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A Yakut Composite Bow from the Toybokhoy Museum

We give the first description of an unusual composite bow of the Central Asian type, owned by the Toybokhoy Museum in the Suntarsky District of Yakutia, and provide information about its discovery. We focus on the details and structural peculiarities of the specimen, and note that this reflex composite bow differs in terms of construction and technology from those of the Northern type used by the Yakuts in the 17th to 19th centuries. It resembles bows of the Central Asian type. Its distinctive features are eight horn and bone frontal plates, four end-plates, and four long edging-plates made of bone. According to folkloric sources and 17th century archival documents, before the Russians migrated to the Lena Territory, the Yakuts had used bone combat bows of the Central Asian type. We cite an archaeological fact demonstrating the use of such bows in Yakutia—a central plate from a composite bow with widening paddle-shaped ends from the mid-15th to early 16th century burial at Sergelyakh. We publish the results of the radiocarbon analysis of the horn plate from the Toybokhoy bow, carried out at the Center for Isotope Research at the University of Groningen. They support the legendary version: the Toybokhoy bow belonged to the brother of the Yakut ruler Tygyn Darkhan, Ala Kyrsyn, who lived in the early 17th century and became the founder of one of the Vilyuy Yakut clans. We conclude that alongside the Northern type bows, the late medieval Yakuts used reflex bows of the Central Asian type.

Keywords: *Yakuts, bows, Central Asian type, composite bows, bone, horn, bow plates, birch-bark, Toybokhoy.*

Introduction

The bow was most likely invented not later than the terminal Paleolithic. This hypothesis is supported by the wooden arrow-shafts and arrowheads found in Germany and dated to the early 9th millennium BC (McEwen, Miller, Bergman, 1991). This type of weapon was used in hunting and battles. In the Late Neolithic, composite bows appeared, with their elements made of various materials. For almost ten thousand years, before the wide distribution of firearms, bows were the main weapons of many peoples of the world for long-range combat. During the medieval period, the bow became a real piece of engineering art. Its manufacture required knowledge of arrow-flight patterns, which today are explained by the laws of physics, mathematics, and ballistics, as well as of the properties of various materials, their combination and resistance, and also certain skills. The bow manufacturing techniques were developed on the basis of personal experience and also the borrowing of various innovations from populations of other regions.

In the 17th to 19th centuries, the Yakuts widely used composite bows of the northern type. The construction of these bows and their manufacturing technique are described in the works by E.D. Strelov (1927), I.V. Konstantinov (1971), Y.B. Simchenko (1976), and F.F. Vasiliev (1995). A.P. Okladnikov argued that the Yakut composite bow "belongs not to the steppe group of bows, but to another group, which should be named the hyperborean or northern group, according to the area of

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its distribution" (1955: 285). The folklore and epic stories, as well as ethnographic materials, provide evidence on the use by the Yakuts of composite bows of the Central Asian type (bows made of bone (*muos okh saa*, *kuraakh saa*)), alongside the northern bows. These bows differed from the Tungus ones by their construction (which was similar to the bows of Xiongnu and Mongol types) and the presence of the end horn-inserts and the middle bone-plate (Tokarev, 1945: 82; Ivanov, 1966: 70; Gogolev, 1990: 101–102; Vasiliev, 1995: 64–65). In this article, we present a description of a bow of this type owned by one of the museums in Yakutia.

The history of the bow's discovery, its description, and the research method

In 2014, among the exhibits of the Bessonov Republic History and Local Lore Museum in Toybokhoy, the authors discovered a unique composite bow of the Central Asian type, with central frontal and several limb horn-plates; central and end-plates; and also edging-plates made of bone (Fig. 1). In the museum, this item is recorded as "an ancient Yakut bow (horn)", its size is 120.5 × 3.5 cm; materials: wood, bone, and birch-bark. According to the museum's records, the bow was donated by the pupils of the Kutana School in the Suntarsky District of the Yakut ASSR on January 25, 1937.

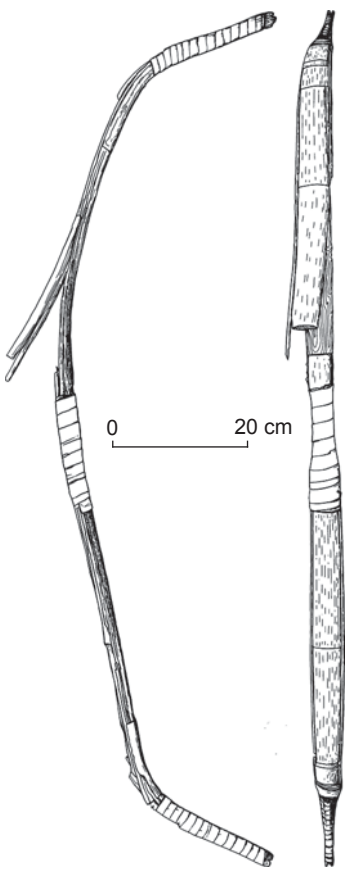

Fig. 1. Toybokhoy composite bow.

Some information about the bow's discovery was provided by N.N. Martynov, the local lore expert. He visited the Toybokhoy Museum in 1967 and became acquainted with its Director, G.E. Bessonov, who told him that the bow belonged to Ala Kyrsyn, an ancestor of the Khochinsky Yakut clan. The bow was passed to blood relatives, until one of them decided to take it to the afterworld upon his death. The ritual construction over Ala Kyrsyn's grave "was until recently situated on the shore of the island in Lake Toybokhoy. This was a hexagonal cribwork, with walls each 3 m long, and as high as a two-storey building. The six-slope roof was topped with a small bulbous dome that was coated with copper plates cut of the old cauldrons. Such constructions over the tombs were widespread among the Yakuts in the 19th to early 20th centuries. The old residents narrated that the bow-owner wanted to divide the bow into two parts, and began to take the upper layer of birch-bark away. Under the birch-bark, there was a horn plate, and he did not dare to break it. Therefore, instead of being placed into the grave, the bow was put in the cellar, where [it] was found by the pupils…"*.

Ala Kyrsyn was a real historical person, a hero of oral legends and stories of the Vilyuy Yakuts. His son, Byulyusyut Kyrsynov, was mentioned among other persons in the Russian records of the 17th century, in connection with the case of Baltuga Timireev, a leader of Yakut rebellion against the tax collectors in 1675–1676 (Petrov, 2017: 99). Ala Kyrsyn was a son of a Tumat woman called Dzhaardaakh (in other versions – Dzhaarkhan), a foremother of the Vilyuy Yakuts, and a Kangalass toyon called Munnyan, a father of the Yakut "king" Tygyn (in other versions – Tygyn himself) (Ksenofontov, 1977: 206; 1992: 67–68).

How did the bow emerge in the school of Kutana? In 1936, a museum of local lore was established in the village of Kutana. It was founded by the teacher and local lore expert N.I. Ivanov. With a group of pupils, he carried out many trips all over the region in search of exhibits for the museum. Ivanov was a friend of G.I. Bessonov's; and quite likely, at the opening ceremony of Toybokhoy museum, he presented the discovered bow to him as a gift.

The Toybokhoy reflex composite bow is similar in its shape to Central Asian bows. Its distinctive features are four long bone plates at the edges, eight horn and bone frontal plates, and four bone end-plates with bow-string notches (Fig. 2). The bow's tips and the area near the grip are wrapped with birch-bark, and the outward surface of the core limbs is glued over with birch-bark.

*R.I. Bravina's personal archive.

In order to specify the shapes and lengths of the plates, as well as to identify any damage and other peculiarities of the elements*, X-ray and tomographic images of the bow in various positions were made. Special studies were aimed at identifying the bow's materials and its time of manufacture (radiocarbon dating).

The bow was found unstrung, with the bowstring missing; the bow-ends were directed forwards (away from the archer), similarly to other reflex bows of this type with the reverse curvature of the core in the unstrung position (Ermolov, 1987: 151). Such bows are also designated as recurve (Apresov, 2008). The "bone" coat on one of the bow's limbs was damaged, possibly intentionally; in the damaged area, part of the edging was missing, horn and bone plates and edging had become partially unglued from the wooden base, and the bow's limbs had become asymmetrical. On the other limb, close to the bow's end, there was more damage, resulting in an unstuck bone plate and broken bone edging.

The distance between the bow's ends is 121 cm; however, with the unstuck elements fixed to each other and to the base, this distance is about 126 cm. The bow's core is 151 cm long along the outside and 146 cm along the inside (facing the archer). The exact length of the bow when strung is unknown. The width of the bow's limbs (in the operating position) is 3.5–3.6 cm, thickness (in the position "the bow lying on its side") 1.6–1.7 cm; the grip is 1.9–2.0 cm wide and 2.9 cm thick; the base of the bow-ends is 2.9 cm wide and 1.9–2.1 cm thick, the narrow ends of the bow tips are 1.0–1.2 cm wide and 1.9–2.0 cm thick. Narrow wooden planks, elongated-triangular in shape, are stuck to the bow-ends from the inside; they are 9.2 and 7.2 cm long and 1.0 and 0.8 cm wide, respectively. These planks form steps of a sort, which probably served as supports for the string knots. In this area, the bow-ends are 2.6 cm thick each.

The bow's core was made of two sorts of wood, most likely larch and birch. Both wooden layers near the central plate, where both layers are visible, are 0.8–0.9 cm thick. The tomographic image clearly shows the two layers: one is dark, and the other is light, which indicates their different density (Fig. 3). The birch plank is shorter than the larch one; it is thin at the bow's ends. In the upper part of the bow, the birch plank is spaced 8.3 cm from the end tips, in the lower part 10 cm. Judging by the CT image, the birch and larch planks are solid; they are glued together and fixed to one another with a wooden dowel fastened in the larch plank.

The bow's ends are rigid and straight, each is covered with two bone end-plates with string notches at the narrow faces; the plates are stuck to the larch base of the bow; the ends of the larch base are perpendicular to the plane of the limb, as in a propeller. The plates on the lower end of the bow are 14.9 and 15.2 cm long and 0.6–1.6 cm wide; the plates on the upper end of the bow are of the same length of 15.3 cm and 0.8–1.7 cm wide. It is visible on the image that the left upper plate is broken in the middle into two fragments 6.9 and 8.5 cm long; in the middle of its outer edge, there is a notch about 3 cm long and up to 0.4 cm deep (Fig. 4). The plates on the narrow faces, close to the string notches, are about 0.3 cm thick. The plates are identical to the end-inserts of the Yakut bows of the Northern type reported from the sites of the Kulun-Atakh culture of the 14th–16th centuries and the Yakut culture of the 17th–19th centuries (Gogolev, 1990: 135, 141, 142, pl. X, *10*; XVI, *7*; XX, *10*). On the Toybokhoy bow, the bone end-plates were wrapped over with sinews, and then carefully in a spiral with the birch-bark band. The birch-bark winding on the upper bow end is 20.5 cm long; that on the lower one is 17.5 cm long. There is birch-bark binding on the bow's grip too; this served to cover the joints between the medial

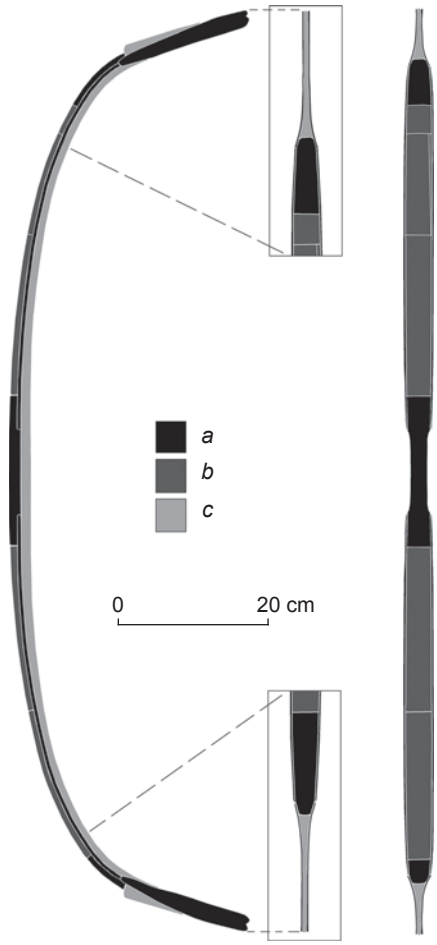

Fig. 2. Diagram of bow construction.
a – bone; *b* – horn; *c* – wood.

*Analyses were carried out in the Suntar Central Regional Hospital and in the X-ray Computer Tomography Department of the Republic Hospital No. 2. Scanning was executed with the CT Toshiba Aquilion 64.

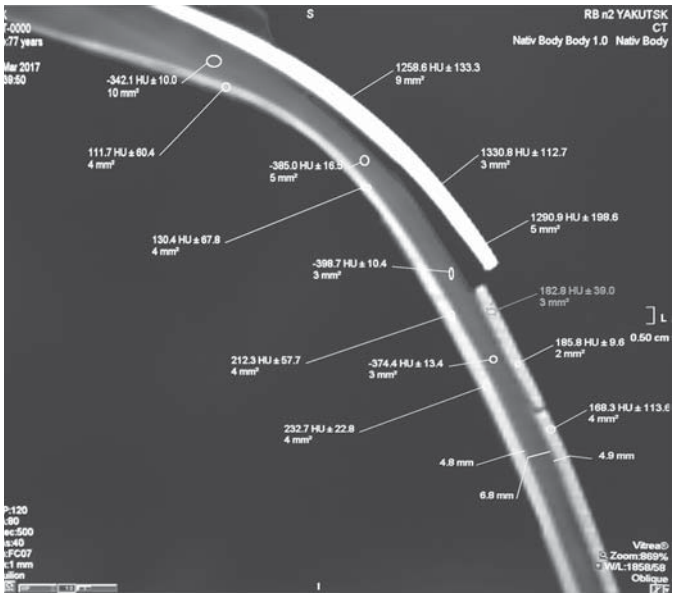

Fig. 3. CT image of the bow-fragment.

Fig. 4. X-ray images of the bow-ends.

and limb-plates. Because one of the limbs is split, the birch binding is probably preserved only partially. The preserved part is 16.3 cm long.

The inward surface of the bow was tightly glued over with horn and bone frontal plates of various shapes and sizes. In total, there are eight frontal plates, one of which is composed of two parts (see Fig. 2). The rigid bone plates are fixed on the grip and bow-ends, the flexible horn plates are on the limbs.

Subrectangular bone plates with curved profiles are glued over both the curved ends, close to the main core of the bow. The upper plate is longer than the lower one; it is narrowed wedge-like in front and side views. The plate is 17.5 cm long on the straight, and 18.5 cm long in an arc. The plate's width is 2.3 cm at the base; 2.1 cm in the middle, at the place where narrowing starts; 0.4 cm at the narrow end; and its thickness varies in the range of 0.1–0.5 cm. The lower plate is shorter and does not show wedge-like narrowing in the side view. It is 9.6 cm long on the straight, 9.8 cm long in an arc; its width is 1.8–2.5 cm; thickness is 0.4–0.6 cm.

The medial frontal plate, semi-oval in cross-section, has widening paddle-shaped ends (Fig. 5). It is made of bone. The plate is 17.3 cm long, 1.7 cm wide in the middle, and 2.3 cm wide at the ends. Narrowing in its medial part starts 3.3 cm from both plate-ends. The plate is 1 cm thick in the medial part, and 0.7 cm thick at the ends.

All the limb-plates were made of cow horn (Fig. 6). In bows of this type, such plates secured elasticity of compression. Three plates (one of which is composite) are glued over one of the limbs; two long plates are on the other. The shortest plate, fixed close to the bow end, is 4.1 cm long and 2.6–2.8 cm wide. The plate in the middle of the limb is 16.1 cm long and 2.8–2.9 cm wide. This plate consists of two parts closely fitted to one another. One of these parts is narrow, 0.05–0.4 cm wide; it is attached to the main plate of 2.4–2.85 cm wide. The third limb-plate, fixed close to the bow's grip, is 20.8 cm long and 2.2–2.9 cm wide. A sample 1.2 cm long was cut off this plate for the radiocarbon analysis.

The plate fixed close to the grip on the opposite limb is 21.5 cm long and 2.5–2.9 cm wide; the second plate located close to the bow end is 18.5 cm long and 1.6 (2.4)–2.9 cm wide. One edge of this plate is damaged, and one of the corners is missing. The tomographic images show that the limb-plates were 0.3–0.7 cm thick and had D-shaped cross-sections.

The plates are fixed to the wooden base with thick fibrous glue; glue remains are visible in the area where the curved plate partially unglued from the bow core (Fig. 7). The glue's fibers are dark gray, almost black. According to the available literary sources, the glue was made of the air-bladders of sturgeon or other fish (see, e.g., (Vasiliev, 1995: 69)), but its manufacturing technology is not known for certain.

The outer surface of the bow core is covered with sheets of birch-bark with a double-line motif carved lengthwise (Fig. 8). In the area close to the grip, the motif also shows four slanting dashes connecting the long lines; 15 such slanting dashes are visible on both sides of the bow core. The other bow-limb shows two more lines (the birch-bark is damaged here). In the top part of the core, near the bow end, a piece of reddish birch-bark 10.9 cm long is glued over; further, closer to the grip, there is a piece of yellowish-white birch-bark 35 cm long; in the area from the grip to the lower

Fig. 5. X-ray image of the middle frontal plate.

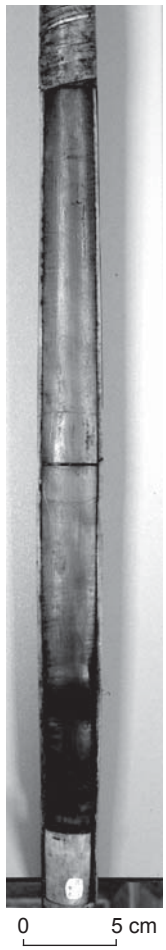

Fig. 6. Horn limb-plates.

Fig. 7. Traces of gluing agent in the area of the bone-plate exfoliation from the wooden core.

Fig. 8. Birch-bark cover on the bow.

bow-end, a piece of yellowish birch-bark 31.1 cm long; and immediately near the bow-end, a piece of birch-bark of ocher-reddish color 11.6 cm long.

The well-polished edgings made of long bones ca 0.4–0.7 cm wide were attached to the lateral bow-surface, in the area from the narrowing part of the medial paddle-shaped plate to the bow-ends, directly against the end side-plates. These plates were apparently decorative. The joining areas of horn edging-plates show fractures and breakages; one fragment is missing. The edging-plates of the lower limb are 51.2 and 51.4 cm long; the intact edging-plate of the upper limb is 53.7 cm long. The complete parallels of such bows with bone edging-plates are not known to the present authors.

Discussion of results

Available museum exhibits and archaeological materials indicate that the Yakut composite bows of the Northern type were most often made of wood. Bone and horn were sometimes used in manufacturing end-inserts, with the string notch on the cut end of the plate rather than on the side. Such inserts were put into the splits on the bow-ends, and tightly wrapped around with sinews and birch-bark (Okladnikov, 1955: 285; Konstantinov, 1971: 112; Gogolev, 1990: 101, 135, 141, 142, 155, pl. X, *10*; XVI, *7*; XVII, *10*; XXX, *3*; Vasiliev, 1995: 63, 67, pl. 2, *6*). The details were glued together with isinglass, additionally wrapped around with sinews, and then with birch-bark to protect the bow from moisture and other external impacts. The distinct feature of the Yakut composite bows is that the inward (facing the archer) bow-plank is normally made of larch; while the outward plank is made of birch. It is believed that larch has the highest compressive strength, while birch has the highest tensile and tearing strength coefficient. The inward (larch) part was composed of several plates. In some cases, the outward (birch) detail was also made composite, to increase the elastic limit of the bow (Strelov, 1927: 66–67). The larch planks were cut

only of heartwood of proper age, growing in the proper place (Vasiliev, 1995: 63).

The folklore sources hold that prior to the arrival of Russians in Yakutia in the 17th century, Yakuts used combat bows of the Yakut type, with reinforcing bone plates. The Yakut epic poem Olonkho describes a "rattling bone bow" (Ibid.: 64–65). The Yakut bone bows are also mentioned in various written sources of the 17th century (see, e.g., (Ivanov, 1966: 70)). The records dating to 1672–1673 report the "Yakut bow for shooting", which was distinct from the Tungus bow (see (Tokarev, 1945: 82)).

According to information from Northern Yakuts, in older times, there were various techniques of shooting with the composite bows. With the Russian intrusion, weapons, including bone bows, were no longer produced; over time, the technology of bow-manufacture was lost (Yakut Scientific Center SB RAS. F. 4, Inv. 12, Item 41, fol. 226).

Probably, it was the harsh climate that forced the Yakuts to abandon the manufacture of Central Asian-type bows. At temperatures of –50 to –40 °C, the elasticity of sinews and horn decreased, and the bow was getting too tight (possibly because of that, the Yakuts waged war only in the fall). The Yakut ancestors that had arrived in the Lena Territory borrowed their bow construction from the local tribes. There is information that bows of both types were used in the late medieval period by a single population group in the Middle Yenisey (Skobelev, Mitko, 2001).

In 1939, the ethnographer A.A. Savvin recorded interviews with the Verkhoyansk residents; they narrated that in former times, additional horn plate was stuck to the bow's back (Yakut Scientific Center SB RAS. F. 4, Inv. 12, Item 3, fol. 36). His field records from 1940 contain sketches of bows resembling the Central Asian ones in the curvature of the bow's core. One of the bows belonged to a forefather of I.N. Nikulin, a resident of the Abyisky District. His ancestor Khobolookh arrived in the Upper Yana River from Central Yakutia during the Kyrgys period (the legendary time of military conflicts between the Yakut tribes in the 14th to 16th centuries). According to the legend, this person was a warrior and wore an armor *kuyakh*, which he sank in the forest lake. Savvin described the bow as follows: on the bow's limbs, in the area of contact of the string and the wood, patches of one-finger thick and two-finger wide cow skin (*dapsy*) were glued, in order to soften the strong impact of the string over the bow's core upon shooting. The string was made from a horse skin, which was not soaked, but coated with warm blood, twisted, and dried. From outside, the bow was wrapped around with the horse's spinal tendons, because it was believed that they did not harden at low temperatures. Then, to protect the bow from moisture, a layer of birch-bark was glued over the bow. The isinglass was boiled from a sturgeon's air-bladder. A bow of this type had a great striking force. I.N. Nikulin's elder brother broke an elk femur with an arrow shot from this bow (Ibid.: Item 41, fol. 223–224).

The evidence of the use of such bows in Yakutia was obtained in 2013, when the Sergelyakh burial of a warrior, dating to the mid-15th to early 16th century, was discovered, yielding horse harness items, a *palma* spear-head, and iron arrowheads, as well as four bone plates from a composite bow of the Central Asian type (Bravina et al., 2016). The middle plate with widening paddle-shaped ends of such bows is composite. The reverse sides of the plates show lengthwise grooves securing strong gluing on the wooden core. The obverse side is ground with a rather hard abrader leaving slanting scratches. The total length of both plates is 23.2 cm, the longer plate is 17.2 cm, the shorter is 6 cm long. The width in the middle is 2 cm, and at the ends 3.5 cm. The middle part of the plate is 0.7 cm thick.

One of the bone limb-plates is subrectangular, slightly widening to the ends, with a slightly convex cross-section. Its obverse side shows slanting scratches. The reverse side bears numerous lengthwise grooves, securing strong gluing on the wooden core. The plate is 7.8 cm long and 3.4–3.7 cm wide (Ibid.). The other bone limb-plate (?) is made of the rib of a large mammal. In fact, it is a rib-fragment fractured at two points. The edges are uneven and unworked. The plate is 7.8 cm long and 3.4 cm wide (Ibid.). This artifact is probably not a part of the bow, but it was located close to the two other plates, and its size was the same as that of the limb-plate described above.

The finds from the Sergelyakh burial are the first archaeological items attesting to the existence in Yakutia of composite bows of the Central Asian type along with the Northern type bows. The composite bows with plates similar to those of Sergelyakh were widespread among the nomads of Central Asia and Siberia from the late antiquity to early medieval period (Hudiakov, 1991: 25–27, 51, 99–104; 1997: 28–29, 60–64, 79–80, 121–123; Klyashtorny, Savinov, 2005: 187; and others). Such bows were used by the Ust-Talkino culture people in the Southern Angara region and the Upper Lena region in the 12th to 14th centuries; this population is considered to be ancestral to the Yakuts (Nikolaev, 2004: 82, 160).

It is difficult to assess the effectiveness and fighting qualities of the Toybokhoy bows; but there is information concerning the Mongolian bows of the same origin and similar construction. The draw weight of Mongolian bows ranged from 46 to 75 kg, which was higher than that of the English, Hungarian, or Chinese bows with a draw of 32–46 kg. The Mongolian one had great power, which could be increased by means of additional bone plates on the bow's limbs. Furthermore, the Mongolian bow was distinguished by its greater flexibility; its string could be drawn further, and produced a greater impulse on the arrow (Nefedov, 2010: 141–142). Reflex bows had

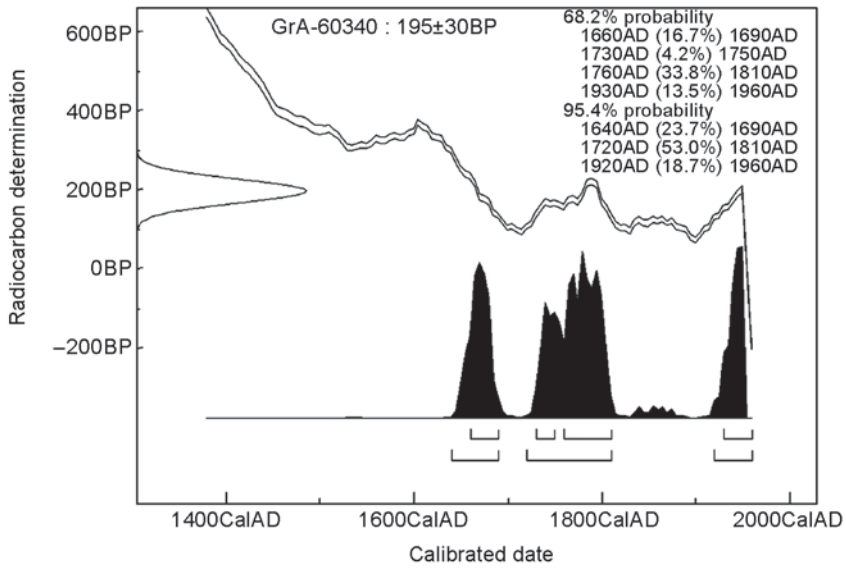

Fig. 9. Results of radiocarbon dating.

pre-tension even unstrung; therefore, these bows resisted tension from the very first millimeters, forming a high and relatively flat (with even force) dynamic curve. This quality, along with elasticity of the horn plates, ensured high accuracy and long range (Apresov, 2008).

The AMS radiocarbon date of 195 ± 30 years BP (GrA-60340) was obtained from a sample of the horn plate of the Toybokhoy bow at the Center for Isotope Research of the University of Groningen (Netherlands). The calibrated date (±2σ, probability 95.4 %)* falls in the range of 1640–1960; the diagram (Fig. 9) shows three peaks within this interval: 1640–1690 (23.7 %); 1720–1810 (53 %); and 1920–1960 (18.7 %). Given that the bow was passed from the first owner to his heirs (from generation to generation), the most likely time the bow was manufactured can be considered the period of 1640–1690. The two other peaks possibly indicate later contaminations of the sample with extraneous organics. Thus, the calibration of the radiocarbon date shows that the bow was manufactured most likely in the mid-17th century. This agrees with the legend that it belonged to Ala Kyrsyn, a brother of the Yakut ruler Tygyn Darkhan.

Conclusions

The Yakut traditional material and spiritual culture was formed in the late medieval period along with the formation of the Yakut ethnic group in Central Yakutia on the basis of intermixture with the cultures of local and foreign ethnic groups. The ethnocultural relations between the ancestors of the Yakuts and the Turko-Mongolic tribes from the Great Steppe are confirmed by both folklore data and the results of archaeological, anthropological, ethnological, and linguistic studies. In the process of adaptation to the harsh climatic conditions of the Lena Territory, the newcomers continued the practice of their pastoral culture and extended the Turkic culture of their southern ancestors far to the north. The Yakuts borrowed many components of the material culture from indigenous tribes. These included hunting tools and weaponry, such as bows of the Northern type, which proved their effectiveness in the Arctic and Sub-Arctic zones, and were used by the local tribes throughout the centuries (Simchenko, 1976). However, the late medieval Yakuts also used other types of weapons, inherited from their steppe ancestors. The composite bows from the Toybokhoy Museum and Sergelyakh burial attest to the fact that the Yakuts used reflex composite bows of the Central Asian type alongside the widespread northern type bows.

*Calibration was carried out using the OxCal 3.10 program, developed at Oxford University (Great Britain).

Acknowledgements

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