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O.I. Goriunova and A.G. Novikov
Irkutsk State University,
K. Marksa 1, Irkutsk, 664003, Russia
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: as122@yandex.ru

Jade Artifacts from Bronze Age Cemeteries in the Cis-Olkhon Area, the Western Coast of Lake Baikal

This study describes all 150 known jade items from ten Early Bronze Age cemeteries on the western coast of Lake Baikal. Although the outcrops of jade are located far away, the material was widely used. Green jade was used for making tools, whereas ornaments were made of white or light-colored jade. The choice was motivated by durability, color, translucency, and rarity. Binocular microscopy was used to reconstruct manufacturing technologies. Most artifacts belong to the Glazkovo culture. Calibrated radiocarbon dates of burials with jade items, corrected for the reservoir effect, fall within the 4597–3726 BP interval. Results of the mineralogical analysis indicate two remote sources: the Eastern Sayan Mountains and the Middle Vitim Highland.

Keywords: *Jade, Lake Baikal, Cis-Olkhon, burials, Bronze Age, tools, ornaments, radiocarbon dating.*

Introduction

The role of jade as ornamental and sacral stone in the culture of ancient inhabitants of Asia is generally known. Owing to its high hardness, durability, and beauty, jade has been used by the populations of various areas of the Eurasian continent since the Neolithic age. It was one of the basic minerals used as a means of exchange and communication by the ancient populations.

Southern Siberia (in particular, the Cis-Baikal region), wherein the world's largest jade-bearing province is located, is among the regions where jade has been used since ancient times (Sekerin, Sekerina, 2000: 150). Items made of green jade have been encountered in Cis-Baikal in the assemblages of burials and settlements, beginning in the Early Neolithic (Okladnikov, 1950). In the Bronze Age, ornaments made of not only green but also white and light-colored jade were widespread (Okladnikov, 1955). Most frequently, green jade was employed to manufacture tools, and light-colored, predominantly white, jade to manufacture ornaments related to the sun cult. In the Cis-Baikal region, the majority of jade items were discovered in the burials of the Upper Angara basin (Ibid.). This region (unlike Cis-Olkhon) is the nearest to the known jade deposits in the Eastern Sayan Mountains.

The Cis-Olkhon area (western coast of Lake Baikal from the cape of Elokhin to the Bolshaya Buguldeyka River) is rather far from the known geological jade deposits, but archaeological materials discovered in this area, especially in recent decades, contain numerous items made of this mineral (Fig. 1) (Goriunova, Novikov, Sekerin, 2007). For the first time, such artifacts were found here in Bronze Age burials, during excavations by the Irkutsk Expedition of the Leningrad Branch of

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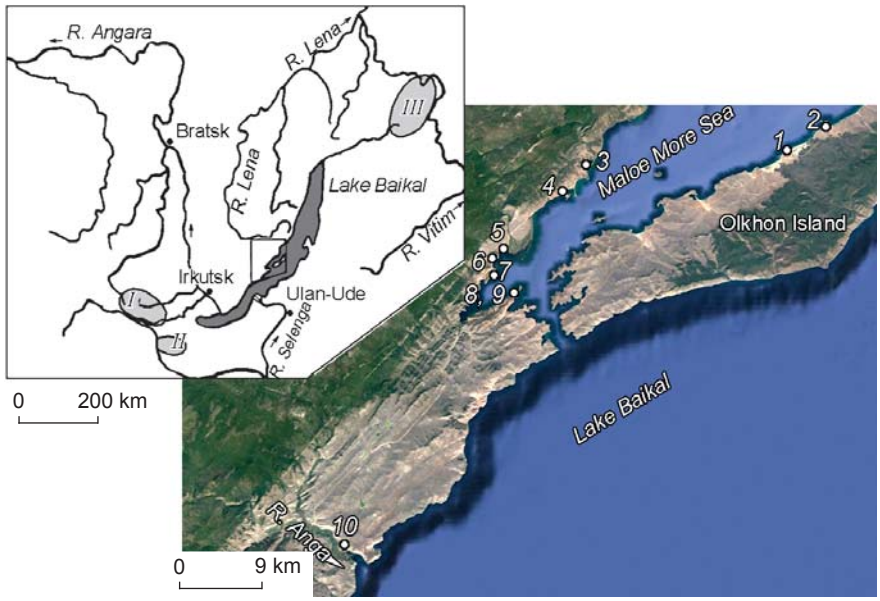

Fig. 1. Bronze Age cemeteries of Cis-Olkhon and the main jade deposits in southern Siberia.
1 – Shamanskii Mys; *2* – Kharansin I; *3* – Kurma XI; *4* – Khadarta IV; *5* – Sarminskii Mys; *6* – Khuzhir-Nuge XIV; *7* – Uliarba; *8* – Ulan-Khada II; *9* – Ulan-Khada IV; *10* – Ust-Anga. *I* – Eastern Sayan; *II* – Dzhida; *III* – Middle-Vitim deposits.

the Institute of Archaeology of the USSR Academy of Sciences, in 1959. Tools and ornaments made of green and light-colored jade were recorded in the burials of Uliarba, Kharansin I, Ulan-Khada II and IV (Komarova, Sher, 1992; Kachalova, Chernikov, 1992; Goriunova et al., 2004). Starting in the 1970s and up to the present, the Cis-Olkhon area has been a place for archaeological studies conducted by a variety of academic and institutional expeditions (Konopatsky, 1982; Goriunova et al., 2004; Goriunova, Sekerin, Novikov, 2005; Goriunova, Novikov, Lbova, 2010; Novikov, Weber, Goriunova, 2010; Goriunova, Weber, Novikov, 2012). These surveys have resulted in considerable expansion of the source-base for the study of the Bronze Age in the region. Excavations at the cemeteries of Shamanskii Mys, Uliarba, Sarminskii Mys, Khuzhir-Nuge XIV, Kurma XI, and Khadarta IV have allowed a representative collection of jade artifacts to be obtained.

The purpose of this article is to summarize and analyze all available data on jade items from the funerary complexes of the Bronze Age in Cis-Olkhon, and to consider the production technologies, possible geological sources of raw materials, and probable communication links among the ancient populations of the region.

Study materials

Many rocks (serpentinites, green compact microquartzites, basic metavolcanics, and others) are similar in appearance to jade; therefore, we conducted determination of mineralogical composition of items conditionally referred to jades (Goriunova, Sekerin, Novikov, 2005; Goriunova, Novikov, Sekerin, 2007). The following assumption was accepted as initial: by "jade" we shall basically mean massive microcryptocrystalline rock, translucent in thin shears, which is actually composed of a monomineralic aggregate of actinolite-tremolite amphibole with a characteristic felted microstructure (Suturin, Zamaletdinov, 1984; Sekerin, Sekerina, 2000). The materials of items from the Bronze Age cemeteries were determined mainly by visual and microscopic methods. To check the results, X-ray analysis was conducted*, which is characterized by a high degree of diagnostic accuracy for minerals, and requires a minimal quantity of the substance to be analyzed (this being very important when studying ancient finds). At present, thanks to analysis of archival and published data, as well as archaeological collections, ten Bronze Age sites (74 burials), containing 150 items made of green and light-colored jade, have been revealed in Cis-Olkhon (Table 1), which is a substantial part of the total number of ancient jade items found in the Cis-Baikal region.

The items are dominated by ornaments (85 spec.) made mainly of light-colored (from light green to milk-white) jade. Only one moonlike pendant made of green jade is known (Kurma XI, burial 12). All tools (65 spec.) are made of green jade.

*The studies were carried out in the Institute of the Earth's Crust, SB RAS (by analyst Z.F. Ushchapovskaya).

Table 1. **Jade items from the Bronze Age cemeteries of Cis-Olkhon, spec.**

Site	Location	Type of item		Total items	Source
		tool	ornament		
Shamanskii Mys	0.7 km to the NE of the Khuzhir village, Cape Burkhan	8	11*	19 (from 7 burials)	(Konopatsky, 1982)
Kharansin I	0.7 km to the W of the *Kharantsy village*	2	1*	3 (from 1 burial)	(Kachalova, Chernikov, 1992)
Kurma XI	0.5 km to the NE of the Kurma village	8	22*+1	31 (from 14 burials)	(Goriunova, Weber, Novikov, 2012)
Khadarta IV	2.7 km to the SW of the Kurma village, 1 km to the NWW of Cape Khadarta	10	5*	15 (from 7 burials)	(Kharinsky, Sosnovskaya, 2000; Goriunova, Weber, 2003; Goriunova, Novikov, Lbova, 2010)
Sarminskii Mys	0.8 km to the SW of the Sarma village, the same-name	5	7*	12 (from 6 burials)	(Goriunova, Sekerin, Novikov , 2005)
Khuzhir-Nuge XIV	2.3 km to the SW of the Sarma village	18	18*	36 (from 21 burials)	(Novikov, Weber, Goriunova, 2010)
Uliarba	4 km to the SW from the Sarma village	12	15*	27 (from 13 burials)	(Goriunova et al., 2004)
Ulan-Khada II	4.5 km to the NNW of the Sakhyurte village, in the Ulan-Khada Bay	2	1*	3 (from 2 burials)	(Komarova, Sher, 1992)
Ulan-Khada IV	Ulan-Khada Bay	–	2*	2 (from 2 burials)	(Ibid.)
Ust-Anga	12.5 km to the SEE of the Elantsy village, the eastern coast of the Gulf of Ust-Anga	–	2*	2 (from 1 burial)	(Goriunova et al., 2011)
	Total	65	85	150	

* The items are made of light-colored jade, others are from green jade.

In Cis-Baikal, particularly in Cis-Olkhon, jade had been used as a fabricating material since the Neolithic. From then onward, it was one of the main sources of raw materials for manufacturing axes, adzes, and knives (Table 2).

The axes (23 spec.) are cutting tools symmetrical in profile (Fig. 2). These have a sharpened, blunted, or rounded backs. Axes polished partially, not over the entire surface, prevail. Length is from 4.2 to 15.5 cm.

The adzes (16 spec.) are tools asymmetrical in profile. These were intended for hollowing, adzing, and scraping (Fig. 3). Their backs are most frequently blunted or rounded. The items are polished. In a number of cases, only the edge, not the entire tool, was treated by polishing. These tools are generally from 3.2 to 8.5 cm long; only one item (Kharansin I, burial 2) is 12.7 cm long.

The knives (24 spec.) are cutting tools. All tools are bladed, with one edge, sharpened on one or two sides (Fig. 4). The surface is almost fully ground. The length is from 2.4 to 7.7 cm.

Ornaments made of white and light-colored (with a greenish tint) jade are represented in the Bronze Age assemblages of Cis-Olkhon. Rings and discs made of so-called milk and sugar jade are rather rare. The ornaments in burials were usually placed near the chest and head; these probably decorated the headdresses of the deceased persons. Discs and rings (Table 2) are most frequent, flat elongated plates (Uliarba, burial 13, and Ulan-Khada IV, burial 4) are rarer, and a pendant (Shamanskii Mys, burial 4 (1973)) and half-rings (Kurma XI, burial 5) are single.

The discs (54 spec.) are round, with small biconical holes in their centers (Fig. 5, *2*; 6, *3–7*). Items 1.2 to 5.0 cm in diameter prevail. Larger discs with diameter from 6.0 to 8.8 cm are also encountered. The thickness of the items is from 0.2 to 0.5 cm. Four large discs from Sarminskii Mys, burial 2, and Shamanskii Mys, burial 1 (1972), have two circular slots located 0.7 to 1.5 cm from the edge of items on both sides (see Fig. 5, *2*; 6, *7*).

A similar, though unfinished, slot is recorded on one disc from Khuzhir-Nuge XIV, burial 24.

The rings (21 spec.) are dominated by items 1.6 to 4.4 cm in diameter (see Fig. 5, *3*, *4*; 6, *1*, *2*). There are three rings with diameter from 5.3 to 7.0 cm. The thickness of the rings is 0.2–0.5 cm.

The half-rings (4 spec.) are represented by items from Kurma XI, burial 5 (Fig. 7). These are made of three different rings 11, 12.5, and 12.8 cm in diameter. Two items of the greatest diameter are halves of the same ring.

Table 2. **Jade items from the cemeteries of Cis-Olkhon, spec.**

Item	Shamanskii Mys	Kharansin I	Kurma XI	Khadarta IV	Sarminskii Mys	Khuzhir-Nuge XIV	Uliarba	Ulan-Khada II	Ulan-Khada IV	Ust-Anga	Total
Green											
Axe	2		4	2	1	7	6	1	–	–	23
Adze	4	1	3	2	1	4	1		–	–	16
Knife	2	1	1	5	3	6	5	1	–	–	24
Flake	–	–	–	1	–	1	–	–	–	–	2
Moonlike pendant	–	–	1	–	–	–	–	–	–	–	1
Light-colored											
Moonlike pendant	1	–	–	–	–	–	–	–	–	–	1
Disc	6	1	13	2	5	15	9	1	–	2	54
Ring	3		5	3	2	3	4	–	1	–	21
Half-ring	–		4	–	–	–	–	–	–	–	4
Plate	–	–	–	–	–	–	2	–	1	–	3
Pendant	1	–	–	–	–	–	–	–	–	–	1
Total	19	3	31	15	12	36	27	3	2	2	150

Fig. 2. Jade axes.
1 – Khuzhir-Nuge XIV, burial 85; *2* – Kurma XI, burial 12; *3* – Kurma XI, burial 4; *4* – Khuzhir-Nuge XIV, burial 78; *5* – Khuzhir-Nuge XIV, burial 4.

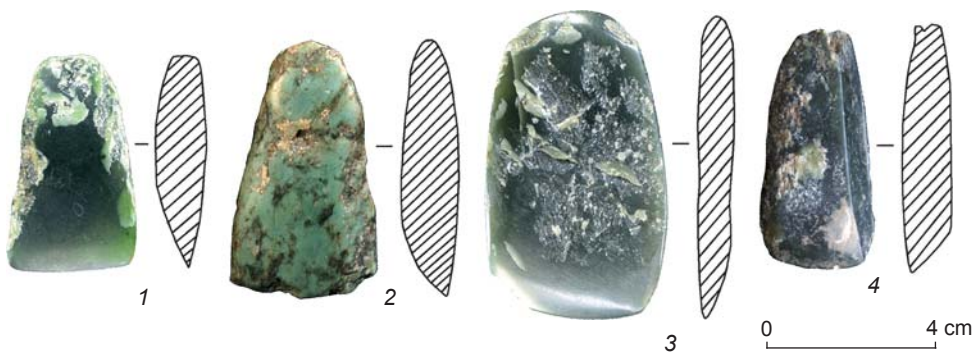

Fig. 3. Jade adzes.
1 – Kurma XI, burial 13; *2* – Khuzhir-Nuge XIV, burial 74; *3* – Kurma XI, burial 4; *4* – Kurma XI, burial 26.

Fig. 4. Jade knives.
1 – Kurma XI, burial 10; *2* – Uliarba, burial 35; *3* – Khuzhir-Nuge XIV, burial 86; 4 – Uliarba, burial 36.

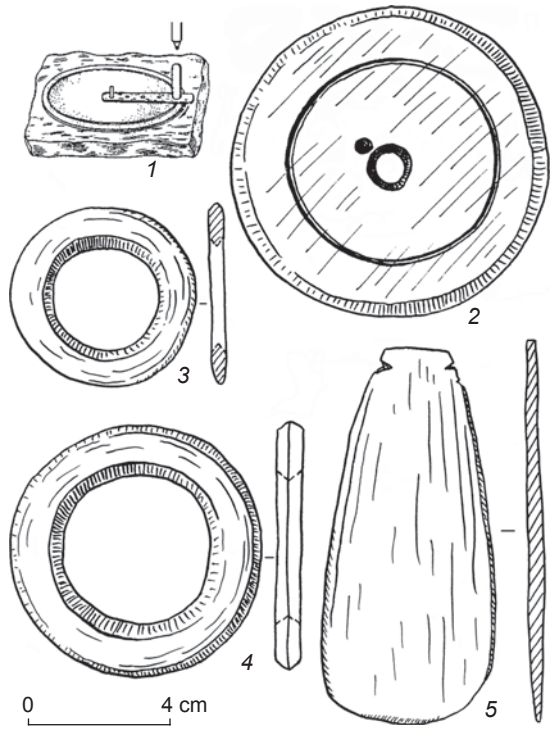

Fig. 5. Reconstruction of a device for manufacture of jade rings (*1*) (after (Semenov, 1957: 101)) and jade ornaments (*2–5*).
2 – a disc from Sarminskii Mys, burial 2; *3*, *4* – rings; *5* – an elongated plate from Uliarba, burial 13.

Fig. 6. Jade rings and disks.
1 – Kurma XI, burial 12; *2* – Kurma XI, burial 7; *3* – Kurma XI, burial 16; *4* – Kurma XI, burial 1; *5* – Uliarba, burial 35; 6 – Kurma XI, burial 18; *7* – Sarminskii Mys, burial 2.

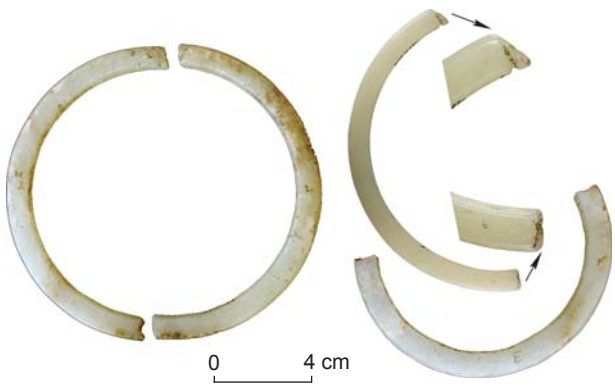

Fig. 7. Jade half-rings from Kurma XI, burial 5.

On their ends, traces of sawing can be seen, carried out on two sides, and subsequent breaking up. The thickness of the half-rings is 0.6 cm. These ornaments were discovered under the thigh bones of a buried person (Goriunova, Weber, Novikov, 2012: 41).

The flat elongated blades are made of white jade (3 spec.). Two of these, along with a jade ring, were in a leather bag on the chest of a buried person (Uliarba, burial 13, skeleton 1) (Goriunova et al., 2004: 21). The plates smoothly expand downward (see Fig. 5, *5*). The long edges (bases) of the plates are rounded. Notches for securing the items are made in the upper (narrow) portion, on the sides. The length of items is 10.5 and 8.1 cm. The plate from Ulan-Khada IV (burial 4, bottom layer) is similar to these in its shape, though adapted for another method of securing: instead of notches, a biconical hole is made in it. The plate is 6.5 cm long. The item was discovered near a skull, in a bone accumulation (secondary burial) (Komarova, Sher, 1992: 37).

The moonlike pendants (2 spec.) are made of green (Kurma XI, burial 12) and light green (Shamanskii Mys, burial 1 (1972)) jade. These have sub-triangular shapes

Fig. 8. Moonlike pendant from Kurma XI, burial 12.

and rounded ends. The tops of the sub-triangular shape are provided with suspending holes. The long edge (base) of the pendant from Kurma XI is wavy (Fig. 8). The pendants are 11.5 and 13 cm long. Both moonlike pendants were discovered in accumulations of inventories; probably these were put into some bags containing tools and ornaments (discs and rings) (Konopatsky, 1982: 57; Goriunova, Weber, Novikov, 2012: 75).

Discussion

All currently studied Cis-Olkhon burials containing items made of green and light-colored jade (74 sites) pertain to the Early Bronze Age. These were dated taking into account the data on features of funerary practices, the presence of metal (copper, bronze) items in the assemblages, and the characteristic typological shapes of tools and ornaments, as well as radiocarbon dates established for the specimens from specified graves. All green and light-colored jade items discovered in Cis-Olkhon pertain to the Bronze Age Glazkovo culture of Cis-Baikal in terms of their nomenclature and typology, as well as the manufacturing technique (Okladnikov, 1955).

The chronological attribution of the analyzed assemblages of Cis-Olkhon burials is based on the series (more than 180 determinations) of corrected (with regard to the reservoir effect) and calibrated radiocarbon AMS dates. These were obtained from human bones and teeth of ungulates from these graves. The results of radiocarbon dating of burials are presented in a number of publications (Mamonova, Sulerzhitsky, 1989; Kharinsky, Sosnovskaya, 2000: 82; Goriunova et al., 2004: 76–77; Novikov, Weber, Goriunova, 2010: 230, 280–281; Goriunova, Weber, Novikov, 2012: 161–162, 226; Weber et al., 2005, 2006, 2016; and others). In general, radiocarbon dates based on Cis-Olkhon burials containing items made of green and light-colored jade lie within 4597–3726 cal BP.

In order to determine the techniques of manufacturing the jade items in Cis-Olkhon, special binocular studies of materials from the largest Bronze Age cemeteries in the region were conducted (Khuzhir-Nuge XIV and Kurma XI) (Kungurova, 2012: 259–260). Analysis was performed using the standard procedure developed by S.A. Semenov, with the involvement of the experimental simulation data obtained by the school of the Institute for the History of Material Culture of the RAS in special expeditions (Semenov, 1955; 1957: 88–104; 1963).

Initially, a jade boulder was probably subjected to sawing in order to obtain smaller pieces. When manufacturing axes and adzes, these pieces were treated by direct percussion to give them a certain shape. The obtained blank acquired the appearance of the desired item in the course of subsequent grinding. Owing to the labor intensity of the process, often only a part of the item was treated by grinding rather than the whole tool. Edges of heavy-duty and cutting tools were additionally sharpened. The sawing traces on the ready tools occur rather rarely; most probably, these disappeared during subsequent treatment. Among 39 studied jade axes and adzes from Cis-Olkhon, only one item (an adze from Kurma XI, burial 26) has a longitudinal saw cut forming a side-face of the tool (see Fig. 3, *4*). The thickness of this tool matches the saw cut depth of 1 cm (Kungurova, 2012: 260).

On one side of an axe from the Khuzhir-Nuge XIV, burial 4, there is a wide (1.5 cm) groove pecked across the item (Novikov, Weber, Goriunova, 2010: 23). Probably, a handle was inserted there.

According to Semenov, who studied jade discs and rings of the Early Bronze Age in Cis-Baikal (1955; 1957: 92–93, 99–104; 1963: 196), the process of ornament manufacture was more labor intensive. To produce discs, it was necessary to drill out a hole in the middle of a thin ground plate, for fastening the central rod—rotation axis. Small holes were obviously drilled by hand flint drills on two sides. Rotation was unidirectional. Then, grooves in the form of circles were cut out on both faces of the discs by a stone (probably flint) burin, using a circular method (see Fig. 5, *1*). With the help of abrasive tools, these cut-outs were deepened until a ring was detached from the disc. Thus, rings of various diameters and smaller discs with central holes could be produced from a single jade plate. A.P. Okladnikov has recorded such discs, with circular cut-outs, in a number of Cis-Baikal sites: Balushkino, Semenovo, burial 1; Ponomarevo, burial 17; Bratskii Kamen, burial 1; Buret II, burial 4; and others (1955: 176–178). Sharp ribs (traces of carving on two opposite sides) are seen on the front and back sides of the items under study. The outer edges of rings and discs were often additionally subjected to facing.

Discs, rings, and half-rings from Cis-Olkhon burials, as well as Cis-Baikal in general, are fully ground. All of these were cut out from ground plates up to

0.5–0.6 cm thick, using the circular method. On the outer edges of small-size discs, irregularities formed by creases are observed. In four discs (Sarminskii Mys, burial 2; Shamanskii Mys, burial 1 (1972)), double-sided circular slots were noted, which appeared owing to the technology of ring manufacture from discs (see Fig. 5, *2*; 6, *7*). The circular slots are uneven, their bottoms are stepped. Probably, cutting was performed by short motions of the hand, using a stone burin (Semenov, 1955). The width of the grooves is 1–2 mm. Cutting of rings was performed on two sides; therefore, the items predominantly have hexagonal cross-sections. Faces were often leveled-off by grinding around the outer circumference.

The half-rings from Kurma XI were obtained by partial sawing of large rings from both sides into equal halves, and by subsequent breaking up. Saw cuts can be seen at four ends of three half-rings (see Fig. 7). In most cases, the break-up remained ragged; at one end, it was grounded. The middle groove (projection), obtained as a result of biconical sawing-out of the item, is treated by grinding around the outer circumference. The middle projection around the inner semicircle is preserved. The width of half-rings is from 0.9 to 1.1 cm.

Small holes in all jade items from Cis-Olkhon are the result of biconical drilling. The hole in the moonlike pendant from Kurma XI is shaped somewhat differently: it is crossed on both sides by engraved strips 1.8–2.0 cm long (see Fig. 8).

Mineralogical study has demonstrated that the items are made of jade of two color varieties: green and dark green, and white and light-colored (greenish-white and light green) (Goriunova, Novikov, Sekerin, 2007). In Cis-Olkhon, no jade deposits have been found; so items or raw materials for their manufacture could have been delivered here only from other regions.

The primary and placer jade deposits in southern Siberia, such as Eastern Sayan, Dzhida, Middle Vitim deposits, and others (Suturin, Zamaletdinov, 1984; Sekerin, Sekerina, 2000), are rather far from the area under study (see Fig. 1). The green jade prevails there. White and other light-colored varieties of jade are encountered very rarely. These are found only in the Middle Vitim basin, and isolated ones are in the form of boulders and pebbles, in the alluvium of Kitoy, Onot, Belaya, Urik rivers (Eastern Sayan). Therefore, discovery of the raw material base of this rare stone is relevant in order to establish communication links among the ancient population.

The nearest primary deposits of green and dark green jade are in the high-mountain part of Eastern Sayan Mountains: the Eastern Sayan deposit is located approximately 370 km along a straight line to the SWW from the Cis-Olkhon area, and the Dzhida deposit 330 km to the SW from it (see Fig. 1). Both in the distant past and at present, this mineral was transported to Cis-Baikal via the Kitoy, Onot, and Urik rivers. A collective term "Sayan jade" is applied to varieties of this type.

Primary deposits of white and other light-colored jades are located to the northeast of Lake Baikal, in the Middle Vitim basin, ca 600 km (along a straight line) from Cis-Olkhon (see Fig. 1). It is not improbable that prehistoric humans could have taken light-colored jade in the alluvium of Kitoy, Onot, and Bolshaya Belaya rivers, which drain Eastern Sayan Mountains. This is also confirmed by the fact that boulders and pebbles of light-colored jade were found near these rivers in historical times (Okladnikov, 1955: 185–187; Sekerin, Sekerina, 2000: 156). However, primary deposits of light-colored jade have not so far been discovered in the Eastern Sayan Mountains, while single jade pebbles, according to the available descriptions, are not fully consistent with the archaeological materials from Cis-Olkhon. Light-colored jade, which is the material of items from the region under study, shows maximum resemblance to jade from the Vitim basin. Said types of jade are almost identical in terms of color, translucency, presence or absence of minor minerals (Goriunova, Sekerin, Novikov, 2005; Goriunova, Novikov, Sekerin, 2007). The results of mineralogical analysis suggest that jade was delivered to Cis-Olkhon from two sources separated by 1 thousand km—from the Eastern Sayan Mountains, and the Middle Vitim Highland. These assumptions have been confirmed by the studies conducted in recent years by Trans-Baikal archaeologists (Tsydenova et al., 2015). On the basis of comparative study of the chemical and physical characteristics of jade items and geological specimens of modern jade from Trans-Baikal deposits, they tried to identify ancient artifacts with the raw materials from specific sources. Among 24 studied items made of jade, eight objects from the Onkuli (Barguzin River valley) and Shamanskii Mys (southwestern tip of Lake Baikal) truly pertain to the Bronze Age. As a result of these analyses, N.V. Tsydenova and her co-authors came to the same conclusions as were drawn by us in relation to the study of the Cis-Olkhon materials: at the Early Bronze Age sites in Trans-Baikal, jade from the Vitim basin and Eastern Sayan deposit was used. On the basis of materials from the Shamanskii Mys cemetery, on the southern coast of Baikal, it has been proved that light jade was transported from the Vitim deposit to a distance of more than 700 km (in a straight line).

Conclusions

Although the outcrops of jade were located far away, the material was widely used in the Bronze Age in Cis-Olkhon for the manufacture of tools and ornaments.

Notably, green jade was used mostly for making tools, whereas ornaments were made of white or light-colored jade. The choice of material was motivated by such criteria as durability, light color, translucency, and rarity. All jade artifacts discovered in Cis-Olkhon are similar to Glazkovo items of the Bronze Age in terms of their nomenclature and typology (Okladnikov, 1955). These also share their technique of manufacturing the tools and ornaments (Semenov, 1955). The series of radiocarbon dates based on Cis-Olkhon burials containing items made of green and light-colored jade falls within 4597–3726 cal BP.

The results of the mineralogical analysis suggest that jade was delivered to Cis-Olkhon from two remote sources—the Eastern Sayan Mountains and the Middle Vitim Highland. This allows the questions to be raised of the existence of prehistoric routes for delivery of the raw material from remote and hard-to-reach places, which routes have not been discovered yet; of the possible presence of intermediate sites or workshops for primary or full processing of jade on these routes; and of the methods for its transportation. To decide the above questions, it is necessary to continue the study of Bronze Age jade artifacts in Cis-Olkhon (and Cis-Baikal in general) and to compare them with jade items from the known primary and placer sources. Taking into account the obtained information, it will probably be possible to trace the communication links between representatives of ancient cultures of Southeast Asia in various periods. Possible cultural contacts among the populations of Cis-Baikal, the Far East, and Northeast China were repeatedly referred to by Okladnikov (1955: 197). In order to determine the time and area of distribution of jade artifacts, it is also necessary to create the chronological base relying on results of radiocarbon dating, and to perform mapping of the archaeological sites containing jade artifacts.

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