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## **A Bronze Age Shaft-Hole Axe from the Northwestern Baraba Forest-Steppe**

*This study introduces a crested shaft-hole axe found on the southern shore of Lake Maidan, Vengerovsky District, Novosibirsk Region. Such random finds are regarded as markers of Bronze Age landscape zones and transportation routes in southwestern Siberia. Shaft-hole axes with slight crests occurred on this territory from the mid to late 2nd millennium BC. In addition to such axes, several casting molds made of clay, stone or metal have been found, possibly suggesting that axes were not only imported but also manufactured locally. These random finds of shaft-hole axes can be considered markers of the complex, mirroring not only Middle and Late Bronze Age distribution areas, but also a considerable northward shift of landscape borders during an episode of climatic change, as well as indicating key routes for the migration of people associated with various traditions and objects. The mapping of various subtypes of shaft-hole axes from the Baraba forest-steppe revealed one such route, leading northward from southwestern Siberia to the Vasyugan Swamp. Apart from the series of axes from Baraba, certain cemeteries, such as Sary Tartas-4, yielded miniature replicas used as personal adornments. This feature links the north of the western part of the axes' distribution area (the forest-steppe zone of the Ob-Irtysh watershed) with its eastern part—the Minusinsk Basin.*

**Keywords:** *Bronze Age, Southwestern Siberia, shaft-hole axes, forest-steppe, Ob-Irtysh interfluvium, boundaries, migration routes.*

### **Introduction**

Shaft-hole axes of the Bronze Age have been known from the Baraba forest-steppe since the late 19th century. The first find came from the village of Lyalino (now the village of Lyanino in Zdvinsky District of Novosibirsk Region) (Pribavleniye..., 1890; Frolov, Tishkin, 2021). In the late 20th and early 21st century, several more shaft-hole axes have been found in Baraba (Molodin, Ermakova, 2009; Molodin, Novikov, Sofeikov, 2000: 162; Molodin, Shatov, Sofeikov, 1999). Detailed

analysis of the spatial distribution of such random finds makes it possible to establish the boundaries of the area where these tools occurred in the Bronze Age (Avanesova, 1991: 15).

In the summer of 2021, a crested shaft-hole axe (Fig. 1, 2) was accidentally discovered north of the village of Pavlovo on the southern shore of Lake Maidan, in the northwest of Vengerovsky District of Novosibirsk Region (Fig. 1). In geomorphological terms, this area is a poorly broken watershed surface of the Baraba low-ridge lake plain (Kuzmin et al., 2013: 88,



Fig. 1. Place of discovery of the shaft-hole metal axe on Lake Maidan in the village of Pavlovo (Vengerovsky District, Novosibirsk Region).

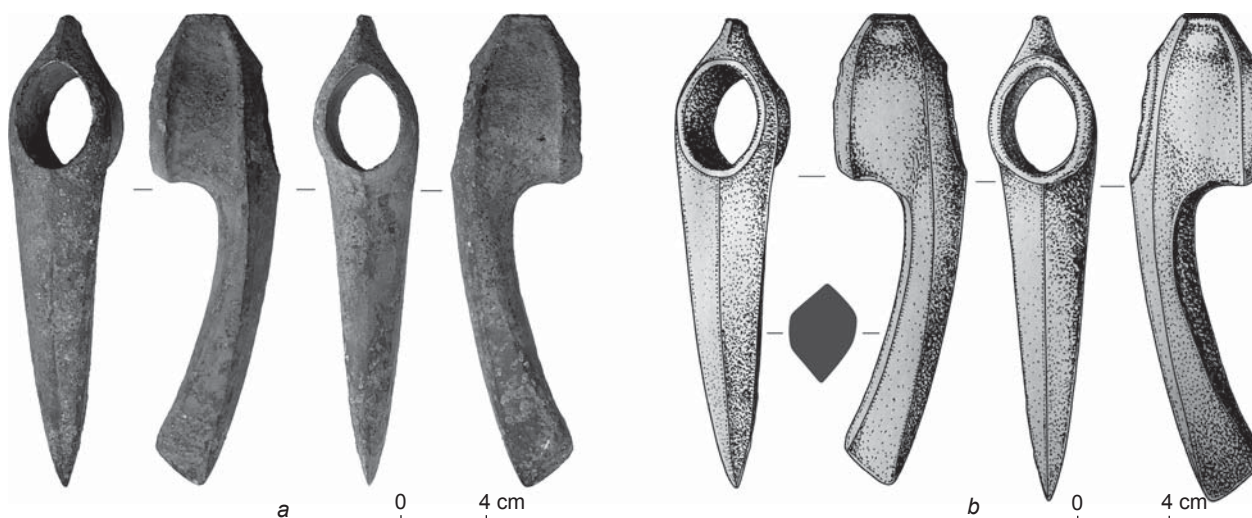


Fig. 2. Shaft-hole axe from Lake Maidan (a) and its drawing (b).

89, fig. 1). The place where the discovery was made is a potential area for searching for a settlement complex or ritual burial of items associated with foundry production. This is confirmed by another random find of a clay mold from the Middle Bronze Age, discovered on the edge of a terrace slope of the Uyen River in the vicinity of the village of Umna, in Kolyvansky District of Novosibirsk Region (Borodovsky, 2002). Currently, the shaft-hole axe is kept in the Museum of Local History “Redut Solyanoy Povorot” in the village of Solyanoye in Cherkassky District of Omsk Region.

## Research results

Recently, a number of studies (Molodin, Ermakova, 2009; Tishkin, Frolov, 2015, 2016, 2017; Frolov, Tishkin, 2021; Kovtun, 2021) have been published on random finds of shaft-hole axes in the southern part of the West Siberian Plain. The available standardized model for their description includes detailed assessment of external technological features of the items, quality of casting, as well as morphology, typology, and weight of the axes.

The shaft-hole axe from Lake Maidan was covered with a layer of patina, manifested by areas of bluish-green oxides covering the main planes of the dark brown item. The axe was cast in a bivalve mold. Casting seams in the form of thin ridges in the center of the blade and butt are clearly visible. These areas reveal the displacement of two opposite parts of the mold relative to one other due to flawed joining of the mold halves during the casting process. A small casting cavity was visible on the left outer side of the socket. This cavity might have been caused by a minimal thickness of cast metal in this section of the item; by a fragment of the wall of the clay mold ending up in the metal as it was poured; or by a low temperature of the smelted metal and insufficient heating of the mold. An even larger cavity was located on the axe blade on the same side. On the inside of the socket, no casting defects were found. In general, the casting was performed at a fairly high level. In this regard, it should be mentioned that the manufacturing quality of shaft-hole axes can suggest their territorial affiliation. For example, in the forest-steppe Altai, a number of such tools have been found showing numerous casting defects (Tishkin, Frolov, 2017: 95); whereas similar tools from the Baraba forest-steppe do not have such defects. These facts still require analysis, since not only the end products, but also various types of foundry equipment for their production have been discovered in the area of distribution of the Bronze Age shaft-hole axes in the Ob-Irtysh interfluvium (Borodovsky, 2018). The examples from the Upper Ob region include a casting mold from the settlement of Samusskoye IV (Kosarev, 1984: 112) and half of a bronze mold from the collection of the Museum of Archaeology and Ethnography of Siberia at Tomsk State University (MAES TSU) (Grishin, 1980: 116, fig. 29, 1; Avanesova, 1991: 14, 133, fig. 14, 69). In the Middle Irtysh region, halves of casting molds for crested shaft-hole axes are known from the settlement of Nizhnyaya Tunuska III (Fig. 3) (Marchenko, 2009) in Muromtsevsky District of Omsk Region. The exposition of the Omsk Museum of Local History presents two halves of a stone casting mold (OMX-4533) for manufacturing such a tool (Avanesova, 1991: 17, 133, fig. 14, 70).

The weight of the shaft-hole axe from Lake Maidan was 924 g, which makes it possible to classify it as a small axe (Ibid.: 16). The item had a long massive hexagonal blade, large socket, and slightly curved cutting edge (see Fig. 2). The cutting edge sloped downward at an angle of 70°. Notably, the Bronze Age shaft-hole axes had various types of cutting edges: straight, sloped downward, and semicircular. Judging by the discovered foundry equipment, these features appeared already at the level of the molds used for casting such products.

The cutting edge of the axe from Lake Maidan showed no traces of sharpening. The total length of the tool was

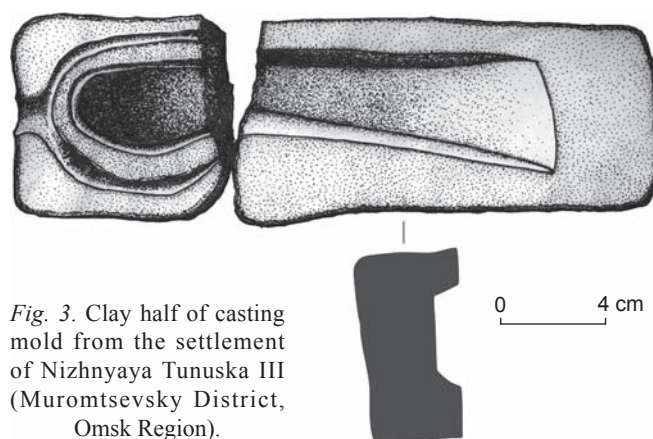


Fig. 3. Clay half of casting mold from the settlement of Nizhnyaya Tunuska III (Muromtsevsky District, Omsk Region).

22.3 cm; the length of the blade starting at the socket was 14 cm; the width at the junction of the socket and blade was 3 cm, and the thickness was 4.5 cm. The blade gradually flattened and expanded towards the cutting edge. A slight ridge on the top of the blade marked the casting seam (see Fig. 2). The hole of the axe socket was oval, measuring  $4.7 \times 3.2$  cm at the top and  $4.4 \times 3.1$  cm at the bottom. The outer size of the socket at the bottom was  $8 \times 5$  cm; the height (in the center) was 5.2 cm. The upper and lower edges of the socket sloped towards the butt (see Fig. 2). The bevel of the upper edge relative to the cutting edge was 175°, which corresponds to the maximum values of this parameter for shaft-hole axes (Ibid.: 12). The lower edge of the socket was even. The thickness of its side walls, which were the thinnest parts of the casting, reached 0.8 cm. There was no decoration on the socket. Two thick bands with sharp ridges ran below and above along the edges of its lateral sides (cheeks). The upper band smoothly passed into the upper part of the blade. The butt of the axe had a distinctive crested protrusion that formed a continuation of the band-like thickenings on the cheeks of the socket. There were no holes on it. A thin protrusion looking like a narrowed hammering surface (see Fig. 2) was in the center of the butt. Its size was  $2.0 \times 2.0 \times 0.5$  cm. According to different available casting molds, the sprue was located at this part of the item (Ibid.: 133, fig. 14, 69, 70) (Fig. 4). After removal of the sprue, this area was not worn down during the use of the axe, as was the case with individual shaft-hole axes (the village of Severnyi) from the Altai Territory (Tishkin, Frolov, 2017: 92, fig. 8).

The material from which the axe was made is quite durable and resistant to mechanical stress. Metal analysis was carried out by M.M. Ignatov from the Institute of Archaeology and Ethnography of the SB RAS, in the Laboratory of Isotope Studies, using elemental analysis based on energy dispersive spectrometry. A Hitachi TM 3000 electron microscope (Japan) with a Bruker Quantax 70 energy dispersive unit (Germany) was used. The sample for the analysis was taken from the outer edge



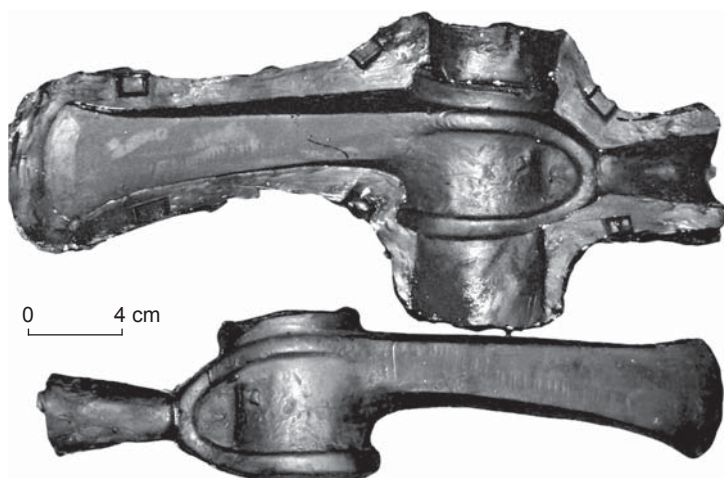


Fig. 4. Reconstruction of casting mold and sprue for the crested shaft-hole axe from Lake Uryum (village of Mikhailovka).

of the bottom part of the socket. In this section of the axe, the alloy consisted of copper (82.7 %), tin (12.9 %), lead (2.6 %), and arsenic (1.7 %). According to the content of copper and tin, the item was similar to the axes from Bor-Forpost (Kulunda) and Karpovo (the Chumysh-Charysh interfluvium) (Ibid.: 93). However, it differed in the admixture of lead, which might have resulted from a different source of raw material.

Shaft-hole axes of relatively light weight have been usually interpreted as weapons (Avanesova, 1991: 16). A light axe is more convenient for making movements, for example a sweeping motion. Nevertheless, a similar tool of larger weight from Lake Uryum (Zdvinsky District, Novosibirsk Region) has also been interpreted as a weapon (Molodin, Novikov, Sofeikov, 2000: 162, 163, fig. 155). Therefore, it is problematic to unambiguously establish the functional purpose of the shaft-hole axe from Lake Maidan. However, one should note the difference in size of the upper and lower edges of the socket ( $4.7 \times 3.4$  cm and  $4.5 \times 3.4$  cm, respectively). This suggests that the axe handle was set in the same way as was typical for a mining pick (from top to bottom) and then wedged in the socket with a locking wedge. The bend of the massive blade also marks the similarity of the shaft-hole axe under discussion to a pickaxe or similar tool. Such interpretations of shaft-hole axes have been discussed (Avanesova, 1991: 16), together with indicating pickaxes found in the Altai (Zmeinogorsk and Zolotukhino mines) (Ibid.: 38; Tishkin, Frolov, 2017: 93, fig. 10, 9, 10). Double-sided mountain picks without sockets were also widespread in Central Asia in the Bronze Age (Avanesova, 1991: 36).

A similar axe from the village of Lyalino, close to the axe under consideration, has upper and lower edges of the socket measuring  $4.7 \times 3.3$  and  $5.0 \times 3.6$  cm, respectively (Frolov, Tishkin, 2021: 189). This difference is also typical of several shaft-hole axes discovered in

the Altai Territory (Bor-Forpost, Karpovo, Severnyi) (Tishkin, Frolov, 2017: 89, pl. 1). These features imply two methods of attaching the axe handle: one method was typical of the pickaxe, while the other method was typical of the axe. In the first method (from top to bottom), the metal blade did not fit tightly with the wooden handle (Fig. 5). Considering this feature of the sockets in the axes from Lyalino and Lake Maidan, it is quite possible to assume their use as a pickaxe. This assumption is also confirmed by the orientation of the cutting edge in these items. In the first case, the cutting edge had a predominantly oval shape, and in the second case, it sloped downward. The latter feature is also typical of several shaft-hole axes (Tyumentsevo, Klyuchi, Uralpovo) from the forest-steppe Altai (Ibid.: 93, fig. 10, 1, 3, 5). The combination of features of

the socket and cutting edge obviously reflects a different functional purpose of similar items. Such a conclusion is quite consistent with basic principles of the typological approach to shaft-hole axes (Avanesova, 1991: 12).

In general, according to the typology elaborated by N.A. Avanesova, the axe from Lake Maidan can be attributed to subtypes B<sub>3</sub>, B<sub>4</sub>, which prevailed after the earlier type A (“smooth shaft-hole” axes) (Ibid.: 13–14). A whole series of such items has been found in the Ob-Irtysh interfluvium (Tishkin, Frolov, 2017: 93, fig. 10). However, shaft-hole axes show a fairly large number of



Fig. 5. Gaps at the edges of the metal part of the axe from Lake Maidan, formed when it was set on a wooden handle.

forms differing from the “classical” varieties (Avanesova, 1991: 11), which is fully applicable to the forest-steppe Ob-Irtysh interfluvium.

Bronze Age shaft-hole axes have been most often found accidentally, as part of hoards, and occasionally in burials. Accidental discovery of such items is most typical of the forest-steppe Ob-Irtysh region (Fig. 6). In a number of cases, these items were moved from their original location during economic activities, as occurred with the axes from the villages of Lyalino (Frolov, Tishkin, 2021: 189), Karpovo (Altai Territory) (Tishkin, Frolov, 2017: 91, fig. 6, 7), and Polomoshnoye (Yashkinsky District of Kemerovo Region) (Kovtun, 2021: 159, fig. 1). In southwestern Siberia and Central Asia, some shaft-hole axes were found in several hoards of the Late Bronze Age (Avanesova, 1991: 10), including the Khonnykh hoard (Abakansky District of the Republic of Khakassia) in the Middle Yenisei region, and Zaysan hoard in East Kazakhstan (Kushch et al., 2016: 203, fig. 3, 1, 2). Cartographic information on the distribution of Bronze Age shaft-hole axes in this region has been published several times (Avanesova, 1991: 11, fig. 1; Tishkin, Frolov, 2015: 136, fig. 1; 2016: 126; 2017: 88, fig. 1; Frolov, Tishkin, 2021: 192, fig. 3).

Close grouping of accidentally found shaft-hole axes was established taking into account territorial, landscape, and hydrological aspects. According to the first aspect, two regions are usually distinguished in Siberia: the western region in the south of the Ob-Irtysh interfluvium (the steppe Irtysh region), and the eastern region in the Minusinsk Basin (Tishkin, Frolov, 2016: 126). However, this corresponds to a predominantly latitudinal distribution of shaft-hole axes. At the present, the Baraba forest-steppe, which is located in the center of the western region, can well be subject to a “meridional” approach in mapping the distribution of shaft-hole axes in southwestern Siberia. This location has long included the northernmost find of the shaft-hole axe near the former village of Zolotye Yurty (Bakcharsky District of Tomsk Region), on the Kenga River in the subtaiga zone of

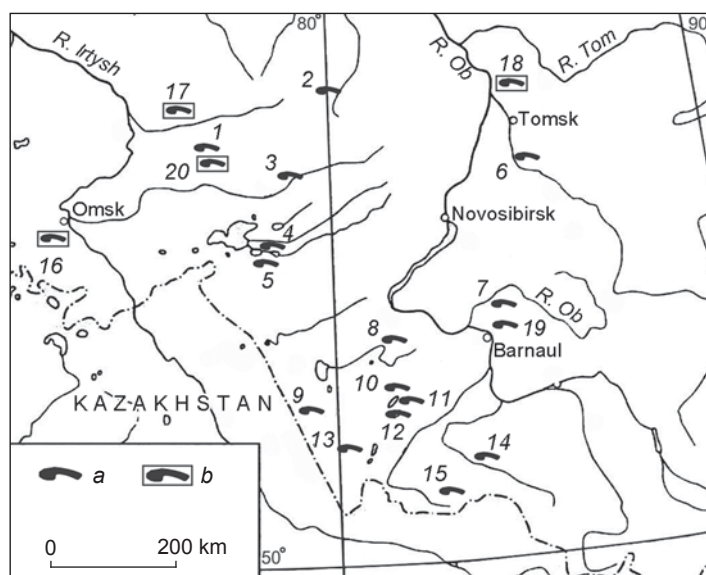
the Vasyugan Swamp (Matyushchenko, 1973: Fig. 6, 1; Kosarev, 1984: 18, fig. 7, 4; Avanesova, 1991: 132, fig. 13, 56; Frolov, Tishkin, 2021: 192, Fig. 3; Kovtun, 2021: 161, fig. 3). This area should also include the items found in the Novosibirsk Region on Lake Maidan (Vengerovsky District), near the village of Sedovo (Staro-Borodino, Kuibyshevsky District), and near Lake Uryum (village of Mikhailovka, Zdvinsky District). Identification of this territory in the context of western and eastern areas of Bronze Age shaft-hole axes makes it possible not only to mark the boundary of the forest-steppe zone in the Bronze Age (Frolov, Tishkin, 2021: 192, fig. 2), but also to detect the northern direction for the distribution of such items. At the same time, the main vector of their “advance” corresponds to their meridional localization (Kosarev, 1984: 169). Previously, a similar localization of shaft-hole axes was also observed in the southern direction, including axes found in the Kulunda steppe and the Charysh-Chumysh interfluvium (Tishkin, Frolov, 2017: 88, fig. 1). Therefore, the shaft-hole axe from Zolotye Yurty can hardly be considered a “single find” (Frolov, Tishkin, 2021: 193). In southwestern Siberia (in the Irtysh region), meridional trade routes from Central Asia still existed in the 16th century (Matveev, Tataurov, 2014: 96; Matveev, 2017: 23).

The emergence of such main lines of communication in Western Siberia was closely associated with natural passageways (Matveev, 2014: 67). Therefore, the landscape context of distribution of shaft-hole axes in southwestern Siberia is also quite indicative. The largest number of such finds from the forest-steppe region of the Altai comes from areas near the ribbon-like pine forests and the northwestern foothills (Tishkin, Frolov, 2017: 88, fig. 1). Since ancient times, these distinctive forest ecosystems emerged in the places of ancient drainage and the valley of the Ob River—one of the main rivers

Fig. 6. Location of places of random finds of Bronze Age shaft-hole axes in southwestern Siberia.

1 – Lake Maidan; 2 – village of Zolotye Yurty; 3 – village of Sedovo (Staro-Borodino); 4 – Lake Uryum (village of Mikhailovka); 5 – village of Lyalino; 6 – village of Polomoshnoye; 7 – village of Severnyi; 8 – village of Tyumentsevo; 9 – village of Klyuchi; 10 – village of Mamontovo; 11 – village of Uralpovo; 12 – settlement of Krestyanskoye IVa; 13 – Bor-Forpost; 14 – village of Karpovo; 15 – Zmeinogorsk mine; 16 – Upper Irtysh region (Omsk State Museum of Local History); 17 – settlement of Nizhnyaya Tunuska III; 18 – Upper Irtysh region (MAES TSU); 19 – village of Kislukha; 20 – cemetery of Sopka-2/5.

a – shaft-hole axe; b – casting mold.



of Western Siberia, and were natural routes from south to north and from north to south. Products made of non-ferrous metal were distributed along these routes. Therefore, it is probably not worth associating the places where shaft-hole axes were accidentally found north of their main distribution area with displacement of landscape boundaries in southwestern Siberia during the Bronze Age (Frolov, Tishkin, 2021: 193).

The hydrological context of the location of finds is no less important. The distribution of shaft-hole axes showed significant differences in various regions of the forest-steppe Ob-Irtysh interfluvium. In the east, in the Upper Ob region, the locations of such items were often associated with river systems, whereas in the west, in Baraba, they were found no less often near lakes, such as the shaft-hole axes from Lake Maidan at the village of Pavlovo (Vengerovsky District) and Lake Uryum near the village of Mikhailovka (Zdvin'sky District) in Novosibirsk Region. Such facts still require detailed analysis, possibly taking into account the ritual context.

One criteria for objectively locating individual distribution areas of shaft-hole axes in southwestern Siberia is not only the close grouping of their locations in a specific area, but also presence of votive replicas of these tools in burial complexes of the Bronze Age. Examples include finds both from the eastern region (Minusinsk Basin) and central part of the western region (Ob-Irtysh interfluvium). Pendants were found in the form of miniature shaft-hole axes in the cemeteries of Lanin Log in the Sydo-Erbinsk Basin (Vadetskaya, 1986: 48; Avanesova, 1991: 132, fig. 13, 63) and Stary Tartas-4 in Baraba (Molodin, Novikov, Grishin, 1998: 297, fig. 2, *b*; Molodin, Novikov, Zhemerikin, 2002: 60–61, fig. 10; Molodin et al., 2012: Pl. 1). According to the radiocarbon dates, the latter item belongs to the 18th–15th centuries BC (Molodin et al., 2012: Pl. 1, p. 740). It is noteworthy that in these two cases, we may speak about the geographical proximity of votive items and their real prototypes, and about possible chronology of randomly found shaft-hole axes. According to some scholars, the protrusion on the butt of the axe from the village of Lyalino (Tishkin, Frolov, 2016: 126) is similar to the protrusion on the axe-shaped pendant from Stary Tartas-4 (Molodin, Novikov, Grishin, 1998: 297, fig. 2, *b*). This similarity may indirectly indicate that axes of this type belonged to the Andronovo cultural tradition (Avanesova, 1991: 14; Tishkin, Frolov, 2016: 126). This feature was also typical of the Minusinsk Basin, where shaft-hole axes with slight crests, also probably associated with the Andronovo complexes, mainly occur (Tishkin, Frolov, 2016: 126). Nevertheless, it should be mentioned that the protrusion on the axe socket from Lake Maidan (village of Pavlovo) somewhat differed from that of the pendant from Stary Tartas-4. The rear protruding part of the socket on the axe was flattened, whereas it was pointed on the

pendant. However, it must be kept in mind that the exact similarity of axe-shaped personal adornments with their real prototypes is likely to be provisional, since it was highly unlikely that the technique of scaling the original models was used in their manufacturing, and only the common features of several varieties of such items were rendered. The same can be said about the pendant in the form of an axe from Lanin Log.

## Conclusions

The cultural and historical attribution of shaft-hole axes is considerably varied (Avanesova, 1991: 12–15; Molodin, Shatov, Sofeikov, 1999: 465; Molodin, Novikov, Sofeikov, 2000: 162; Tishkin, Frolov, 2015: 142), but they are generally correlated with a number of archaeological cultures of the Middle and Late Bronze Age, chronologically corresponding to the period from the mid to late 2nd millennium BC (Tishkin, Frolov, 2015: 142). According to some scholars, discovery of shaft-hole axes and their votive counterparts at the archaeological sites of Baraba and forest-steppe Altai indicates that the relative chronology of types of these tools proposed by N.A. Avanesova (1991: 15) is not so clear-cut (Tishkin, Frolov, 2015: 142). For example, morphological features of shaft-hole axes from the villages of Lyalino and Tyumentsevo demonstrate transitional features typical for items of both the Andronovo historical and cultural community and Late Bronze Age cultures (*Ibid.*). On the contrary, on the shaft-hole axe from Lake Maidan, the “bands” with ridges along the socket and butt were more pronounced. This makes it possible to attribute it to belonging to earlier specimens (Tishkin, Frolov, 2017: 94), since the items from Lyalino and Tyumentsevo show a combination of two types of “bands”—rounded and with ridges (*Ibid.*). This feature is also present in another random find—a shaft-hole axe from the village of Kislukha (Pervomaisky District of the Altai Territory) (Golovchenko, Shevchenko, 2022). The wide geographical presence of this morphological feature in the mentioned axes makes it possible to synchronize such items. Notably, the reliability of establishing cultural affiliation (Andronovo, Sargara-Alekseevka, or Begazy culture) for shaft-hole axes from the forest-steppe zone of Western Siberia (Avanesova, 1991: 14; Molodin, Novikov, Grishin, 1998: 297, fig. 2, *b*; Tishkin, Frolov, 2016: 126; 2017: 94), which were accidentally discovered outside specific archaeological sites, remains quite hypothetical (Tishkin, Frolov, 2017: 94). As for the location of the shaft-hole axe from the southern shore of Lake Maidan, the Bronze Age (Andronovo) sites in this area were usually located on watersheds, while complexes of the Late Bronze Age (Irmen) were located on the edge of the watershed bordering on lake-like depressions



(Kuzmin et al., 2013: 93). Thus, the topographic feature of the place of discovery of that find is not quite typical, especially if we take into account relatively narrow dating and cultural affiliation of the item.

Nevertheless, we should agree that localization of the shaft-hole axes that were discovered accidentally may be a sign of yet unidentified sites of archaeological heritage, including not only Bronze Age settlements (Tishkin, Frolov, 2015: 143), but also hoards, caches, as well as items that were lost. The place where the shaft-hole axe was discovered near Lake Maidan is located far to the north of the main area of Bronze Age sites in Vengerovsky District of Novosibirsk Region (Kuzmin et al., 2013: 90, fig. 1). Obviously, this may indicate another promising area for the search for archaeological sites of the Bronze Age on the southern periphery of the Vasyugan Plain. Close spatial localization of such finds in latitudinal and meridional terms makes it possible to identify not only cultural and landscape boundaries of the Bronze Age, but also main directions of movements of the ancient population who used natural corridors as communication routes.

Generally, the Baraba forest-steppe typically manifests both shaft-hole axes and their casting equipment, including various forms of these tools corresponding to their different functions and the chronology of their existence (Avanesova, 1991: 12). The main directions of distribution of such items through Baraba to the Vasyugan Plain can be seen. In the Bronze Age, this region was less swampy than today; therefore, natural transportation corridors that are marked by random finds of shaft-hole axes of the Bronze Age could have been present in some of its areas.

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