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ТЕХНОЛОГИЧЕСКОЕ ИССЛЕДОВАНИЕ МЕТАЛЛИЧЕСКОЙ АТРИБУТИКИ ШАМАНСКОГО КОСТЮМА СЕВЕРНЫХ СЕЛЬКУПОВ XVII–XVIII вв.

Статья посвящена исследованию предметов шаманского костюма из черного металла, обнаруженных в североселькупском могильнике Кикки-Акки (Западная Сибирь, р. Таз). Материалом для исследования стали предметы из железа и железоуглеродистых сплавов от костюмов двух шаманов из двух захоронений XVIII и XVII вв. Из захоронения № 4 для исследования были взяты 34 изделия: орнитоморфные изображения, пластинчатые подвески, стержни от бубна, шумящие трубчатые подвески, крупные пластины, напоминающие рога оленя. Атрибуты шаманского костюма в погребении № 6 включали: шумящие трубчатые и пластинчатые подвески, «кости шамана» и изображения «медвежьих лап», всего 27 предметов. С помощью методов металлографического анализа необходимо было реконструировать процесс их производства и выявить его особенности. Кроме этого нужно было определить назначение предметов и образы, которые они олицетворяли. В процессе изучения изделий использованы методы металлографического анализа, включающего макро- и микроструктурное исследование, измерение микротвердости металла. Результаты исследований показали, что основным материалом в кузнечном производстве шаманского инвентаря выступала неравномерно науглероженная сталь, из нее отковано около 2/3 продукции из погребения 4 и примерно столько же из погребения 6. Наряду с ней кузнецы употребляли мягкое железо — в общей сложности из него отковано около 16 % изделий. Очень редко использовались высокоуглеродистая сталь и пакетированные заготовки. Мастера сами не занимались выплавкой металла, а получали его от русского населения. Основой технологии производства являлась свободная ручная ковка железа и стали в горячем состоянии, с помощью которой заготовке придавали необходимую форму. Селькупские кузнецы большей частью соблюдали температурные рамки свободной ковки, изредка допуская лишь незначительный перегрев металла. Таким образом, сделан вывод, что в XVII–XVIII вв. железные предметы шаманского костюма северных селькупов ковались профессиональными кузнецами. Этнографические материалы XX в. полностью подтверждают данное заключение. Кроме этого можно с уверенностью сказать, что шаманский костюм, а соответственно образы и представления, являвшиеся основой шаманской идеологии, которые он олицетворял, сформировался как минимум к XVII в. и более не менялся.

Ключевые слова: Западная Сибирь, позднее средневековье, верхнетазовские селькупы, шаманский костюм, черный металл, металлографический анализ, технология производства.

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TECHNOLOGICAL RESEARCH INTO THE METAL ATTRIBUTES OF THE NORTHERN SELKUP SHAMAN COSTUME OF THE XVII–XVIII CENTURIES

To reconstruct the technological methods and technical achievements of Northern Selkup blacksmiths, the components of the Northern Selkup shaman costume, which is composed of ferrous metal, were studied using metallographic analysis methods. The materials were found in two graves in a Kikki-Akki burial ground from the XVII–XVIII centuries (Western Siberia, Taz river). It was found that the basic raw materials for production were unevenly carbonized steel and soft iron; high-carbon steel was also found in rare instances, which was most likely received by Northern Selkup blacksmiths from Russia. The iron items of the shaman costume were forged by professional blacksmiths who possessed complex technological skills and production equipment.

Key words: Western Siberia, Late Middle Ages, Upper-Taz Selkups, shaman costume, ferrous metal, metallographic analysis, production technology.

Introduction

This article studies the components of the shaman costume made from ferrous metal found in the North Selkup burial ground of Kikki-Akki (Krasnoselkupsky district of YaNAO, Taz river) (Fig. 1, *1*, *2*). The use of archaeological, metallographic and ethnographic sources allowed us to reconstruct the processes involved in producing the items and identify the production features. The study was possible due to the good material preservation, which is rare for the Northern taiga subzone. The monument dates back to the XVII–XIX centuries; the recently obtained radiocarbon analysis results allowed us to correct the lower date, which was previously designated as the XVIII century [Olga E. Poshekhonova et al., 2018, etc.]. The burial ground included 22 burial sites, 18 of which were excavated in 2013 and 2016 by an expedition led by O.E. Poshekhonova. As historical sources, open complexes are complex phenomena that reflect various aspects of the economic life, ethnogenesis, and religious beliefs of the Northern Selkup. Among all the burial sites, there were two sites that contained numerous parts of the shaman costume.

To date, there is a fairly extensive literature on the issue of Siberian shamanism, which is represented primarily by the works of ethnographers. Among the numerous problems raised by the authors is the study of the attributes of the shaman costume, the shaman practice, symbolism, etc. In the study of the costume of the Selkup shaman, the publications of G.N. Prokofiev and E.D. Prokofieva,

which were based on fundamental sources, played important roles [Prokofiev, 2006; Prokofieva, 1949, 1971, 1981]. The work by ethnographer L.R. Pavlinskaya, which was based on the external visual features of metal sculptures, investigated the technique of forging the artistic products of the shamanic costumes of the peoples of Siberia [Pavlinskaya, 1988]. In recent years, Russian archaeologists have shown an increasing interest in the issue. Information about the materials of several burials containing the details of shamanic vestments were published, including the following: mound #21 of the Kalmak burial mounds (X–XI centuries) [Belikova, 1996, p. 83–85], mound #1 burial #1 of the Zyryansky burial mounds (end of XVI–XVII centuries) [Belikova, 2010], mound #4 burial #60 of the Tiskinskoe burial ground (XV century) [Bobrova, 2000], mound #24 of the Lukyanovskoe-1 burial ground (XVII century) [Grebneva, 1977], burial #4 of the Bederovsky Bor-2 burial ground (XVII–XVIII centuries) [Bobrova, Maksimova, Toroshchina, 2002], etc. However, the issues regarding the forging technology used in the production of the metal goods for the shaman costume have not previously been the subject of an independent study.

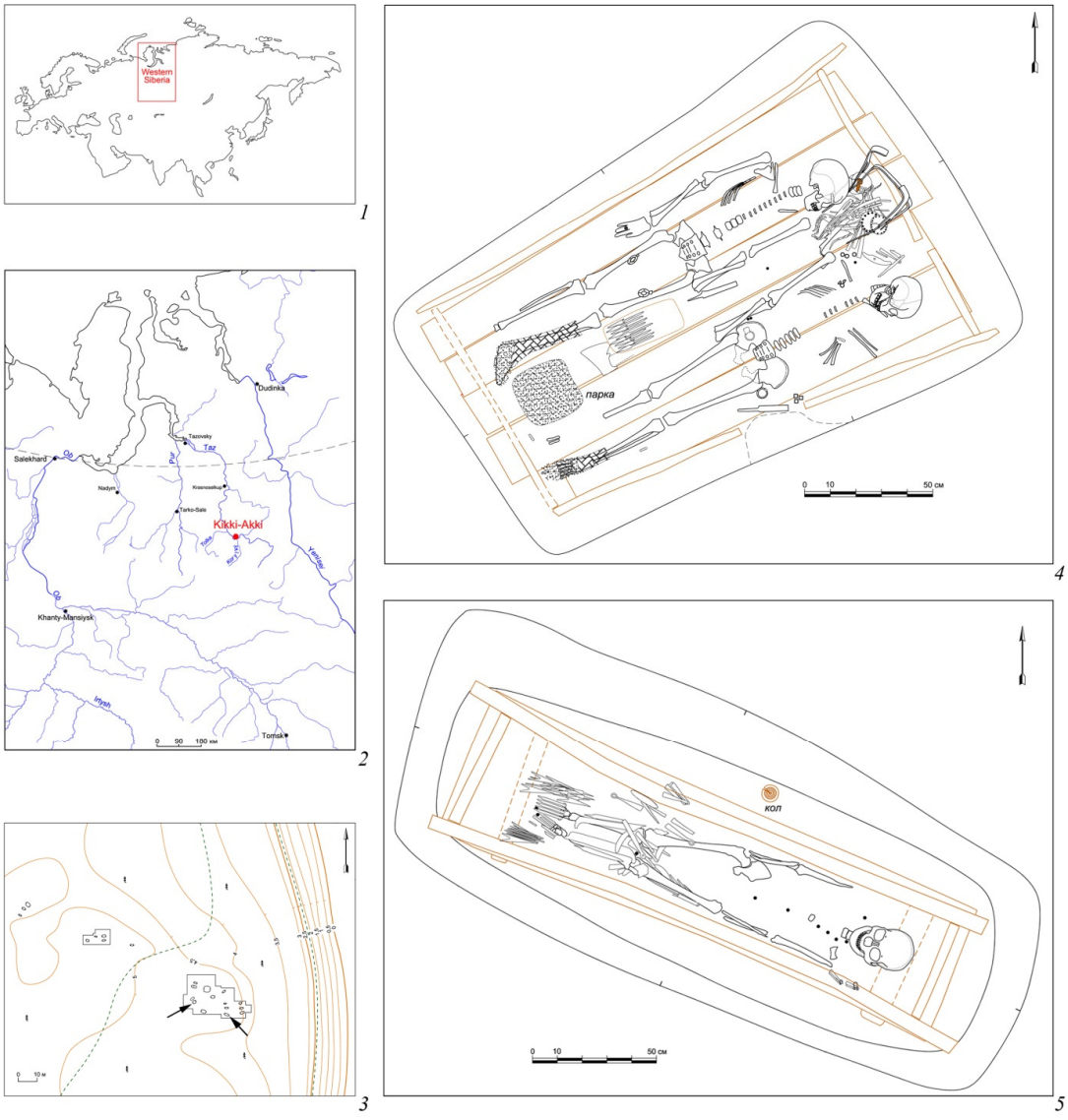

Fig. 1. Location of the Kikki-Akki burial ground (*1, 2*), the archaeological site plan (*3*) and the plans of burial sites #4 (*4*) and #6 (*5*).

Рис. 1. Расположение могильника Кикки-Акки (*1*, *2*), план памятника (*3*) и планы захоронений № 4 (*4*) и № 6 (*5*).

The objectives of this study are as follows: 1 — to study, using metallographic analysis, the metal parts of the shamanic costume of the Northern Selkup of the XVII–XVIII centuries that were made of

iron and iron-carbon alloys; 2 — to use analytical data to reconstruct the technological methods and technical achievements that the Selkup blacksmiths used in this field of production. In addition, based on data from the shaman costume of the early XX century, it was necessary to determine the purposes of the objects and images that were represented.

Materials

The ethnographers G.N. Prokofiev and E.D. Prokofieva, who lived in the Yanov Stan village among the Northern Selkups from 1925 to 1928, mention in their publications 10 shamans who practiced at that time in the territory of the Taz river basin. For every few major tributaries, there was one shaman; if there were more, they were father and son, or uncle and nephew. The information about the number of shamans in the basin of the Taz river in the second half of the XIX century was obtained from the original archival documents stored in the state archive of the Krasnoyarsk region. In 1884, the elder of the Tymsko-Karakonskaya Authority produced a special report for the Church administration, which indicated that in his authority, 11 people are engaged in shamanism [GAKK. F. 397, op. 1, d. 220, l. 2–3 reverse side]. It can be assumed that during the XVII–XVIII centuries in the Taz river basin that 10–15 shamans also practiced, and the costumes of two of them (possibly relatives) are the sources of this research. They were found in two burial sites of the Kikki-Akki burial ground — #4 and #6 (Fig. 1, *3*). It should be mentioned that these graves did not differ from other burial sites in any way other than the actual presence of shamanic items. The ages of the graves were determined by radiocarbon analysis as follows: grave #4 — XVIII century [Olga E. Poshekhonova et al., 2018], grave #6 — XVII century (280 ± 47, NSKA-2311).

Burial #4 is a burial site containing two men who died at the ages of 30–40 (individual #1) and 25–35 (individual #2) years (Fig. 1, *4*). Their skeletons were laid in a grave on a boardwalk with a frame-lining, parallel to each other, in winter clothing and shoes. Between them, in the area of the feet and shin bones, closer to individual #1, the remains of a square-folded shaman's parka made of reindeer fur were found. According to the location of the artefacts, this particular man was a shaman. Next to the skull and under it were items from the shaman's costume, lying, with some exceptions, without any order in a compact pile, among which are items made of brass, tin bronze, bone, wood, fur, birch bark, and glass; however, most of the items are made of iron. There are 54 items in total. The collection of iron objects, 34 items in total, consisted of the following: one "bird" item; four ornithomorphic images (two "loons", one certain waterfowl and an ornithomorphic plate with two "heads"); three plate pendants with elongated curved ends, stylized as serpentine "heads"; three rods from a tambourine; 19 noise-making tubular pendants; 4 large plates resembling deer horns, making up two items.

Items from a shaman costume were also found in burial #6 (Fig. 1, *5*). The buried man (over 50 years old), according to the fragments of clothing found, was dressed in a parka made of reindeer fur and cloth trousers and *pimy*[1] were on his feet. During the clearing of the skeleton, numerous metal pendants were found, which, according to their position, were attached to the shaman's parka, including the following: 17 iron tubular pendants, 4 curved iron plates with loops, and 2 bronze pendants. In addition, there were four items called "shaman's bones" on the bones of the shins, imitating the tibia and fibula. And finally, on the bones of the feet were images of "bear paws", in the form of phalanges, topped with sharp curved claws. In general, the findings in the burial sites are distributed unevenly. Above the waist, only buttons and two paired tubular pendants (at the skull) were found. Most of the artefacts were located below the waist.

Research methods

The study of ferrous metal objects was carried out by the following three metallographic analysis methods: macrostructural and microstructural research and the measurement of the metal microhardness. The method applied is described in a number of works by Russian and foreign researchers [Kolchin, 1953; Pleiner, 1962; Tylecote, 1962]. Microscopic analysis was performed using "MIM-8" and "Neophot-32" metallographic microscopes. The structures were described using the terminology used in metallography based on the type of microstructure and its corresponding hardness. The microhardness measurement was performed on a "Microhardometer PMT-3" measuring microscope by pressing a Vickers diamond tip with a load of 50 g into the test metal, followed by measuring the diagonal lengths of the resulting print and, based on this, determining the hardness index (according to the table adopted in metallography). To determine the purposes of the objects and images that they repre-

[1] One-piece leather hide shoes.

sented, the publications of ethnographers G.N. Prokofiev and E.D. Prokofieva were primarily used, which give detailed descriptions, photos and sketches of all the details of the shaman costume of the Northern Selkups of the XX century.

Results

Objects from burial #4

Iron ornithomorphic images and plates, 7 units in total. They include the following: pendants — images of two "loons", a waterfowl, an ornithomorphic plate with two "heads" and three plates with serpentine "heads". Loons, according to ethnographic sources on the Selkup, were considered spirit-assistants of shamans. They could allegedly communicate with the "heavenly world" and with the "underwater" and "underground" worlds. The Selkups believed that the shaman often turns into a loon during his journey to the other world and escapes prosecution by diving under the water. The loon was also credited with transporting the shaman's prayers to the sky [Prokofieva, 1949, p. 353]. The studied images of loons symbolized the spirit-assistants of the shaman. The visual representation of metal images that express the mythological representations of Selkups contains both real birds existing in nature and some unnatural features. This combination of ornithomorphic images created by the master distinguished its significance. Such pendants could be attached to both the bib and back of the shaman's parka, and they were also found on the tambourine [Prokofiev, 1949, p. 353, 364, 365].

The images, which have a general external similarity, are endowed with some individual features. The first "loon" (Fig. 2, *2*) — a flat item, made of a small iron plate. The bird's neck is bent up at an angle of 35 degrees relative to the body. The head is disproportionately long, bent in the opposite direction. The item length is 22.2 cm. The beak is highlighted — at this point, the rod is flattened and pointy at the end. The rod representing the neck is twisted in 4 turns. The body in the middle is expanded by a lenticular hole. The tail of a bird consists of two appendages, spread apart. The metallographic study of the microsection indicates that the image is made of bloom iron. The microstructure of the source metal consists of ferrite containing a significant amount of slag inclusions (Fig. 2, *6*, an. 2718).

The second "loon" (Fig. 2, *1*) has a shape that is significantly similar to the previous one, but differs in terms of the size, the proportions of the parts of the figure depicted, and the details of the design of the tail and neck. The total length of the artefact is 20 cm. The rod representing the neck is twisted by 3 turns. The microstructural analysis of the metal of the second "loon" showed that the pendant was forged in a hot state from a packaged three-layer billet consisting of an iron plate (in the centre) and two plates of low-carbon steel (on the sides) (Fig. 2, *5*, an. 2699). The carbon concentration in steel is approximately 0.1%.

The image of an indeterminate waterfowl represents the spirit-assistant of the shaman (Fig. 2, *3*). The item is flat, made of a black metal plate, and approximately 2.7 cm wide. The bird's neck is bent up at an angle of 35 degrees relative to the body. The head is bent in the opposite direction. The product length is 15.2 cm. The beak is highlighted and is pointy at the end. In the direction of the tail, the body of the object gradually expands, and the wings are formed in the middle part. The tail of the bird is wider than the body and consists of three appendages. Low-carbon steel is used as the raw material. The concentration of carbon in the metal is approximately 0.1% (Fig. 2, *7*, an. 2714).

An ornithomorphic plate with two "heads" represents an image of an imaginary "bird" (Fig. 2, *4*). On one end of the plate, there are two "heads" on twisted curved necks. The rods representing necks are twisted into 3–4 turns and bent up at an angle of 80 degrees. The ends of the rods are bent in the opposite direction and flattened, thus representing "heads". The edge of the "heads" is cut off at a right angle. The images of the "heads" are very schematic. On the other end of the plate, a wide tail is formed, which consists of three appendages. In the centre of the plate, there are two differently sized lenticular holes located parallel to each other. Low-carbon raw steel is used as the raw material. The concentration of carbon in the metal varies from 0.1 to 0.3% (Fig. 2, *8*, an. 2704). During forging, a slight overheating of the metal occurred.

Zoomorphic plate with two "heads" (Fig. 3, *1*). According to Selkup understanding, the defectiveness (otherness) of images corresponds to the vision of another, otherworldly world. Among the inhabitants of the otherworld, there are many peculiar spirits. They are the shaman's assistant-spirits, his nephews. This two-headed spirit is "*utkyl loz*" — the water spirit [Prokofiev, 1949, p. 357; Stepanova, 2008, p. 145]. The artefact is a flat rectangular plate with two longitudinal holes, topped with two heads on one of the ends. The product length is 14.2 cm. The "heads" are located on long twisted (6–7 turns) and curved necks. The "heads" are not designed in any particular way and represent a curved edge of the appendage, cut off at the end at a right angle. Two lenticular holes are sewn along

the lower edge of the plate. Attention is drawn to the fact that the implemented figure resembles the image of a snake in a threatening position, with a vertical body and the head slightly thrown back. Iron was used as the raw material (Fig. 3, *6*, an. 2712).

Fig. 2. Ornithomorphic images from burial #4 and photos of the microstructures (100x).
1, *2* — "loons", *3* — undefined waterfowl, *4* — ornithomorphic plate with two "heads", *5* — "loon", an. 2699, *6* — "loon", an. 2718, *7* — waterfowl, an. 2714; *8* — ornithomorphic plate with two "heads" an. 2704.

Рис. 2. Орнитоморфные изображения из погребения № 4 и фото микроструктур (ув. 100):
1, *2* — «гагары», *3* — неопределенная водоплавающая птица, *4* — орнитоморфная пластина с двумя «головами», *5* — «гагара», ан. 2699, *6* — «гагара», ан. 2718, *7* — водоплавающая птица, ан. 2714; *8* — орнитоморфная пластина с двумя «головами», ан. 2704.

Plate pendants with a single "head". There are two items in the collection. The first image is on a narrow rectangular plate (Fig. 3, *2*). At one end of the plate is a flattened oval-shaped head on a twisted and curved neck. The second appendage, from which a small peg has been preserved, has been removed. There are two lenticular holes on the lower edge of the plate. The edge of the plate is slightly pushed back at the lenticular holes. The holes under the "head" are damaged. They were in-

tended to be attached to a shaman's costume. The product length is 26 cm, and the width is 2.1 cm. Soft low-carbon steel was used as the raw material (Fig. 3, *4*, an. 2703).

The second plate pendant with a single "head" (Fig. 3, *3*) is not identical in terms of the stylistic features but is close to the previous image, which is why it is believed that the plates considered reveal a close mythological text. The length of the item is 21 cm and the width is 1.9 cm. The product is a rectangular plate with two lenticular holes on the lower edge, topped with a neck on one of the ends. The neck is twisted and bent, and the "head" is lost. At one of the lenticular holes, at the corner of the plate, another small round hole is punched for mounting. As shown by the metallographic analysis, the product is made of low-carbon raw steel (Fig. 3, *5*, an. 2711). The plates with heads correspond to the pendants sewn on the bottom of the sleeves of the shaman's parka, depicting the bones of the forearm. The bent twisted ends should have encircled the hand, and the slits should have represented the bone marrow [Prokofiev, 1949, p. 365].

Fig. 3. Plates with "heads" from burial #4 and photos of the microstructures.
1 — zoomorphic plate with two "heads", *2*, *3* — plates with one "head", *4* — plate with one "head", an. 2703, 50x, *5* — plate with one" head", an. 2711, 100x, *6* — plate with two "heads", an. 2712, 100x.

Рис. 3. Пластины с «головами» из погребения № 4 и фото микроструктур:
1 — зооморфная пластина с двумя «головами», *2*, *3* — пластины с одной «головой», *4* — пластина с одной «головой», ан. 2703, ув. 50, *5* — пластина с одной «головой», ан. 2711, ув. 100, *6* — пластина с двумя «головами», ан. 2712, ув. 100.

Iron transversal rods from a tambourine. Three items were found in the burial site (Fig. 4, *1–5*), one of which is fragmented (Fig. 4, *3–5*). Four samples were subjected to metallographic examination.

Similar iron rods are described by E.D. Prokofieva during the examination of the costume of the Selkup shaman. The rods were attached to the tambourine from the inside with a smaller diameter with leather belts. Transversal iron rods represented the seven circles of the universe. In addition, tambourines were fastened with images of spirit helpers, tubular pendants, etc. In the Selkup legends, it is said that "on the rods of the tambourine come, crawl the "*lozy*" called by the shaman [Prokofieva, 1949, p. 349–351]. The rods found in the burial site are narrow plates that are rectangular in cross-section with loops and hooks with four thicknesses at the ends for fastening. E.D. Prokofieva noted that the loops were intended to obtain uniform distribution of the pendants on the rod [Prokofieva, 1961, p. 438]. All the identified rods are deliberately bent twice. The length of the less damaged item is 60 cm. The widths of the plates are uneven and range from 0.5 cm (at the ends) to 1.2 cm (in the middle). The metallographic analysis of the metal samples indicates that the rods are forged in a hot state at the necessary temperature range for plastic processing of the metal. Only in one case does a slight overheating occur. Low-carbon steel with a carbon concentration of 0.1–0.2% (Fig. 4, *6*, *8*, an. 2698, 2774) and medium-carbon steel with an uneven distribution of carbon across the section were used as the raw materials. The carbon concentrations in these forgings range from 0.3 to 0.5% (Fig. 4, *2*, an. 2701) and from 0.4 to 0.6% (Fig. 4, *4*, an. 2777).

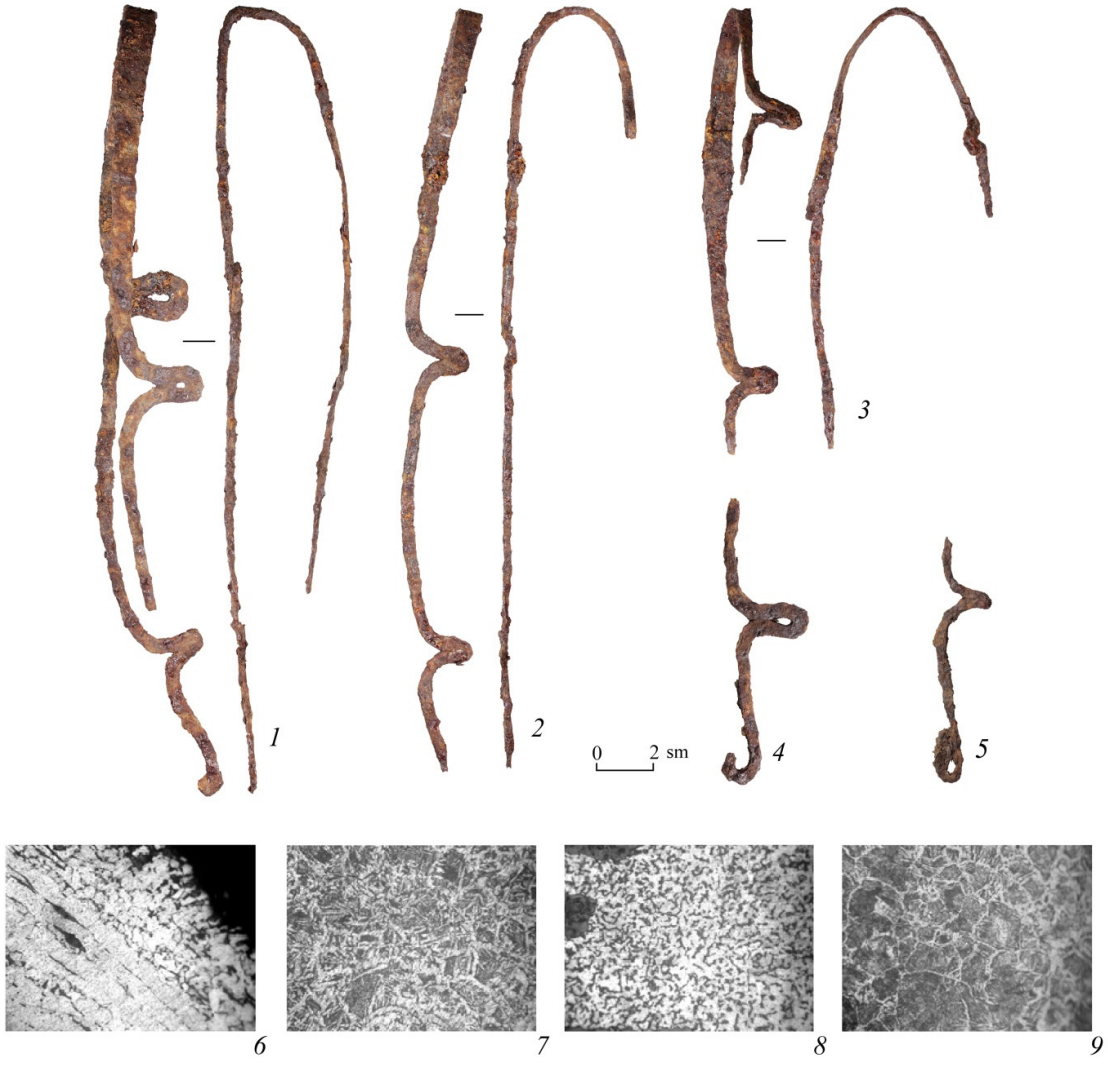

Fig. 4. Transversal rods from the tambourine from burial No. 4 and photos of the microstructures (100x).
1–5 — whole rods and fragments, *6* — an. 2698, *7* — an. 2701, *8* — an. 2774, *9* — an. 2777.

Рис. 4. Поперечные стержни от бубна из погребения № 4 и фото микроструктур (ув. 100):
1–5 — целые стержни и фрагменты, *6* — ан. 2698, *7* — ан. 2701, *8* — ан. 2774, *9* — ан. 2777.

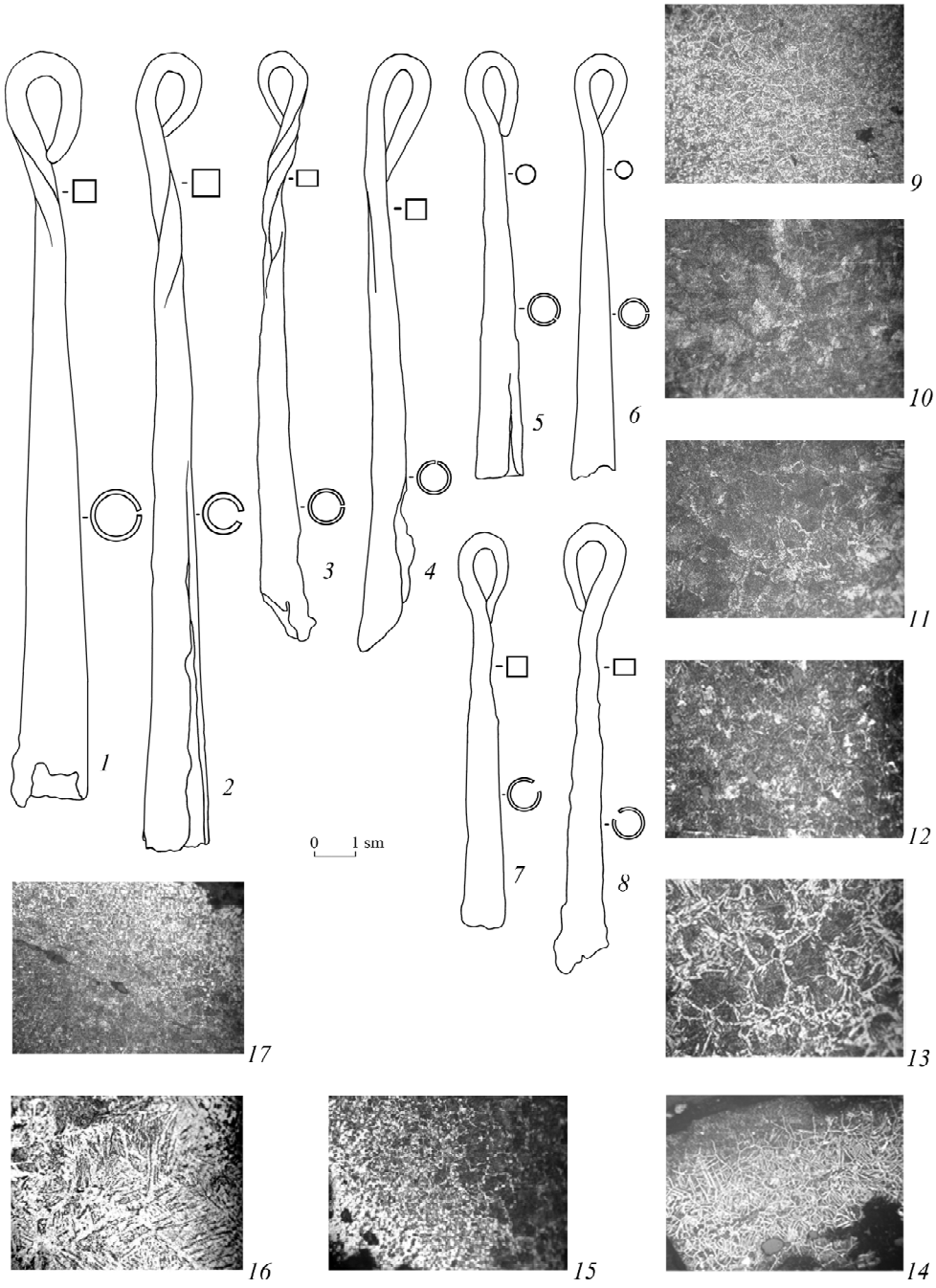

Fig. 5. Noise-making tubular pendants from burial # 4 and photos of the microstructures.
1–8 — suspension, *9* — an. 2696, 100x, *10* — an. 2700, 100x, *11* — an. 2702, 100x, *12* — an. 2706, 100x, *13* — an. 2708, 100x, *14* — an. 2710, 50x, *15* — an. 2715, 100x, 16 — an. 2716 300x, 17 — an. 2772, 100x.
Рис. 5. Шумящие трубчатые подвески из погребения № 4 и фото микроструктур:
1–8 — подвески, *9* — ан. 2696, ув. 100, *10* — ан. 2700, ув. 100, *11* — ан. 2702, ув. 100, *12* — ан. 2706, ув. 100, *13* — ан. 2708, ув. 100, *14* — ан. 2710, ув. 50, *15* — ан. 2715, ув. 100, *16* — ан. 2716, ув. 300, *17* — ан. 2772, ув. 50.

Iron noise-making tubular pendants (Fig. 5). Nineteen specimens (whole and fragmented) were found in the burial site. According to the ethnographic sources, tubular pendants are an indispensable attribute of the shaman's tambourine. It is known that in the hands of an experienced Selkup shaman, the tambourine was a musical instrument producing various sounds. The “kamlanie” ritual was accom-

panied by various blows to the tambourine and multiple methods of shaking the tambourine, which caused the rattling of the metal pendants, which then merged into a general hum [Prokofieva, 1981, p. 53–54]. Iron tubular pendants were also sewn on the shaman's parka and shaman's bib. The meanings of the tubular pendants on the parka and bib are the same — they are "like feathers" — since both the bib and the shaman's parka symbolized a bird. Numerous pendants on the parka and on the bib were intended to produce a ringing and noise to scare away the "*lozy*" from the path of the shaman or to expel evil spirits from the soul of a sick person [Prokofieva, 1949, p. 356, 357, 360, 362]. The noise-making pendants found in the burial are narrow cone-shaped tubes, on top of which are loops made for hanging. The tubes are rolled from sheets of iron with thicknesses of 1–2 mm. For all items, there is a longitudinal gap at the junction of the edges of the sheet. At the junction of the tube in the loop, a square (Fig. 5, *1–4*, *7*, *8*) or circle (Fig. 5, *5*, *6*) is made in the cross-section of the rod. Some rods are twisted in 2–3 turns. The pendants are divided into two groups by size, as follows: 1 — large, with a length of 18–19 cm, the diameter of the cone is 1.7 cm; and 2 — small, with a length of 9.8–13.5 cm and a cone diameter of 1.0–1.2 cm.

Fig. 6. Image of "reindeer antlers" from burial #4 and photos of the microstructures (100x).
1, *2* — front, *3*, *4* — side, *5* — an. 2775, *6* — an. 2717.
Рис. 6. Изображения «рогов оленя» из погребения № 4 и фото микроструктур (100x):
1, *2* — вид спереди, *3*, *4* — вид сбоку, *5* — ан. 2775, *6* — ан. 2717.

Nine tubular pendants were subjected to metallographic studies. Raw steel with an uneven distribution of carbon across the cross section was mainly used as the raw material. The concentration of carbon in the metal ranges from 0.1–0.3 to 0.4–0.6% (Fig. 5, *9*, an. 2696, *11*, an. 2702, *12*, an. 2706,

13, an. 2708, *14*, an. 2710, *15*, an. 2715, *16*, an. 2716, *17*, an. 2772). One of the pendants is forged from high-carbon steel (Fig. 5, *10*, an. 2700).

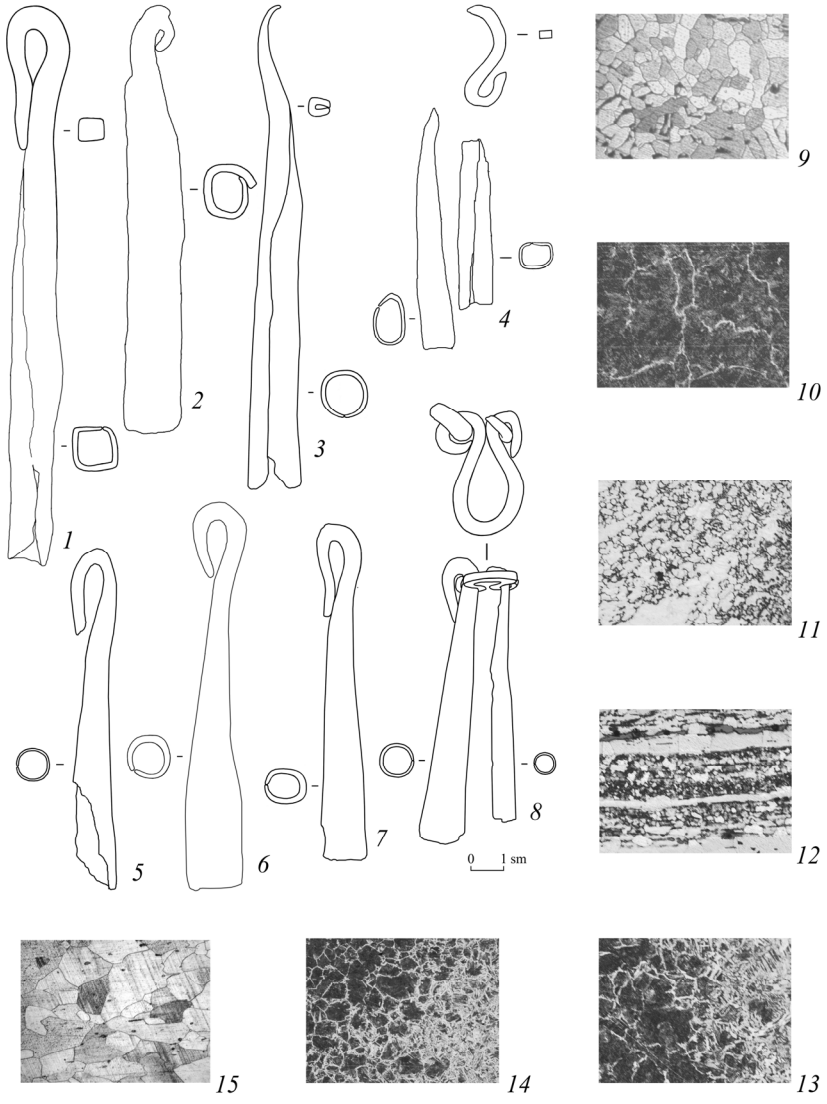

Fig. 7. Noise-making tubular pendants from burial #6 and photos of the microstructures (100x).
1–8 — pendants, *9* — an. 2878, *10* — an. 2871, *11* — an. 2872, *12* — an. 2868, *13* — an. 2869, *14* — an. 2859, *15* — an. 2866.
Рис. 7. Шумящие трубчатые подвески из погребения № 6 и фото микроструктур (100x):
1–8 — подвески, *9* — ан. 2878, *10* — ан. 2871, *11* — ан. 2872, *12* — ан. 2868, *13* — ан. 2869, *14* — ан. 2859, *15* — ан. 2866.

Images of "reindeer antlers" (Fig. 6). Two intentionally broken iron images of reindeer antlers, consisting of four fragments, were found in the burial site. It is known that the tradition of spoiling the items that accompanied the deceased still exists in the Northern Selkups to this day [Stepanova, 2008, p. 146]. On the back of the Northern Selkup shaman's parka, which is stored in the Kunstkamera (Saint-Petersburg) collection, reindeer antlers — "heavenly deer antlers" — are attached to the middle of iron pendants [Prokofieva, 1949, p. 361]. Images of reindeer antlers were typically found on shaman crowns (headgear) [Prokofieva, 1949, p. 370]. However, the large size and structure of the items found in the burial site preclude this option.

The first item is a U-shaped narrow plate with the dimensions of 34x14 cm (Fig. 6, *2*, *3*). The plate is smoothly curved in two points up at an angle of 90 degrees. One of the antler beams has traces of repair — in the middle part it is fastened with a rivet. The attached segment at the base is rounded. Part of the plate, which represented the main beam of the antlers, narrows and has a pointy end. On each antler beam, there are two sharp-ended appendages, each 2–4 cm long. In the lateral projection,

the item is curved. The second item's dimensions are 33x8 cm, and it consists of two halves (Fig. 6, *1*, *4*). An image of antlers is made, as in the first case, on a U-shaped plate. In the middle part of the plate, a seam from forge welding is fixed, which is where the product was later intentionally broken. The main beams of the antlers are damaged; one is missing the upper part, and the upper lateral appendage is cut off from the other. The general image production scheme is similar to the previous one. The main difference is the larger size of the lateral appendages. On each beam, there is one appendage (9.9 and 11 cm long), and their ends are sharp, slightly taken aside from the main plate. In the lateral projection, the second item is curved much less than the first one.

Fig. 8. Noise-making plate pendants, image of a "bear's paw" from burial #6 and photos of the microstructures (100x).
1–4 — pendants, *5* — image of a bear's paw, *6* — pendant, an. 2858, *7* — pendant, an. 2870, *8* — image of a "bear's paw", an. 2865.

Рис. 8. Шумящие пластинчатые подвески, изображение медвежьей лапы из погребения № 6 и фото микроструктур (100x):
1–4 — подвески, *5* — изображение медвежьей лапы, *6* — подвеска, ан. 2858, *7* — подвеска, ан. 2870, *8* — изображение, ан. 2865.

The study of the images showed that forge welding and manual riveting were used to obtain a permanent connection between the individual elements of the products. The blacksmiths used iron with a ferrite structure (Fig. 6, *5*, an. 2775) and high-carbon steel with a perlite structure (Fig. 6, *6*, an. 2717) as the raw materials.

Items from burial #6

Tubular noise-making pendants, 17 units (Fig. 7). The tubular pendants included in the collection, in addition to the common unifying features, have some individual features that are not characteristic of the shamanic complex from burial #4. These include the following: paired pendants fixed on lyre-shaped hooks (2 units) (Fig. 7, *4*, *8*); pendants in the form of tubes without a bell (2 units) (Fig. 7, *1*, *2*); the use of an elongated loop for hanging (3 units) (Fig. 7, *1*, *7*). The tubular pendants can be divided into two groups by size, as follows: 1 — large, the length is 12.9–16.8 cm and the cone diameter is 1.2–1.8 cm; 2 — small, the length is 8.7–12 cm and the cone diameter is 1.2–1.8 cm.

Fig. 9. "Shaman's Bones" from burial #6 and photos of the microstructures (100x).
1, *4* — large bones, *2*, *3* — small bones, *5* — small bone, an. 2873, *6* — large bone, an. 2876, *7* — large bone, an. 2860, *8* — small bone, an. 2867.

Рис. 9. «Кости шамана» из погребения № 6 и фото микроструктур (100x):
1, *4* — большие кости, *2*, *3* — малые кости, *5* — малая кость, ан. 2873, *6* — большая кость, ан. 2876, *7* — большая кость, ан. 2860, *8* — малая кость, ан. 2867.

The technological scheme of production of the seven studied tubular pendants consisted of pulling and flattening the workpiece, as follows: in one case, in the form of a blade, in the other, in the form of a narrow fan (most often the entire length of the workpiece), followed by bending the tube on the forging base ("mandrel") and forming a loop for hanging. The raw materials for the manufacturing of these pendants were as follows: in the first case, raw steel with an uneven distribution of carbon

across the section (Fig. 7, *14*, an. 2859; *13*, an. 2869, *10*, an. 2871, *11*, an. 2872); in the second case, iron (Fig. 7, *15*, an. 2866; *9*, an. 2878) and a four-layer package billet consisting of two plates of low-carbon steel (in the centre) and two ferrite plates (on the sides) (Fig. 7, *12*, an. 2868).

The iron plate pendants (Fig. 8, *1–4*). Four items, which were located among the tubular pendants, were found in the burial site and are also noise-making items. Some of the plates show signs of deliberate fracture. The products are narrow, curved plates topped with small loops. The cross-sections of the plates are lenticular. The size of the most well-preserved item is 10.5x2 cm. The microstructural study of the two pendants shows that they are forged from iron (Fig. 8, *7*, an. 2870) and unevenly carbonized steel (Fig. 8, *6*, an. 2858). The concentration of carbon ranged from 0.1 to 0.4%.

The tubular and plate pendants in this burial site were found in the area of the knee joints of the buried individual, both above and below them. Some were found in the middle of the femoral diaphyses (both below and above them), and a few were found near the tibial diaphyses. Since the Northern Selkups did not sew noise-making pendants on the shaman's *pimy*, we can assume that these items were attached to the shaman's parka. As some of the items lay under the bones, they were definitely not sewn on the bib.

"Shaman's bones". The artefacts were found on the anterior surfaces of the tibia and fibula, and they appear to have been sewn onto the *pimy*. Their location fully corresponds to the description of the shamanic costume of E.D. Prokofieva [Prokofieva, 1949, p. 367]. Two large "shaman's bones" with lengths of 27.3 and 28.3 cm were located on the tibia, in the area of the former boot-leg of the *pimy* (Fig. 9, *1*, *4*). They were products made from two narrow plates, joined together along their longitudinal edge by forge welding. The free edges of the plates welded along the edge are separated to the sides so that the section is V-shaped. On one of the ends of the forgings, there are two appendages that diverge in opposite directions. The described items were located in the burial site at the following different locations: on the right tibia — with forked appendages down — and on the left — with appendages up. According to the provisions of E.D. Prokofieva, in the first case, the image symbolized the leg bones of a reindeer, in the second — the so-called "Shin bone of iron" — the two appendages represented the muzzles of a water beast [Prokofieva, 1949, p. 367; 1971, p. 21].

The microstructural study of the first microsection, made on a full cross-section, showed that the item is made of two different pieces of unevenly carbonized steel. The concentration of carbon in the metal does not exceed 0.4%. Forge welding, which is necessary for the formation of the edge, is performed at a very low level (Fig. 9, *6*, an. 2876). The second forging is made according to a similar technological scheme of low-carbon steel (Fig. 9, *7*, an. 2860).

Two small "shaman's bones" with lengths of 23 and 16.5 cm were located on the fibula. They are leaf-shaped objects made on a long plate (Fig. 9, *2*, *3*). One of the items was deliberately broken. In the cross-section, the items under consideration are triangular, with an edge on one side. The metallographic analysis shows that the small "shaman's bones" are made of unevenly carbonized (low-carbon) steel (Fig. 9, *8*, an. 2867, 5, 2873).

Images of bear paws (two units) found on the bones of the feet of the buried person. It is known that images of bear paws — "bear's claws" — were attached to the *pimy* on the costume of the Selkup shaman above the fingers. The image represents the "strongest" spirit-helper of the lower world [Prokofieva, 1949, p. 367]. One item is fragmented. The other was in a satisfactory condition, which allowed us to identify the structure of the artefact and to conduct technological research (Fig. 8, *2*). The bear paw images consist of metal rods, rectangular in cross-section (7x5 mm), topped with curved sharp claws. The other ends are bent into loops and placed on the cross-sections of 7 cm long circular rods. This connection of parts ensured the mobility of all the combined rods. The metallographic analysis was performed on the end of the "claw". The results of the analysis indicate that the rods are forged from unevenly carbonized steel. To increase the hardness of the claws, their ends are subjected to soft quenching. The microhardness of the resulting sorbit-like perlite is 358 kg/mm^2 (Fig. 8, *8*, an. 2865).

Discussion

Summing up the results of the technological analysis of the metal items of the shaman costume of the Taz Selkups of the XVII–XVIII centuries, we can draw the following conclusions. In general, the range of forging products includes 13–15 items. The studied forgings represent images and representations that were the basis of shamanic ideology. The main material in the blacksmithing production of shamanic equipment was unevenly carbonized steel. The concentration of carbon in the steel most often ranged from 0.1 to 0.4% and less often ranged from 0.4–0.6%. Approximately 2/3 of the products from burial #4 and approximately the same amount from burial #6 were forged from carbonized steel. High-carbon steel was very rarely used (two items from burial #4 and one from burial #6). Along

with steel, blacksmiths sometimes used soft iron. In total, approximately 16% of products were forged from soft iron. In isolated cases, the use of packaged blanks was noted. Attention is drawn to the fact that for the production of products identical in form and meaning, blacksmiths used completely different raw materials. That is, they used any material available at that time. Based on this, we can assume that the craftsmen themselves were not engaged in metal smelting.

The basis of the production technology of the considered attributes of the shamanic costume was free hand forging of iron and steel in a hot state, with which the workpiece was given the necessary shape. It was identified that the technological process of manual forging consisted of several operations performed in a certain sequence, as follows: drawing, draining, bending, cutting, punching holes, twisting, forging welding, smoothing. The lenticular holes were punched with a chisel. For the design of the tails, short cuts were made at the ends of the plates, the side appendages were slightly pushed apart, and their edges were sometimes forged. For a specific neck design, the masters used the torsion operation. In the process of forming the "heads" on the plate images, the end of the plate was cut in half, and the resulting processes were forging, bending and twisting. For iron and each grade of steel, there is a different temperature range for the beginning and end of forging. On average, the temperature at the beginning of forging should be 1100–1300° C, while it should be 800–900° C at the end. Violating the specified temperature regime can lead to serious defects. According to the available analytical data, Selkup blacksmiths in the XVII–XVIII centuries mostly observed the temperature limits of free forging, occasionally allowing only a slight overheating of the metal.

There is reason to believe that the Taz blacksmiths received iron and steel from the Russians during this period. This is confirmed, on the one hand, by the evidence provided by the Russian and foreign scholars researching Siberia in the XVII–XIX centuries (V.F. Zuev, A. Kastren, O. Finsh, A. Brem, U.D. Sirelius), who did not meet any master-metallurgists from the local non-Russian population during their travels. On the other hand, there are reports from P.I. Tretyakov, who explored the Turukhansky region in the middle of the XIX century, about the trade in Russian goods, including iron. The centre of trade was Turukhansk, where the Taz Selkups brought furs in exchange for Russian-made goods. In addition, the Russian goods trade was carried out on the Taz river. It is also possible that the Taz Selkups could obtain iron from the southern trade route. This is indicated by the records of P.I. Tretyakov, as follows: "The Ostyaks of the upper Taz river go along the Vakh river to the Berezovsky district to the first settlement of Lariata to purchase certain necessary items" [Tretyakov, 1871, p. 289, 303, 304]. Russian products found in the Kikki-akki burial ground also indicate that there was an active exchange trade between the Northern Selkups and the Russians.

The blacksmiths who made forgings possessed complex technological skills and production equipment and, in this regard, created the forms and designs of products, including their sacred images. It is noteworthy that all the images are forged roughly. This was done intentionally, which cannot be said about other forgings, for example, arrowheads, spears, so-called "palma" (single-bladed tips), etc., found in the burial ground. It is known that when describing the parts of shamanic clothing in the XX century, the Selkups did not say "this is a feather", "this is the sun," "this is the moon," and instead used the following expressions: "like a feather", "like the sun", etc. In accordance with these ideas, Selkup blacksmiths in the more ancient period forged images that did not correspond to the real appearances of animals, birds, and reptiles, emphasizing the conventionality of their inherent features embodied in metal.

Conclusions

The results of the metallographic studies allow us to conclude that in the XVII-XVIII centuries, the iron components of the shamanic costumes of the Northern Selkups were forged by professional blacksmiths. The ethnographic materials of the XX century fully confirm this conclusion. G.N. Prokofiev and E.D. Prokofieva, who worked with Selkup shamans in the age range of 40–55 years, i.e., born at the end of the XIX century, noted that the forging of iron pendants to the tambourine, parka and bib was carried out by two blacksmiths — representatives of two groups of Selkups — the Eagle group and the Nutcracker group. At the same time, the shaman gave instructions to the blacksmiths about the necessary number and forms of pendants and images [Prokofiev, 2006, p. 138; Prokofieva, 1981, p. 56]. The fact that after the death of the shaman, some of the pendants were stored by his family and passed on to the new shaman, provided continuity in the technology of production of the metal parts of the shaman's costume. There is reason to believe that the forging of metal paraphernalia was accompanied by certain sacred actions, which is indicated by the following message from P.I. Tretyakov from the Turukhansk region: "A blacksmith, at the request of a shaman forging an idol, stands

while working on a reindeer skin" [Tretyakov, 1871, p. 214]. In addition, it is without doubt that the shamanic costume, and accordingly the images and representations that were the basis of shamanic ideology, which it represented, was formed at least by the XVII century and not changed thereafter.

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