spearheads and harpoons. The earliest of them emerge in the first half of the Preboreal period, but the full flourishing of various categories of barbed weapons is observed during the late Preboreal to early Boreal periods and later. Some types and variants are numerous and have a long history, while others are represented only by single finds. The former represent more or less standard mass products, while the latter can be treated as experimental artefacts which played no significant role. Together with other types of bone and antler hunting weapons barbed projectile points played an important role in subsistence strategies of the Early Mesolithic population of the Volga-Oka interfluvium and their adaptation to the forest environment during the early Holocene.

1 Introduction

Among a range of Mesolithic bone and antler artefacts various points occupy a prominent place. They were used in different ways, but the majority of them was connected with hunting and fishing. The term ‘barbed points’ is widely used in publications concerning the Mesolithic and unites different artefacts with a point and one or several barbs. The aim of the present paper is to discuss ‘barbed points’ which were found during excavations of Early Mesolithic sites in western Russia. The lower border of the Mesolithic here roughly coincides with the Pleistocene/Holocene border about 10,000 BP uncal., and the upper border of the Mesolithic in central Russia is at about 7000 BP uncal., when pottery first emerges as a clearly visible chronological marker. If we divide the Mesolithic of this territory into two chronological phases – Early and Late –, then sites dated to the Preboreal and the first half of the Boreal period should be ascribed to the Early Mesolithic.

2 The main Early Mesolithic sites with bone points

During the last decades about 20 peat bog sites containing Mesolithic find layers with good preservation of bone and antler were excavated in the Volga-Oka interfluvium in the centre of European Russia. Seven of them yielded Early Mesolithic find layers reliably ¹⁴C-dated and related to the Preboreal and early Boreal periods by pollen data. They are situated in five large peat bogs (Fig. 1).

2.1 The Ozerki peat bog

It is situated c. 20 km south of Tver, connected with the Upper Volga by Rivers Inyuha and Shosha. About 20 sites were discovered in the western part of this peat bog, two of them contain Early Mesolithic layers with good preservation of organic materials (ZHILIN 2006; 2007a; b; 2009). Ozerki 17 was situated at the outlet of a small river, starting from a lake about 5 x 3 km large. The lower Middle Mesolithic cultural layer of the site (IV) is dated by radiocarbon method (all ^{14}C -dates in this article are conventional uncalibrated ones) to 8830 ± 40 BP (GIN-6655, pine fishtrap fragments) and 8840 ± 50 BP (GIN-7474, birch stake), and to the first third of the Boreal (8800 – 8600 BP) by pollen. 67 m^2 were excavated there. Finds include bone arrowheads of different types: needle-shaped ones, biconical arrowheads, asymmetrical one-winged ones and one blunt-headed one for fur hunting as well as fragments of barbed points, but also lanceheads, elk scapula knives, awls, antler scrapers, 'ice-picks', elk and beaver incisor pendants, and a small perforated disc. Of special interest is an intact fishing hook with remains of a line, attached to its head by a knot. A small fragment of a fishing net, made of a twisted cord, 1 mm in diameter, made of plant

fibre, with a mesh of $2 \times 2 \text{ cm}$ was found, accompanied by one half of an elongated rhomboidal pine bark float, which is perforated in the middle. A series of net sinkers include large pebbles, bound in the middle with a strip of lime bark or some bog grass. Some sinkers have shallow hollows made by direct percussion at their sides for a better fixing of the binding. The latter is either preserved, or indicated by transverse dark stripes at the pebble's surface. Usually the binding is preserved only at the underside of the sinker, while its upper part was torn off when ancient fishermen tried to extract sinkers which were deeply sunk in gyttja layers at the lake bottom. One sinker made of a limestone slab had a natural perforation with a fragment of a twisted rope 5 mm in diameter made of lime bark still preserved in it. Numerous long straight pine splinters with rectangular cross-sections were also found. Such splinters were used for making conical fishtraps, usually woven trans-



Fig. 1. Peat bogs with Early Mesolithic sites. 1 – Ozerki peat bog: sites Ozerki 16 and 17; 2 – Dubna peat bog, site Nushpoli 11; 3 – Ivanovskoye peat bog, site Ivanovskoye 7; 4 – Podozerskoye peat bog, site Stanovoye 4; 5 – Sakhtysh peat bog, sites Sakhtysh 9 and 14.

versally with lime bark or plant fibres. Two long splinters were found near a pine stake 6–7 cm in diameter, which had been sharpened with a flint adze. Ends of such stakes, found stuck in the lake bottom, are numerous in shallow water deposits near Mesolithic and Neolithic sites. Most of them are connected with ancient fishing activities and once served for fixing nets and fish traps.

The site Ozerki 16 is situated c. 150 m from the previously discussed one, the lower cultural layer (II) is dated by ^{14}C to 8770 ± 40 BP (GIN-6654, pine fishtrap fragments) and to the first third of the Boreal (about 8800–8600 BP) by pollen data. 12 m^2 were excavated there. Finds include a perforated pine bark float, pebble sinkers, one with hollows at its sides and lime bark binding preserved, a fragment of a lance-head and two long bone arrowheads. The first one has a biconical head, which was very carefully carved; the surface is smoothed in a turning lathe-manner. The second one has a double biconical head and a very long tang.

2.2 The Dubna peat bog

It is situated about 100 km north of Moscow in the middle stretch of the River Dubna, the right tributary of the Upper Volga. About 40 sites were discovered there, ten of which have Mesolithic layers with good preservation of organic materials (ZHILIN 2001).

The site Nushpoli 11 is situated at the western border of the Dubna peat bog. 85 m^2 were excavated there. The terminal Mesolithic layer (III) is dated by ^{14}C -method to 7310 ± 40 BP (GIN-6657, worked stake), and to the beginning of the Atlantic period (about 7600–7200 BP) by pollen data. The lower find level (IV) belongs to the end of the Early Mesolithic, if we keep to its division into two parts. It is dated by pollen data to the first third of the Boreal (about 8800–8600 BP), which is confirmed by a ^{14}C -date on a worked wooden plank of 8540 ± 60 BP (GIN-6653). Various bone tools include arrowheads: needle-shaped ones, with massive biconical heads, and one blunt one; there are also a fragment of a barbed point, a wide elk scapula knife, and elk and beaver bone/tooth pendants.

2.3 The Ivanovskoye peat bog

It is situated about 150 km northeast of Moscow, between Moscow and Yaroslavl in the middle stretch of the River Nerl, which ran through a large lake during the Stone Age, connecting it with the Klyazma river, the left tributary of the Oka. Ten sites were discovered there. The site Ivanovskoye 7 has three Mesolithic and two Neolithic find levels. 106 m^2 were excavated there by D. A. Krainov in 1974–1975 (KRAINOV/CHOTINSKI 1984), and 332 m^2 by M. G. Zhilin in 1992–1996 (ZHILIN et al. 2002). During lake regressions Mesolithic settlements occupied a low promontory, which was submerged during transgression phases. The lower, Early Mesolithic find level (IV) is dated by ^{14}C to 9650 ± 110 BP (GIN-9520, wood gnawed by beaver) and 9640 ± 60 BP (GIN-9516, worked elk bone). It is dated by pollen data to the first half of the Preboreal period before its optimum phase. During the middle Preboreal transgression it was submerged; the bottom of a gyttja layer covering the lower find level is dated by ^{14}C to 9690 ± 120 BP (GIN-9367), 9500 ± 110 BP (GIN-9517) and 9500 ± 100 BP (GIN-9385). About 300 bone and antler artefacts were found. Among the arrowheads long needle-shaped ones are most numerous, some of them with a slot for insets; one with a relief belt near the tang was treated in a turning lathe-manner near the belt and in the middle of the stem. Other types include long ones with regular biconical heads, narrow tang slotted ones with microblades preserved in slots at both sides, fixed with a glue; there are also asymmetrical two-winged ones with a slot for insets opposing the wing, and a small barbed one for shooting pike. Uni-laterally barbed points with sparse or dense barbs, massive lanceheads as well as fragments of slotted spearheads and intact and slotted daggers were found together with intact fishing hooks and a short double-pointed rod, which served as a toggle hook for catching big pike and pike-perch.

Of special interest is a spearhead, made of an obliquely cut tubular bone, which is richly ornamented with geometric designs covering the whole surface. Other tools include hollow end scrapers, side scrapers made of tubular elk bones, wide elk scapula knives, fish scaling knives made of split ribs, awls, needles and a needle case, beaver mandible tools, antler axes, adzes, chisels and gouges, perforated antler sleeves for mounting axe and adze blades, punches and pressure flakers; there are also animal tooth pendants. Several pebble sinkers with traces of plant binding were discovered, too, one with concave sides.

2.4 The Podozerskoye peat bog

It is situated between Ivanovo and Yaroslavl, c. 50 km to the southeast from the latter. The River Lahost, the right tributary of the River Kotorosl, the right tributary of the Upper Volga, starts from this bog. The Stanovoye 4 site contains Early and Middle Mesolithic find levels. It is situated on a promontory between a shallow gulf of a large ancient lake and a smaller one, connected with the larger lake by a small outlet. 385 m² were excavated there in 1992–2000; trench 1 (16 m²) was on the dry land part of the site, trench 2 (139 m²) in the bog close to the dry land, and trench 3 (230 m²) deeper in the bog. The lower, earliest Mesolithic layer (IV) was investigated in trench 3, it was documented also in trench 2. Pollen data indicate that the formation of cultural layer IV took place during the transition from the Younger Dryas to the Preboreal period. 14C-dates of gyttja incorporating cultural remains in the central and deepest part of trench 3 point to 10,060±120 BP (GIN-10127 I), 10,040±90 BP (GIN-10027 II), 9970±50 BP (GIN-10026 I), and 9940±50 BP (GIN-10026 II). A gyttja sample, from gyttja covering the upper part of the find layer with artefacts deposited on the gravel 7 m to the northwest, was dated to 9850±60 BP (GIN-8379) and 9760±150 BP (GIN-8379a), indicating the beginning of a transgression phase during which the site was flooded. An elk scapula knife was AMS-dated to 9879±50 BP (KIA 35152; HARTZ et al. 2010). Bone and antler artefacts include long narrow arrowheads, most of them with slots for insets along one or both sides, fragments of massive lanceheads, an antler dagger with grooves for insets along both sides, massive antler tine points, broad knives made of elk shoulder blades, awls, bone polishers, beaver mandible tools, antler axe and adze blades, and two adze sleeves (one with a fragment of a wooden shaft in the shaft hole), an antler pressure flaker, antler wedges, preforms as well as cut bones.

The next occupation of the site took place during a short lake regression: an Early Mesolithic cultural layer (IIIa) was formed during a very short period. Pollen analysis places this layer in the first half of the Preboreal period, just before its optimum (about 9600 BP). A wooden stake, sharpened with a stone axe or adze, found in this layer in trench 3 is 14C-dated to 9620±60 BP (GIN-8377). Two more, quite similar stakes, found in horizontal positions in trench 2 below cultural layer III in the upper part of layer 8 (level of cultural layer IIIa) yielded 14C-dates of 9620±50 BP (GIN-8374) and 9590±40 BP (GIN-8376). A sample of gyttja, overlaying cultural layer III in the central part of trench 3, is 14C-dated to 9560±40 BP (GIN-10125 II) and 9480±120 BP (GIN-10125 I), marking the submergence of the site during the middle Preboreal transgression.

The upper Mesolithic layer in trench 3 is dated to the second half of the Preboreal period by pollen data (about 9300–9000 BP). 14C-dates of gyttja samples from this layer are 9280±240 BP (GIN-10122 I), 9090±400 BP (GIN-10124), 8610±40 BP (GIN-10122 II). The last date probably reflects some later admixture to the sample, while the first two are in good accordance with pollen data. There is a fragment of a slotted bone arrowhead, dated to 9413±50 BP (KIA 35154), a fragment of a slotted bone dagger, dated to 9383±42 BP (KIA 35156), a fragment of a wooden handle from an axe sleeve, dated to 8860±47 BP (KIA 35157), a fragment of a massive spearhead, dated to 8799±44 BP (KIA 35158), and an elk bone from this layer in the western part of the trench, dated to 8850±90 BP (GIN-11093a). Numerous wooden stakes were driven from this layer into bottom layers, especially in the river bed. One of them, sharpened with a stone adze, is dated to 9220±60 BP (GIN-8375). Most probably they are remains of fish weirs.

Fragments and details of wooden fishing equipment were also found there, among them discs 10–12 cm in diameter, 1–2 cm thick, and perforated in the centre. They were once hafted to sticks and used to drive fish into nets. Various bone and antler artefacts were found, among them numerous arrowheads: needle shaped ones, with biconical heads or bases, one with a leaf-shaped head, narrow flat ones, mostly with slots for inserts along one or both sides, asymmetric two-winged ones with slots for inserts, and with barbs near the tip or along one side. Barbed points are scarce, with sparse or dense fine barbs. Fragments of harpoons are also scarce. Slotted spearheads and massive lanceheads were found. Straight or slightly curved daggers were supplied with microblades, mounted in one or two slots with the help of a grey glue. Fragments of fishing hooks indicate their widespread use. Numerous bone and antler tools were used for various domestic activities: knives, scrapers, perforated plates for working sinews, awls, a needle case, chisels/knives/scrapers made of beaver mandibles, antler axe and adze blades as well as sleeves for mounting them, narrow bone chisels, punches, and a pressure flaker. One adze sleeve was found with a chert core adze still preserved in the groove at its working edge. A butt end of a broken antler adze was preserved in the groove of the other. A sleeve for an axe had a fragment of a wooden handle in the shaft hole. Many items are decorated with engraved geometric designs. Personal ornaments include various tooth pendants and flat rectangular perforated pendants.

Find level III in trench 2, situated closer to the mineral shore, dates a little later. It is dated to the second quarter of the Boreal period (about 8800–8600 BP) by pollen. 14C-dates of gyttja with cultural remains from trench 2 are: 8930±40 BP (GIN-10109 II), 8640±60 BP (GIN-10110 II), 8540±80 BP (GIN-10109 I), 8500±150 BP (GIN-10110 I). Three wooden stakes from this layer, sharpened with a stone adze, gave the following dating results: 8700±70 BP (GIN-8854), 8670±50 BP (GIN-8856) and 8540±60 BP (GIN-8853), which define an occupation period at the very end of the Early Mesolithic. Bone and antler tools are numerous and impressive, among them various arrowheads: needle shaped ones with biconical heads and long stems, needle shaped ones with biconical bases, narrow flat ones, the latter with slots along one or both sides, asymmetric two-winged ones with slots for inserts. Fragments of harpoons or barbed points and spearheads were found, accompanied by massive lanceheads made of tubular elk bones and daggers with slots for inserts along one or both sides. It is worth noting that some slotted artefacts had regular unretouched microblades preserved in their original positions in the slots, fixed there with the same dark grey glue as observed in trench 3. Many bone artefacts were ornamented with engraved geometric designs. Fishing tools include intact hooks and sinkers. Bone and antler domestic activity tools include various knives, scrapers, awls, needle and needle case, chisels/knives/scrapers made of beaver mandibles, antler axes, adzes and sleeves for their mounting, bone chisels and gouges, digging tools, punches, and pressure flakers. Personal ornaments are represented by various animal tooth pendants with grooves and flat rectangular perforated pendants, made of split ribs.

2.5 The Sakhtysh peat bog

This bog is situated 40 km to the southwest of Ivanovo; it is connected by the small River Koika through River Nerl to the River Klyazma, the left tributary of the Oka. The site Sakhtysh 14 occupies a place in the peat bog at the foot of a very slanting promontory of a terrace of the late glacial lake. During the Mesolithic it occupied a low lake shore near a river outlet. The site was discovered in 1999, and about 200 m² were excavated in 1999–2003 (ZHILIN 2006). Five Mesolithic cultural layers were investigated at this site. The bottom find level (IV) is dated to the Preboreal period by pollen. 14C-dates are: 9550±60 (GIN-11616), 9450±60 (GIN-11624); 9420±40 (GIN-11621), 9320±40 BP (GIN-11619) on worked wood, and 9350±40 BP (GIN-11179) on elk antler, 9200±90 (GIN-11181) on an elk mandible. Similar dates – 9550±40 (GIN-11609), 9390±90 (GIN-11045), 9390±60 (GIN-11177 II), 9340±40 (GIN-11610), 9250±210 (GIN-11177 I) BP – were obtained on the organic deposits incorporating this find level. It yielded bone tools such as

needle shaped arrowheads, an antler dagger or axe blade, a fragment of a massive lancehead, an intact fishing hook, fragments of broad elk scapula knives, a fragment of a side scraper made of a tubular bone, awls, hollow edge gouges, a beaver mandible chisel-knife, elk tooth pendants, preforms, and fragments of tools.

Find level III is dated to the late Preboreal/early Boreal period by pollen data. 14C-dates of gyttja are: 9280±50 BP (GIN-11607 II) and 9150±50 BP (GIN-11607 I); a wooden stake from this level is dated to 9010±60 BP (GIN-11053), and a fragment of an elk skull to 8800±100 BP (GIN-11180). The find level yielded numerous bones of forest mammals, birds and fish as well as coprolites, chert and flint flakes, and blades. Bone and antler artefacts are represented by a short massive needle-shaped arrowhead with glue preserved on its basal part, a fragment of a flat dagger without slots, fragments of slotted daggers, broad knives made of elk shoulder blades, a fragment of a knife made of a tubular elk bone, a denticulate end-scraper, beaver mandible tools, an antler adze, a hollow edge gouge, a bone chisel, fragments of shallow spoons, one of them ornamented, an antler punch, elk tooth pendants, and a flat rectangular perforated pendant. The two upper find levels are dated by pollen to the late Boreal period.

3 Early Mesolithic barbed points in the Volga-Oka-interfluvial area

Various bone points with barbs were found during excavations of the sites described above. It is widely accepted that these points were used as heads of projectiles. A number of typological lists and classifications of these tools used in the Mesolithic of Northern and Eastern Europe has been published, accompanied by papers and books concerning the technology of their manufacture (CLARK 1936; DAVID 1999; GURINA 1956; 1991; INDREKO 1948; LOZOVSKAYA/LOZOVSKI 2013; OSHIBKINA 1983; 1997; ZAGORSKA 1991; ZHILIN 1998; 2001, and others). Questions of their purpose and use are still rather poorly studied. Scarce finds of such points attached to wooden shafts or coming from clearly defined contexts, together with ethnographic observations, are the main sources for conclusions concerning the function of these points. Use-wear analyses and experiments conducted by the author now help to define the purpose and use of barbed points from Early Mesolithic sites of central Russia.

The main function of barbed points was not only to pierce through, but also to stay in the body of hunted prey. Results of morphological and use-wear analyses conducted by the author make a division of barbed projectile points into several functional groups possible. Depending on the category of hunting weapons the following categories of projectile points are singled out: I – arrowheads, II – javelin and leister points; III – spearheads, IV – harpoons. Within some of these categories functional types are singled out based on effects they produce when hitting a target. The shape of projectile points makes it possible to single out variants of these artefacts within the functional types.

3.1 Group I: Arrowheads

This group includes projectile points with barbs supplied by a bevel specially shaped for hafting in a thin shaft of an arrow (about 1 cm in diameter), as defined from scarce finds of shafts of arrows from peat bog sites in central and northern European Russia (OSHIBKINA 1983; 1997; ZHILIN 2004). Bevels of arrowheads are usually conical or pyramid-like, suited for hafting in a conical hollow at the end of the shaft. Wedge-like bevels suited for hafting in a split shaft are scarce. Remains of glue often preserved on bevels of arrowheads indicate a tight attachment of the arrowhead to the hollow or split of the shaft. Experiments conducted by the author together with S. N. Savchenko and O. Yu. Yulanov showed that a conical hollow, suitable by its shape and size for hafting the bevel of a bone arrowhead, can be drilled into the end of a pine shaft 1 cm in diameter in less than one minute with the help of a flint borer fixed

in a wooden rod rotated between the palms of the worker. Such borers are often found at Mesolithic sites in central Russia. Sharp splinters of bone hafted and used as flint borers were also good for this purpose. When the hollow was prepared it was filled with melted glue made from coniferous or birch pitch. The use of pure melted pine or spruce pitch, which looks like dark resin under the microscope, was a rare occasion. A matt granulated brown or grey surface with a lot of fine charcoal dust indicates an admixture of ashes, etc. Beeswax mixed with ash makes the glue stronger. In our experiment we used ash from a camp fire, and the glue was grey in colour with a matt surface and strong enough for hafting exact replicas of Mesolithic bone arrowheads. Scarce finds of arrows preserved intact with bone arrowheads as well as multiple traces of different bindings on remains of glue preserved on bone arrowheads indicate that bone arrowheads hafted with glue were additionally bound by threads or thin cords made from sinew or plant material. The size of barbed arrowheads does not differ from various arrowheads without barbs (ZHILIN 2001). Barbed arrows were placed together with arrowheads of other types of the same size in several burials of the Oleneostrovski cemetery (GURINA 1956), most probably in quivers.

Large barbed arrowheads were used for hunting large mammals, smaller ones for hunting various animals and for shooting fish. Two functional types are singled out in this group.

Type 1 unites stabbing barbed arrowheads which penetrated deep into the body of game and remained there. It consists of three formal variants:

1. With barbs near the tip (Fig. 2,8; Fig. 3,1). Found at Ozerki 17 and Stanovoye 4 (find level III of trench 3).
2. With large barbs along one lateral side (Fig. 2,5). Discovered in Stanovoye 4 (find level III of trench 3).
3. With small barbs or deep incisions along one lateral side (Fig. 2,6–7). Present in Ivanovskoye 7 (find level IV) and Stanovoye 4 (find level III of trench 3).

Use-wear traces observed under a stereo-microscope at magnification levels from 8 to 70 times are mostly the same as on other types of arrowheads, and include a smashing or rounding of the tip of the point, accompanied by a rather bright polishing, gradually decreasing at a distance from the tip, and fine striations running from the tip inside described polishing along the tool axis or at acute angles to it (ZHILIN 2015; 2016a; b). Some artefacts deserve separate description.

A long arrowhead with a flattened point with three very small barbs on one lateral side of the point (Stanovoye 4, trench 3, find level III) has an oval cross-section in the upper part, but in the middle and bottom part its cross-section is round (Fig. 3,1). The bevel is conical with a small circular interrupted line running around the stem where it changes into the bevel. It is made of a splinter cut from the wall of a long bone, most probably of an elk, treated by careful longitudinal whittling and fine grinding afterwards. The tip is obliquely broken; bright polishing, gradually decreasing, runs down from it. Fine short grooves and fine striations run from the tip at acute angles to the arrowhead axis, overlaying traces of fine grinding, but running at a different angle (Fig. 3,2–5).

A small barbed arrowhead from the bottom find level (IV) of Ivanovskoye 7 is made of a flat splinter cut from the wall of a long bone of some small mammal or bird. Its lateral sides were treated by longitudinal whittling at the ventral (interior) side of the bone, and by fine scraping on the dorsal (exterior) bone surface. Very fine barbs were shaped by longitudinal whittling towards the point of the arrowhead, and chips were removed also by whittling from the tip of a barb towards its base. The base was treated by longitudinal whittling along the lateral sides and on the ventral face (Fig. 4,1). The tip of the point is rounded; polishing is observed near the tip, accompanied by long fine grooves and striations of various size running from the tip parallel to its axis. Some of them are rather robust and visible under low magnifications (Fig. 4,2–4), while others are clearly visible only under higher magnifications (Fig. 4,5–6). Such traces are usually observed on bone leister points used for stabbing fish in shallow water. They are

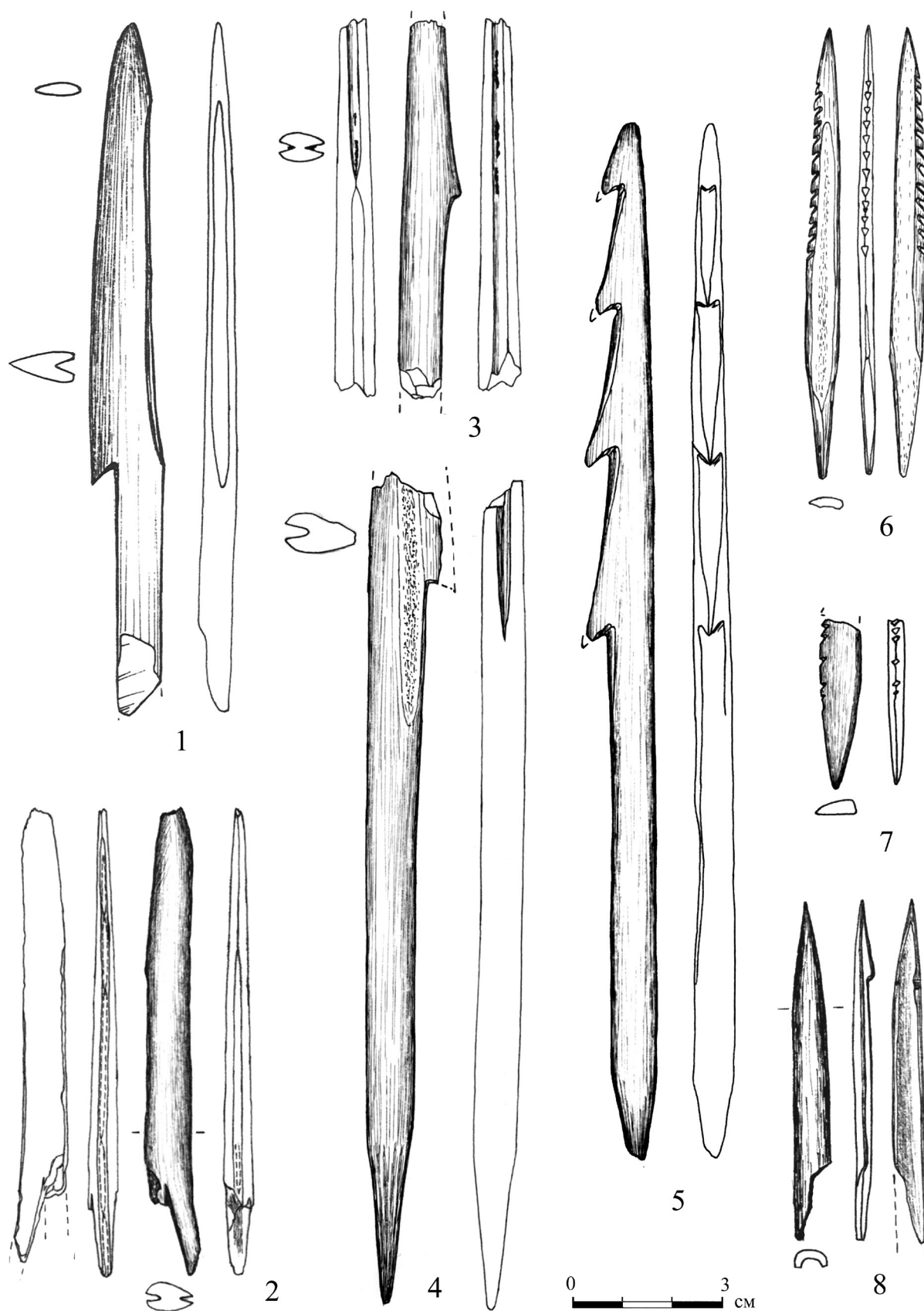


Fig. 2. Barbed bone arrowheads: 1.4.6 – Ivanovskoye 7 (find level IV); 2 – Stanovoye 4 (find level III, trench 2); 3.5.7 – Stanovoye 4 (find level III, trench 3); 8 – Ozerki 17.

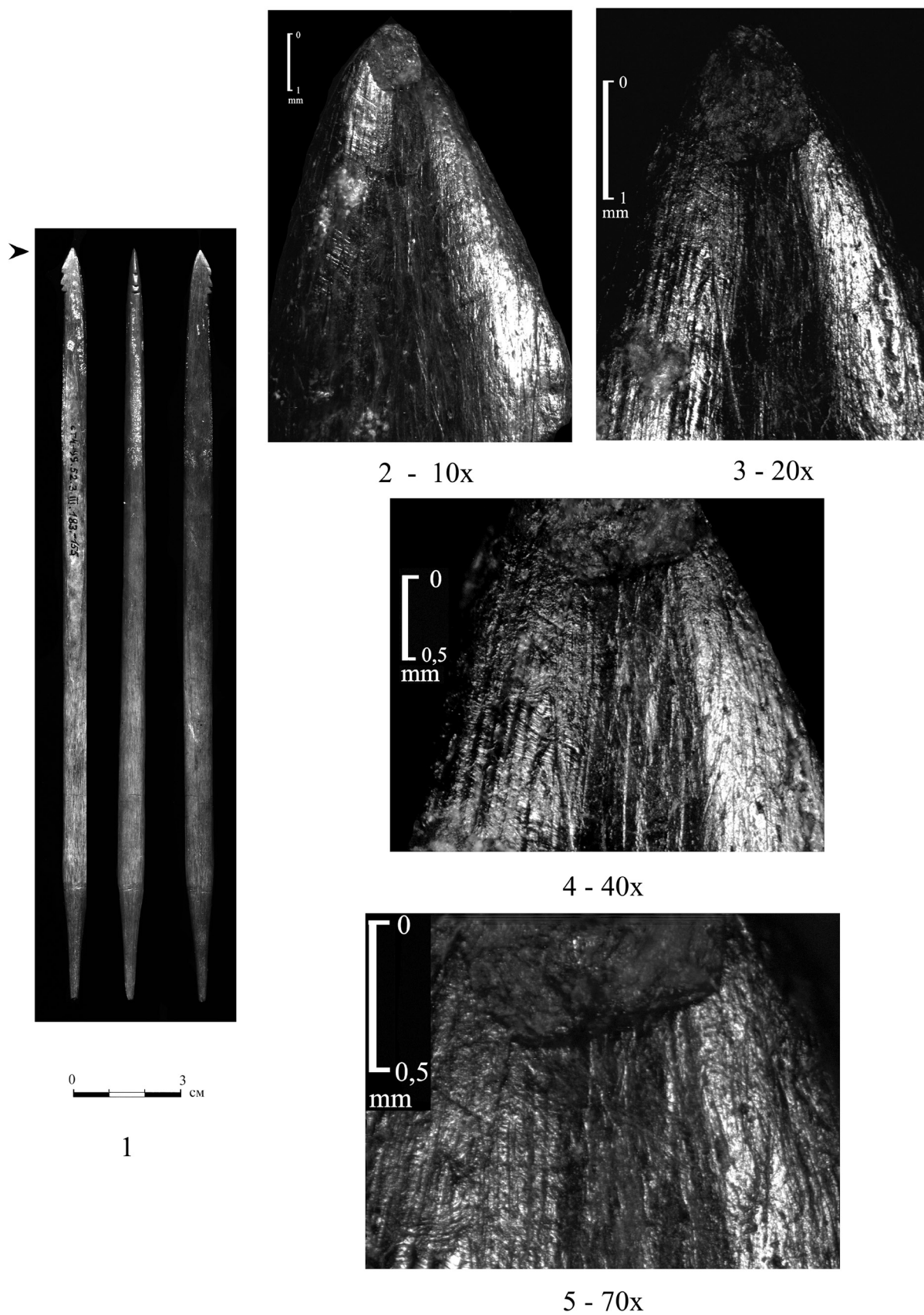


Fig. 3. Barbed bone arrowhead from Stanovoye 4 (find level III, trench 3).

produced when the point hits a sandy and silty lake bottom, similar to what we have in Ivanovskoye 7. Impressive traces on this arrowhead indicate its long use with multiple occasions of hitting the lake bottom. It was found deeply stuck in the bottom of the ancient lake near the shore, at an angle about 70°. Such a position fits well with shooting fish with bow and arrow and missing the target. Most probably it was used to shoot pike when the fish were warming themselves in shallow water, but the point missed the target and got stuck in the lake bottom. Pike dominates among the fish bones in the bottom find level of Ivanovskoye 7 and other Mesolithic sites in central Russia (ZHILIN 2004). Shooting fish with bow and arrow is also documented in ethnographic data (ZAGORSKA 1991).

Type 2 includes stabbing-cutting arrowheads with barbs at the end of the wing and one or two slots for inserts – microblades – along one or both of the lateral sides. Arrowheads of this type combined the ability of barbed arrowheads to remain in the body of a wounded beast with producing a deep cut which caused intensive loss of blood. If the arrow did not kill the animal at once, such a wound exhausted it and made pursuit easier. Two variants of arrowheads of this type can be singled out:

1. With one slot on the lateral side opposite the barbed wing (Fig. 4,1,4). Found in Ivanovskoye 7 (find level IV) and Stanovoye 4 (find level III of trench 2).
2. With slots on both lateral sides of the arrowhead (Fig. 2,2–3). Present in Stanovoye 4 (find level III of trenches 2 and 3).

Some arrowheads of this type display impressive traces of use. A fully preserved specimen with a barb at the end of the wing and a partly preserved stem comes from Ivanovskoye 7 (find level IV). The slot on the lateral side opposite the wing starts c. 1 cm from the tip and ends opposite the barb (Fig. 2,1). The base with the lower part of the stem is broken off, but most probably it was conical like on another fragment of a similar arrowhead from the same find level (Fig. 2,4). The surface was treated by very careful whittling, then partly smoothed with a fine abrasive slab and polished. Remains of brown melted coniferous pitch with a characteristic resin-like appearance are preserved in the slot. Imprints of three inserts/microblades are visible in this glue, the first two of which were unretouched, and the lower end of the last one was obliquely truncated by fine steep retouch. When intact, the arrowhead was symmetric with two wings ending in barbs, resembling a complete arrowhead of this variant from the site Veretye 1 (OSHIBKINA 1983, fig. 26). The tip of the described arrowhead is blunted with flat microchips running from it, accompanied by bright polishing and rare fine striations running from the tip at acute angles to the artefact axis. This arrowhead was obviously used for hunting mammals for a rather long time.

Another arrowhead was found in find level III of trench 2 at the Stanovoye 4 site. The stem is broken off at the base of the blade which has a long barb at the end of one wing (Fig. 2,2). The blade was treated by longitudinal whittling and polishing, the barb was bifacially cut with a burin with a very sharp working edge, or most probably with a broken blade. Slots 1–1.5 mm wide and 3–5 mm deep run along both lateral sides of the arrowhead blade, the slot on the barbed side starts at 1 cm from the point and ends at the point of a barb. The slot on the opposite side starts at 3 cm from the point and ends on the broken stem. Remains of grey glue with imprints of inserts – unretouched microblades – are preserved in both slots. The tip of the point is smashed and cracked in the direction of the arrowhead base, and the breakage of the stem runs towards the tip. Flat scars run from the breakage of the stem along both sides of the slot towards the point (Fig. 2,2). Such damage is typical for arrowheads which hit hard material. Similar damage is observed on the other barbed arrowhead with two slots from find level III of trench 3 at Stanovoye 4 (Fig. 2,3).

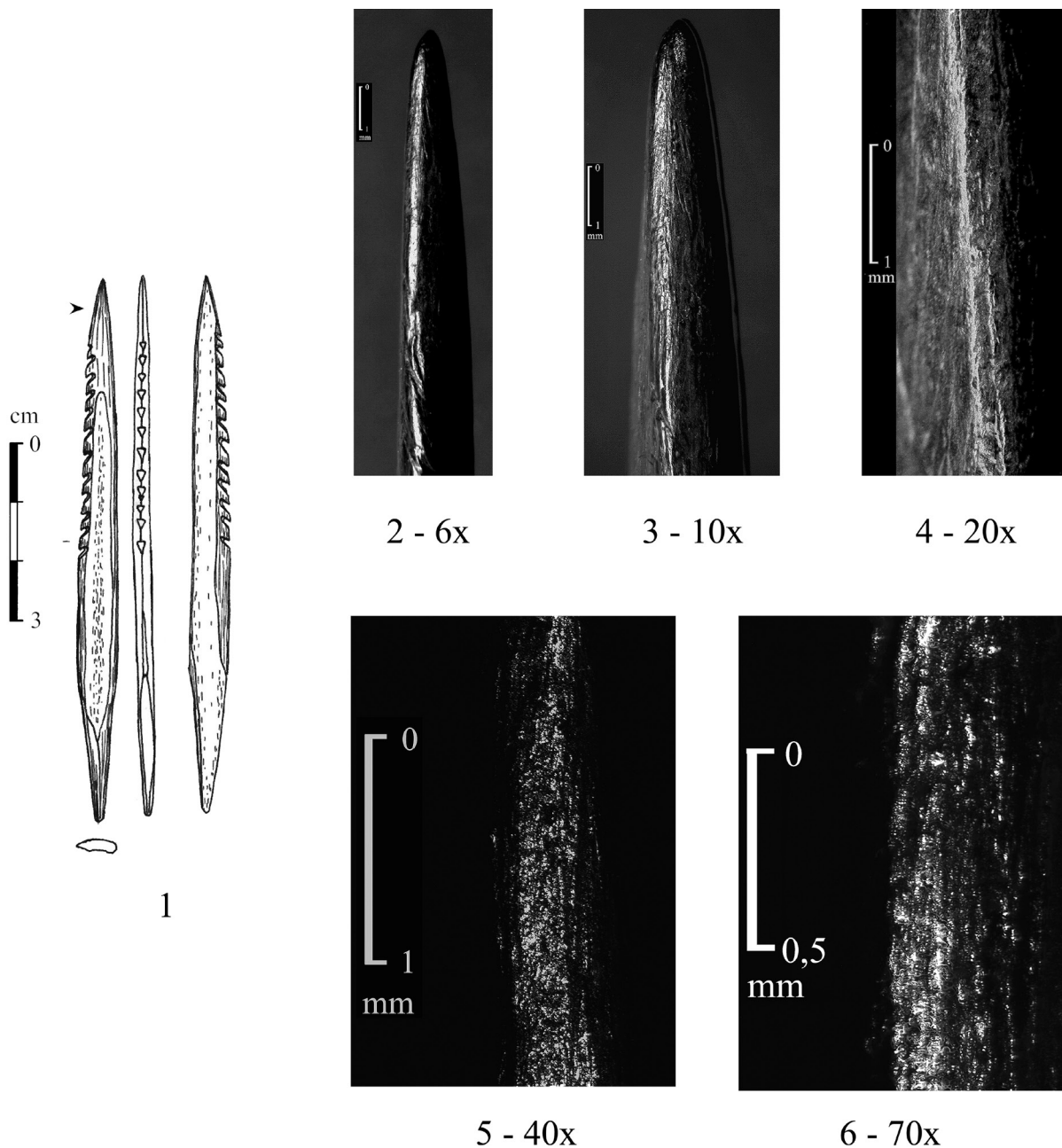


Fig. 4. Barbed bone arrowhead from Ivanovskoye 7 (find level IV).

3.2 Group II: Javelin and leister points

Besides arrowheads other types of projectiles were used in the Mesolithic of central Russia, too. Javelins and throwing spears are among them. According to archaeological and ethnographic data these weapons were used for hunting dry land mammals, water mammals, birds, and large fish. If prey was not killed at once, the javelin stuck in it made escape practically impossible. The shaft also allowed taking pierced water mammals like beavers, otters, etc., and fish from the water, as well as collecting hit birds. Possible reconstructions involve one or several barbed javelin points attached to the same shaft depending on the prey hunted (CLARK 1975; OSHIBKINA 1983; ZAGORSKA 1991; ZHILIN 2004). Javelins with barbed points became leisters without changing their morphology when they were used to take fish. Leisters

were used mainly in shallow water. Pike was the main prey hunted with leisters. Pike bones dominate among fish remains at most Mesolithic sites in Eastern Europe (ZHILIN 2004; 2014). Rare finds of leister points in context, like the famous pike skeleton from Kunda (INDREKO 1948) with a uni-laterally barbed point among its bones directly confirm such hunting. At the same time ethnographic data show that fish spears with barbed spearheads were used to hunt fish in transparent water at a depth of up to 5 m, either stabbing a fish or throwing such a spear into the water (ZAGORSKA 1991).

This group incorporates projectile points with bases suitable for tight hafting in shafts about 2 cm in diameter, corresponding to rare finds of hafted artefacts. Compared with arrowheads their bases are longer (sometimes up to half the length of the artefact: Fig. 5,1) and more massive. Remains of glue with imprints of binding on it also help to determine the hafting of these points. A long base of one uni-lateral javelin point from Stanovoye 4 (layer III, trench 3) was almost entirely covered with residue of grey glue. Traces of binding – narrow flat lines – are clearly visible on one side of the artefact, but absent on the other. It indicates hafting in a groove made on one side of a shaft. The bases of some points are supplied with transverse incisions (Fig. 5,2), small protrusions or barbs oriented towards the tip of the projectile point (Fig. 5,3). S. V. Oshibkina supposed that such details were made for a better connection of head and shaft. Two finds with such details were additionally bound with birch bark (OSHIBKINA 1983, 102 fig. 20).

Points of barbed javelins or throwing spears belong to one type, the purpose of which was to penetrate deep into the body of hunted prey and remain there. Compared with barbed arrowheads they were larger and heavier and especially effective when thrown from a short distance. Several variants of this type are singled out based on their shape for the Early Mesolithic of the Volga-Oka interfluvium:

1. Uni-lateral points with sparse barbs (Fig. 5,1–2; 6,1). They come from Nushpoli 11 (find level IV), Ivanovskoye 7 (find level IV) and Stanovoye 4 (find level III of trench 3).
2. Uni-lateral points with dense barbs (Fig. 5,3). They were found in Ivanovskoye 7 (find level IV) and Stanovoye 4 (find level III of trench 3).
3. Uni-lateral points with dense deep oblique incisions (Fig. 5,4). They are present in Ivanovskoye 7 (find level IV) and Stanovoye 4 (find level III of trench 3).

Use-wear analyses conducted by the author made possible a more exact determination of the use of some barbed javelin and leister points. Use-wear traces in general are similar to those observed on arrowheads described above, but some deserve separate description.

One uni-lateral point from Stanovoye 4 (find level III of trench 3) once had three sparse beak-shaped barbs, the middle one is broken. The base is very short (Fig. 6,1). Probably it was reshaped after breakage. The surface shows traces of longitudinal whittling, the barbs are transversally sawn. The tip of the point is obliquely broken, bright polishing, gradually decreasing, runs from the tip, long grooves and fine striations running in the same direction parallel to the artefact axis and at acute angles to it are clearly visible (Fig. 6,2–4). Such traces are typical for leister points used for hunting fish in shallow water with a silty bottom with gravel. The ancient lake gulf close to the site had such a bottom during site habitation.

3.3 Group III: Massive thrusting spearheads

It includes massive points with barbs suited for hafting in massive shafts about 3 cm or more in diameter. They were designed for stabbing large prey and then remaining in its body, or for extracting it from the water. Such artefacts are very scarce in Early Mesolithic layers in the Volga-Oka interfluvium. One was found at Stanovoye 4 (find level III of trench 3). It was made of a long bone, the point is flat with two small barbs near the tip on the left lateral side; its base is broken off (Fig. 5,5). The surface shows traces of longitudinal whittling and is partly polished. The tip is smashed, a dull polishing with scarce striations running from the

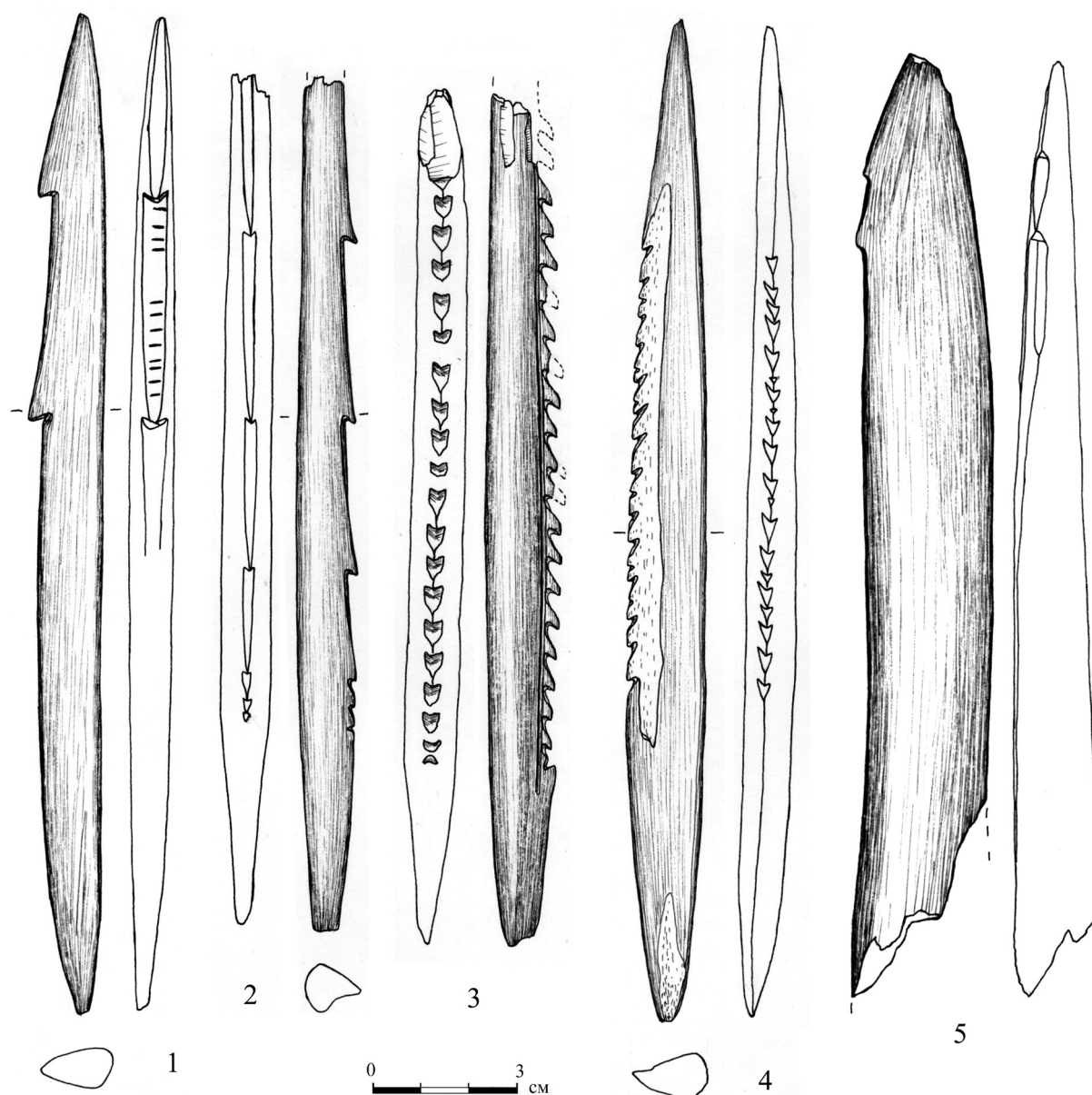


Fig. 5. Barbed bone arrowheads: 1–4 – Ivanovskoye 7 (find level IV); 5 – Stanovoye 4 (find level III, trench 3).

tip at an acute angle to the artefact axis is similar to traces observed on projectile points. The barbs are very small compared with the large size of the spearhead itself.

One more unique artefact combines features characteristic for spearheads and daggers. It is massive and straight with blunt sides and a sharp point, the base displays traces of spiral binding and has a hole produced by bifacial scraping. Its general shape, its treatment by longitudinal whittling, traces of spiral binding and a perforation at the end of the handle (?) are typical for daggers from the same layer (ZHILIN 2001). But a small barb on the left lateral side near the tip (Fig. 7,1) makes it possible to treat it as a 'barbed point'. This artefact is a kind of 'hybrid', combining diagnostic features of two types. If broken in the middle and found separately in two parts, the upper part would have been classified as a fragment of a barbed spearhead, whereas the bottom part would have been called a handle of a dagger. The tip of the point is flattened and rounded with rather bright polishing accompanied by grooves and striations running from the tip at acute angles to the artefact axis overlaying traces of grinding (Fig. 7,2–4). Such traces are seen in spearheads as well as daggers.

3.4 Group IV: Harpoons

Unlike the objects of the previous categories these projectile points had a flexible hafting and detached from the shaft after hitting the target. They were inserted in the hollow at the end of a wooden shaft and connected with it by a line. Bases of harpoons were supplied with special details for fastening the line, such as perforations, hollows, grooves, protrusions, and large teeth directed from the base to the tip of the artefact. The absence of residue of glue and traces of binding on harpoons also speaks in favour of their flexible hafting. Harpoons were used for hunting large fish. Bones of pike which were up to 2 m long and those of catfish over 2,5 m long were recovered from Early Mesolithic sites in central Russia (ZHILIN 2004; 2014). The harpoons were also used to hunt water mammals, beavers the most important among them. Their bones take second place after elk bones in both number of bones and minimal number of individuals in Early Mesolithic levels of peat bog sites in central Russia. These, too, were larger than modern beavers (ZHILIN 2004; 2014). A beaver skull with an embedded fragment of a harpoon from a Neolithic layer of the Sakhtysh 1 site is a direct confirmation for taking beavers with a harpoon (ZHILIN 2004; 2014). It was very important to hit a beaver in the head with a harpoon, because a wounded beaver hit in some other body part can easily bite off the line. Ethnographic data indicate that harpoon lines were usually made of hide. The absence of finds of harpoons or shafts with remains of line made from plant materials in layers where cords, ropes, remains of nets and bindings made from plant materials are well preserved also confirms this. Mesolithic harpoons from central Russia belong to one functional type supplied with barbs or teeth for keeping the point in the body of hunted prey. Turning harpoons are not known in the Mesolithic of the forest zone of Eastern Europe. Based on the shape of artefacts Early Mesolithic harpoons of this type from central Russia are divided into three variants:

1. Uni-lateral ones with sparse barbs (Fig. 8,1.5–6). They come from Ivanovskoye 7 (find level IV) and Stanovoye 4 (find level III of trench 3).
2. Uni-lateral ones with dense barbs (Fig. 8,3). They were found in Ivanovskoye 3 (find level IV) and Sakhtysh 14 (find level III).
3. Bi-lateral ones with dense barbs (Fig. 8,7). A unique harpoon of this variant with a wide shovel-shaped perforated base was found at the site Berendeevo 9. A fragment of another unique bi-laterally barbed point or harpoon comes from Ozerki 17 (Fig. 8,4).

Use-wear traces observed on harpoons are similar to traces on leisters, but usually they are less pronounced. An intact uni-lateral flat harpoon with two sparse beak-shaped barbs and an opposite barb was found at Ivanovskoye 7 (find level IV). The surface is carefully treated by longitudinal whittling, smoothed with a fine abrasive slab and polished, the bases of the barbs are transversally sawn (Fig. 8,1). The tip of the point displays light smashing with micro-chipping; bright polishing, gradually dulling, runs from the point, accompanied by short and longer fine grooves and striations running from the tip along the artefact axis and at acute angles to it. Such traces indicate a long use of this harpoon for hunting large fish in shallow water, where it often hit the silty and sandy lake bottom.

4 Conclusion

Complex research on various barbed points from Early Mesolithic sites of the Volga-Oka interfluvium showed that they were the heads of different categories of hunting weapons – mostly projectiles. Analyses of their shape, size and use-wear traces made it possible to single out arrowheads, javelin or leister points, spearheads of throwing and thrusting spears, and harpoons. The earliest of them emerge in the first half of

the Preboreal period, but the full flourishing of various categories of barbed weapons is observed during the late Preboreal/early Boreal periods and later (ZHILIN 2013). Some types and variants are numerous and had a long history, while others are represented by single finds only. The first are more or less standard mass products, while the latter can be seen as experimental artefacts which played no significant role. Together with other types of bone and antler hunting weapons the barbed projectile points played an important role in subsistence strategies of the Early Mesolithic population of western Russia and its adaptation to the forest environment during the early Holocene. They show the highly developed bone-working skills of Early Mesolithic craftsmen, and some of these items are real masterpieces.

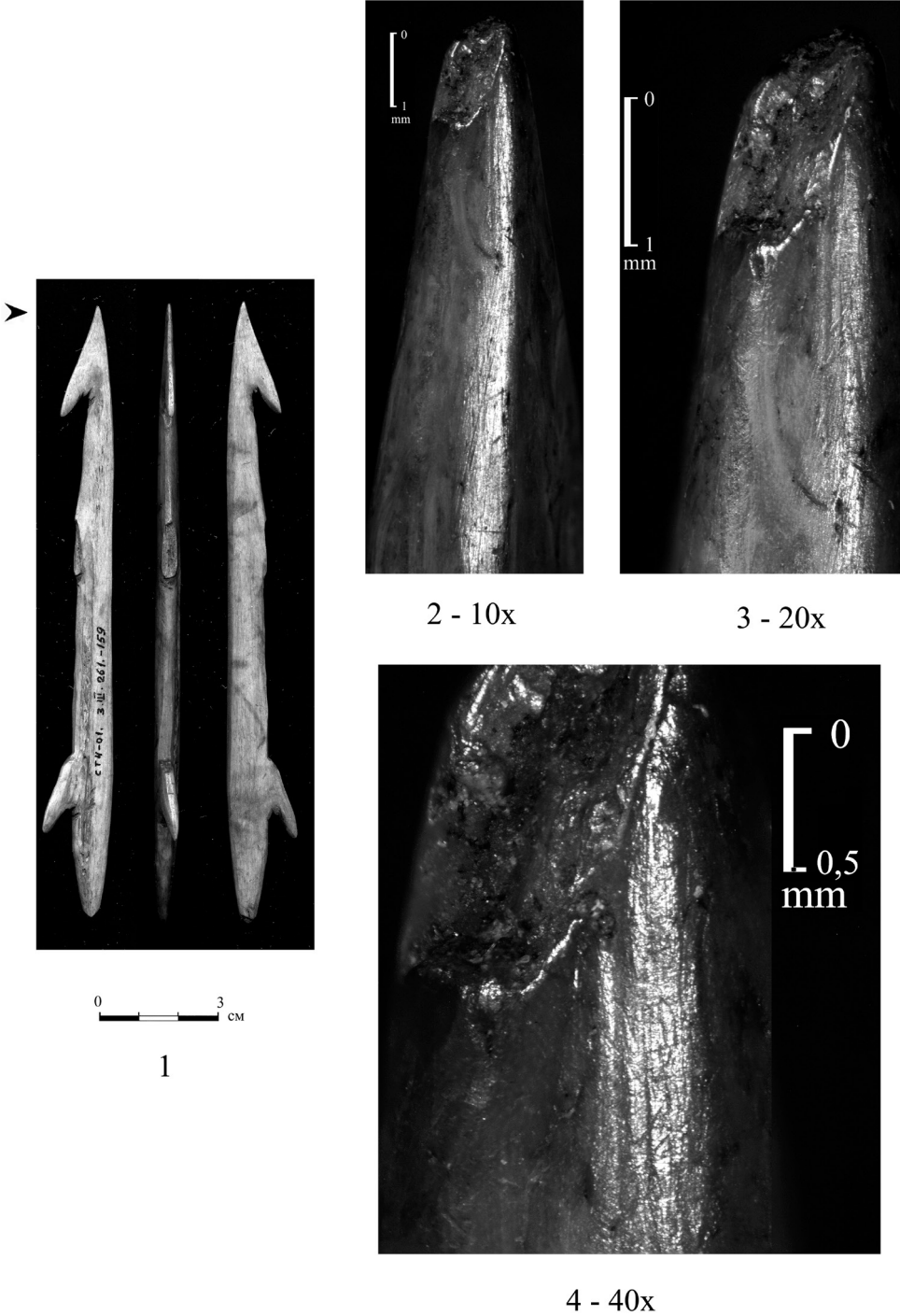
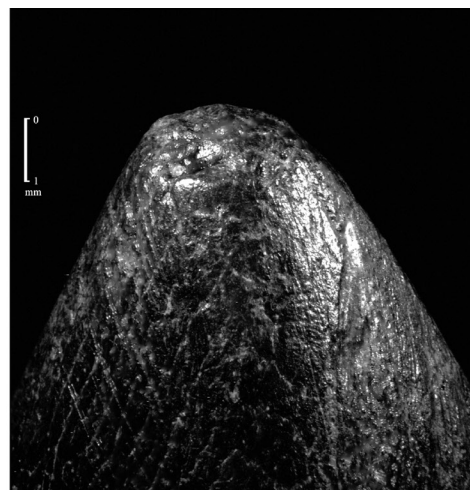
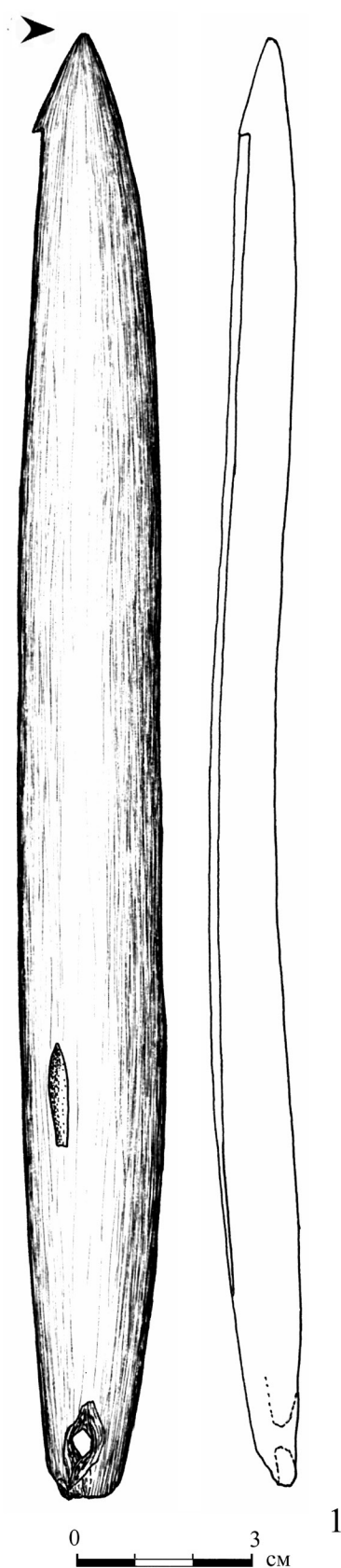
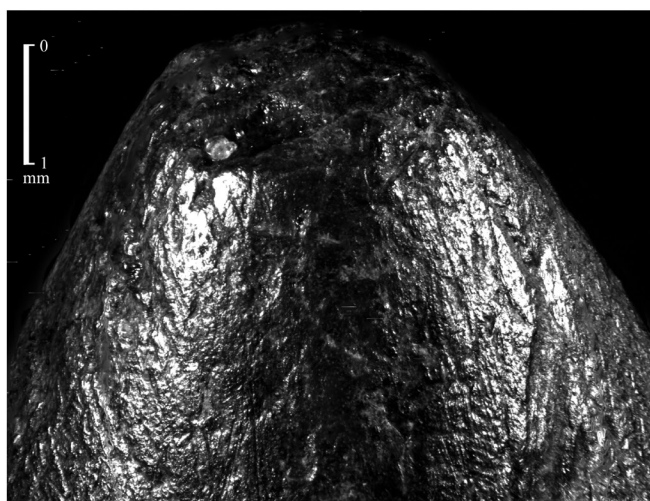


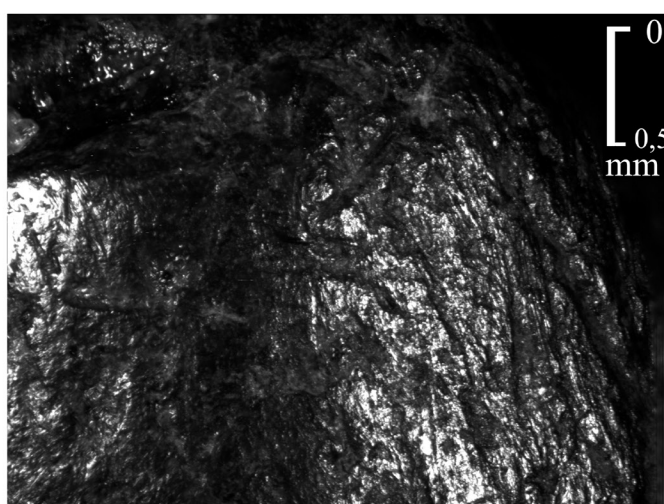
Fig. 6. Barbed bone leister point from Stanovoye 4 (find level III, trench 3).



2 - 10x



3 - 20x



4 - 40x

Fig. 7. Barbed bone spearhead or dagger (?) from Stanovoye 4 (find level III, trench 3).

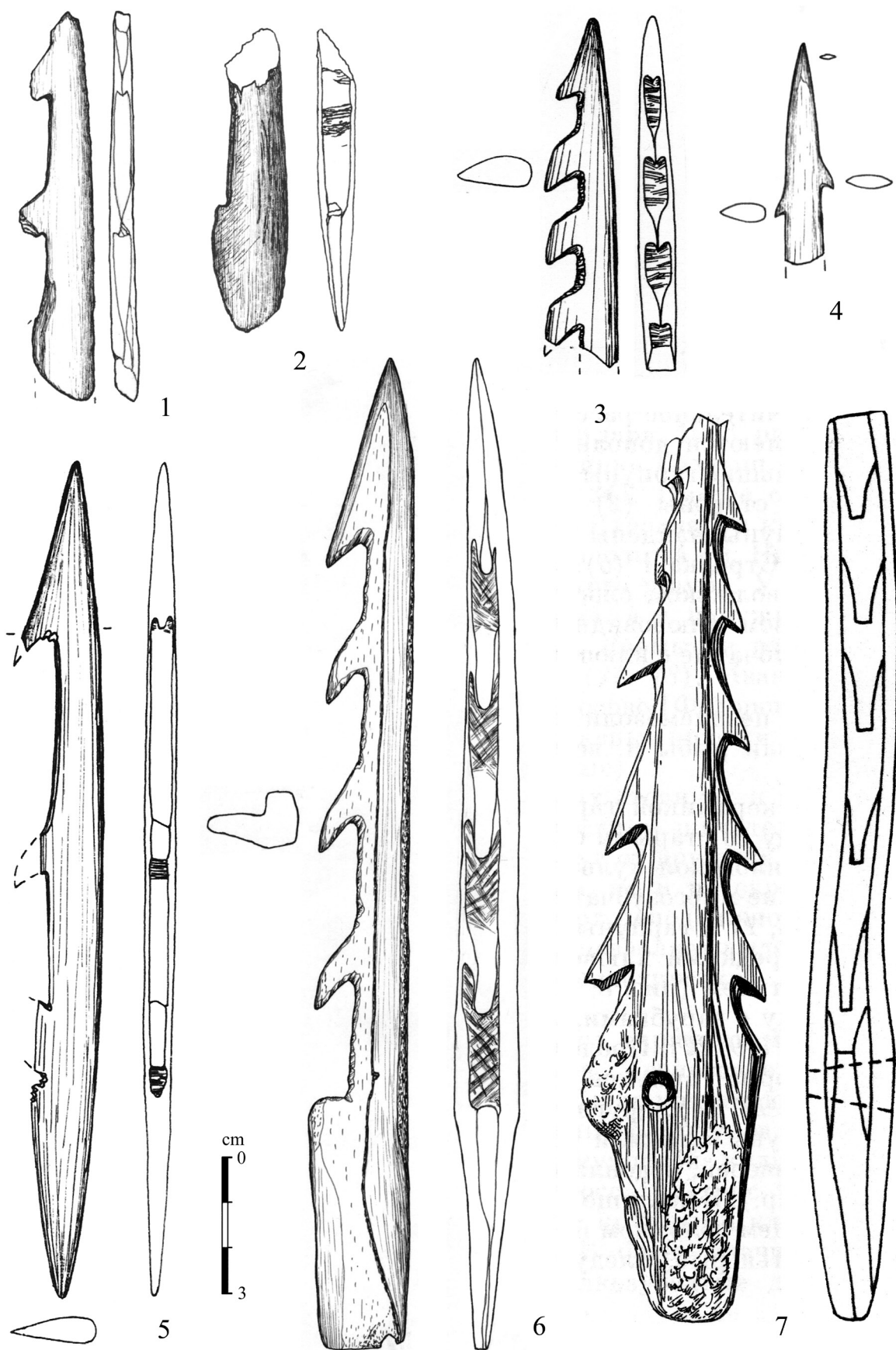


Fig. 8. Bone harpoon heads: 1-2,5-6 – Ivanovskoye 7 (find level IV); 3 – Ivanovskoye 3 (find level IV); 4 – Ozerki 17; 7 – Berendeevo 9.

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Mikhail Zhilin
 Planernayastr. 3-2-235
 Moscow 125480
 Russia
 mizhilin@yandex.ru

Table 1. Radiocarbon dates from early Mesolithic sites with barbed points in the Volga-Oka interfluvium (calibration by OxCal v4.3.2 [BRONK RAMSEY 2017], r:5, Intcal 13 atmospheric curve [REIMER et al. 2013]).

Site / find level	Dated material	Lab. index	BP uncal.	cal. BC
Ozerki 17 / IV	Worked wood	GIN-6655	8830±40	8203–7755
Ozerki 17 / IV	Worked wood	GIN-7474	8840±50	8210–7773
Ozerki 16 / II	Worked wood	GIN-6654	8770±40	8164–7622
Nushpoli 11 / IV	Worked wood	GIN-6653	8540±60	7677–7489
Ivanovskoye 7 / IV	Wood gnawed by beaver	GIN-9520	9650±110	9296–8745
Ivanovskoye 7 / IV	Worked elk bone	GIN-9516	9640±60	9245–8826
Ivanovskoye 7 / between III and IV	Gyttja	GIN-9367	9690±120	9381–8730
Ivanovskoye 7 / between III and IV	Gyttja	GIN-9517	9500±110	9220–8570
Ivanovskoye 7 / between III and IV	Gyttja	GIN-9385	9500±100	9215–8575
Stanovoye 4 / IV	Gyttja	GIN-10127 I	10,060±120	10,087–9296
Stanovoye 4 / IV	Gyttja	GIN-10027 II	10,040±90	10,012–9307
Stanovoye 4 / IV	Gyttja	GIN-10026 I	9970±50	9746–9299
Stanovoye 4 / IV	Gyttja	GIN-10026 II	9940±50	9660–9288
Stanovoye 4 / IV	Elk scapula knife	KIA 35152	9879±50	9643–9249
Stanovoye 4 / above IV	Gyttja	GIN-8379	9850±60	9643–9221
Stanovoye 4 / above IV	Gyttja	GIN-8379a	9760±150	9759–8745
Stanovoye 4 / IIIa	Worked wood	GIN-8377	9620±60	9230–8810
Stanovoye 4 / IIIa	Worked wood	GIN-8374	9620±50	9224–8824
Stanovoye 4 / IIIa	Worked wood	GIN-8376	9590±40	9180–8805
Stanovoye 4 / above IIIa	Gyttja	GIN-10125 II	9560±40	9143–8781
Stanovoye 4 / above IIIa	Gyttja	GIN-10125 I	9480±120	9229–8485
Stanovoye 4 / III, trench 3	Worked elk bone	KIA 35154	9413±50	8812–8562
Stanovoye 4 / III, trench 3	Worked elk bone	KIA 35156	9383±42	8765–8557
Stanovoye 4 / III, trench 3	Gyttja	GIN-10122 I	9280±240	9264–7876
Stanovoye 4 / III, trench 3	Worked wood	GIN-8375	9220±60	8603–8296
Stanovoye 4 / III, trench 3	Gyttja	GIN-10124	9090±400	9644–7322
Stanovoye 4 / III, trench 3	Worked wood	KIA 35157	8860±47	8223–7798
Stanovoye 4 / III, trench 3	Unworked elk bone	GIN-11093a	8850±90	8249–7680
Stanovoye 4 / III, trench 3	Worked elk bone	KIA 35158	8799±44	8197–7685
Stanovoye 4 / III, trench 2	Gyttja	GIN-10109 II	8930±40	8249–7965
Stanovoye 4 / III, trench 2	Worked wood	GIN-8854	8700±70	7962–7585
Stanovoye 4 / III, trench 2	Worked wood	GIN-8856	8670±50	7822–7585
Stanovoye 4 / III, trench 2	Gyttja	GIN-10110 II	8640±60	7825–7552
Stanovoye 4 / III, trench 2	Gyttja	GIN-10109 I	8540±80	7753–7378
Stanovoye 4 / III, trench 2	Worked wood	GIN-8856	8540±60	7677–7489
Stanovoye 4 / III, trench 2	Gyttja	GIN-10110 I	8500±150	7965–7085
Sakhtysh 14 / IV	Worked wood	GIN-11616	9550±60	9184–8742
Sakhtysh 14 / IV	Gyttja	GIN-11609	9550±40	9140–8765
Sakhtysh 14 / IV	Worked wood	GIN-11624	9450±60	9121–8570
Sakhtysh 14 / IV	Worked wood	GIN-11621	9420±40	8803–8612
Sakhtysh 14 / IV	Gyttja	GIN-11045	9390±90	9121–8348
Sakhtysh 14 / IV	Gyttja	GIN-11177 II	9390±60	8818–8477

Tab. 1 continued.

Site / find level	Dated material	Lab. index	BP uncal.	cal. BC
Sakhtysh 14 / IV	Elk antler	GIN-11179	9350±40	8742–8476
Sakhtysh 14 / IV	Gyttja	GIN-11610	9340±40	8731–8478
Sakhtysh 14 / IV	Gyttja	GIN-11177 I	9250±210	9199–7962
Sakhtysh 14 / IV	Elk mandible	GIN-11181	9200±90	8636–8261
Sakhtysh 14 / III	Gyttja	GIN-11607 II	9280±50	8637–8329
Sakhtysh 14 / III	Gyttja	GIN-11607 I	9150±50	8537–8276
Sakhtysh 14 / III	Worked wood	GIN-11053	9010±60	8308–7969
Sakhtysh 14 / III	Elk skull	GIN-11180	8800±100	8215–7611