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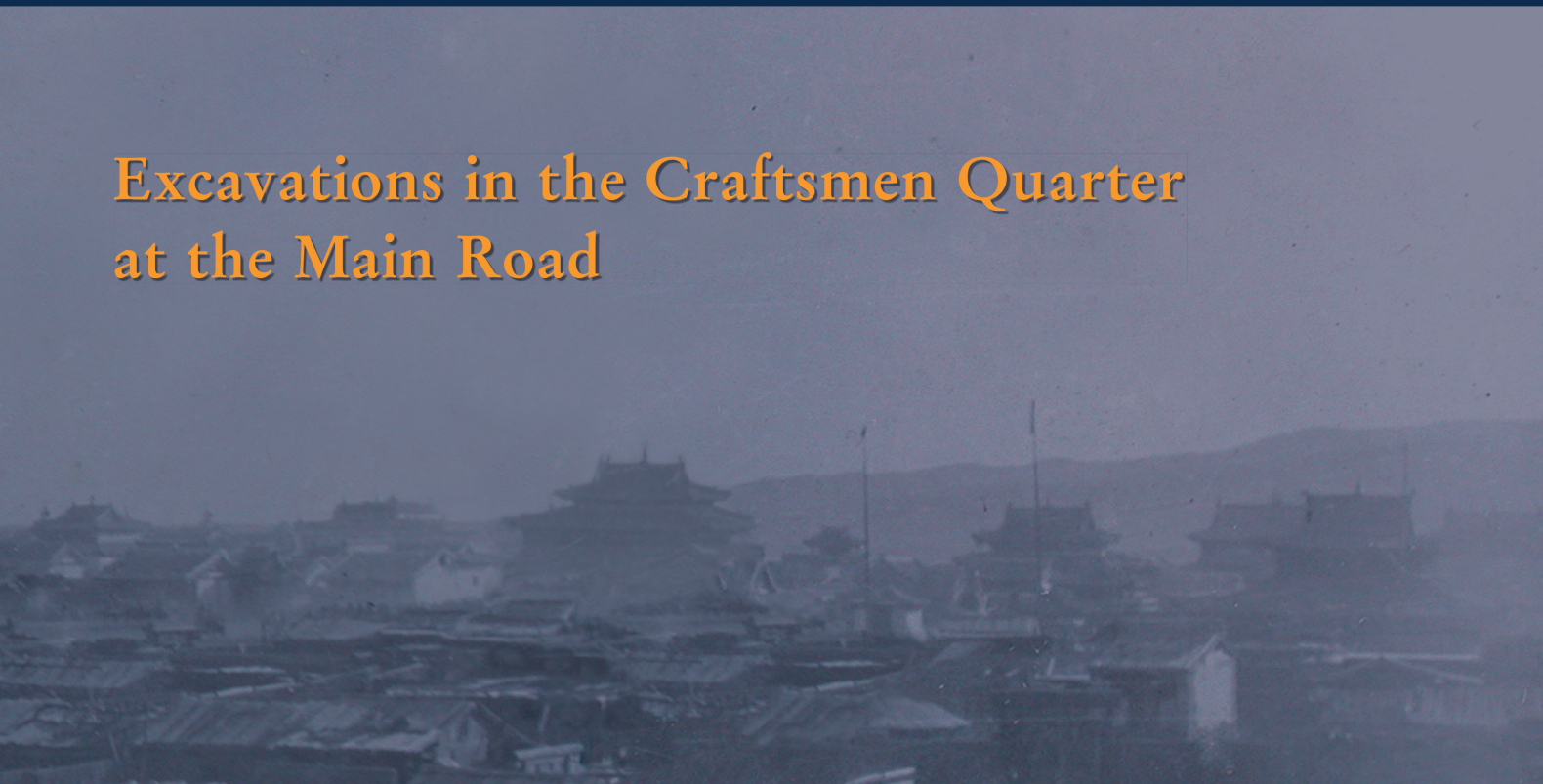
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MONGOLIAN - GERMAN KARAKORUM EXPEDITION

VOLUME 1

Excavations in the Craftsmen Quarter
at the Main Road



edited by
Jan Bemann, Ulambayar Erdenebat, & Ernst Pohl



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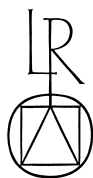
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Contents

Preface	7
1. W. SCHWANGHART, S. MÖLLER, B. SCHÜTT, Environmental Characteristics of the Upper and Middle Orkhon Valley, Mongolia	14
2. E. BECKER, Die sowjetisch-mongolischen Ausgrabungen von 1948/49	27
3. I. ELIKHINA, The Most Interesting Artefacts from Karakorum in the Collection of The State Hermitage Museum, St. Petersburg	39
4. U. ERDENEBAT, M. JANSSEN-KIM, E. POHL, Two Ceramic Deposits from the Territory of Karakorum	49
5. E. POHL, The Excavations in the Craftsmen-Quarter of Karakorum (KAR-2) between 2000 and 2005 – Stratigraphy and Architecture	63
6. E. POHL, KAR-2, Catalogue of Artefacts I: Processed Bones (with Faunal Analysis by A. von den Driesch and J. Peters)	137
7. E. POHL, KAR-2, Catalogue of Artefacts II: Spindle Whorls and other Clay Objects	165
8. G. NOMGUUNSÜREN, Preliminary Study of Cart Wheel-Bushings from Karakorum, Mongolia	173
9. CHR. LEE, Human Skeletal Remains from the Excavations in the Craftsmen-Quarter of Karakorum (KAR-2)	213
10. M. RÖSCH, E. FISCHER, T. MÄRKLE, B. OYUNTUYA, Medieval Plant Remains from Karakorum, Mongolia	219
11. A. VON DEN DRIESCH, J. PETERS, L. DELGERMAA, Animal Economy in the Ancient Mongolian Town of Karakorum. Preliminary Report on the Faunal Remains	251
12. K. KELM, Chemical Investigations on some Archaeological Findings from Karakorum	271
13. D. BAYAR, V. E. VOITOV, Excavation in the Islamic Cemetery of Karakorum	289
14. J. BEMMANN, E. POHL, B. SCHÜTT, W. SCHWANGHART, Archaeological Findings in the Upper and Middle Orkhon Valley and their Geographical Setup	307
15. U. B. BARKMANN, Die Geschichte des Klosters Erdeni Joo oder das Prinzip der Verflechtung von Staat und Religion	321
Supplements	

Gonchigsüren Nomguunsüren

Preliminary Study of Cart Wheel-Bushings from Karakorum, Mongolia

INTRODUCTION

Certain artefact categories within Central Asian archaeology are in need of classification and clarification. This article will address the issue of the Medieval Mongolian cart. The reason lies in the absence of a reliable list of information about primary documentary evidence, eg. on such artefact as wheel-bushing. Therefore, the author decided to make a list of all reported documents on the definitions of cart wheel-bushing and its preliminary typological classification, mostly based on the archaeological finds from the Karakorum excavations and other archaeological sites. Also, using petroglyphs and other recorded information about the carts of the Medieval Mongols, some related problems such as workshops for the casting of wheel-bushings and their forms, dimensions, sizes as well as their chemical composition and chronology will be discussed.

Between 1999 and 2005 the Mongolian-German Karakorum Expedition (MDKE) investigated the central area of Karakorum (KAR 2) and recovered numerous artefacts. At present we have registered 166 wheel-bushings of various shapes and different sizes. Based on historical sources and archaeological findings it has become quite evident that Medieval Mongolians used the cart widely for their daily needs. One category of evidence is cart wheel-bushings which are often reported from excavations of the ruins of early and Medieval settlements, graves and shrines in the territory of Mongolia. The discovery of so many finds represents a significant technological development, but up to now no research has completely documented the character of this development. This study therefore will (a) provide a complete list of wheel-bushings found so far, (b) produce a

clear classification of them, (c) explain their material composition, and (d) show how cart weight capacities can be calculated on the basis of these wheel-bushings.

While the main focus remains on the wheel-bushings found at Karakorum and the explanation of Medieval Mongolian carts, this study was expanded to include wheel-bushings from all periods and from collections of previously excavated material at the Archaeological Institute of the Academy of Sciences of Mongolia and Mongolian Archaeological Museum, Mongolian National History Museum, Mongolian Military History Museum and the Bogd Khaan's Palace Museum, Ulaanbaatar.

SOME EXPLANATORY NOTES ON THIS RESEARCH SUBJECT FROM MONGOLIAN DICTIONARIES

As explained in the "Explanatory Dictionary of Mongolian" the word "tsöng" "Tsöng bol tereḡnij gold khamyālahk behelgeē bolyon khijkh tömörlög züjl" ("a metal lining for a round hole of the wheel-hub, in which an axle revolves") (Tsevel 1966: 795). The wheel-bushing originated as a kind of separation sleeve between the hub and axle. The cart's speed, loading capacity and durability were significantly improved. This led to progress in cart construction development, on the whole (Fig. 1).

DEFINITION OF WHEEL-BUSHINGS AND HISTORY OF RESEARCH

Based on twelve findings from Rashaan Ders ruins in Delgerkhaan sum of Khentii aimag, in 1959 Kh. Perlee (1959: 26–29) first put forward the hypothesis that these circular artefacts

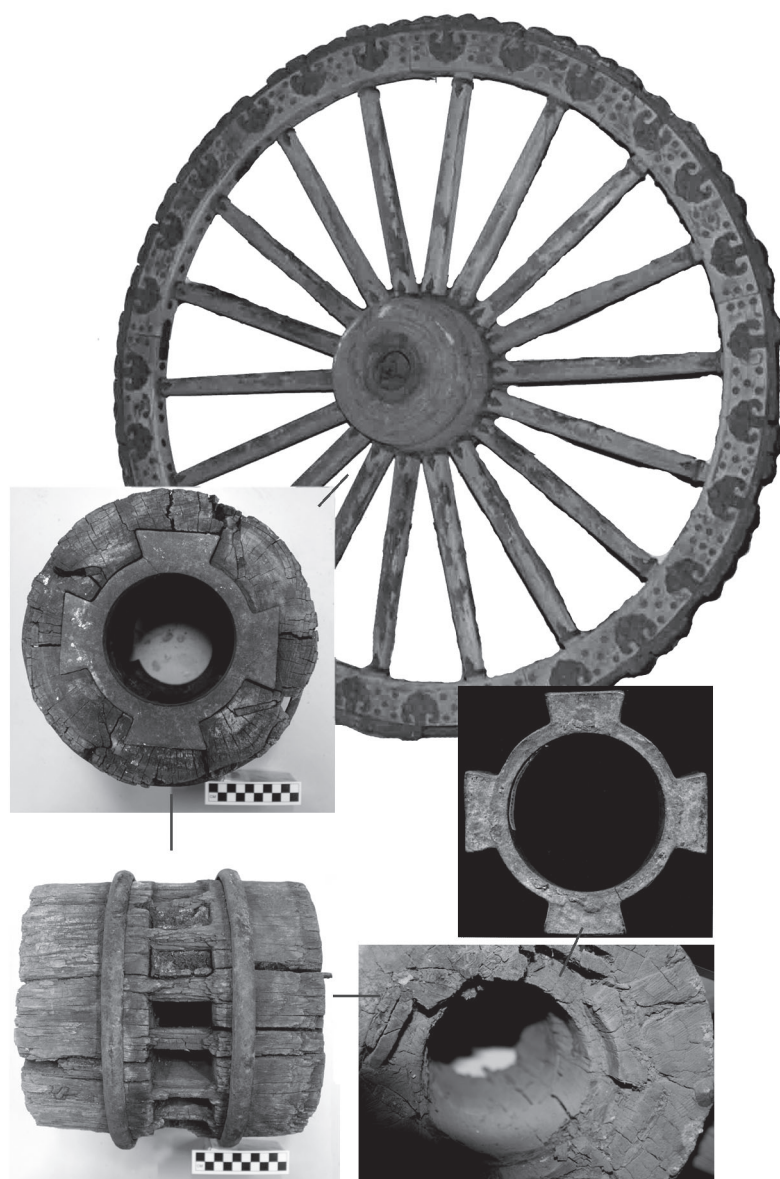


Fig. 1. Position of an iron wheel bushing within a wooden cart-wheel.

might be remains of wheel-bushings of the so-called ger-cart. In 1965, S. V. Kiselev and N. Ia. Merpert (Kiselev et al. 1965: 188–215) mentioned that during their archaeological fieldwork of 1948–1949 numerous cast iron wheel-bushings occurred in the ruins of Karakorum. Later, two wheel-bushings from Rashaan Ders were examined to establish their chemical composition, and a cart loading capacity formula was calculated through the friction traces on the items (Tömörbaatar / Bold 1969: 26). Then N. N. Terekhova (1974: 69–77) investigated the composition of the wheel-bushings found at Karakorum. After this Perlee (1982: 46) updated the issue and presented a

classification of twelve wheel-bushings found at Rashaan Ders, Takhilyn us, and Chingissiin togoo, dividing them into four types according to size. Twenty years later, on the basis of a wheel-bushing unearthed at Avarga ruins in Khentii aimag, Masami Osawa (2005: 45–49) produced a report focussing on the chemical composition of wheel-bushings. In that same year, Ch. Amartüvshin, G. Eregzen and J. Park (2005: 128–143) focussed on the methodological analysis of bushing findings within a subsequent examination on site. These were excavated at Chin Tolgoi ruins and Ulaan Kherem in Bulgan aimag.

REVIEW OF ARCHAEOLOGICAL EVIDENCE FROM EXPEDITION REPORTS

Numerous artefacts relating to carts have occurred at settlement ruins and cemeteries, yet all too often the research reports on these archaeological excavations in Mongolia mention them only briefly and provide at best a few scant facts. I will try to synthesize the available information in the following account of the finds so far. At Noyon uul, several tombs of Xiongnu noblemen yielded the fragmentary remains of carts, some of which had a unique lacquered paint (Dorzhsüren 1961). At Noyon uul in 1925, S. A. Kondratiev's field team recovered 25 graves and found two cart wheels and from 23 graves several cart pieces (Dorzhsüren 1961). At Karakorum, in 140 small trenches dug by D. D. Bukinich in 1933–1934 further wheel bushings were discovered (Bukinich 1934; Kiselev et al. 1965: 123–137).

In 1948–1949 the Mongol-Soviet historical and ethnographic research team led by S. V. Kiselev recovered numerous bushings at the Karakorum ruins (Kiselev et al. 1965: 188–215). In 1951, the best known and biggest wheel-bushing emerged from the ruins of Takhilyn us in Deren sum of Dundgovi aimag. The reported dimensions are as follows: diameter 34.5–40 cm, width 7.5–8 cm, depth 4.3–6 cm (Perlee 1954: 26–29). Since 1954, Ts. Dorzhsüren has been specializing in Xiongnu studies. In 1954–1957 excavations were made at Noyon uul, in Batsumber sum of Töv aimag where the grave of Xiongnu nobleman and 15 other graves were recovered. Graves No. 13 and 15 yielded cart wheels (Perlee 1959: 24–29). In 1955 a research team led by Ts. Dorzhsüren recovered fragments of lacquered remains of a cart from the noblemen's burial site at Sujigt place of Noyon uul. The wheel rim width was 6 cm (Dorzhsüren 1957: 99–118). During 1976–1985 the expeditions of the Institute of History continued fieldworks at Karakorum ruins and discovered a few wheel bushings. Between 1994 and 1999, excavations were conducted by a joint Mongol-French expedition in the territory of Khutug Undur sum of Bulgan aimag. Among various artefacts, two pieces of the birch bark cover with depictions of the cart with twelve spoke wheels were recovered from the burial site 79 (Törbat 2004: 92). During 1998–2005, a Mongol-French field team excavated graves in Khairkhan sum of Arkhangai aimag. In 2001, cast iron segments of a cart wheel as well as its hub were found on site 1

(Mongolie 2003: 130–131). Wheel bushing parts were also found amongst them. The grave was dated 20–50 A.D. (Erööl-Erdene / Desroches 2003). Between 2000 and 2003, a Mongol-Turkish joint expedition conducted research in the sacral complex at Khöshöö Tsaidam, Khashaat sum of Arkhangai aimag. Here a few wheel-bushings were found (Bayar 2001: 38). In 2004, a Mongol-Russian joint expedition excavated graves in Dashinchilen sum of Bulgan aimag, where wheel-bushings were found (Ochir et al. 2005: 104). In 2004, a Mongol-Russian joint expedition excavated ruins relating to the Kitan ages in Zaamar sum of Töv aimag, and found some wheel-bushings (Ochir / Enkhtör 2004: 21). Between 1999 and 2005 the Mongolian-German Karakorum-Expedition (MDKE) excavated ruins of trader's and master's living quarters and discovered 166 cart wheel-bushings. In 2005, a Mongolian-Japanese joint expedition conducted excavations at the Avarga ruins in Khentii aimag. Iron items came to light and among them cast iron bushings (Osawa 2005: 32). In 2006, a joint Mongolian-Russian project "The archaeological studies of burials at Noin-ula" excavated Sujigt place of Noyon uul on the territory of Töv aimag. The 13 m deep grave yielded two wheels and broken pieces of bushings (Tseveendorzh et al. 2006: 48). In the same year, the Mongolian-Chinese joint expedition reported a surface find of wheel-bushings in the territory of Tüvshinshiree sum of Sükhbaatar aimag (Ochir et al. 2005: 36).

We presented a short history of collecting cart wheel-bushings in the territory of Mongolia. Information related to finds which occurred in ruins such as Gua Dov in Töv aimag, Bars I in Dornod aimag, Züün Kherem in Khentii aimag as well as the one in Bayankhongor aimag are still missing.

CLASSIFICATION OF WHEEL-BUSHINGS

In her study of cast iron technology of wheel-bushings recovered from Karakorum, N. N. Terekhova presented the first classification of early wheel-bushings found in Mongolia. She divided them into three types: "shestigrannyi" (hexagonal), "v vide zvezdi" (star-shaped), and "krugliye so shipami" (round with tenon) – though reservations regarding her terminology have been expressed (Terekhova 1974: 71). Later, Perlee (1982: 46) suggested a classification according to size into four types: "very small", "small", "medium" and "large". During

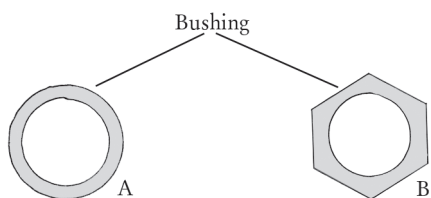


Fig. 2. Main classification of wheel bushing. A: circular, B: angular.

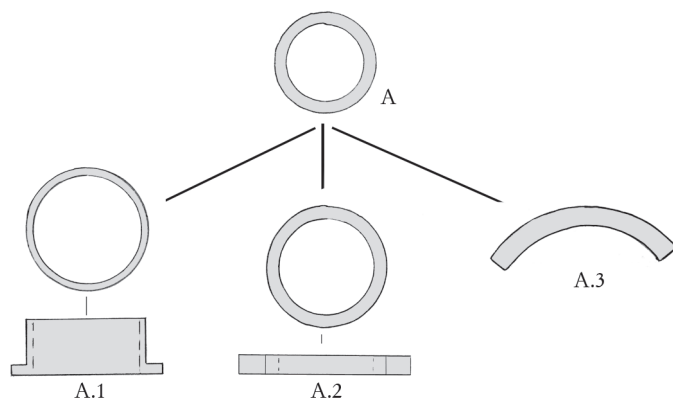


Fig. 3. Circular wheel-bushing with flat or half tenons (Type A.1), complete tenons (Type A.2) and with incomplete ring (Type A.3).

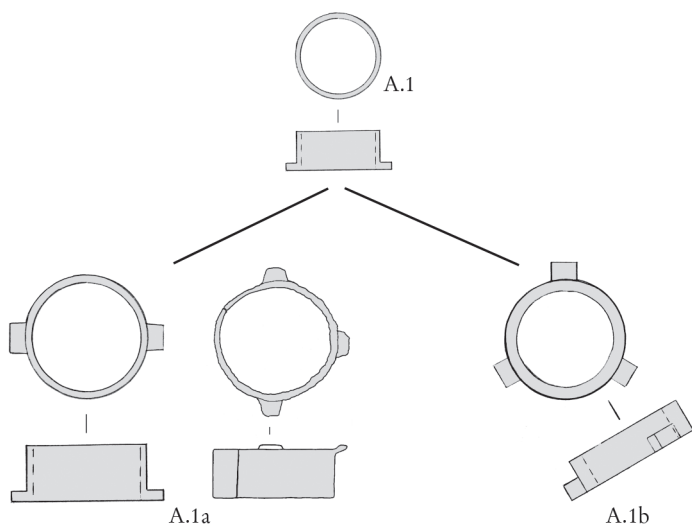


Fig. 4. Circular wheel bushing with flat tenons (Type A.1a) and half tenons (Type A.1b).

our cataloguing of all preserved and/or documented wheel-bushings, it became evident that wheel-bushings fall into at least two main types, differentiated in terms of form and details.

One of the most definitive criteria of the wheel-bushing is a round solid. Consequently, we created the following bipartite classification. Two different groups can be specified on the basis of the general shape of the wheel-bushing: (A) Circular and (B) angular (Fig. 2).

Group A: Circular bushings

Bushings of this group can be subclassified into two main different types (Fig. 3).

Type A.1: Wheel-bushings with flat or half tenons

The wheel-bushings from Type A.1 can be divided into two different variants (Fig. 4).

Variant A.1a has a cylindrical section with two or three flat tenons of semicircular or trapezoid form. This variant dates from the Xiongnu-period (3rd century B.C.–1st century A.D.; cf. cat.-no. 1–10).

Variant A.1b has a cylindrical section with three half tenons of rectangular form. This variant dates from the Medieval period (13th–14th century A.D.; cf. cat.-no. 11).

Type A.2: Wheel-bushings with complete tenons

The wheel-bushings from Type A.2 can be divided into two main variants based on the section of the ring: (a) cylindrical and (b) conical (Fig. 5).

Based on the shape of the tenons both fall into several sub-variants (Fig. 6 and 7).

Variant A.2a-a has vertical semicircular tenons. This sub-variant dates from the Xiongnu-period (3rd century B.C.–1st century A.D.; cf. cat.-no. 12).

Variant A.2a-b has two horizontal semicircular tenons. This sub-variant dates from the Medieval period (13th–14th century A.D.; cf. cat.-no. 13).

Variant A.2a-c has five rectangular or trapezoid tenons. This sub-variant dates from the Early Medieval period (7th–8th century A.D.; cf. cat.-no. 14).

Variant A.2a-d has six smaller trapezoid tenons. This sub-variant dates from the Medieval period and later (13th–20th century A.D.; cf. cat.-no. 15–86).

Variant A.2a-e has two or four larger trapezoid tenons. This sub-variant dates from the Medieval period and later (13th–20th century A.D.; cf. cat.-no. 87–103).

Variant A.2b-a has five or six horizontal semicircular tenons. This sub-variant dated from the Medieval period (13th–14th century A.D.; cf. cat.-no. 104–108).

Variant A.2b-b has five smaller trapezoid tenons. This sub-variant dates from the Medieval period (13th–14th century A.D.; cf. cat.-no. 109–145).

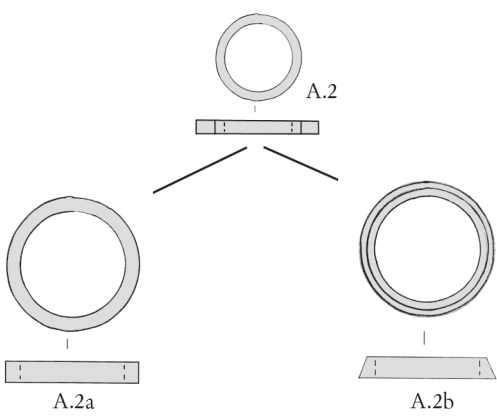


Fig. 5. Circular wheel bushing with complete tenons and rectangular section (Type A.2a) and conical section (Type A.2b).

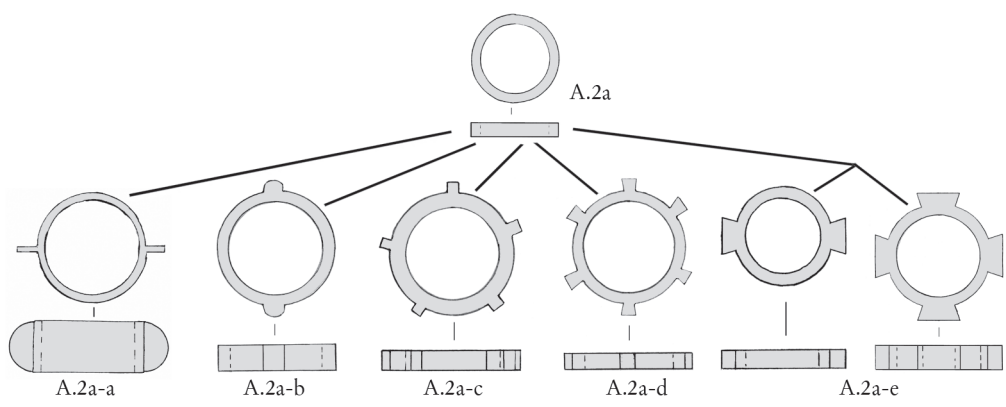


Fig. 6. Sub-variants of circular wheel bushing with complete tenons and rectangular section.

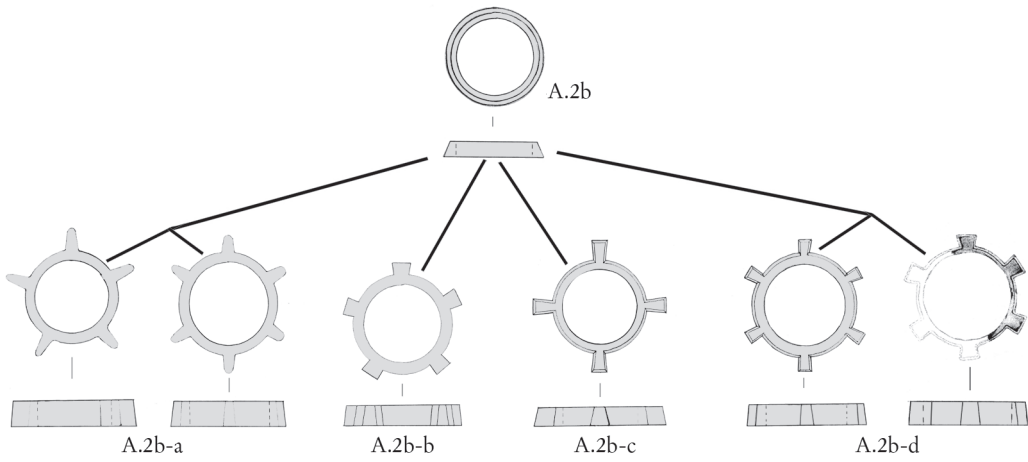


Fig. 7. Sub-variants of circular wheel bushing with complete tenons and conical section.

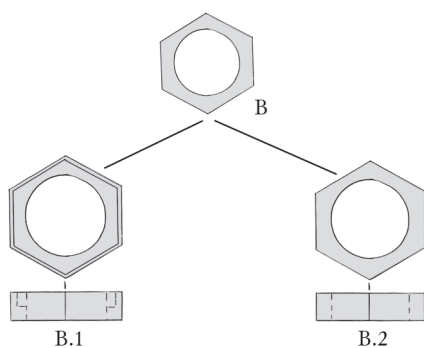


Fig. 8. Angular wheel bushing with grooved ring (Type B.1) and with full ring (Type B.2).

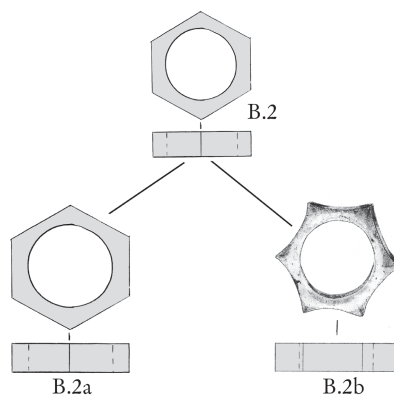


Fig. 10. Variants of angular wheel bushing with full ring.

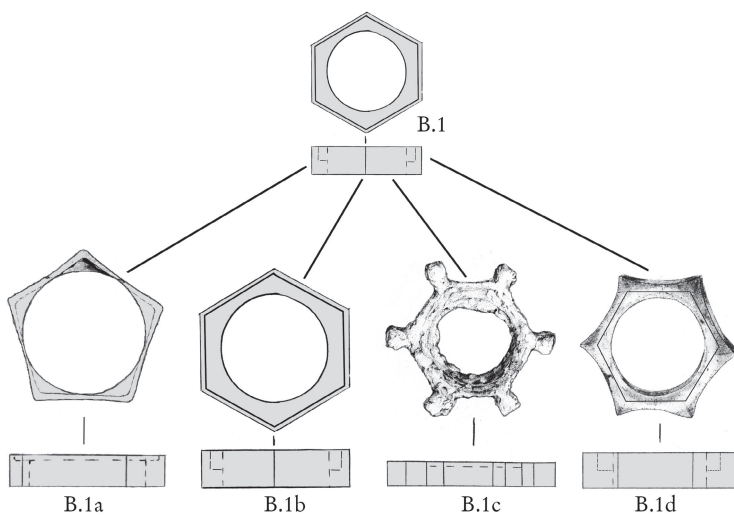


Fig. 9. Variants of angular wheel bushing with grooved ring.

Variant A.2b-c has four smaller trapezoid tenons. This sub-variant dates from the Medieval period (13th–14th century A.D.; cf. cat.-no. 146–154).

Variant A.2b-d has six smaller trapezoid tenons. This sub-variant dates from the Medieval period (13th–14th century A.D.; cf. cat.-no. 155–288).

Type A.3: Wheel bushings with incomplete bushing (cf. Fig. 4)

Within the group of round bushings, a third type of incomplete ring with one trapezoid tenon can be described which probably belongs not to the wheel itself but to the construction of the cart. This type dates from the Medieval period and later (13th–20th century A.D.; cf. cat.-no. 289–296).

Group B: Angular bushings

Bushings of this group can be classified into 2 main types (Fig. 8).

Type B.1: Grooved wheel-bushing.

This type can be divided into four variants (Fig. 9).

Variant B.1a is a five-sided wheel-bushing without tenons. This variant dates from the Medieval period (13th–14th century A.D.; cf. cat.-no. 297).

Variant B.1b is a six-sided wheel-bushing without tenons. It dates from the Medieval period and later (13th–20th century A.D.; cf. cat.-no. 298–313).

Variant B.1c is a six-sided wheel-bushing with six trapezoid tenons. It dates from the

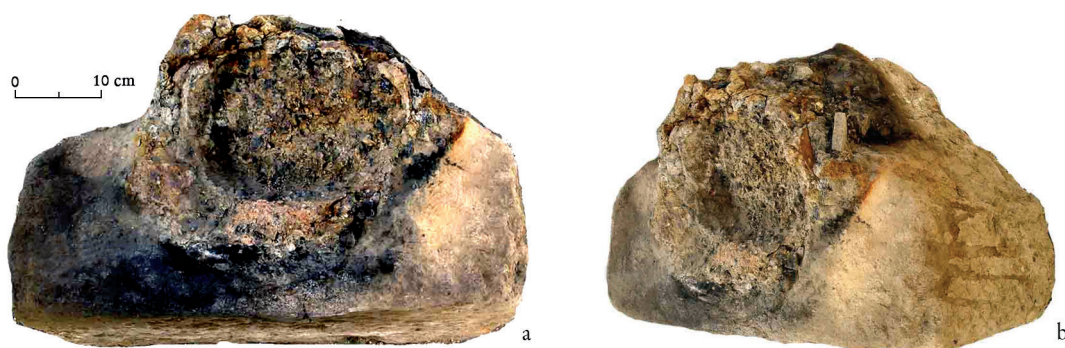


Fig. 11. Stone basis with remains of an iron production from the excavation KAR-2 at the city's centre of Karakorum.

Medieval period (13th–14th century A.D.; cf. cat.-no. 314).

Variant B.1d is a six-sided concave wheel-bushing. It dates from the Medieval period (13th–14th century A.D.; cf. cat.-no. 315–316).

Type B.2: Wheel-bushing without groove.

This Type can be divided into 2 variations (Fig. 10).

Variant B.2a is a six-sided wheel-bushing without tenons. It dates from the Medieval period (13th–14th century A.D.; cf. cat.-no. 317).

Variant B.2b is a six-sided concave wheel-bushing without tenons. It dates from the Medieval period (13th–14th century A.D.; cf. cat.-no. 318–322).

MANUFACTURE OF THE WHEEL-BUSHINGS

It is evident that Karakorum was not only the economic, political or trade capital of the Mongolian Empire, but was also a production centre with a thriving smithy industry. In 1948–1949, the joint Mongol-Soviet Archaeological and Ethnographical Field Expedition at Karakorum exposed several production sites. The excavations also unearthed various forged and cast iron artefacts (Kiselev et al. 1965: 198–215). This led to the conclusion that the city was a prospering centre of craftsmanship (Kiselev et al. 1965: 173–182). The Mongolian-German Karakorum expedition (MDKE-KAR 2) also discovered craftsmen's quarters (Erdenebat / Pohl 2005).

During excavations, traces of stores were found. Those stores were built of mudbricks and were 50–80 cm in diameter. Karakorum was a prospering centre of craftsmanship. During excavations the traces of a smithy were found (Heidemann et al. 2006).

Also near this site, on Karakorum's main street, a smithy's kiln and other accessories were excavated (Fig. 11 a–b). Among these finds 240 kg of iron slag as well as blacksmith's equipment and ceramic forms were found. It contained numerous iron items such as stirrups, soles, 21 knives of 4 different shapes, axes, 166 wheel-bushings, scissors, bells, stove pots, 45 pot remains, and 36 arrowheads of 15 different types and nails and instruments for land cultivation. This and many other sources point to Karakorum as a production centre which prospered at that time. This evidence suggests that most of the wheel-bushings found were cast in Karakorum.

WRITTEN RECORDS OF THE CRAFTSMEN'S QUARTER IN KARAKORUM AND OTHER CENTRES

Various kinds of evidences indicates that in earlier times, iron casting, crafts and weapon-making prospered in Mongolia and were under government control. Information from the reign of Ögedei Khan indicates that craftsmanship was the main occupation. Various anecdotes about Ögedei Khan record his generous attitude toward the craftsmen. Also in So Mu Zi's we read: "...north to the Yuan state lies Karakorum where cattle-breeding, land cultivation, hunting and craftsmanship are prospering..." (Ye Zi Chi 2006). The official dynastic chronicle "Yuan shi" recalls how the towns were flourishing. These reports give considerable information on the prosperity of such towns as Karakorum, Chingai and Khem Khemchig with their blacksmiths, gold and silversmiths. There were five to seven grades of high-ranking state officials governing the various offices. At the same time the industry of the whole Mongol Empire was under the

control of the different high ranking officials, divided also into production units, arming and department for protection of Daidu. According to the sources at the Shandung office, every kind of craftsman unit had 17 branches, big and small. Members and workers differed in numbers some totalling 1000 (Yuan shi Vol. 82).

With regard to the treatment of craftsmen we can turn to the short notes of Giovanni Piano Carpini: "The Tatars made a selection from their captives and chose craftsmen" (Piano Carpini 1988: 44). In "Yuan shi" it is said: "...near Karakorum, in a place called Bilge, lots of craftsmen were gathered to produce bows, arrows and other weaponry" (Yuan shi Vol. 100). Also our own field excavations prove the existence of the craftsmen's quarters of different nationalities.

EVIDENCE FROM GEOLOGICAL RECONNAISSANCE

We can quote the results of geological investigations in the area near to Karakorum to verify the above mentioned source. The fieldwork obtained information on the excavation of twelve main iron deposits (Jargalan 2007: 3). The coordinates for iron mines in Övörkhangai aimag are as follows:

N: 45° 55' 35"	E: 101° 22' 30"
N: 44° 30' 00"	E: 101° 56' 00"
N: 44° 09' 00"	E: 101° 58' 20"
N: 46° 25' 00"	E: 102° 37' 30"
N: 46° 35' 00"	E: 104° 02' 00"
N: 46° 07' 30"	E: 104° 12' 00"
N: 46° 33' 00"	E: 104° 01' 09"
N: 44° 57' 00"	E: 102° 12' 25"
N: 45° 43' 00"	E: 102° 42' 00"

The nearest iron-ore deposit lies around 17 km southeast of Karakorum. Coordinates are N: 47° 17' 21", E: 103° 02' 03" (Fig. 12).

But at present it is not clear whether those deposits were used from early times. This should be verified by further studies. For verification purposes a question must be asked: were there open cast mines? At present we have no satisfactory data on the subject.

SOME FACTS ON TRADING IN THE MONGOLIAN EMPIRE

From historical sources it has become clear that the trading network of the whole empire was centred in Karakorum. The evidence points to heavy and regular trade within various parts of the Mongolian Empire and also other parts of that world, verified by the copper and silver coins which were found (Erdenebat / Pohl 2005).

Other sources say that Ögedei-, Güyük- and Möngke-Khan fostered foreign trade. Traders of Muslim and other origins were in charge of commerce and the Persian historian Rashid al-Din notes that Ögedei Khan issued 200 gold balysh for commercial purposes (Rashid ad Din 1994: 142–143).

In "Hei-Ta shi-leüh", it is mentioned that the Khan and high-ranking officials financially supported Muslim traders to increase their numbers. Texts mentioned that Mongolians sold mostly sheep, horses and gold and bought silk and kitchen iron utensils (Lin Chiun-yi / Munkuev 1960: 144).

From these short passages it is clear that Karakorum was a commercial centre connecting the East and West. In conclusion, we can assume that Karakorum was an important centre of different crafts with a highly developed industry. At the same time, we presume that the bushings were cast mainly in Karakorum but a few insignificant types might have come from extensive outside trading contacts.

DATA ON THE CHEMICAL COMPOSITION OF THE WHEEL-BUSHING

To obtain more detailed information on the importance of wheel-bushings it is important to analyze the chemical composition of the cast iron bushings. The composition gives an accurate impression of the materials, tempering quality and level of craftsmanship.

Some iron items found during the 1948–49 excavations of the Karakorum ruins were studied in the laboratory of the Moscow Institute of Metallurgy. It was established that they were of light cast melted at 1350 c. S. Kiselev and N. Merpert assumed that such a high temperature could not be obtained by hand fanning but only with a bellows (Kiselev et al. 1965: 188–215). In this connection it is interesting to quote a note in Wan Zhen's "Farming

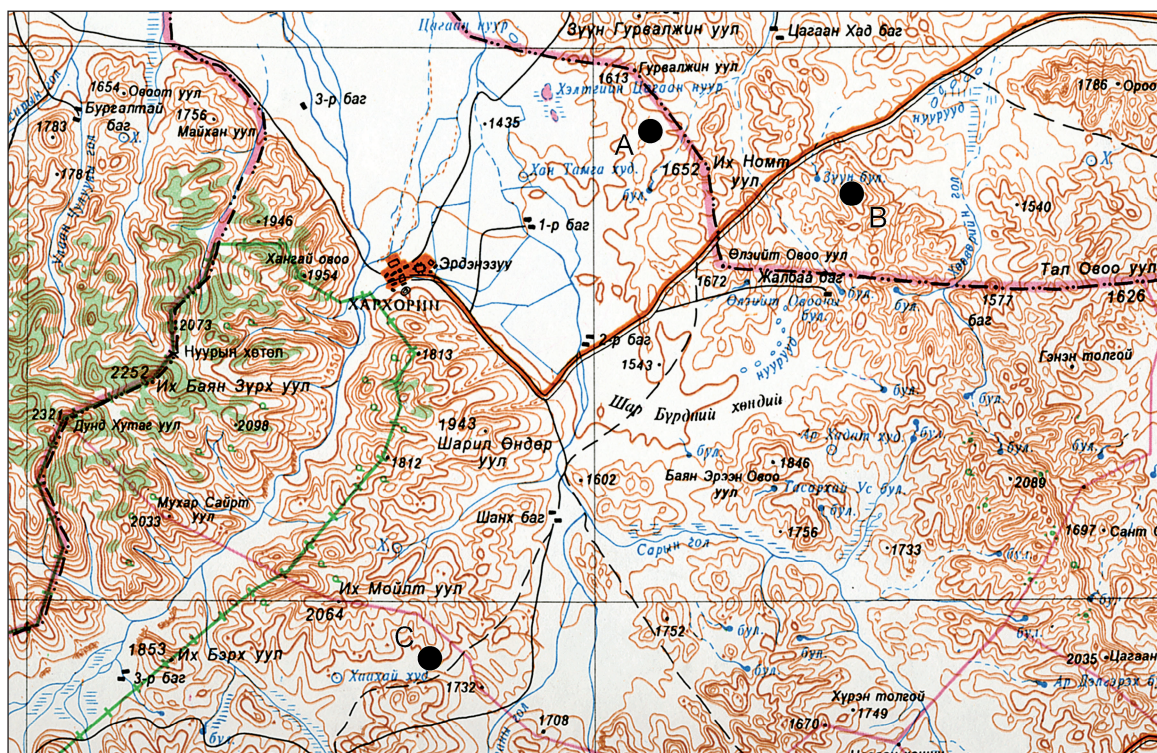


Fig. 12. Distribution of iron (A) and coal (B-C) deposits in the vicinity of Karakorum.

book” about the use of the water-driven fan bellows to purify the ore and forge it (Ye Zi Chi 2006).

In 1967 N. Tömörbaatar and D. Bold examined a number of analysed examples with regard to composition, hardness and other qualities of bushings found at Rashaan Ders, Delgerkhaan sum of Khentii aimag. The bushings were made of high quality light cast iron alloys (Tömörbaatar / Bold 1969: 26).

In 1974 N. Terekhova analysed the metallurgical microstructure of cast iron artefacts recovered from sites at Karakorum in 1948–1949 (Terekhova 1974: 69–77). Examination reveals that all bushings were made of light cast iron alloys which contain sulphur, phosphorus and chromium. Analysis also showed that for casting, the craftsmen used fossil coal as illustrated in Tab. 1.

In 2002 S. Amgalanbaatar and G. Nomguunsüren analysed bushings from Karakorum at the Institute of Chemistry and Technology of the Academy of Sciences of Mongolia. Samples were tested by chemical and atomic absorption spectral methods. It was observed that bushings were made of high quality light cast iron. Tab. 2 gives the comparative chemical compositions of the artefacts.

In 2005 Ch. Amartүvshin, G. Eregzen and J. Park selected three bushings from Chin Tolgoi ruins in Bulgan aimag and Ulaan Kherem memorial place in Bayannuur sum of Bulgan aimag for metallurgical examination at Hongik University of the Republic of Korea at the Department of the Metallurgical Engineering. Optical microscope and SEM showed that the artefacts from Chin Tolgoi were made of light cast iron and contained cement of 6.67 oxides and phenonlite of 4.3 percent. (cf. Fig. 13 a–d). Moreover it was noticed that those bushings were made of high quality light cast iron alloy smelted by means of fossil and wooden coal (Amartүvshin et al. 2005).

GEOLOGICAL EVIDENCE

Sources are available for the coal mining in southern territories of the Great Mongolian Empire (Cha’n Ch’un 1997: 54). For example: “...after 3 days we reached southern parts of Abuhan shan. Coal is mined here in the hills. From here 1000 miles to the north-west, iron ore is mined” (Cha’n Ch’un 1997: 51).

Near Karakorum geological research and excavations were conducted. The purpose was

LOCATION	CHRONOLOGY	No.	LIST №	C	Si	Mn	S	P
Karakorum	XIII-XIV	1	K-1	2,52	0.60	0.105	0.89	0.55
		2	K-2	2.70	0.42	0.010	0.80	0.215
		3	K-3	1.86	1.29	0.05	0.63	0.260
		4	K-4	2.52	0.87		0.79	0.44
		5	K-9	1.88	0.51	0.08	1.00	0.44
		6	K-10	2.50	0.48		0.61	0.55
		7	K-11	2.25	0.47		0.71	0.49
		8	K-12	1.88	0.42		0.52	0.49
		9	K-14	2.52	1.42	0.17	0.54	0.48
		10	K-16	1.86	1.42	0.13	0.79	0.46
		11	K-17	–	0.89	0.07	0.81	–
		12	K-18	2.80	1.25	0.06	1.27	0.25
Khakhiraa	XIII-XIV	13	X-15	2.50	0.65	0.10	0.50	0.14
		14	X-18	2.52	0.60		0.52	0.16
		15	–	3.99	0.09	0.08	0.035	0.026
		16	–	4.46	0.08	0.08	0.85	0.16
Bolgar	XIV	17	-	2.93	0.14	0.052	0.067	0.34
		18	-	3.31	0.18	0.31	0.047	0.48
	VI	19	1	3.35	2.42	0.13	0.067	0.205
		20	2	3.22	2.39	0.23	0.077	0.17
		21	3	3.35	1.98	0.78	0.063	0.312
		22	4	3.33	2.12	0.64	0.064	0.186
	X	23	5	3.12	2.07	0.81	0.053	0.297
		24	6	3.96	0.09	-	0.022	0.231
Kitai	XI	25	7	3.58	0.16	0.28	0.024	0.134
	?	26	8	3.84	0.08	0.02	0.024	0.097
	II	27	9	4.5	-	-	-	0.124

Tab. 1. Chemical composition of iron cast artefacts (after Terkhova 1974).

to investigate brown coal deposits. Geological study and excavation shed light on twelve main coal deposits (Jargalan 2007: 4). The coordinates of coal deposits in Övörkhangai aimag are as follows:

1. N: 45° 41' 30" E: 101° 33' 15"

2. N: 45° 51' 30" E: 101° 34' 08"

3. N: 45° 23' 15" E: 101° 42' 05"

4. N: 44° 45' 00" E: 101° 43' 30"

5. N: 44° 36' 45" E: 101° 53' 50"

6. N: 45° 21' 10" E: 101° 50' 00"

7. N: 46° 57' 30" E: 102° 52' 00"

8. N: 45° 51' 00" E: 103° 48' 00"

9. N: 44° 41' 30" E: 102° 02' 30"

10. N: 44° 58' 35" E: 103° 02' 30"

11. N: 46° 31' 58" E: 102° 15' 32"

12. N: 46° 31' 18" E: 102° 15' 22"

The nearest coal deposit to Karakorum is around 28 km south-east with the coordinates

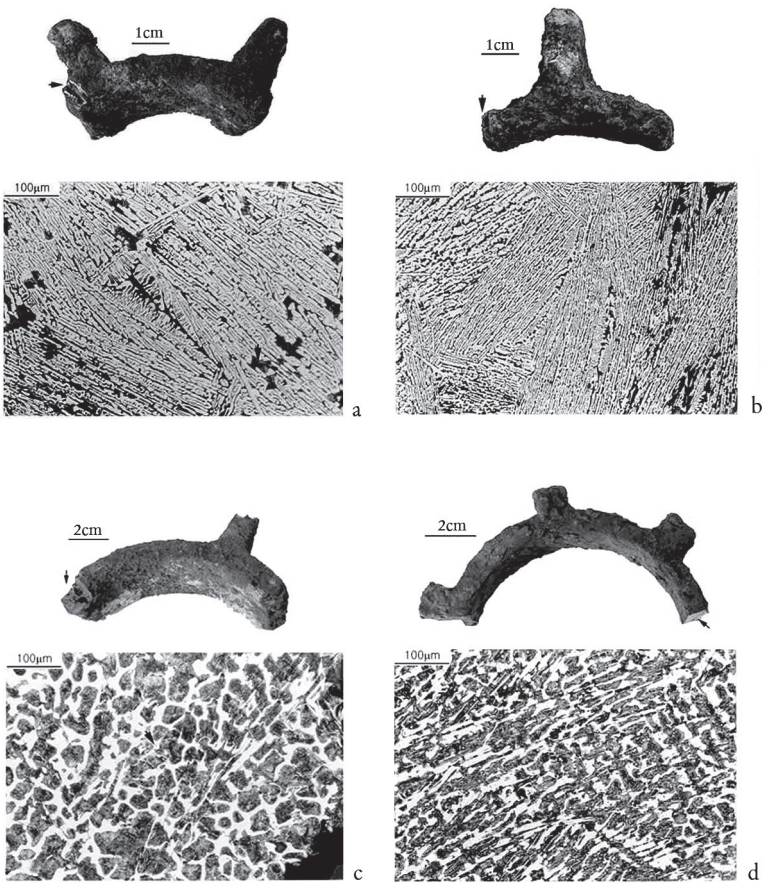
N: 46° 57' 30" E: 102° 52' 40".

Only shale coal could have been used in casting. Five deposits of coaly shale are proven in Övörkhangai aimag (Jargalan 2007: 4)

No.	LOCATION OF THE FINDING	CARBON PERCENTAGES	SILICON SI AND ITS OXIDE SiO ₂	PHOSPHORUS AND ITS OXIDE (P ₂ O ₅)	MANGANES	CHROMIUM	NICKEL
1	Karakorum	3.5	0.26 SiO ₂	0.54 P ₂ O ₅	0.092	0.075	–
2	Rashaan Ders	4.27	0.37 Si	0.11 P	–	–	–
3	Rashaan Ders	2.11	2.10	0.24	–	–	–
4	Currently used cast iron chemical composition	3.10-3.40	2.0-2.4	0.40	0.5-0.9	0.18	0.15

Tab.2. Chemical composition of bushing from Rashaan Ders and Karakorum.

Fig. 13. Optical and chemical analysis of three selected wheel bushing from Chin Tolgoi und Ulaan Kheerem.



N: 47° 15' 00", E: 103° 12' 00"
N: 44° 46' 00", E: 102° 57' 00"
N: 45° 14' 40", E: 103° 20' 35"
N: 45° 50' 50", E: 103° 17' 50"
N: 44° 45' 00", E: 103° 04' 00"

The nearest deposit of coal shale lies 30 km north-east of Karakorum. Its coordinates are: N: 47° 15' 00", E: 103° 12' 00" (cf. Fig. 12). But the proportionate use of coal shale in ancient and Medieval times is not certain.

Further study is needed. The craftsmen of Karakorum might have used brown coal, coal shale or charcoal.
Geological study in the region indicates the possibility of open coal deposits that were conceivably accessible during the Mongolian Empire. In the travel notes of that day it is said that coal mining was developed in the southern provinces of the Empire (Cha'n Ch'un 1997: 51).



Fig. 14. Drawing of a big ger-cart.

BOTANICAL STUDY

During our research, the question presented itself whether it was possible to obtain temperatures high enough for smelting, using local woods. Botanical data shed light on this matter. This complements the observation regarding the occurrence of open brown coal deposits in the neighbouring region of Karakorum.

The most common combustible wood plant on the territory of Mongolia is saxaul. It is a desert tree which grows in poor soil. The sand dunes nearest to Karakorum lie in a place called Elsen tasarkhai, 70 km to the north-east. Nowadays no saxaul in Elsen tasarkhai grows there. No botanical study was ever conducted recording the distribution of saxaul growth in that region. Another place nearby with saxaul growth lies 300 km to the south from Karakorum in Tögrög sum. It becomes clear that transportation of the fire-wood from this place could be difficult but profitable in Medieval times.

Saxaul burns at a high temperature, but not for very long. While fresh birch firewood was available it is not an efficient fuel. Therefore, coal was probably preferred by craftsmen from Karakorum. Both charcoal and brown fossil coal were used.

CALCULATIONS OF CART-CARRYING-CAPACITY FROM WHEEL-BUSHINGS

Much data pertains to the use of the Mongolian ger cart. For instance, in the course of his travels William of Rubruck wrote that

Mongols had a dwelling called ger cart: "I myself once measured a breadth of twenty feet between the wheel-tracks of a wagon, and when the dwelling was on the wagon it protruded beyond the wheels at least five feet on either side. I have counted twenty-two oxen to one wagon, hauling along a dwelling, eleven in a row, corresponding to the width of the wagon, and another eleven in front of them. The wagon's axle was as large as a ship's mast, and one man stood at the entrance to the dwelling on top of the wagon, driving the oxen" (Jackson / Morgan 1990: 73) (Fig. 14).

We tried roughly to calculate the loading capacity of the giant ger cart with the help of a dynamometer used by V. P. Goryachkin and others. The traction force can be calculated by the following formulas: $P=Q/q+12$ (where P indicates the traction force, Q – total weight of bulls) and $P=g \times f + g \times \sin \alpha$, where g – is a cart with full installations, f – road resistance, α – slope) (Khashbat 2001: 42–46).

According to the above formula, the loading capacity of 22 bulls was calculated, assuming an average bullock to weigh 250 kg (Songino 1991: 84). When the road slope is 60°, the road resistance increases with the dragging force. In this case, 22 bulls can pull up to a load of 4 tons.

N. Tömörbaatar and D. Bold proposed the following formula for finding the load capacity: $S=q \times d$, $P=2 \times S$, where S indicates the friction surface, P – weight on one bushing, q – thickness, d – bushing diameter. According to this formula, the load capacity may be 2 tons assuming use of large bushings of 40 cm in diameter.

No giant carts have been found in archaeological excavations until now. All calculations are based on bushing findings, some petroglyphs and other sources. Therefore, we can conclude that ger carts were technically very uniquely balanced transporting means of Mongolians of the 13th century. Moreover it shows the level of technical knowledge of the craftsmen of that period.

Methods of calculating tenon numbers of the broken bushings

Fig. 15 shows a plan of a tenon, where X indicates the tenon numbers; d_1 – the outer diameter; d_2 – the total of the inside diameter; b – the width of the tenon part attached; L_1 – the total length of the grand diameter; L_2 – the attached segment length; L_3 – the length between parallel tenons; α – the angle of the segment at the tenon, β – the central angle between 2 tenons; r – the diameter of the bushing; a – the base length of the tenon; e – the bushing width. Estimates made on the objects in the study show that all of the tenons in the bushing are of the same size, and the distance between 2 tenons is assumed to be equal.

Calculating the bushing tenon number, one may use the formulas: $L_1 = X \times (L_2 + L_3)$ and $L_1 / L_2 + L_3$ to answer the question: How many tenons and what is the diameter of a wheel? In the formula we can set ($X = 360^\circ / \alpha + \beta$, $\alpha = \arcsin a / r \sqrt{1 - a^2 / 4r^2}$, $\beta = \arcsin b / r \times \sqrt{1 - b^2 / 4r^2}$). Therefore, L_2 can be substituted by b for the tenon base length, L_3 can be substituted by the distance between parallel tenons. Then it is easy to calculate the numbers of tenons: $L_1 = 2\pi R \rightarrow L_1 = d_2 \times \pi$, $X \approx L_1 / L_2 + L_3$ where $X \approx (d_2 \times \pi) / (a + b)$ ($\pi = 3.14$ constant). The calculations result in mainly fraction numbers, which were estimated with an error tolerance of ± 0.4 .

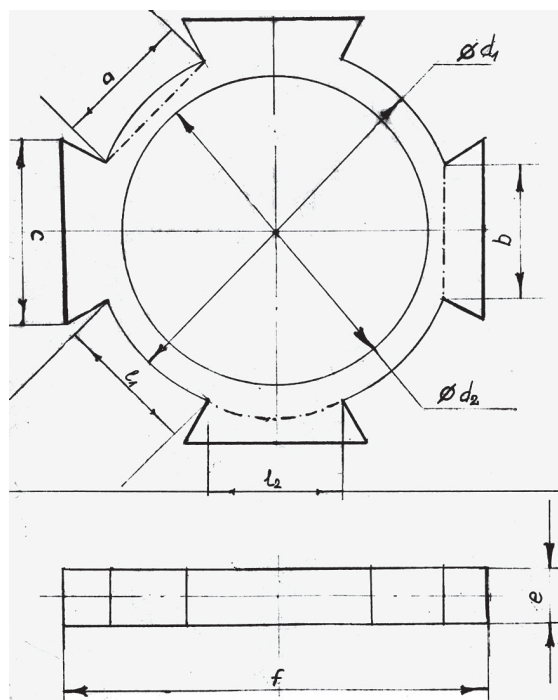


Fig. 15. Technical drawing of a wheel bushing for calculation of the numbers of tenons.



Fig. 16. Petroglyph from Bichigiin am.

ART SOURCES

Petroglyphs

Nomadic communities living in the territory of Mongolia used carts from early times. This is proven by archaeological research. Petroglyphs which occur in Mongolia form one source of evidence. Currently more than 100 rock carvings which show carts have been investigated (Mongoliin tüükh 2003: 125). Such carvings are found at Chuluut gol river, Yamaan us, Tsagaan gol (Sanzhmyatav 1983),

Tevsh uul, Tsagaan salaa, Baga Oigor, Gurvan Mandal, Bichigiin am (Fig. 16), Modtoi tolgoi (Shagdarsüren 1974: 62–64).

Some details of the constructions could be seen in the cart carved into rock in Yamaan us of Üench sum in Khovd aimag, which is a source of evidence of a technically developed carriage (Fig. 17). A carriage drawn by four horses appears in petroglyphs at Tevsh uul (Dorzh 1969: 52–55) (Fig. 18). Those carts date from the end of the first millennium B.C. to

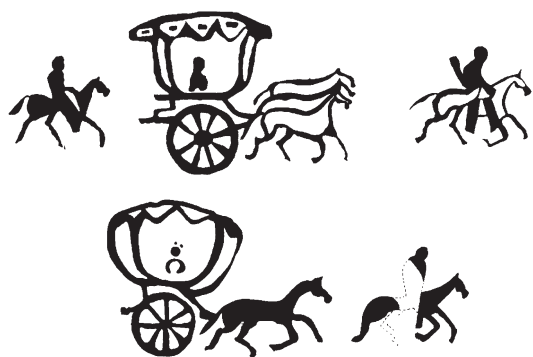


Fig. 17. Petroglyph from Yamaan us.



Fig. 18. Petroglyph from Tevsh uul.

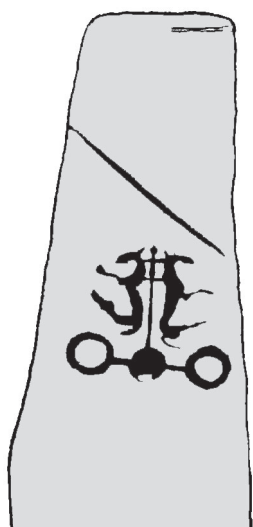


Fig. 19. Deer stone from Chuluut (Ömnö Khairkhan mountain) with depiction of a cart.

the second century A.D. (Mongoliin түүхх 2003: 125). At present these petroglyphs are the earliest pictures of carts found in the territory of Mongolia.

Pictures of the carts on the Deer stone

At a place called Chuluut on the Ömnö Khairkhan mountain in Darvi sum of Khovd aimag a unique picture of a cart depicted on a deer stone should be mentioned here (Volkov 2002: 93) (Fig. 19).

Frescoes (Wall painting) and others

Between 1994 and 1999 excavations conducted by a joint Mongol-French expedition in the territory of Khutug Öндөр sum of Bulgan aimag at burial site 79 yielded two pieces of birch bark with depictions of a cart with a 12 spoke wheel (Törbat 2001: 92) (Fig. 20 a–d).

A cart is depicted in religious wall-painting themes. An example exists in Khar Khot (Qara Qot). In addition to the development and typology of Mongolian carts, we carried out an ethnographical study of more contemporary carts. In the National Museum of Mongolian History a cart wheel is on loan, used in the first decades of the last century during a religious ceremony at Khüree (present Ulaanbaatar) (Fig. 21). A photo of that ceremony in the Museum provides us with a true impression of our subject. One might also mention a wall painting in Erdeni Joo monastery at Kharkhorin sum of Övörkhangai aimag, where several carts are represented. This painting is attributed to the 16th century by virtue of its style.

Ceramic sculpture

A ceramic sculpture, which shows a Mongolian cart dated from the Yuan dynasty, is on view in the Museum in Inner Mongolia (Chengji Sihan 2004) (Fig. 22). This sculpture allows some details of the Medieval Mongols to be reconstructed in correlation with the documentary evidence from the “Secret history of the Mongols”.

WRITTEN RECORDS ON THE MONGOLIAN CART WITH SHORT COMMENTS

A few written sources illustrate the history of the early and Medieval Mongolian cart. In a diary of the Daoist monk Cha’n Ch’un

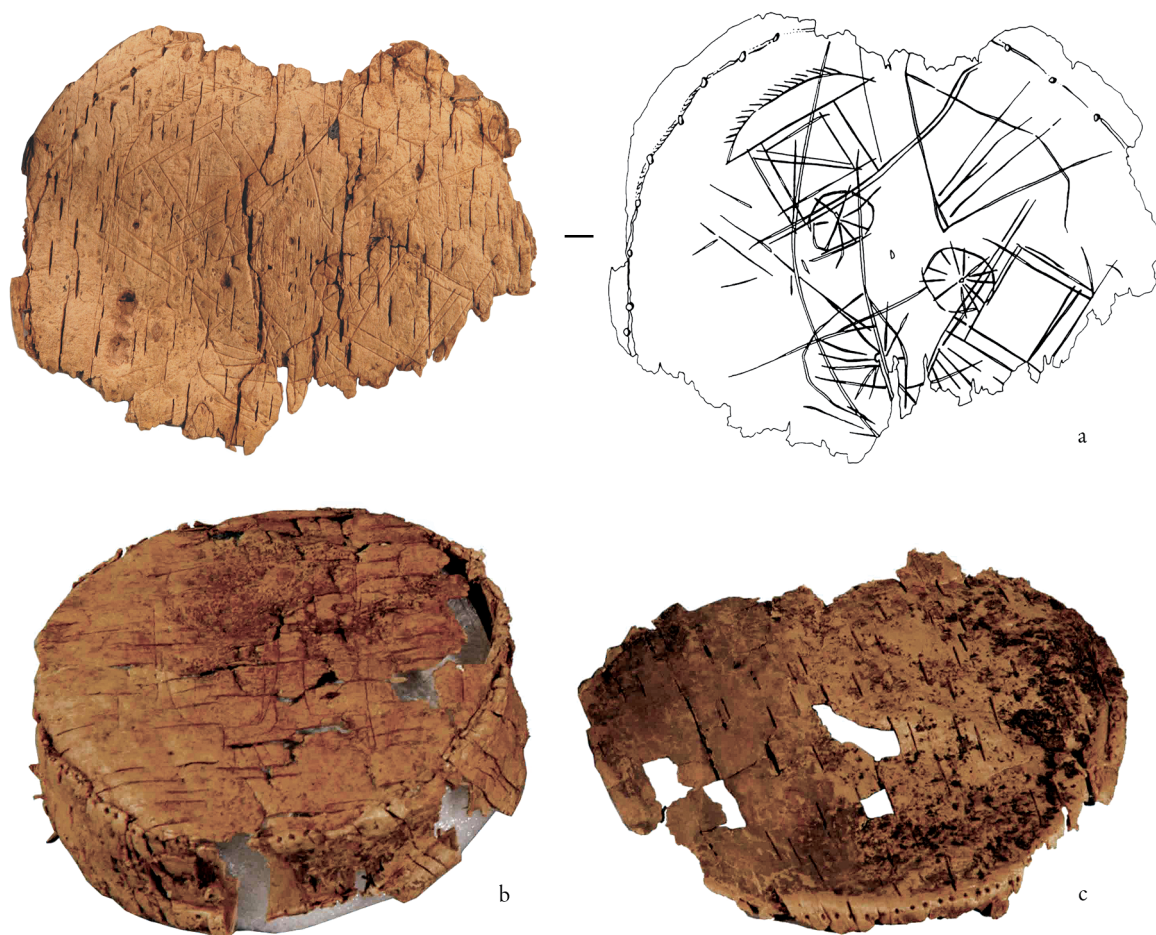


Fig. 20. Birch bark objects from burial site 79 from Khutug Öndör sum of Bulgan aimag with depictions of a cart.

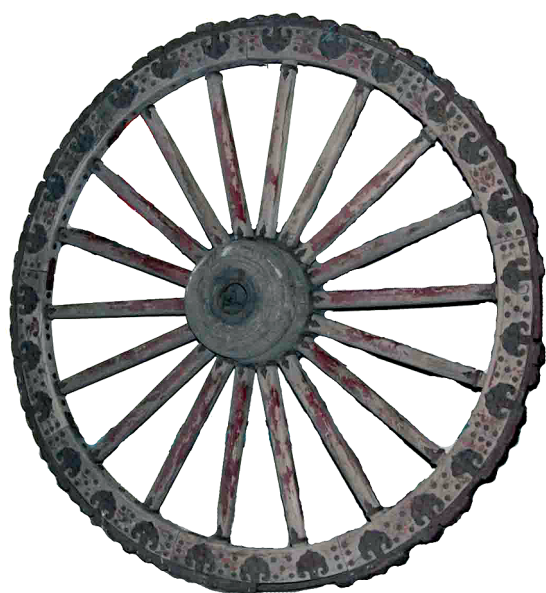


Fig. 21. Wooden cart wheel from the first decades of the 20th century from Ulaanbaatar.



Fig. 22. Ceramic sculpture of a Mongolian cart from Yuan dynasty (after Chengji Sihan 2004).

we can read some interesting notes. For example, on April 1st he paid a visit to noyon (rank) Otchigin where a wedding was going on, and saw thousands of black carts and felt gers. From a mountain peak he saw numerous white felt gers and black carts (Cha'n Ch'un 1997: 18, 20).

The Franciscan monk, William of Rubruck, was present at Joan the Saint's holiday in Karakorum and saw how the Khan organized a big wedding ceremony and during that feast he counted 105 carts loaded with *airag*, the Mongolian horse milk. There are also some notes on using bulls, camel, horse and yak for pulling carts. Rubruck said that they used bulls or camels. He also mentioned that in Karakorum there were big trading carts. Short legged cattle with thick tails drew the carts:

II.3: "In addition, they make thinly cut twigs into squares large enough to form a large box, and then they place on top of it from end to end a carapace fashioned of similar twigs, and make a small entrance at the front end. Next, this chest or miniature house is covered with black felt smeared with fat or ewe's milk, to render it rain-proof, which is again decorated with patchwork or embroidery. In the chest they put all their bedding and their valuables, lashing them tightly onto high wagons which are drawn by camels, to enable them to ford rivers. These chests are never removed from the wagons. When they unload their dwelling-houses, they always turn the door-way towards the south, and following that draw up the wagons with the chests half a stone's throw away from the dwelling on either side, so that the dwelling stands between two rows of wagons as if they were two walls" (Jackson / Morgan 1990: 73–74).

II.4: "The married women make themselves very fine wagons, which I could describe to you only by drawing – and indeed I should have drawn everything for you had I known how to draw. One rich Mo'al or Tartar has easily a hundred or two hundred such wagons with chests. Batu has twenty-six wives, each of whom has a large dwelling, not counting the other, smaller ones placed behind the large one, which are chambers, as it were, where the maids live: To each of these dwellings belong a good two hundred wagons. When they unload the dwellings, the chief wife pitches her residence at the westernmost end, and the others follow according to rank, so that the last wife will be at the eastern end: there is a space of a stone's throw between the residence

of one lady and the next. Hence the court of one wealthy Mo'al will have the appearance of a large town, though there will be very few males in it" (Jackson / Morgan 1990: 74).

II.5: "One woman will drive twenty or thirty wagons, since the terrain is level. The ox- or camel-wagons are lashed together in sequence, and the woman will sit at the front driving the ox, while all the rest follow at the same pace. If at some point the going happens to become difficult, they untie them and take them through one at a time. For they move slowly, at the pace at which a sheep or an ox can walk" (Jackson / Morgan 1990: 74).

VII.2: "The men make bows and arrows, manufacture stirrups and bits, fashion saddles, construct the dwellings, and the wagons, tend the horses and milk the mares, churn the *comos* produce the skins in which it is stored, and tend and load the camels. Both sexes tend the sheep and goats, and they are milked on some occasions by the men, on others by the women. The skins are dressed with curdled ewe's milk, thickened and salted" (Jackson / Morgan 1990: 91).

XXV.9: "The Mo'als, or tartars, belong to their sect, in so far as they believe in only one God and yet make felt effigies of their dead, dressing them in the most expensive materials and putting them in one or two wagons. Nobody dares touch these wagons, which are left in the care of their soothsayers: these are their priests, about whom I shall tell you below" (Jackson / Morgan 1990: 156).

XXVI.2: "Beyond them, to the east among the mountains are the Tangut, a very brave race, who captured Chingis in battle: he obtained his release by making peace, though he later reduced them to submission. They have extremely strong cattle, with tails which are abundantly hairy like a horse's and with shaggy bellies and backs: they are shorter in the leg than other cattle, but stronger by far. They haul along the large dwellings of the Mo'als, and have long, slender, twisted horns which are extremely sharp so that the points constantly require to be sawn off. The cow will not let herself be milked unless one sings to her. They have a bull's temper, moreover, in that if they see a person dressed in red they charge at him in a desire to kill him" (Jackson / Morgan 1990: 157–158).

XXVIII.11: "Only a little snow fell there in winter, but around Easter, which came in the latter half of April, it fell in such quantities that it filled all the streets of Caraco-

rum and had to be carried away in wagons” (Jackson / Morgan 1990: 176).

XXXII.1: “Regarding the city of Caracorum, you should know that, discounting the Chan’s palace, it is not as fine as the town of St Denis, and the monastery of St Denis is worth ten of the palace. It contains two quarters: one for the Saracens, where there are bazaars and where many traders gather due to the constant proximity of the camp and to the great numbers of envoys; the other is the quarter of the Cataians, who are all craftsmen. Set apart from these quarters lie large palaces belonging to the court secretaries. There are twelve idol temples belonging to different peoples, two mosques where the religion of Mahomet is proclaimed, and one Christian church at the far end of the town. The town is enclosed by a mud wall and has four gates. At the east gate are sold millet and other kinds of grain, though they are seldom imported; at the western, sheeps and goats are on sale; at the southern, cattle and wagons; and at the northern, horses” (Jackson / Morgan 1990: 221).

In the history of the Yuan dynasty, written sources inform us about using horse or bull driven carts (Yuan shi Vol. 101).

In Mongol Tatar notes it is mentioned that they preferred to use bulls in carts (Munkuev 1975: 137).

In the report of Hei-Ta shi-lüeh or “Sketch of affairs of the Black Tatar” written in 1236 by P’en Ta-ya and Hsü T’ing it is noted that in monasteries the Mongols used bulls. Their bulls were strong and used to pulling carts but never used in for sowing work (Wang Kuo-wei 2005, 4b).

LIST OF THE PASSAGES WITH TERMINOLOGY OF THE CARTS AND ITS EQUIPMENT

Among various sources, the most important source for our investigation in this direction is the great Mongolian written source well-known as “The Secret History of the Mongols”.

“qara’utai tereg”

In § 6 of the “SHM”: “when he spoke, at the forefront of one black cart in the midst of those people who, journeying, are drawing nigh, one maiden is good. If she has not yet been given unto a man, I shall request her for thee, my younger brother Dobun mergen, he

sent his younger brother (4v) Dobun Mergen for to see (her)” (Cleaves 1982). In transliteration: “*ügüleriün tede newüjü ayisuqun irgen-nü dотора niken qara’utai tergen-ü öljige-de niken ökin sayin buyu gü’ün-ne ese ökteksen bö’esü dobun-mergen de’ü-de’en cima-da quyuqa ke’ejü dobun-mergen de’ü-yü’en üjere ilēba*” (Rachewiltz 1972: 522).

We come across this word in §§ 6, 55, 100 and 244. In the original text of the “SHM” the word “qara’utai tereg-” transcribed by Chinese characters as 合刺兀台 帖兒格 and explained as 黑車 “black cart” (Cleaves 1982). D. Tserensodnom explained the word in question as a tented cart (Tserensodnom 1990: 193).

Eldentei and Ardaajav used dialect pronunciation for this word: “mug” and “kharaa”. A crafted cart like this is usually called “kham cart” and may be an old Mongolia term “khar tereg” or black cart became more known and used (Eldentei / Ardaajav 1986).

F. Cleaves and E. Haenisch also use the version “khar tereg” or black cart (Haenisch 1935: 1; Cleaves 1982: 2).

Other sources mentioned black felt tented carts. Even when it rained the inside was dry and therefore they transported their wives and children inside.

“qasaq” cart

In § 64 of the “SHM”: “For those of you who have become qahan, we make [our] daughters comely of cheek. To ride in a Qasaq cart. And, making [one] to harness a black camel [to it], making him to trot, we go [unto the qahan]. And make [them] to sit together [with the qahan] on the qatun throne” (Cleaves 1982). In transliteration: “. . . onggirat irgen erte üdür-ece je’e-yin jisün ökin- ü önggeten ulus ülü temeced qacar qo’a ökid-i qayan boluqsan-a tan-u qasaq tergen-tür unu’ulju qara bu’ura köljeju qatara’ulju odcu qatun sa’urin-tur qamtu sa’ulumu ba” (Rachewiltz 1972: 1314).

In the original text of the “SHM” the word “qasaq tereg-” transcribed by Chinese characters as 合撒黑 帖兒堅 and explained as 大車 “great cart” (Cleaves 1982).

D. Tserensodnom translates khasag as “round” and therefore it is called round cart (Tserensodnom 1990). In the Explanatory dictionary of Mongolian the word “qasaq” means big, large (Tsevel 1966: 668).

“böken”

In § 100 of the “SHM”: “The old woman Qo’ayčın sang, I shall hide Börte Üjin, making her to ride in a böken, black cart, harnessed to an ox speckled of loins” (Cleaves 1982). In transliteration: “... qoaqčın-emeken, Borte-užin-i nıusu keen, bokaŋ qaratai terken-tur unoulžu, boere alaŋ hoker kolžu...” (Kozin 1941: 219).

Eldentei and Ardaajav explained it as “bog-tor”-“hunchbacked” (Eldentei / Ardaajav 1986: 230). D. Tserensodnom suggested the explanation as something to cover or hide (Tserensodnom 1990: 228).

“gürdü”

In § 177 of the “SHM”: “...if a cart having two shafts break its second shaft, its ox is not able to pull [it]. Am I not thy second shaft like that” (Cleaves 1982: § 100). In transliteration: “qoyar kil<ü>gütei tergen nökö’e kil<ü>gü-ben qugura’asu hoker inu jikdün yadayu tere metü nökö’e kil<ü>gün cinu bi ese-ü ayu’u qoyar gürdü-tei tergen nökö’e gürdü-ben qugura’asu newün yadayu tere metü nökö’e gürdün cinu bi ese-ü aju’u” (Rachewiltz 1972: 5816).

In the original text of the “SHM” the word “gürdü” transcribed by Chinese characters as 古兒都台 (Cleaves 1982, 177).

“čiyun-tür”

In § 154 of the “SHM”: “When Belgutei spake, he said, we have said unto one another that, comparing [your height] unto [that of] a linchpin, we would slay you all” (Cleaves 1982). In transliteration: “belgütei ügüürün”: “tan-i bügüde-yi čı’un-tür ulijü kidunya ke’eldüba” (Rachewiltz 1972: 4724).

In the original text of the “SHM” the word “čı’un-tür” transcribed by Chinese characters as 赤兀 and explained as 車轄 “linchpin” (Cleaves 1982).

“ölžige-de tergen-dür”

In § 6 of the “SHM”: “When he spoke, at the forefront of one black cart in the midst of those people who, journeying, are drawing nigh, one maiden is good. If she have not yet been given unto a man, I shall request her for thee, my younger brother, Dobun mergen, he sent his younger brother/4v/ Dobun Mergen

for to see/her/” (Cleaves 1982). In transliteration: “ügüleriün: tede newüjü ayısuqun irgen-nü dотора niken qara’utai tergen-ü öijige-de niken ökin sayın buyu gü’ün-ne ese ökteksen bö’esü dobun-mergen de’ü-de’en cima-da quyuya ke’ejü dobun-mergen de’ü-yü’en üjere ileba” (Rachewiltz 1972: 522).

We come across this word in §§ 55 and 64. In the original text of the “SHM” the word “tergen-ü öijige-de” is explained by F. Cleaves as “forefront of a cart” (Cleaves 1982). It seems from this passage as well as those in § 55 and 64 below, that the place occupied by women was the front inside the cart (Cleaves 1982).

D. Tserensodnom explains word “olzhig” as a special seat in a cart (Tserensodnom 2000: 193).

Eldentei and Ardaajav explain it as something like a seat or something similar at the front of the cart (Eldentei / Ardaajav 1986: 14).

“tengeli”

In § 101 of the “SHM”: “Old Woman Qo’ayčın having struck her ox speckled of loins, as, hastening, she began to move forward, the axletree of the cart brake in pieces” (Cleaves 1982: § 35 § 101). In transliteration: “... qo’aqcin-emegen bö’ere alaŋ hoker-iyen deledü’et öterlen ne’ügü bolun tergen-ü teŋgeli ququs otba” (Rachewiltz 1972, 2310).

In the original text of the “SHM” the word “tergen-ü teŋgeli” transcribed by Chinese characters as 騰格里 (車) and explained as “axletree” (Cleaves 1982).

“Co’orga”

In § 124 of the “SHM”: “When his younger brother Güčügür spoke, saying “May I not cause. Its lynch-pin. To overturn the cart having a lock. May I not cause. The cart having a tenggisge. To break on the road” (Cleaves 1982). The transliteration runs as: “... de’ü inu gücügür ügüleriün co’orgatai tergen-i ci’ü inu bu ci’üde’ülsü tenggisgetei terge-i terge’ür de’ere bu te’üre’ülsü ke’ejü ger tergen doyasu ke’eba” (Rachewiltz 1972, 3302).

We come across this word in §§ 121, 124 and 150. In the original text the word “co’orga” transcribed by Chinese characters as 撘 幹兒 合台 帖兒格 and explained as 鎖 有的 車子 “lock” (Cleaves 1982).

“tergegür”

In § 124 of the “SHM”: “When his younger brother Gücügür spake, sang, “May I not cause. Its lynch-pin. To overturn the cart having a lock. May I not cause. The cart having a tenggisge. To break on the road” (Cleaves 1982). The transliteration runs as: “...*de’ü inu gücügür ügülerün co’orgatai tergen-i ci’ü inu bu ci’üde’ülsü tenggisgetei terge-i terge’ür de’ere bu te’üre’ülsü ke’eju ger tergen doyasu ke’eba*” (Rachewiltz 1972: 3302).

In the original text of the “SHM” the word “tergegür” transcribed by Chinese characters as 騰格里 (車) and explained as “cart road” (Cleaves 1982).

In Barga dialect cart road can be read as terguur. Eldentei and Ardaajav said the meaning of “tergu” was road (Eldentei / Ardaajav 1986: 324).

“kil<ü>gütei”

In § 177 of the “SHM”: “...if a cart having two shafts break its second shaft, its ox is not able to pull [it]. Am I not thy second shaft like that” (Cleaves 1982). In transliteration: “*qoyar kil<ü>gütei tergen nökö’e kil<ü>gü-ben qugura’asu hūker inu jikdün yadayu tere metü nökö’e kil<ü>gün cinu bi ese-’ü ayu’u qoyar gürdütei tergen nökö’e gürdü-ben qugura’asu newün yadayu tere metü nökö’e gürdün cinu bi ese-’ü aju’n*” (Rachewiltz 1972: 5816).

In the original text of the “SHM” the word “kil<ü>gütei” transcribed by Chinese characters as 乞魯古台 and explained as 轅條 “shaft” (Cleaves 1982).

“temür telegetü”

In § 236 of the “SHM”: “Sübe’etei Ba’atur-(he) with an iron cart going to warfare, pursuing the sons such as Qutu and Čila’un of Toγto’a of the Merkid, overtaking (them) at the Čui River, destroyed (them) and came (back)” (Cleaves 1982: 172). In transliteration: “*sübe’etei-ba’atur temür telegetü merki-ün toqto’a-yin gutu cila’un teri’üten kö’üdi-i inu neken ca’uraju cui-müren-e güyiceju muqutgaju ireba*” (Rachewiltz 1972: 9303).

We come across this word in §§ 177, 199 and 236. In the original text of the “SHM” the words “temür telegetü” are explained as 帖列格禿 “iron cart” (Cleaves 1982).

In the 1980s, Japanese archaeologists recovered remains of an iron chariot cart near Busan in South Korea and verified it to be a cart of the Mongolian warriors. This cart is two-wheeled and made of iron. Chemical analysis established that the cart was made of steel (Bayasakh 2005, 100).

In the Museum of History of Dornod aimag two wooden wheels are on exhibition. Wheel diameter is 105 cm, width is 12 cm, depth 6 cm, spoke axis 15 cm, width 10 cm, head length 82 cm, width 15 cm, depth 20 cm, central hole deep 15 cm, width 10 cm, depth 12 cm, nail head diameter 5 cm, lock length 52 cm, depth 5 mm, width of 2 kinds as of 3.5 and 5 cm respectively. Wheels have four hangings each blocked by eight nails. Hanging diameter depth is 3 cm; flat square head nails 1 × 3 cm are used.

In the excavations at Karakorum of the Mongol-German joint expedition nails were found which could have been used in wheels (Fig. 23).

“ger tergen”, “gerlüge”

In § 124 of the “SHM”: “A fallow cow coming, going round about Jamuḡa, having butted his tent cart, butting Jamuḡa, breaking one of two horns, becoming one with a crooked horn, saying and saying: Bring my horn”, bellowing and bellowing toward Jamuḡa, she standeth, raising and raising the dust. A hornless fallow ox lifting up a great stake under the tent, harnessing” (Cleaves 1982, 172). In transliteration: “*qo’aqcin ünien ireju jamuḡa-yi horcižju jabuju ger tergen inu mürgüle’et jamuḡa-yi mürgüju öre’ele eber-iyen quḡuraju so[l]jir eberty bolju eber minu aca ke’en ke’en jamuḡa-yin jü[k] mö’ören mö’ören siro’ai sacun bayimu muqular qo’a hūker yeke gerlüge de’ere...*” (Rachewiltz 1972: 3128).

In Chinese translation “gerlüge” means head ger cart. For this word F. Cleaves gave an explanation as “a great stake under tent” (Cleaves 1982). But Dugarjav gave the explanation as “great ger by base”.

D. Tserensodnom explains ger carts as “one of those used in long distance conquering travels” (Tserensodnom 2000: 243).

D. Maidar and L. Dar’suren explained the word “gerluge” as something close to ger cart which had been used in travels (Maidar / Dar’suren 1976: 85–86).

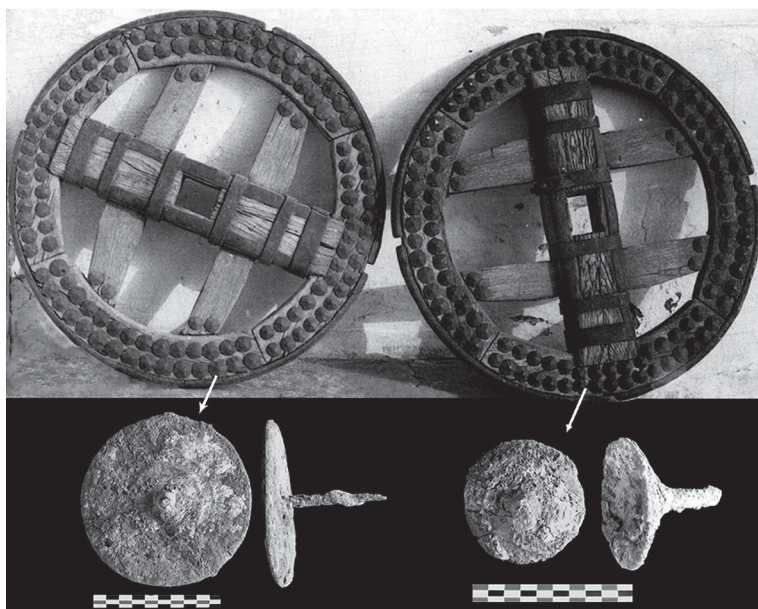


Fig. 23. Iron nails from the excavation at the city's centre of Karakorum (KAR 2) and their use on carts.

On cart craftsmen “gücügür”

Records report there were craftsmen of carts as of 12th century. Since ancient times there have been craftsmen of carts among the Mongolians. In 1189 in Khamag Mongol state craftsmen existed, producing carts and working with wood.

In the SHM it is said a head master of crafting and repairing carts was named “gücügür” master. In 1206, he was appointed as head commander of a one thousand unit after 17 years of his service to Cinggis khan.

In § 121 of the “SHM” in transliteration: “...gücügür ügüleriin co’orgatai tergen-I ci’ü in bu ci’üde’ülsü tenggisgetei terge-i terge’ür de’ere bu te’üre’ülsü ke’e’jü ger tergen doyasu ke’eba” (Rachewiltz 1972: 3302).

SUMMARY

For the purpose of better understanding the nature of techniques related to mobility, communication, and military strategy among peoples of the nomad states, a single type of archaeological artefact yields much information. Recently we turned our attention to the question of the nomadic materials and technology for transportation, in particular the cast iron wheel-bushings and related issues. This piece of vehicle equipment was integral to the nomadic life style, and it is well represented in the archaeological and historical records. Numerous well-preserved examples come from

recent excavations at Karakorum. The typological classification presented here has included all known examples of wheel-bushings from all historical periods and will ideally be applicable to further collections which have yet to be unearthed. A chronology of development may also be established, beginning with the Xiongnu.

In the archaeological and historical record this artefact is well represented. A large quantity of the well-preserved and registered cast iron wheel-bushings come from recent archaeological excavations in Karakorum, Mongolia. Based on this item we began our registration of all cast iron wheel-bushings during the time from Xiongnu to the Medieval Mongolian period, which were reported and/or preserved in several museums in Mongolia, Russia and China.

Also the result of the metallurgical examination showed that wheel-bushings from Karakorum were made of tempered light cast iron and that, during the casting process, wooden charcoal and also high quality fossil coal were used.

People lived in the territory of Mongolia from early times and used carts for their daily needs.

From brief observations made above on bushings, it is possible to suggest Mongolia as a nomadic civilization’s cradle, rich in archaeological and historical-cultural heritage, where the various cart types from the Xiongnu imperial era down to the Mongolian great state were used.

Bushings can be divided into nine main classes and each class could bring us some information about its dates. A future study might be devoted to elaborating the problem of the emergence of consolidated industry and militarisation to the point where military and

cultural expansion against distant neighbors became a possibility. In the course of further collection of all obtainable information, the more elaborated typological and chronological classification could be presented.

APPENDIX I: TRADITIONAL WORD EXPLANATIONS ON CARTS (CF. FIG. 24–26)

Kind of cart

Tereg /tergen/ *ᠲᠡᠷᠭᠡᠨ* Sūkh ačikhad zoriulsan aral, duγujtaj, mor', ükher, temeē zeregt khöl-lökh kheregsel (Tsevel 1966: 579).

Arvā *ᠠᠷᠪᠠ* Khojor duγujtaj khasag tereg: arvā tereg (örgön möörtej tönölžin khegeēstej khasag tereg) (Mongol 2008: 126).

Bürkhültej tereg *ᠪᠦᠷᠬᠦᠯᠲᠡᠵᠡ* *ᠲᠡᠷᠭᠡᠨ* Bitū tereg (Mongol 2008: 401).

Bükheēgtej tereg *ᠪᠦᠬᠡᠭᠡᠳᠡᠵᠡ* *ᠲᠡᠷᠭᠡᠨ* Bitū khalkhavčtaj tereg (Mongol 2008: 412).

Ger tereg *ᠭᠡᠷ* *ᠲᠡᠷᠭᠡᠨ* Tergen deér bökhlon bar'san ger (Mongol 2008: 583).

Dācā tereg *ᠳᠠᠴᠠ* *ᠲᠡᠷᠭᠡᠨ* Ačā barā teēverlekh tom morin tereg (Mongol 2008: 607).

Dajcā *ᠳᠠᠵᠴᠠ* *ᠲᠡᠷᠭᠡᠨ* Ačānij morin tereg (Mongol 2008: 642).

Dörövdej *ᠳᠦᠷᠦᠪᠳᠡᠵᠡ* Ükher goldū khöllödög dörvön möörtej tereg (Mongol 2008: 733).

Žar (an) *ᠵᠠᠷ* Žaran šarijn ger (žaran šar ükher khöllösön ger tereg, khömrögijn sūc) (Mongol 2008: 874).

Zadyaj tereg *ᠵᠠᠳᠠᠵᠠᠵᠠ* *ᠲᠡᠷᠭᠡᠨ* Adar deēverguj tereg, deēd tal n' onyorkhoj tereg (Mongol 2008: 949).

Züjmel tereg *ᠵᠦᠵᠢᠮᠡᠯ* Arandal züjmel tereg, ugsarmal tereg (Mongol 2008: 1054).

Lūyar tereg *ᠯᠦᠶᠠᠷ* Tömör möörtej maš khünd ajan žingijn tereg (Mongol 2008: 1172).

Modon tereg *ᠮᠣᠳᠣᠨ* Modör khijsen tereg (Mongol 2008: 2158).

Morin tereg *ᠮᠣᠷᠢᠨ* *ᠲᠡᠷᠭᠡᠨ* Mor' khöllösön tereg (Mongol 2008: 1241).

Mukhlag tereg *ᠮᠤᠬᠤᠯᠠᠭ* *ᠲᠡᠷᠭᠡᠨ* Buryas, khols zergijg mataž teregnij aral deér Bürkhül bolyon sūlyaz esgij, bös zergeēr bürsen üdtej tereg (Mongol 2008: 1280), Deēgüreē Bürkhül бүхий üdtej tereg (Tsevel 1966: 52).

Müglen *ᠮᠦᠭᠦᠯᠡᠨ* Jaltnijg khürgekhed khereglek khoriul tereg (Mongol 2008: 1286).

Ölzigtej tereg *ᠥᠯᠵᠢᠭᠡᠲᠡᠵᠡ* *ᠲᠡᠷᠭᠡᠨ* Urd taldā sūdaltaj tereg (Mongol 2008: 1570).

Ööžin *ᠥᠭᠡᠵᠢᠨ* Njalkh khūkhdeē khijdeg dörvölžin tergencer (Mongol 2008: 1597).

Tömör tereg *ᠲᠥᠮᠦᠷ* *ᠲᠡᠷᠭᠡᠨ* Tömör duγujtaj tereg, duγujny möörijg tömröör bekhelsen tereg (Tsevel 1966: 579).

Tülkhekh tereg Dund n' neg khürd tav'ž, khün tülkhež javakh tereg (Rasi et al. 1961: G2657a; T3729).

Tülkhūr tereg *ᠲᠦᠯᠬᠦᠷ* *ᠲᠡᠷᠭᠡᠨ* Ganc duγujtaj, tülkhež javdag ār sār jum zöök tereg (Mongol 2008: 2103).

Türdeg tereg Khun türž javulakh tereg (Mongol 2008: 2158).

Temeēn tereg Temeēnd khöllösön tereg (Mongol 2008: 2158).

Tergencer *ᠲᠡᠷᠭᠡᠨᠴᠡᠨᠡᠷ* Ačā teēš türž, čirč javakh žižig tereg (Mongol 2008: 2156).

Uysrā tereg *ᠤᠶᠢᠰᠷᠠ* *ᠲᠡᠷᠭᠡᠨ* Ar arās n' zalyūlan örsön tereg (Mongol 2008: 2178).

Ükheg tereg *ᠤᠭᠬᠡᠭ* *ᠲᠡᠷᠭᠡᠨ* Khün sūkhad zoriulsan tereg (Mongol 2008: 2343).

Ükher tereg *ᠤᠭᠬᠡᠷ* *ᠲᠡᠷᠭᠡᠨ* Ükher höllösön tereg (Mongol 2008: 2344).

Khātaj tereg *ᠬᠠᠲᠠᠵᠠ* *ᠲᠡᠷᠭᠡᠨ* Delbeētei tereg, delbeēž javakhad sūkh khesegtej tereg (Mongol 2008: 2353).

Kham tereg *ᠬᠠᠮ* *ᠲᠡᠷᠭᠡᠨ* Esgij bükheēgtej mukhlag tereg, nüdel sūdāl khiikhed khūkhed nastnijg avč javna (Mongol 2008: 2423).

Khankhai tereg *ᠬᠠᠨᠬᠠᠢ* *ᠲᠡᠷᠭᠡᠨ* Ačāgūj tereg (Mongol 2008: 2445).

Kharūtaj tereg *ᠬᠠᠷᠠᠲᠠᠵᠠ* *ᠲᠡᠷᠭᠡᠨ* Khātaj tereg (Mongol 2008: 2472).

Khasag tereg **ᠬᠠᠰᠠᠭ ᠲᠡᠷᠭᠡ** Möörijg n' cagariglan bekhelsen mal khöllöž ačā ačikhad zoriulsan tom tereg (Mongol 2008: 2480), Mal khöllöž ačā ačikh tom tereg (Tsevel 1966: 668).

Khodōg **ᠬᠣᠳᠣᠭ** Khojd talijn khojor duγuj n' öndör, urd khojor duγuj n' žižgevtter, aral бүkhij tereg (Mongol 2008: 2525).

Khösög tereg **ᠬᠣᠰᠣᠭ ᠲᠡᠷᠭᠡ** Unalya ačayataj tereg (Mongol 2008: 2158).

Khün tereg **ᠬᠡᠭᠦᠨ ᠲᠡᠷᠭᠡ** Khün khöllösön tereg (Mongol 2008: 2755).

Šanš tereg **ᠰᠠᠩᠰ ᠲᠡᠷᠭᠡ** Šanš modör khijsen tereg (Mongol 2008: 3060).

Šart tereg **ᠰᠠᠷᠲ ᠲᠡᠷᠭᠡ** Šar lüt tereg (Najman mor' khöllökh tereg) (Mongol 2008: 3069).

Jašin **ᠵᠠᠰᠢᠨ** Čingelegees araj bogino khašlaya бүkhij neg züjl tereg (Mongol 2008: 3278).

Cart parts

Adar **ᠠᠳᠠᠷ** Khana, khašlaya, adargüj tereg (khašlayaguj tereg) (Mongol 2008: 39).

Adajr **ᠠᠳᠠᠵᠢᠷ** Teregnij arlyn jalū modond narijn savkh modör sülžiz khijsen čig (Mongol 2008: 38).

Aral **ᠠᠷᠠᠯ** Süjkh bolon teregnij khašilayyg tosson, tenkhlegt tulγurlan tav'san khojor urt mod (Rasi et al. 1961: G2657a; T3729), Tereg čaryand mor' mal khöllöž čirekhed zoriulan belsen urt khojor guja mod (Mongol 2008: 124), Tereg čaryand mor' mal khöllökhöd belsen hoyor urt iš mod (Tsevel 1966: 48).

Aralt **ᠠᠷᠠᠯᠲ** Tereg čarga zeregt bajkh khojor guja mod бүkhij (Mongol 2008: 125).

Bōdoj **ᠪᠣᠳᠣᠵ** Tereg čirekh malyn khōloj dōγūr torγož ujakh ōsor (Mongol 2008: 300).

Bōltoryo **ᠪᠣᠯᠲᠣᠷᠢᠣ** Teregnij boj (Mongol 2008: 301).

Boryolj (boryulji) Tergenij khojno ujasan ereēdes dürekx mod (Rasi et al. 1961: G2658b; T3735).

Bul (bulu) **ᠪᠤᠯ** Teregnij khürdnij dund tenkhleg khelkhekh dügreğ mod (Rasi et al. 1961: G2658a; T3733), Teregnij golyg tojron ergekx, mod tömröör khijsen bulcū; duγujn tövijn budūn kheseğ (Mongol 2008: 348), modon ba tömör khigees šākh tövijn bulcūt kheseğ (Tsevel 1966: 104).

Bulkham **ᠪᠤᠯᠬᠠᠮ** Tergend khöllökh ükher malyn khüzünd tavikh bögtör mod; būlya (Mongol 2008: 358).

Būlya **ᠪᠤᠯᠠ** Ükhrijn khüzünd torγokx muruj mod (Rasi et al. 1961: G2658b; T3735), Tergend khöllökh malyn khüzün deēr tav'ž ujakx bögtör mod (Tsevel 1966: 111), arlyn ömnökh üzürt tav'san mod (G2658b; T3735), Malyg tergend khöllökhödö khüzün deegūr n' khavčín tavikh bögtör mod, **būlyanij ōsor** mal khöllökh bögtör modny ōsor (Mongol 2008: 374).

Bökhön **ᠪᠥᠬᠡᠬᠡᠨ** Mukhlag teregnij esgijg tulakh kharā mod (Mongol 2008: 338).

Bürkhül **ᠪᠦᠷᠬᠡᠭᠦᠯ** Teregnij khöšignij deegūr бүteekh bös zereğ jumār khijsen бүrkhüljig (dugtuj) khelne (Rasi et al. 1961: G2657a; T3729), Teregijg бүteēž khalkhlakh züjl (Mongol 2008: 401).

Ereēdes (eregedesü) Boryolžny khōrond dürekx šūmyai mod (Rasi et al. 1961: G2658b; T3735), Jumyg erž čanyalakh khereğsel, teregnij ačāny tatlaya darūlya čanyalakh züjl (Tsevel 1966: 889).

Gilū **ᠭᠢᠯᠠ** Teregnij dal (Mongol 2008: 456).

Gilün **ᠭᠢᠯᠦᠨ** Teregnij aral (Mongol 2008: 498).

Gol **ᠭᠣᠯ** Khojor duγujg kholbokx urt mod esvel tömör (Mongol 2008: 511).

Gīšgūr Arlyn bayand uglasan khöndlön mod (Rasi et al. 1961: G2659a; T3736).

Guvčūr **ᠭᠤᠪᠴᠦᠷ** Modond ōsor ujaž tereg čirekh malyn khüzünd zūkh khereğsel (Mongol 2008: 546).

Guja **ᠭᠤᠵᠠ** Teregnij guja (tereñnij öröösön kheseğ) (Mongol 2008: 560).

Gūšin **ᠭᠤᠰᠢᠨ** Teregnij duγujny ergekx golyg kholbokx bekhlekx ed angī (Mongol 2008: 574).

Dāju **ᠳᠠᠵᠤ** 1. Temeenij urd bökhönd uglan bögtörč, teregnij khojor arlyg kholbon bekhlekx esgijgeēr khijsen khöllögöönij tonog khereğsel; 2. Ükher teregnij arlyn khojor gujayg deēš tataž šökhojtoj kholbokx darūlya; darūlya ōsor, tatlagyn ols (Mongol 2008: 608).

Danz **ᠳᠠᠨᠵᠤ** 1. Ükher, morin tereğ zergijn tavcan; 2. Teregnij khojor gujayg kholbon aral bolyoson daj modnūd, tereñnij jalū: **tereñnij danz** (tereñnij aral khōrond kholboson mod) (Mongol 2008: 664).

Duyuj **ᠳᠤᠭᠤᠵ** Alivā jumyg gazrār önkhrülekh zoriulalt бүkhij tenkhlegt khürden tulγūr, khürdet jum; tereñnij önkhrön javakh khürd (Mongol 2008: 740).

Dülij ᠳᠦᠯᠢᠵᠢ Tereġnij khürdend khereglekhe tehkhleg, khegeesnij nükh garġägüj bul (Mongol 2008: 769).

Delbeġ ᠳᠡᠯᠪᠡᠭ Tereġ, anġisnij mor', malyg zalġ delbekh urt žolō (Mongol 2008: 798).

Delbeleġ ᠳᠡᠯᠪᠡᠯᠡᠭ Tereġnij žolō; delber (Mongol 2008: 798).

Erkh jalū Terenij jalūgijn urd, khojd khojor zakhyn jalū mod (Tsevel 1966: 886).

Jorōl ᠵᠣᠷᠣᠯ Khojor khašlagyn tus dundakh gazryg khelne (Rasi et al. 1961: G2657a; T3730), Tereġnij khojor khašlagyn khōrondokh kheseġ, **khašlagyn jorōl** (khašlagyn šal, tevšnij šal) (Mongol 2008: 852).

Zajnag ᠵᠠᠵᠢᠨᠭᠠᠨ Narijn mod, tömrin üzūrt baġa khemġeēnij khjalġas torġoġ khijsen tereġ toslokhe kheregsele (Mongol 2008: 958).

Zanyalaj ᠵᠠᠨᠶᠠᠯᠠᠵᠢ Duyuj khürdnij khegees-nij zavsryn zaj: **tereġnij zanyalaj** (tereġnij duyujny khegees khōrondyn zavsar) (Mongol 2008: 976).

Žindū ᠵᠢᠨᠳᠤ Tereġ godildokhōs khamġalakhe neġ zūjl tonog kheregsele (Mongol 2008: 904).

Žintū ᠵᠢᠨᠲᠤ Tereġ gulsakhās khamġalakhe neġ zūjljin kheregsele (Mongol 2008: 905).

Zulavč ᠵᠤᠯᠠᠪᠴᠢ Khojor arald khadsan, tenkhleġijg khavčsan muruj tömör (Rasi et al. 1961: G2658a; T3732), Tereġnij tenkhleġijg khavčikhār arald khadsan muruj temör (Tsevel 1966: 282), Tereġnij tenkhleġijg khavčikhār arald khadsan muruj tömör (Mongol 2008: 1034).

Züleē ᠵᠤᠯᠡᠭ Tereġnij aral, būġa khojorijg khoboson sur (Mongol 2008: 1057).

Zütgūr ᠵᠦᠳᠭᠦᠷ Tereġ, teērem zergijġ čirekh, ergūlekhe zoriulġ, deēs surār ōsorloson būġa, khōndlōn mod (Mongol 2008: 1055).

Mār ᠮᠠᠷ Tereġnij neġ kheseġ (Mongol 2008: 1181).

Mušgiur Ereēdsijg mušgikh mod (Rasi et al. 1961: G2658b; T3736).

Möör ᠮᠥᠭᠦᠷ Khigeēs-nij tojron nijlūlen tav'san muruj mod (Rasi et al. 1961: G2658b; T3734),

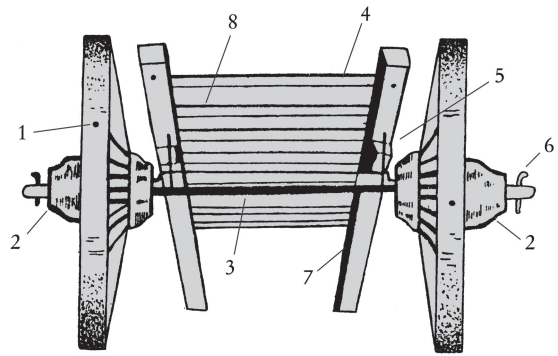


Fig. 24. Technical drawing of a cart with selected Mongolian notations. 1) Ul tumor, 2) Bul, 3) Tenkhleg, 4) Erkh yaluu, 5) Emeel, der mod, 6) Tsuu, 7) Aralnii guya, 8) Yaluu.

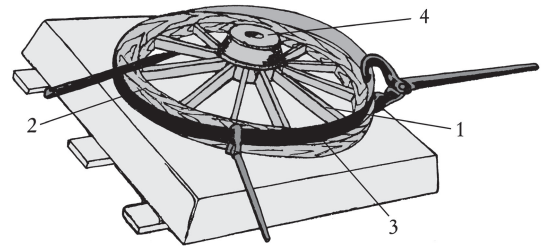


Fig. 25. Technical drawing of a cart with selected Mongolian notations: 1) Khigees, 2) Moor, 3) Ul tumor, 4) Moor.

Modon tereġnij duyuj khüreē (Mongol 2008: 1252), Duyuj jumny khüreē, duyujni möör (Tsevel 1966: 44).

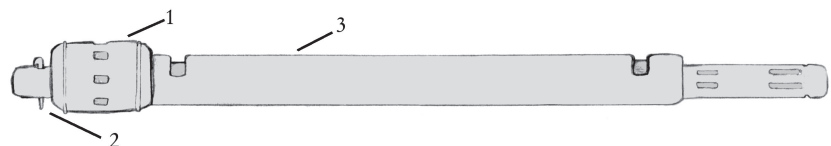
Num(an) ᠨᠤᠮᠤᠨ tereġnij num (tereġnij tenkhleġt sūġlasan tömör) (Mongol 2008: 1398).

Nurūvč ᠨᠤᠷᠤᠪᠴᠢ tereġnij nurūvč tömör (tereġnij gol tulġūr mod) (Mongol 2008: 1403).

Ölzig ᠣᠯᠵᠢᠭ Tereġnij urd khesgijn öndörlög sūdal (Mongol 2008: 1570).

Ōsor Tereġ khülekh tokhokh zujl (Rasi et al. 1961: G2657b; T3731).

Fig. 26. Technical drawing of an axis with selected Mongolian notations: 1) Bul, 2) Tsuu, 3) Tenkhleg.



Savkh tömör Tenkhleḡijn hojor üzürt orūlan tav'san dörvölžin tömör (Rasi et al. 1961: G2658b; T3732), Khovil garyasan khojor jumny khōrond šākh zujl (Tsevel 1966: 458).

Sül Tereḡnij khojd tal (Rasi et al. 1961: G2657b; T3731).

Tatlaja ᠲᠠᠲᠤᠯᠠᠵᠠ Ačāg bekhelž khülekh ōsor (Mongol 2008: 1944).

Tonog ᠲᠣᠨᠭᠠ Morin tereḡnij khöllögöönij khereḡsel (Mongol 2008: 2004).

Tögij ᠲᠦᠭᠢᠵᠢ Tergend khöllökh moriny khüzün deḡgūr davūlž araltaj kholbokh takhir modon tonog (Mongol 2008: 2038).

Tū ᠲᠦ Anžis, tereḡ, čarya zergijn khöllögöönij urt dees (Mongol 2008: 2084).

Tujanž ᠲᠤᠵᠠᠨᠵᠢ Morin tereḡ, čarya khöllökhod moriny khüzünd ukladag zöölövc būkhij tonog (Mongol 2008: 2094).

Tenkhleḡ ᠲᠡᠩᠬᠡᠯᠡᠭᠢ Jamar neḡ bijejin gold čig bolon oršikh šulūn, guld zujl (Mongol 2008: 2150), Tereḡnij tenkhleḡ, Tereḡnij aral tosson bulny nūkhend dūren, khöndlön temör esvel mod (Tsevel 1966: 577).

Tereḡnij gol ᠲᠡᠷᠡᠭᠢᠨᠭᠣᠣᠯ Khojor duḡujg kholbokh urt mod buju tömör (Mongol 2008: 511).

Tereḡnij nurūvc tömör ᠲᠡᠷᠡᠭᠢᠨᠢᠷᠦᠭᠦᠪᠴᠢᠲᠠᠮᠣᠷ Tereḡnij gol tulūr tömör (Mongol 2008: 1403).

Tereḡnij num ᠲᠡᠷᠡᠭᠢᠨᠨᠠᠮ Tereḡnij tenkhleḡ sūlyasan tömör (Mongol 2008: 1398).

Tereḡnij šāntag ᠲᠡᠷᠡᠭᠢᠨᠱᠠᠨᠲᠠᠭ Morin tereḡnij duḡujny zaj zavsriḡ čigžikh žijreḡ mod (Mongol 2008: 3023).

Tereḡnij bōdoj Tereḡnij būlyā (Mongol 2008: 300).

Tereḡnij guja ᠲᠡᠷᠡᠭᠢᠨᠭᠤᠵᠠ Tereḡnij aral (Mongol 2008: 560).

Tereḡnij num ᠲᠡᠷᠡᠭᠢᠨᠨᠠᠮ Tereḡnijg khöngön zöölön javdaltai bolyokh zūjl (Mongol 2008: 1403).

Tereḡnij khašlaya ᠲᠡᠷᠡᠭᠢᠨᠬᠠᠰᠯᠠᠶᠠ Tereḡnij khüree mod (Mongol 2008: 2498).

Tereḡnij cōn Tereḡnij bulyn khüjsnij amsart sūlyan tenkhleḡ bulyg idekhees sergijlekh der tömör (Mongol 2008: 2158).

Tereḡnij savā Bulyn ürelted eleḡdež narijsakhās sergijlž tenkhleḡijn üzürt sūlyasan urt dörvölžin tömör (Mongol 2008: 2158).

Tereḡnij kholkhivč Tereḡnij cōn (Mongol 2008: 2158).

Tereḡnij čikh Tereḡnij arlyn gogcō, tatūrya (Mongol 2008: 2158).

Tereḡnij būkheeḡ ᠲᠡᠷᠡᠭᠢᠨᠪᠦᠬᠡᠭᠡ Tereḡnij saravč (Mongol 2008: 411).

Ūraj ᠤᠷᠠᠵᠢ Tereḡnij bulyn tenkhleḡ šuryūlakh, khojor üzūrtej kholkhovčoj nūkh (Mongol 2008: 2261).

Khavčūr cū Sūjkh bolon tereḡnij tenkhleḡijg khavčīn dūrekh dörvön gadas (Rasi et al. 1961: G2658a; T3732).

Khasag ᠬᠠᠰᠠᠭ Tereḡnij möörmij gadūr bekhelsen cagarig (Mongol 2008: 2480).

Khašlaya ᠬᠠᠰᠯᠠᠶᠠ Tereḡnij khojor etgeēded gereēsgelen daldavčlan tav'san mod (Rasi et al. 1961: G2657a; T3730), Jumyḡ khākh, khašās tereḡnij khašlaya (tereḡnij khašās) (Mongol 2008: 2498).

Khigeēs (kegesü) Bulu, möörijg nijlūlen toirog khadsan jalū (G2658b; T3734), Khürd duḡuj telūr (Tsevel 1966: 687).

Khiteḡ ᠬᠢᠲᠡᠭ Tereḡnij ömnöd khojd kheseḡ (Mongol 2008: 2516).

Kholkhivč (qolqubči) Bulny nūkhend tav'san dügreḡ tömör (Rasi et al. 1961: G2658a; T3734), Bulu ergen kholkhikh tulūr (Tsevel 1966: 687).

Khom ᠬᠣᠮ Mor', ilžig khöllökhöd khüzünd n' uglaž, ōsrör tereḡnij arald kholbokh khöllögöönij khereḡsel; tereḡnij khom (tereḡnij mor' malyn khüzünd uglaž, tereḡnij arald kholbodog kholkhovč bambaj) (Mongol 2008: 2544).

Khomūt ᠬᠣᠮᠤᠲᠤ Žāvanz modyg šineēr bürž, esgij zöölövc khijsen, suran uja būkhij morin tereḡnij khöllögöönij tonog khereḡsel (Mongol 2008: 2546).

Khölbör (kölbüri) Ükher tereḡnij aral (Rasi et al. 1961: G2657a; T3729).

Khöllövör ᠬᠥ᠋ᠯᠯᠥᠪᠦᠷ Temeenij urd bökhönd uglaž tereḡ khöllökh khereḡsel; khöllövriḡn döröō (khöllövört tereḡnij aral bekhlekh kheseḡ) (Mongol 2008: 2611).

Khöllögövc ᠬᠥ᠋ᠯᠯᠥᠭᠦᠪᠴᠢᠲᠠᠮ Tergend khöllökh temeenij bökhönd khijkh tokhovč (Mongol 2008: 2612).

Khöšig Toryo, esgij zergeēr tereḡ sūjkhijg buteēkhuj zujl (Rasi et al. 1961: G2656b; T3727).

Khürd Bulu kegesü möörijg nijlūlen dügreḡ bolyož, tenkhleḡt khelkhež önkhrön ergekhūjg n' khelne (Rasi et al. 1961: G2658a; T3733).

Cū (gadas) Arlyn ömnökh üzürt bosyon dūrsen gadsijg cū gene (Rasi et al. 1961: G2658b;

T3735), Tereġnij arlyn gujany ömnökh üzürt bosyon khijkh mod (Tsevel 1966: 80).

Šāntag *ᠰᠠᠨᠲᠠᠭ* tereġnij **šāntag** (morin tereġnij duujny zaj zavsryg čigžekh žijreġ) (Mongol 2008: 3023).

Šalan *ᠰᠠᠯᠠᠨ* Tereġ čirekh mor' malyn gujany dayū tataž, tereġnij arlyn gujany dayū tatan ujakh ōsor (Mongol 2008: 3042).

Šalan mod *ᠰᠠᠯᠠᠨ ᠮᠣᠳ* Tereġnij arlyn gujany dayū ōsor ujakh mod (Mongol 2008: 3042).

Šokhoj *ᠰᠣᠬᠣᠵᠢ* Emeel šig khelberteġ tereġnij khereġlel (Mongol 2008: 3122).

Šövrög *ᠰᠥᠪᠷᠦᠭ* Tereġnij aral dörkh tulyūr mod (Mongol 2008: 3128).

Šižemnekhuj Anžis, tergend mal nemž urd čirkhujlijg khelne (Rasi et al. 1961: G2659b; T3738).

Jalū *ᠵᠠᠯᠤ* Jorōr khöndlön khadsan khed kheden mod (Rasi et al. 1961: G2657b; T3730), Tereġnij aral, šatny gujany khōrond kholboson khöndlön mod (Tsevel 1966: 905), Tereġnij aral, šat zergijn khöndlövč mod (Mongol 2008: 3260).

Jalū khegees *ᠵᠠᠯᠤ ᠬᠡᠭᠡᠭᠡᠰ* tereġnij khürdnij bekhleēs mod (Mongol 2008: 3260).

Jajšin *ᠵᠠᠵᠢᠰᠢᠨ* Tereġnij duujny golyg araltaj n' kholbož bekhlekh khereġsel: tereġnij jajšin (tereġmij bekhelgeēnij mod) (Mongol 2008: 3253).

APPENDIX II. CATALOGUE OF WHEEL-BUSHINGS FOUND ON THE TERRITORY OF MONGOLIA

Group A, Type A.1, Variation A.1a

Gol-mod, Khairkhan sum, Arkhangai aimag (Mongolian-French Expedition 2002 and 2007)

1. Wheel-bushing, complete, 2/2; open with semicircular flat tenon (Grave 1, 2002).
2. Wheel-bushing, complete, 2/2; open with semicircular flat tenon (Grave 1, 2002).
3. Wheel-bushing, complete, 2/2; open with semicircular flat tenon (Grave 1, 2002).
4. Wheel-bushing, complete, 3/3; open with semicircular flat tenon (Grave 1, 2002).
5. Wheel-bushing, complete, 3/3; open with semicircular flat tenon (Grave 1, 2002).
6. Wheel-bushing, complete, 2/2; open with trapezoid flat tenon (Grave 20, 2007).
7. Wheel-bushing, complete, 3/3; open with trapezoid flat tenon (Grave 20, 2007).

Noyon uul, Batsumber sum, Töv aimag (Mongolian-Russian Expedition 2006)

8. Wheel-bushing, complete, 3/3 (no further information).
9. Wheel-bushing, fragment (no further information).
10. Wheel-bushing, fragment (no further information).

Group A, Type A.1, Variation A.1b

Karakorum, Kharkhorin sum, Övörkhantai aimag (Mongolian expedition 1976–1985; based on the registration list of the Institute of Archaeology, MAS)

11. Wheel-bushing, complete, 3/3; W. 4.1 cm; Th. 1.3 cm; 300 gr. (no further information).

Group A, Type A.2, Variation A.2a-a

Noyon uul, Batsumber sum, Töv aimag (Mongolian-Russian Expedition 2006)

12. Wheel-bushing, complete, 3/3 (no further information).

Group A, Type A.2, Variation A.2a-b

Karakorum, Kharkhorin sum, Övörkhantai aimag (Mongolian expedition 1976–1985; based on the registration list of the Institute of Archaeology, MAS)

13. Wheel-bushing, complete, 2/2; W. 4.2 cm; Th. 1.5 cm; Dm. 9.0 cm (no further information).

Group A, Type A.2, Variation A.2a-c

Khöshöö Tsaidam, Khashaat sum, Arkhangai aimag (Excavation by Mongolian-Turkic expedition 2003)

14. Wheel-bushing, fragment, 2/5; (no further information).

Group A, Type A.2, Variation A.2a-d

Karakorum, Kharkhorin sum, Övörkhangai aimag (Excavations by Soviet-Mongolian expedition 1948/49; based on the registration list of the Institute of Archaeology, MAS)

15. Wheel-bushing, complete, 6/6; W. 4.4 cm; Th. 2.4 cm; Dm. 12.0 cm (no further information; Kiselev-Nr. 2264).
16. Wheel-bushing, complete, 6/6; W. 2.1 cm; Th. 1.2 cm; Dm. 7.0 cm (Trench 1, Sq. 10, Level 8; Kiselev-Nr. 2271).
17. Wheel-bushing, complete, 6/6; W. 2.0 cm; Th. 1.0 cm; Dm. 7.0 cm (no further information; Kiselev-Nr. 2273).
18. Wheel-bushing, complete, 6/6; W. 2.2 cm; Th. 1.1 cm; Dm. 7.0 cm (Trench 1, Sq. L 5-6, Level 6-8; Kiselev-Nr. 2275).
19. Wheel-bushing, fragment, 1/?; W. 2.4 cm; Th. 1.2 cm; Dm. 8.0 cm (Trench 4, Sq. A 2, Level 4-5; Kiselev-Nr. 2315).
20. Wheel-bushing, fragment, 1/?; W. 2.2 cm; Th. 0.9 cm; Dm. 11.0 cm (no further information; Kiselev-Nr. 2335).

Karakorum, Kharkhorin sum, Övörkhangai aimag (Excavations by Soviet-Mongolian expedition 1948/49; based on the registration list of the National Museum of History)

21. Wheel-bushing, complete, 6/6; W. 2.7 cm; Th. 1.2 cm; Dm. 9.0 cm (Inv. No. NHM 266; Trench 1, Sq. A 10, Level 5).
22. Wheel-bushing, complete, 6/6; W. 1.8 cm; Th. 1.2 cm; Dm. 7.0 cm (Inv. No. NHM 223; Trench 2, Sq. ? Level 6).
23. Wheel-bushing, complete, 6/6; W. 4.8 cm; Th. 2.2 cm; Dm. 11.0 cm (no further information).

Karakorum, Kharkhorin sum, Övörkhangai aimag (Excavations by Mongolian expedition 1976-1985; based on the registration list of the Institute of Archaeology, MAS)

24. Wheel-bushing, fragment, 1/6; W. 4.1 cm; Th. 1.3 cm; 300 gr. (no further information).
25. Wheel-bushing, complete, 2/6; W. 4.6 cm; Th. 0.9 cm; Dm. 7.0 cm (no further information).
26. Wheel-bushing, fragment; W. 2.0 cm; Th. 6.9 cm; Dm. 8.0 cm; 90 gr. (no further information).

Karakorum, Kharkhorin sum, Övörkhangai aimag (Excavations by MDKE-KAR 2, 1999-2005)

27. Wheel-bushing, fragment, 3/6; W. 2.5 cm; Th. 1.5 cm; Dm. 9.0 cm; 330 gr. (MDKE-KAR 2/3; LH 17/2, 0).
28. Wheel-bushing, fragment, 1/6; W. 2.6 cm; Th. 1.4 cm; Dm. 12.0 cm; 180 gr. (MDKE-KAR 2/75; LH 26/82, 1).
29. Wheel-bushing, fragment, 1/6; W. 3.8 cm; Th. 1.1 cm; Dm. 11.0 cm; 190 gr. (MDKE-KAR 2/371; LH 26/33, 1, F 33).
30. Wheel-bushing, fragment, 0/6; W. 2.2 cm; Th. 1.1 cm; Dm. 9.0 cm (MDKE-KAR 2/262; LH 17/56-100, 3).
31. Wheel-bushing, complete, 6/6; W. 1.7 cm; Th. 1.0-1.2 cm; Dm. 6.0 cm; 330 gr. (MDKE-KAR 2/816; LH 17/20, 7).
32. Wheel-bushing, fragment, 2/6; W. 2.3 cm; Th. 1.4 cm; Dm. 10.0 cm (MDKE-KAR 2/963; LH 26/81, 7).
33. Wheel-bushing, fragment, 2/6; W. 2.4 cm; Th. 1.3 cm; Dm. 10.0 cm; 225 gr. (MDKE-KAR 2-995; LH 16/20, 7).
34. Wheel-bushing, fragment; 1/6; W. 3.0 cm; Th. 1.4 cm; Dm. 8.0 cm; 170 gr. (MDKE-KAR 2/1281; LH 26/62, 1).
35. Wheel-bushing, fragment; 1/6; W. 3.4 cm; Th. 0.6-1.0 cm; Dm. 10.0 cm; 160 gr. (MDKE-KAR 2/1361; LH 87/48, 2-10).
36. Wheel-bushing, fragment, 1/6; W. 2.3 cm; Th. 1.1-1.3 cm; Dm. 10.0 cm; 875 gr. (MDKE-KAR 2/1629; LH 18/97, 3).
37. Wheel-bushing, complete, 6/6; W. 2.4 cm; Th. 1.6 cm; Dm. 8.0 cm; 965 gr. (MDKE-KAR 2/1648; LH 17/65, Pl. 1).
38. Wheel-bushing, fragment, 2/6; W. 2.3 cm; Th. 1.6 cm; Dm. 10.0 cm; 420 gr. (MDKE-KAR 2/1652; LH 18/97, 4; F 295).
39. Wheel-bushing, complete, 6/6; W. 4.9 cm; Th. 2.6 cm; Dm. 9.0 cm; 2900 gr. (MDKE-KAR 2/1664; LH 17/82, 1).
40. Wheel-bushing, complete, 6/6; W. 2.6 cm; Th. 1.1 cm; Dm. 10.0 cm; 870 gr. (MDKE-KAR 2/1740; LH 16/73, Pl. 2, F 338).
41. Wheel-bushing, fragment, 2/6; W. 2.0 cm; Th. 1.7 cm; Dm. 10.0 cm (MDKE-KAR 2/1741; LH 16/73, Pl. 2, F 338).
42. Wheel-bushing, complete, 6/6; W. 5.7 cm; Th. 2.4 cm; Dm. 13.0 cm; 4125 gr. (MDKE-KAR 2/1776; LH 16/84, Pl. 2, F 345).
43. Wheel-bushing, complete, 6/6; W. 3.2 cm; Th. 1.5 cm; Dm. 9.0 cm; 1190 gr. (MDKE-KAR 2/1811; LH 16/83, F. 351).

44. Wheel-bushing, complete, 6/6; W. 2.6 cm; Th. 2.0 cm; Dm. 8.0 cm; 1300 gr. (MDKE-KAR 2/1824; LH 16/92-95, 2 F 345a).
 45. Wheel-bushing, complete, 6/6; W. 4.7 cm; Th. 1.6 cm; Dm. 9.5 cm; 2105 gr. (MDKE-KAR 2/1940; LH 16/93, Pl. 2, F 409).
 46. Wheel-bushing, complete, 6/6; W. 2.6 cm; Th. 1.4 cm; Dm. 8.0 cm; 170 gr. (MDKE-KAR 2/2248; LH 26/33, 12).
 47. Wheel-bushing, complete, 6/6; W. 3.2 cm; Th. 1.2 cm; Dm. 8.0 cm; 765 gr. (MDKE-KAR 2/2333; LH 27/81, F 623).
 48. Wheel-bushing, fragment, 1/6; W. 2.8 cm; Th. 1.3 cm; Dm. 9.0 cm (MDKE-KAR 2/2363c; LH 26/14, 15).
 49. Wheel-bushing, fragment, 1/6; W. 3.0 cm; Th. 1.0–1.4 cm; Dm. 10.0 cm; 130 gr. (MDKE-KAR 2/2631; LH 17/69, 8).
 50. Wheel-bushing, fragment, 1/6; W. 2.7 cm; Th. 1.3 cm; Dm. 10.0 cm (MDKE-KAR 2/2676b; LH 26/6, 19).
 51. Wheel-bushing, fragment, 1/?; W. 2.6 cm; Th. 0.9 cm; Dm. 10.0 cm; 108 gr. (MDKE-KAR 2/2865; LH 17/90, 8).
 52. Wheel-bushing, fragment, 5/6; W. 3.0 cm; Th. 0.8–1.1 cm; Dm. 10.5 cm; 655 gr. (MDKE-KAR 2/2915; LH 17/69, 8).
 53. Wheel-bushing, fragment, 4/6; W. 3.0 cm; Th. 1.0–1.4 cm; Dm. 10.0 cm; 625 gr. (MDKE-KAR 2/2916a; LH 17/69, 8).
 54. Wheel-bushing, fragment; 3/6; W. 2.6 cm; Th. 0.8–1.0 cm; Dm. 8.5 cm; 240 gr. (MDKE-KAR 2/2916b; LH 17/69, 8).
 55. Wheel-bushing, fragment, 2/6; W. 2.0 cm; Th. 2.0 cm; Dm. 12.0 cm; 550 gr. (MDKE-KAR 2/2921; LH 17/56-100, 8).
 56. Wheel-bushing, fragment, 1/6; W. 2.5 cm; Th. 1.7 cm; Dm. 10.0 cm; 140 gr. (MDKE-KAR 2/3529; LH 18/59, Pl. 12).
 57. Wheel-bushing, complete, 6/6; W. 4.0 cm; Th. 1.6–2.3 cm; Dm. 9.0 cm; 1770 gr. (MDKE-KAR 2/3900; LH 17/91, 5).
 58. Wheel-bushing, complete, 6/6; W. 3.0 cm; Th. 0.9–1.2 cm; Dm. 7.0 cm; 435 gr. (MDKE-KAR 2/4131 a; LH 26/84, 16).
 59. Wheel-bushing, complete, 6/6; W. 5.3 cm; Th. 1.5 cm; Dm. 11.0 cm (MDKE-KAR 2/4263; LH 27/11, 24).
 60. Wheel-bushing, fragment, 4/6; W. 4.0 cm; Th. 2.0 cm; Dm. 9.0 cm; 1270 gr. (MDKE-KAR 2/4302; LH 16/100, Pl. 3).
 61. Wheel-bushing, complete, 6/6; W. 5.3 cm; Th. 1.5 cm; Dm. 11.0 cm (MDKE-KAR 2/4263; LH 27/11, 24).
 62. Wheel-bushing, fragment, 4/6; W. 4.0 cm; Th. 2.0 cm; Dm. 9.0 cm; 1270 gr. (MDKE-KAR 2/4302; LH 16/100, Pl. 3).
 63. Wheel-bushing, fragment, 1/6; W. 2.7 cm; Th. 1.0 cm; Dm. 9.0 cm; 120 gr. (MDKE-KAR 2/4667; LH 87/65, 6).
 64. Wheel-bushing, fragment, 1/6; W. 2.4 cm; Th. 1.3–1.5 cm; Dm. 8.0 cm; 110 gr. (MDKE-KAR 2/4785b; LH 28/44-54).
 65. Wheel-bushing, fragment, 1/6; W. 1.9 cm; Th. 0.9–1.2 cm; Dm. 8.0 cm; 60 gr. (MDKE-KAR 2/4797; LH 16/86, 3).
 66. Wheel-bushing, fragment, 3/6; W. 1.6 cm; Th. 1.8 cm; Dm. 8.0 cm; 225 gr. (MDKE-KAR 2/4958; LH 16/98, 8).
- Khar-Sairi-Garam, Tsagaan-Nuur sum, Khuvsugul aimag (1982)*
67. Wheel-bushing, fragment, 2/6; W. 3.4 cm; Th. 1.9 cm; Dm. 11.0 cm (no further informations).
 68. Wheel-bushing, fragment, 1/?; W. 3.3 cm; Th. 12.3 cm (Nr. 2419).
- Without location, Tamsag bulag sum, Dornod aimag*
69. Wheel-bushing, complete, 6/6; W. 2.0 cm; Th. 1.2 cm; Dm. 10.5 cm; 945 gr. (Inv. No. Do-88).
- Without location*
70. Wheel-bushing, fragment, 4/6; W. 2.6 cm; Th. 1.7 cm; Dm. 13.0 cm (Inv. No. NHM V 50-1-5).
 71. Wheel-bushing, complete, 6/6; W. 9.0 cm; Th. 5.7 cm; Dm. 22.5 cm; 27.55 kg (Inv. No. NHM V 50-1-1).
 72. Wheel-bushing, complete, 6/6; W. 6.9 cm; Th. 4.8 cm; Dm. 21.5 cm; 22.7 kg (no further information).
 73. Wheel-bushing, fragment, 6/6; W. 8.2 cm; Th. 4.5 cm; Dm. 21.0 cm; 23.46 kg (Inv. No. NHM V 50-1-1).
 74. Wheel-bushing, fragment, 1/6; W. 3.4 cm; Th. 2.5 cm; Dm. 15.0 cm; 495 gr. (no further information).
 75. Wheel-bushing, fragment, 1/6; W. 3.4 cm; Th. 1.6 cm; Dm. 14.0 cm; 360 gr. (no further information).
 76. Wheel-bushing, fragment, 1/6; W. 3.7 cm; Th. 1.9 cm; Dm. 16.0 cm; 340 gr. (no further information).

77. Wheel-bushing, fragment, 2/6; W. 3.2 cm; Th. 1.3 cm; Dm. 7.0 cm; 265 gr. (no further information).
78. Wheel-bushing, fragment, 3/6; W. 1.9 cm; Th. 1.3 cm; Dm. 7.0 cm; 190 gr. (no further information).
79. Wheel-bushing, fragment, 1/6; W. 3.4 cm; Th. 1.2 cm; Dm. 8.0 cm; 185 gr. (no further information).
80. Wheel-bushing, fragment, 1/6; W. 2.8 cm; Th. 1.2 cm; Dm. 7.5 cm; 115 gr. (no further information).
81. Wheel-bushing, fragment, 3/6; W. 4.0 cm; Th. 2.1 cm; Dm. 13.0 cm; 560 gr. (Inv. No. 1295).
82. Wheel-bushing, fragment, 1/6; W. 3.4 cm; Th. 1.3 cm; Dm. 10.0 cm; 245 gr. (Inv. No. 1295).
83. Wheel-bushing, fragment, 3/6; W. 4.0 cm; Th. 2.1 cm; Dm. 13.0 cm; 560 gr. (Inv. No. 1295).

Inventory of the National History Museum, without artefact

84. Wheel-bushing, complete, 6/6 (no further information).
85. Wheel-bushing, complete, 6/6 (no further information).
86. Wheel-bushing, complete, 6/6 (no further information).

Group A, Type A.2, Variation A.2a-e

Erdeni Joo, Kharkhorin sum, Övörkhangaï aimag (Excavation by MDKE-KAR 1, 2000–2007)

87. Wheel-bushing, complete, 2/2; W. 1.4 cm; Th. 1.25 cm; Dm. 8.8 cm; 515 gr. (MDKE-KAR 1/Ez-07-0262).
88. Wheel-bushing, complete, 4/4; W. 1.15 cm; Th. 0.95 cm; Dm. 6.0 cm (MDKE-KAR 1/Ez-07-0263).
89. Wheel-bushing, complete, 2/2; W. 1.35 cm; Th. 1.1 cm; Dm. 8.0 cm; 365 gr. (MDKE-KAR 1/Ez-07-0264).

Erdeni Joo, Kharkhorin sum, Övörkhangaï aimag (2006)

90. Wheel-bushing, complete, 2/2 (no further information).
91. Wheel-bushing, complete, 2/2; W. 1.35 cm; Th. 1.1 cm (no further information).

Kherem II, Khatanbulag sum, Dornogovi aimag

92. Wheel-bushing, fragment, 1/4; W. 1.4 cm; Th. 0.9–1.1 cm; Dm. 7.0 cm; 95 gr. (no further information).
93. Wheel-bushing, fragment, 2/4; W. 2.3 cm; Th. 1.4–1.6 cm; Dm. 10.5 cm; 470 gr. (no further information).
94. Wheel-bushing, fragment, 1/4; W. 1.8 cm; Th. 0.8–1.1 cm; Dm. 8.0 cm; 120 gr. (no further information).

Tumurtiin ovoo, Sukhbaatar sum, Sukhbaatar aimag (2007)

95. Wheel-bushing, complete, 4/4 (no further information).

Without location, Tamsag bulag sum, Dornod aimag

96. Wheel-bushing, fragment, 3/4; W. 1.4 cm; Th. 0.9 cm; Dm. 7.8 cm; 350 gr. (Inv. No. Do-88).

Without location, Tuvshinshiree sum, Sukhbaatar aimag (2006)

97. Wheel-bushing, complete, 4/4 (no further information).

Without location

98. Wheel-bushing, fragment, 3/4; W. 1.5 cm; Th. 1.3 cm; Dm. 8.0 cm (Inv. No. NHM V 95-4-11,3).
99. Wheel-bushing, complete, 4/4; W. 1.4 cm; Th. 1.0 cm; Dm. 7.0 cm (no further information).

Inventory of the National History Museum, without artefact

100. Wheel-bushing, complete, 4/4 (no further information).
101. Wheel-bushing, complete, 4/4 (no further information).
102. Wheel-bushing, complete, 4/4 (no further information).
103. Wheel-bushing, complete, 4/4 (no further information).

Group A, Type A.2, Variation A.2b-a

Chin tolgoi, Dashinchilen sum, Bulgan aimag (2004)

104. Wheel-bushing, fragment, 2/5 (no further information).

105. Wheel-bushing, fragment, 5/5 (no further information).
 106. Wheel-bushing, fragment, 1/5 (no further information).

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by MDKE-KAR 2, 1999–2005)

107. Wheel-bushing, fragment, 4/6; W. 4.3 cm; Th. 1.0 cm; Dm. 9.0 cm; 585 gr. (MDKE-KAR 2/860; LH 27/88–100, 4).
 108. Wheel-bushing, fragment, 3/6; W. 3.6 cm; Th. 1.4 cm; Dm. 11.5 cm; 760 gr. (MDKE-KAR 2/1045; LH 88/52).

Group A, Type A.2, Variation A.2b-b

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by Soviet-Mongolian expedition 1948/49; based on the registration list of the Institute of Archaeology, MAS)

109. Wheel-bushing, fragment, 2/5; W. 2.1 cm; Th. 0.6–1.1 cm; Dm. 9.0 cm (Excavation 1948, Sq. D 11, Level 6; Kiselev-Nr. 1678a).
 110. Wheel-bushing, complete, 5/5; W. 3.0 cm; Th. 0.5–1.4 cm; Dm. 11.0 cm (Trench 1, Sq. MN 4, Level 7; Kiselev-Nr. 2279a).
 111. Wheel-bushing, fragment, 1/5; W. 2.7 cm; Th. 1.4–1.9 cm; Dm. 10.0 cm (Trench 2, Sq. A 6, Level 4; Kiselev-Nr. 2339).

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by Soviet-Mongolian expedition 1948/49; based on the registration list of the National Museum of History)

112. Wheel-bushing, fragment, 4/5; W. 2.4 cm; Th. 0.8–1.4 cm; Dm. 7.0 cm (Inv. No. NHM 262; Trench 1, Sq. A 10, Level 5).
 113. Wheel-bushing, fragment, 5/5; W. 3.0 cm; Th. 0.6–1.8 cm; Dm. 11.0 cm (Inv. No. NHM 250; Trench 1, Sq. A 10, Level 6).

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by MDKE-KAR 2, 1999–2005)

114. Wheel-bushing, fragment, 1/5; W. 2.6 cm; Th. 1.5 cm; Dm. 9.0 cm; 165 gr. (MDKE-KAR 2/4; LH 17/2, 0).
 115. Wheel-bushing, fragment, 1/5; W. 1.9 cm; Th. 0.6–0.9 cm; Dm. 9.0 cm; 75 gr. (MDKE-KAR 2/0; LH 87/87, 10).

116. Wheel-bushing, fragment, 1/5; W. 2.3 cm; Th. 0.2–1.2 cm; Dm. 7.0 cm; 110 gr. (MDKE-KAR 2/0; LH 28/8, 4).
 117. Wheel-bushing, fragment, 2/5; W. 2.6 cm; Th. 1.6 cm; Dm. 10.0 cm (MDKE-KAR 2/135; LH 17/10, 5).
 118. Wheel-bushing, fragment, 1/5; W. 2.3 cm; Th. 1.0 cm; Dm. 7.5 cm; 105 gr. (MDKE-KAR 2/475; LH 17/56–100, 4).
 119. Wheel-bushing, fragment, 1/5; W. 2.5 cm; Th. 1.1–1.2 cm; Dm. 10.0 cm (MDKE-KAR 2/1434; LH 87/38, 11).
 120. Wheel-bushing, fragment, 1/5; W. 1.8 cm; Th. 0.8 cm; Dm. 7.0 cm; 95 gr. (MDKE-KAR 2/1511; LH 27/69, 3).
 121. Wheel-bushing, complete; 5/5; W. 2.8 cm; Th. 1.7–1.9 cm; Dm. 7.8 cm; 395 gr. (MDKE-KAR 2/1530; LH 17/91, pr).
 122. Wheel-bushing, fragment, 1/5; W. 2.6 cm; Th. 1.6 cm; Dm. 10.0 cm (MDKE-KAR 2/2072; LH 28/69, Pl. 10).
 123. Wheel-bushing, complete, 5/5; W. 4.4 cm; Th. 1.4–1.9 cm; Dm. 11.0 cm; 1470 gr. (MDKE-KAR 2-2341; LH 27/81, F 623).
 124. Wheel-bushing, complete, 5/5; W. 2.0 cm; Th. 0.6–0.9 cm; Dm. 7.0 cm; 305 gr. (MDKE-KAR 2/2358; LH 26/21, 15).
 125. Wheel-bushing, fragment, 1/5; W. 2.8 cm; Th. 1.4 cm; Dm. 8.0 cm (MDKE-KAR 2/2363a; LH 26/14, 15).
 126. Wheel-bushing, fragment, 1/5; W. 2.4 cm; Th. 0.4–1.0 cm; Dm. 9.5 cm (MDKE-KAR 2/2363b; LH 26/14, 15).
 127. Wheel-bushing, complete, 5/5; W. 4.6 cm; Th. 0.9–1.2 cm; Dm. 7.0 cm; 445 gr. (MDKE-KAR 2/2487; LH 27/65, 18).
 128. Wheel-bushing, fragment, 1/5; W. 2.9 cm; Th. 1.5 cm; Dm. 11.0 cm; 220 gr. (MDKE-KAR 2/2572; LH 18/59, 7).
 129. Wheel-bushing, fragment, 3/5; W. 2.5 cm; Th. 1.0–1.4 cm; Dm. 9.0 cm; 285 gr. (MDKE-KAR 2/2693b; LH 27/52).
 130. Wheel-bushing, fragment, 2/5; W. 2.6 cm; Th. 1.1–1.2 cm; Dm. 9.0 cm; 185 gr. (MDKE-KAR 2/2693c; LH 27/52).
 131. Wheel-bushing, fragment, 1/5; W. 2.3 cm; Th. 0.9–1.4 cm; Dm. 9.0 cm; 155 gr. (MDKE-KAR 2/2876; LH 27/73, pl. 12).
 132. Wheel-bushing, fragment, 2/5; W. 2.5 cm; Th. 1.0 cm; Dm. 7.0 cm (MDKE-KAR 2/3478; LH 28/95, 18).

133. Wheel-bushing, fragment, 2/5; W. 3.6 cm; Th. 2.0 cm; Dm. 8.0 cm; 525 gr. (MDKE-KAR 2/3572; LH 26/63, 10).
134. Wheel-bushing, fragment, 3/5; W. 2.9 cm; Th. 1.2–1.4 cm; Dm. 9.0 cm; 305 gr. (MDKE-KAR 2/3703; LH 26/65, 11).
135. Wheel-bushing, fragment, 2/5; W. 2.9 cm; Th. 1.2–1.8 cm; Dm. 11.0 cm; 260 gr. (MDKE-KAR 2/3896; LH 27/25, 22).
136. Wheel-bushing, complete, 5/5; W. 2.75 cm; Th. 1.35–1.7 cm; Dm. 7.0 cm; 520 gr. (MDKE-KAR 2/4131b; LH 26/84, 16).
137. Wheel-bushing, fragment, 2/5; W. 2.3 cm; Th. 1.0 cm; Dm. 7.0 cm; 205 gr. (MDKE-KAR 2/4433; LH 18/58, 19).
138. Wheel-bushing, fragment, 3/5; W. 2.0 cm; Th. 0.8–0.9 cm; Dm. 7.0 cm; 150 gr. (MDKE-KAR 2/4437; LH 28/53, 4).
139. Wheel-bushing, fragment, 2/5; W. 1.9 cm; Th. 1.0 cm; Dm. 7.0 cm; 105 gr. (MDKE-KAR 2/4538; LH 87/55, 3).
140. Wheel-bushing, complete, 5/5; W. 2.0 cm; Th. 0.6–1.0 cm; Dm. 7.0 cm; 280 gr. (MDKE-KAR 2/4560; LH 87/6, 4).
141. Wheel-bushing, complete, 5/5; W. 2.3 cm; Th. 0.8–1.0 cm; Dm. 7.0 cm (MDKE-KAR 2/4601; LH 87/85, 4).
142. Wheel-bushing, fragment, 2/5; W. 3.0 cm; Th. 1.1–1.4 cm; Dm. 10.0 cm; 340 gr. (MDKE-KAR 2/4739; LH 18/100, 22).
143. Wheel-bushing, fragment, 2/5; W. 3.0 cm; Th. 1.0–1.4 cm; Dm. 9.0 cm; 225 gr. (MDKE-KAR 2/4814a; LH 16/76, 90, 5, F 1648).
144. Wheel-bushing, complete, 5/5; W. 2.8 cm; Th. 0.8–1.1 cm; Dm. 7.0 cm (MDKE-KAR 2/P1530; LH 17/91, northern profile).

Without location

145. Wheel-bushing, fragment, 3/5; W. 2.5 cm; Th. 0.6–1.2 cm; Dm. 11.0 cm (Inv. No. NHM V 95-4-11,3).

Group A, Type A.2, Variation A.2b-c

Karakorum, Kharkhorin sum, Övörkhangai aimag (Excavations by Soviet-Mongolian expedition 1948/49; based on the registration list of the National Museum of History)

146. Wheel-bushing, fragment, 3/4; W. 2.1 cm; Th. 0.9 cm; Dm. 9.0 cm (no further information).
147. Wheel-bushing, fragment, 3/4; W. 3.6 cm; Th. 0.6–2.1 cm; Dm. 10.0 cm (Inv. No. V 50).

Karakorum, Kharkhorin sum, Övörkhangai aimag (Excavations by Mongolian expedition 1976–1985; based on the registration list of the Institute of Archaeology, MAS)

148. Wheel-bushing, complete, 4/4; W. 4.6 cm; Th. 0.9 cm; Dm. 7.0 cm (no further information).

Karakorum, Kharkhorin sum, Övörkhangai aimag (Excavations by MDKE-KAR 2, 1999–2005)

149. Wheel-bushing, fragment, 1/4; W. 2.4 cm; Th. 9.0 cm; Dm. 7.0 cm; 595 gr. (MDKE-KAR 2/479; LH 16/96, 4).
150. Wheel-bushing, fragment, 3/4; W. 1.9 cm; Th. 1.0–1.3 cm; Dm. 7.0 cm; 150 gr. (MDKE-KAR 2/1535; LH 28/28, 3).
151. Wheel-bushing, fragment, 3/4; W. 2.1 cm; Th. 0.6–1.1 cm; Dm. 7.0 cm; 370 gr. (MDKE-KAR 2/1601; LH 87/85, 4).
152. Wheel-bushing, fragment, 3/4; W. 2.7 cm; Th. 1.1–1.5 cm; Dm. 9.8 cm; 273 gr. (MDKE-KAR 2/2139 b; LH 28/21, 6).
153. Wheel-bushing, complete, 4/4; W. 2.2 cm; Th. 0.8–1.2 cm; Dm. 7.0 cm; 145 gr. (MDKE-KAR 2/3513; LH 26/62, 8).
154. Wheel-bushing, complete, 4/4; W. 2.2 cm; Th. 1.0–1.2 cm; Dm. 10.0 cm (MDKE-KAR 2/4479; LH 16/96, 4).

Group A, Type A.2, Variation A.2b-d

Avarga, Delgarkhaan sum, Khentii aimag (Excavation by Mongolian-Japanese expedition 2005)

155. Wheel-bushing, fragment, 2/6 (no further information).

Bar khot(?), sum(?), aimag(?)

156. Wheel-bushing, fragment, 2/6; W. 3.6 cm; Th. 1.8–2.0 cm; Dm. 13.0 cm; 905 gr. (Inv. No. 1295).
157. Wheel-bushing, fragment, 1/6; W. 3.7 cm; Th. 1.8–2.0 cm; Dm. 13.0 cm; 450 gr. (Inv. No. 1295).
158. Wheel-bushing, 1/6; W. 3.5 cm; Th. 1.8 cm; Dm. 13.0 cm; 400 gr. (Inv. No. 1295).

Chingisiin togoo, Deren sum, Dundgovi aimag, (1959)

159. Wheel-bushing, complete, 6/6; W. 8.0 cm; Th. 4.5 cm; Dm. 22.5 cm (no further information).

160. Wheel-bushing, fragment, 4/6; W. 7.5 cm; Th. 4.3 cm; Dm. 21.5 cm (no further information).

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by D. D. Bukinich 1933/34)

161. Wheel-bushing, complete, 6/6 (no further information).

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by Soviet-Mongolian expedition 1948/49; based on the registration list of the Institute of Archaeology, MAS)

162. Wheel-bushing, complete, 6/6; W. 2.8 cm; Th. 1.0–1.6 cm; Dm. 10.0 cm (Excavation 1948, Sq. D 11, Level 6; Kiselev-Nr. 1678b).
163. Wheel-bushing, fragment, 2/6; W. 2.5 cm; Th. 0.8–1.0 cm; Dm. 9.0 cm (no further information; Kiselev-Nr. 2033).
164. Wheel-bushing, fragment, 4/6; W. 2.6 cm; Th. 1.0–1.4 cm; Dm. 9.0 cm (Trench 1, Sq. A 3, Level 3; Kiselev-Nr. 2270).
165. Wheel-bushing, complete, 6/6; W. 1.7 cm; Th. 0.5–0.9 cm; Dm. 7.0 cm (Trench 1, Sq. MN 1, Level 8; Kiselev-Nr. 2272).
166. Wheel-bushing, complete, 6/6; W. 2.8 cm; Th. 1.5–1.7 cm; Dm. 7.0 cm (Trench 1, Sq. MN 3, Level 7; Kiselev-Nr. 2276a).
167. Wheel-bushing, complete, 6/6; W. 3.2 cm; Th. 1.2–1.8 cm; Dm. 10.0 cm (Trench 1, Sq. MN 3, Level 7; Kiselev-Nr. 2276b).
168. Wheel-bushing, complete, 6/6; W. 2.4 cm; Th. 0.9–1.2 cm; Dm. 9.0 cm (Trench 1, Sq. L 11, Level 2; Kiselev-Nr. 2277).
169. Wheel-bushing, complete, 6/6; W. 2.0 cm; Th. 0.7–1.0 cm; Dm. 7.0 cm (Trench 1, Sq. MN 4, Level 7; Kiselev-Nr. 2279b).
170. Wheel-bushing, fragment, 4/6; W. 3.6 cm; Th. 1.7–1.9 cm; Dm. 9.0 cm (Trench 1, Sq. 2, Level 6; Kiselev-Nr. 2282).
171. Wheel-bushing, fragment, 1/6; W. 2.8 cm; Th. 1.0–1.4 cm; Dm. 1.0 cm (Trench 2, Sq. G 4, Level 6; Kiselev-Nr. 2338).

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by Soviet-Mongolian expedition 1948/49; based on the registration list of the National Museum of History)

172. Wheel-bushing, complete, 6/6; W. 2.7 cm; Th. 1.0–1.2 cm; Dm. 8.0 cm (Trench 1, Sq. 4, Level 8).
173. Wheel-bushing, complete, 6/6; W. 2.5 cm; Th. 1.0–1.7 cm; Dm. 11.0 cm

(Inv. No. NHM 251; Trench 1, Sq. A 10, Level 6).

174. Wheel-bushing, complete, 6/6; W. 2.6 cm; Th. 1.2–1.4 cm; Dm. 9.0 cm (Inv. No. NHM V 50-1-4; Kiselev 243; Trench? Sq. G 10, Level 5).
175. Wheel-bushing, complete, 6/6; W. 2.7 cm; Th. 1.0–1.2 cm; Dm. 11.0 cm (Inv. No. NHM? Kiselev-No. 253; Trench 1, Sq. an 11, Level 5).
176. Wheel-bushing, complete, 6/6; W. 2.7 cm; Th. 1.0–1.2 cm; Dm. 6.0 cm (Kiselev-Nr. 267; Trench 1, Sq. A 13, Level 5).
177. Wheel-bushing, complete, 6/6; W. 2.2 cm; Th. 0.7–1.0 cm; Dm. 7.0 cm (no further information).
178. Wheel-bushing, complete, 6/6; W. 2.9 cm; Th. 0.7–1.2 cm; Dm. 9.0 cm (Kiselev-Nr. 259; Trench ?, Sq. A 15, Level 5).

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by Mongolian expedition 1976–1985; based on the registration list of the Institute of Archaeology, MAS)

179. Wheel-bushing, fragment, 4/6; W. 3.3 cm; Th. 2.3 cm; Dm. 6.0 cm (no further information).
180. Wheel-bushing, fragment, 3/6; W. 1.5 cm; Th. 3.4–3.6 cm; Dm. 6.3 cm (no further information).
181. Wheel-bushing, complete, W. 4.5 cm; Th. 2.3 cm; Dm. 10.5 cm (no further information).
182. Wheel-bushing, fragment, W. 1.8 cm; Th. 0.8–1.2 cm; Dm. 9.5 cm; 100 gr. (no further information).
183. Wheel-bushing, fragment, 1/6; W. 2.2 cm; Th. 0.8–1.1 cm; Dm. 19.0 cm; 550 gr. (no further information).
184. Wheel-bushing, fragment, 1/6; W. 1.9 cm; Th. 0.5–0.8 cm; Dm. 7.0 cm; 60 gr. (no further information).

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by MDKE-KAR 2, 1999–2005)

185. Wheel-bushing, fragment, 2/6; W. 2.6 cm; Th. 1.1–1.3 cm; Dm. 9.0 cm; 105 gr. (MDKE-KAR 2/193; LH 17/56–100, 2).
186. Wheel-bushing, fragment, 1/6; W. 3.6 cm; Th. 0.4–1.9 cm; Dm. 9.0 cm; 315 gr. (MDKE-KAR 2/292; LH 17/56–100, 3).
187. Wheel-bushing, fragment, 3/6; W. 3.6 cm; Th. 0.4–0.9 cm; Dm. 10.0 cm (MDKE-KAR 2/328; LH 17/56–100, 3).

188. Wheel-bushing, fragment, 4/6; W. 3.6 cm; Th. 1.0–1.2 cm; Dm. 9.0 cm; 90 gr. (MDKE-KAR 2/355; LH 16/15, 3).
189. Wheel-bushing, fragment, 1/6; W. 2.1 cm; Th. 0.8–1.3 cm; Dm. 9.0 cm; 90 gr. (MDKE-KAR 2/413; LH 27/86–97, 0–5).
190. Wheel-bushing, fragment, 1/6; W. 2.2 cm; Th. 1.2 cm; Dm. 9.0 cm; 195 gr. (MDKE-KAR 2/589; LH 17/20, 6).
191. Wheel-bushing, fragment, 1/6; W. 2.4 cm; Th. 0.7–1.0 cm; Dm. 7.0 cm (MDKE-KAR 2/590; LH 17/26, 6).
192. Wheel-bushing, fragment, 3/6; W. 2.3 cm; Th. 0.8–1.1 cm; Dm. 7.5 cm; 260 gr. (MDKE-KAR 2/808; LH 18/11, 7).
193. Wheel-bushing, complete, 6/6; W. 2.0 cm; Th. 0.8–1.2 cm; Dm. 10.0 cm; 370 gr. (MDKE-KAR 2-815; LH 17/20, 7).
194. Wheel-bushing, fragment, 2/6; W. 2.4 cm; Th. 1.2 cm; Dm. 10.0 cm; 130 gr. (MDKE-KAR 2/873; LH 27/88–90, 9).
195. Wheel-bushing, fragment, 1/?; W. 2.6 cm; Th. ?; Dm. ?. (MDKE-KAR 2/953; LH 26/35, 6, F 101).
196. Wheel-bushing, fragment, 1/6; W. 2.8 cm; Th. 1.2 cm; Dm. 9.0 cm; 125 gr. (MDKE-KAR 2/992; LH 16/1–20, 0–7).
197. Wheel-bushing, fragment, 1/?; W. 2.6 cm; Th. 0.7–1.7 cm; Dm. 9.0 cm; 120 gr. (MDKE-KAR 2/1000; LH 26/6, 19).
198. Wheel-bushing, fragment, 1/?; W. 2.7 cm; Th. 1.2 cm; Dm. 10.0 cm; 120 gr. (MDKE-KAR 2/1022; LH 88/72, 1).
199. Wheel-bushing, fragment, 2/6; W. 2.8 cm; Th. 0.8–1.6 cm; Dm. 11.0 cm; 210 gr. (MDKE-KAR 2/1071; LH 28/19, 1).
200. Wheel-bushing, fragment, 1/6; W. 3.6 cm; Th. 0.4–1.0 cm; Dm. 10.0 cm; 185 gr. (MDKE-KAR 2/1357; LH 87/30, 2–10).
201. Wheel-bushing, fragment, 1/6; W. 2.2 cm; Th. 1.0 cm; Dm. 9.0 cm; 140 gr. (MDKE-KAR 2/1388; LH 28/69, 3).
202. Wheel-bushing, complete, 6/6; W. 1.8 cm; Th. 0.6–1.0 cm; Dm. 7.0 cm; 385 gr. (MDKE-KAR 2/1626; LH 87/57, 13).
203. Wheel-bushing, fragment, 1/?; W. 3.0 cm; Th. 1.5–1.9 cm; Dm. 8.0 cm (MDKE-KAR 2/1696; LH 27/69, 6).
204. Wheel-bushing, complete, 6/6; W. 3.0 cm; Th. 1.2–1.6 cm; Dm. 8.0 cm; 1100 gr. (MDKE-KAR 2/1739; LH 16/73, Pl. 2, F 338).
205. Wheel-bushing, fragment, 2/6; W. 3.4 cm; Th. 1.5–1.8 cm; Dm. 7.0 cm; 440 gr. (MDKE-KAR 2/1767; LH 27/69, 8).
206. Wheel-bushing, fragment, 1/6; W. 2.1 cm; Th. 0.9–1.2 cm; Dm. 7.0 cm; 110 gr. (MDKE-KAR 2/2204; LH 87/59, Profile).
207. Wheel-bushing, complete, 6/6; W. 1.9 cm; Th. 0.7–1.0 cm; Dm. 7.0 cm; 345 gr. (MDKE-KAR 2/2359; LH 26/12, 15).
208. Wheel-bushing, fragment, 2/6; W. 3.4 cm; Th. 1.7–2.0 cm; Dm. 8.0 cm; 440 gr. (MDKE-KAR 2/2360; LH 26/12, 15).
209. Wheel-bushing, complete, 6/6; W. 2.0 cm; Th. 0.8–1.1 cm; Dm. 9.5 cm; 470 gr. (MDKE-KAR 2/2397; LH 87/98, 24 F 583).
210. Wheel-bushing, fragment, 5/6; W. 3.0 cm; Th. 1.4–1.8 cm; Dm. 7.0 cm; 888 gr. (MDKE-KAR 2/2425; LH 26/3, 16).
211. Wheel-bushing, complete, 6/6; W. 3.0 cm; Th. 1.3–1.4 cm; Dm. 5.0 cm; 1040 gr. (MDKE-KAR 2/2427; LH 26/5, 16).
212. Wheel-bushing, fragment, 1/6; W. 2.2 cm; Th. 0.6–0.9 cm; Dm. 9.0 cm (MDKE-KAR 2/2676a; LH 26/6, 19).
213. Wheel-bushing, fragment, 5/6; W. 2.0 cm; Th. 1.2 cm; Dm. 8.0 cm; 210 gr. (MDKE-KAR 2/2693a; LH 27/52).
214. Wheel-bushing, complete, 6/6; W. 2.7 cm; Th. 0.9–1.2 cm; Dm. 10.0 cm; 930 gr. (MDKE-KAR 2/2752; LH 26/5, Pl. 22).
215. Wheel-bushing, complete, 6/6; W. 1.6 cm; Th. 0.6–0.9 cm; Dm. 7.0 cm; 235 gr. (MDKE-KAR 2/2753; LH 26/5, 22).
216. Wheel-bushing, fragment, 6/6; W. 1.4 cm; Th. 0.6–1.0 cm; Dm. 10.0 cm; 340 gr. (MDKE-KAR 2/2861; LH 17/98, 8).
217. Wheel-bushing, fragment, 4/6; W. 1.4 cm; Th. 0.6–1.0 cm; Dm. 10.0 cm; 400 gr. (MDKE-KAR 2/2866; LH 17/99, 8).
218. Wheel-bushing, complete, 6/6; W. 2.8 cm; Th. 0.9–1.2 cm; Dm. 9.0 cm; 1060 gr. (MDKE-KAR 2/2917; LH 17/60, 8).
219. Wheel-bushing, fragment, 3/6; W. 2.4 cm; Th. 1.0–1.2 cm; Dm. 7.0 cm; 230 gr. (MDKE-KAR 2/2924; LH 27/44–45, Pl. 13).
220. Wheel-bushing, complete, 6/6; W. 2.5 cm; Th. 1.1–1.3 cm; Dm. 7.5 cm; 475 gr. (MDKE-KAR 2/2939; LH 27/21, 13).

221. Wheel-bushing, complete, 6/6; W. 3.1 cm; Th. 0.8–0.9 cm; Dm. 8.0 cm; 590 gr. (MDKE-KAR 2/3036; LH 28/94, 14).
222. Wheel-bushing, fragment, 2/6; W. 2.9 cm; Th. 1.2–1.4 cm; Dm. 10.0 cm; 260 gr. (MDKE-KAR 2/3065; LH 28/94, 14).
223. Wheel-bushing, complete, 6/6; W. 2.2 cm; Th. 1.0–1.2 cm; Dm. 10.0 cm; 540 gr. (MDKE-KAR 2-3105; LH 27/11, 17).
224. Wheel-bushing, complete, 6/6; W. 2.0 cm; Th. 1.1–1.4 cm; Dm. 7.0 cm (MDKE-KAR 2/3113; LH 28/80, 14).
225. Wheel-bushing, fragment, 3/6; W. 2.3 cm; Th. 1.3–1.8 cm; Dm. 11.0 cm; 540 gr. (MDKE-KAR 2/3316; LH 26/77, 7).
226. Wheel-bushing, fragment, 3/6; W. 2.4 cm; Th. 0.8–1.4 cm; Dm. 7.0 cm; 195 gr. (MDKE-KAR 2/3351; LH 26/66, 7).
227. Wheel-bushing, fragment, 4/6; W. 2.3 cm; Th. 1.1–1.4 cm; Dm. 10.0 cm; 375 gr. (MDKE-KAR 2/3373; LH 28/64, 17).
228. Wheel-bushing, fragment, 2/6; W. 2.0 cm; Th. 1.2 cm; Dm. 8.0 cm; 160 gr. (MDKE-KAR 2/3485; LH 28/78, 17).
229. Wheel-bushing, complete, 6/6; W. 3.6 cm; Th. 1.3–1.6 cm; Dm. 8.0 cm; 1085 gr. (MDKE-KAR 2/3491; LH 28/78, 17).
230. Wheel-bushing, fragment, 1/6; W. 3.2 cm; Th. 1.6–1.9 cm; Dm. 11.0 cm (MDKE-KAR 2/3499; LH 19/100, 11).
231. Wheel-bushing, fragment, 2/6; W. 2.5 cm; Th. 1.5–1.8 cm; Dm. 10.0 cm; 160 gr. (MDKE-KAR 2/3526; LH 19/91, Pl. 12).
232. Wheel-bushing, complete, 6/6; W. 3.6 cm; Th. 1.6–1.9 cm; Dm. 7.0 cm; 670 gr. (MDKE-KAR 2/3574; LH 26/64, 10).
233. Wheel-bushing, fragment, 2/6; W. 3.5 cm; Th. 1.7–1.9 cm; Dm. 10.0 cm; 400 gr. (MDKE-KAR 2/3604; LH 18/60, 13).
234. Wheel-bushing, complete, 6/6; W. 2.7 cm; Th. 1.2–1.5 cm; Dm. 7.0 cm; 540 gr. (MDKE-KAR 2/3631; LH 17/91, 4).
235. Wheel-bushing, fragment, 1/6; W. 5.3 cm; Th. 3.3 cm; Dm. 12.0 cm; 785 gr. (MDKE-KAR 2/3657; LH 27/4, 21).
236. Wheel-bushing, fragment, 1/6; W. 3.0 cm; Th. 1.2–1.7 cm; Dm. 7.0 cm; 135 gr. (MDKE-KAR 2/3705; LH 26/72, 11).
237. Wheel-bushing, fragment, 1/6; W. 3.0 cm; Th. 1.1–1.5 cm; Dm. 10.0 cm; 135 gr. (MDKE-KAR 2/3749; LH 18/77, 14).
238. Wheel-bushing, complete, 6/6; W. 1.9 cm; Th. 1.1–1.3 cm; Dm. 7.0 cm; 355 gr. (MDKE-KAR 2/3835; LH 26/85, 12).
239. Wheel-bushing, fragment, 2/6; W. 2.9 cm; Th. 1.1–1.5 cm; Dm. 10.0 cm; 215 gr. (MDKE-KAR 2/3839; LH 26/82, 12).
240. Wheel-bushing, fragment, 3/6; W. 5.0 cm; Th. 2.2–2.9 cm; Dm. 12.0 cm; 1405 gr. (MDKE-KAR 2/3886; LH 17/95, 5).
241. Wheel-bushing, fragment, 2/6; W. 1.9 cm; Th. 0.7–1.2 cm; Dm. 7.0 cm; 135 gr. (MDKE-KAR 2/3887; LH 27/45, 22).
242. Wheel-bushing, complete, 3/6; W. 3.1 cm; Th. 1.5 cm; Dm. 10.0 cm; 445 gr. (MDKE-KAR 2/4238; LH 27/22, Pl. 24).
243. Wheel-bushing, fragment, 2/6; W. 2.7 cm; Th. 0.6–1.2 cm; Dm. 11.0 cm; 255 gr. (MDKE-KAR 2/4303; LH 87/60, 17).
244. Wheel-bushing, complete, 6/6; W. 2.5 cm; Th. 0.9–1.3 cm; Dm. 9.0 cm; 585 gr. (MDKE-KAR 2/4304; LH 87/60, 17).
245. Wheel-bushing, fragment, 1/6; W. 2.6 cm; Th. 1.9 cm; Dm. 7.0 cm (MDKE-KAR 2/4399; LH 87/90, 18).
246. Wheel-bushing, complete, 6/6; W. 1.6 cm; Th. 1.1 cm; Dm. 7.0 cm; 285 gr. (MDKE-KAR 2/4401; LH 87/90, 18).
247. Wheel-bushing, fragment, 1/6; W. 2.3 cm; Th. 1.1 cm; Dm. 8.0 cm; 115 gr. (MDKE-KAR 2/4526; LH 87/25, 3).
248. Wheel-bushing, fragment, 2/6; W. 1.7 cm; Th. 0.7–0.9 cm; Dm. 9.0 cm; 80 gr. (MDKE-KAR 2/4563; LH 87/36, 4).
249. Wheel-bushing, complete, 6/6; W. 2.0 cm; Th. 0.9–1.2 cm; Dm. 7.0 cm; 530 gr. (MDKE-KAR 2/4564; LH 87/56, 4).
250. Wheel-bushing, fragment, 1/6; W. 2.8 cm; Th. 1.1–1.4 cm; Dm. 8.0 cm; 190 gr. (MDKE-KAR 2/4565; LH 87/65, 4).
251. Wheel-bushing, complete, 6/6; W. 2.6 cm; Th. 1.3–1.4 cm; Dm. 10.0 cm; 860 gr. (MDKE-KAR 2/4593; LH 87/75, 4).
252. Wheel-bushing, fragment, 1/6; W. 1.8 cm; Th. 0.8–1.0 cm; Dm. 8.0 cm; 105 gr. (MDKE-KAR 2/4594; LH 87/76, 4).
253. Wheel-bushing, complete, 6/6; W. 2.0 cm; Th. 0.8–1.1 cm; Dm. 7.0 cm; 370 gr. (MDKE-KAR 2/4595; LH 87/76, 4).
254. Wheel-bushing, complete, 6/6; W. 3.5 cm; Th. 0.9–2.0 cm; Dm. 7.0 cm; 620 gr. (MDKE-KAR 2/4598; LH 18/77, Pl. 21).

255. Wheel-bushing, complete, 6/6; W. 3.8 cm; Th. 0.6–2.2 cm; Dm. 9.0 cm; 920 gr. (MDKE-KAR 2/4600; LH 87/95, 4).
256. Wheel-bushing, fragment, 2/6; W. 4.0 cm; Th. 0.4–2.3 cm; Dm. 8.0 cm; 200 gr. (MDKE-KAR 2/4613; LH 87/26, 5).
257. Wheel-bushing, complete, 6/6; W. 1.6 cm; Th. 0.6–1.0 cm; Dm. 6.5 cm; 275 gr. (MDKE-KAR 2/4614; LH 87/16, 5).
258. Wheel-bushing, fragment, 1/6; W. 1.6 cm; Th. 0.7–0.8 cm; Dm. 7.0 cm; 100 gr. (MDKE-KAR 2/4620; LH 87/14, 5).
259. Wheel-bushing, fragment, 2/6; W. 2.0 cm; Th. 0.8–1.1 cm; Dm. 7.0 cm; 130 gr. (MDKE-KAR 2/4633; LH 87/75, 5).
260. Wheel-bushing, fragment, 1/6; W. 2.6 cm; Th. 1.3–1.7 cm; Dm. 12.0 cm; 260 gr. (MDKE-KAR 2/4636; LH 87/5, 5).
261. Wheel-bushing, complete, 6/6; W. 1.9 cm; Th. 0.8–1.1 cm; Dm. 7.0 cm; 450 gr. (MDKE-KAR 2/4665; LH 87/25, 6).
262. Wheel-bushing, fragment, 2/6; W. 2.0 cm; Th. 1.0–1.2 cm; Dm. 8.0 cm; 120 gr. (MDKE-KAR 2/4785a; LH 28/44–54).
263. Wheel-bushing, complete, 6/6; W. 1.9 cm; Th. 0.7–1.2 cm; Dm. 7.0 cm; 325 gr. (MDKE-KAR 2/4788; LH 27/3, Profile).
264. Wheel-bushing, fragment, 1/6; W. 3.2 cm; Th. 0.6–0.8 cm; Dm. 12.0 cm; 148 gr. (MDKE-KAR 2/4793; LH 87/56, 0).
265. Wheel-bushing, fragment, 1/6; W. 3.2 cm; Th. 1.5–2.0 cm; Dm. 11.0 cm; 185 gr. (MDKE-KAR 2/4796; LH 18/66, 17).
266. Wheel-bushing, fragment, 1/6; W. 3.4 cm; Th. 2.0 cm; Dm. 9.0 cm; 245 gr. (MDKE-KAR 2/4814b; LH 16/76, 90, 5, F 1648).
267. Wheel-bushing, fragment, 1/?; W. 3.1 cm; Th. 1.5–1.8 cm; Dm. ? (MDKE-KAR 2/4878; LH 16/58, 7).
268. Wheel-bushing, fragment, 3/6; W. 3.6 cm; Th. 1.6–1.8 cm; Dm. 10.0 cm (MDKE-KAR 2/4879; LH 16/59, 7).
269. Wheel-bushing, fragment, 1/6; W. 3.1 cm; Th. 1.0–1.5 cm; Dm. 8.0 cm (MDKE-KAR 2/4906; LH 16/77, 7).
270. Wheel-bushing, complete, 6/6; W. 1.7 cm; Th. 1.0 cm; Dm. 7.0 cm; 280 gr. (MDKE-KAR 2/4922; LH 16/86, 8).
271. Wheel-bushing, complete, 6/6; W. 3.0 cm; Th. 1.0–1.4 cm; Dm. 7.0 cm; 645 gr. (MDKE-KAR 2/4930; LH 26/100, Pl. 14).
272. Wheel-bushing, complete, 6/6; W. 3.2 cm; Th. 0.9–1.3 cm; Dm. 9.0 cm; 880 gr. (MDKE-KAR 2/4932a; LH 26/100, Pl. 14).
273. Wheel-bushing, complete, 6/6; W. 3.4 cm; Th. 1.5–1.7 cm; Dm. 6.0 cm; 665 gr. (MDKE-KAR 2/4932b; LH 26/100, Pl. 14).
274. Wheel-bushing, complete, 6/6; W. 2.0 cm; Th. 0.9–1.2 cm; Dm. 9.0 cm; 395 gr. (MDKE-KAR 2/4944; LH 26/87, 14).
- Kherem II, Khatanbulag sum, Dornogovi aimag*
275. Wheel-bushing, fragment, 1/6; W. 2.9 cm; Th. 1.1–1.2 cm; Dm. 12.0 cm; 245 gr. (no further information).
- Khuurai burgastai, Munkh khaan sum, Sukhbaatar aimag (1976)*
276. Wheel-bushing, fragment, 1/6; (no further information).
- Rashaan Ders Balgas, Delgerkhaan sum, Khentii aimag (1959)*
277. Wheel-bushing, fragment, 1/6; W. 3.4 cm; Th. 1.2–1.6 cm; Dm. 10.0 cm (Excavation 2, Sq. B 10, Level 2).
- Takhalin us, Deren sum, Dundgovi aimag (1959)*
278. Wheel-bushing, fragment, 2/6; W. 2.4 cm; Th. 1.7–1.9 cm; Dm. 10.5 cm; 250 gr. (Inv. No. NHM 995).
279. Wheel-bushing, fragment, 2/6; W. 1.8 cm; Th. 0.7–0.9 cm; Dm. 8.5 cm; 130 gr. (Inv. No. NHM 995).
280. Wheel-bushing, fragment, 2/6; W. 1.8 cm; Th. 0.7–0.8 cm; Dm. 9.0 cm; 75 gr. (Inv. No. NHM 995).
281. Wheel-bushing, fragment, 4/6; W. 2.5 cm; Th. 0.6–0.8 cm; Dm. 9.5 cm; 125 gr. (Inv. No. NHM 995).
282. Wheel-bushing, fragment, 2/6; W. 1.9 cm; Th. 1.2–1.3 cm; Dm. 7.0 cm; 175 gr. (Inv. No. NHM 995).
283. Wheel-bushing, fragment, 1/6; W. 1.5 cm; Th. 0.6–0.8 cm; Dm. 7.0 cm; 45 gr. (Inv. No. NHM 995).
- Tsagaan Agui cave, Bayanlig sum, Bayankhongor aimag (1989)*
284. Wheel-bushing, fragment, 2/6; (no further information).

Uizen Abai ruins, Deren sum, Dundgovi aimag (1959)

285. Wheel-bushing, complete, 6/6; W. 6.0 cm; Th. 1.6 cm; Dm. 22.0 cm (no further information)

Without location

286. Wheel-bushing, complete, 6/6; W. 4.4 cm; Th. 0.9–2.1 cm; Dm. 11.0 cm (Inv. No. NHM V 50-1-5).
287. Wheel-bushing, fragment, 1/6; W. 4.5 cm; Th. 2.2–2.4 cm; Dm. 13.0 cm (Inv. No. NHM V 50-1-5).
288. Wheel-bushing, complete, 6/6; W. 3.5 cm; Th. 0.7–1.7 cm; Dm. 7.0 cm (no further information).

Group A, Type A.3

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by Mongolian expedition 1976–1985; based on the registration list of the Institute of Archaeology, MAS)

289. Bushing; W. 3.7–4.0 cm; Th. 0.7–0.9 cm; Dm. 19.0 cm; 550 gr. (no further information).
290. Bushing; W. 3.75 cm; Th. 0.85–1.1 cm; Dm. 19.0 cm; 575 gr. (no further information).
291. Bushing; W. 3.6–3.7 cm; Th. 0.9–1.0 cm; Dm. 19.0 cm; 560 gr. (no further information).

Khotiin Bulan (Qing Garrison's Settlement), Bumbugur sum, Bayankhongor aimag (2006)

292. Bushing; W. 3.3 cm; Th. 2.0 cm; Dm. 28.0 cm; 535 gr. (no further information).
293. Bushing; W. 3.3 cm; Th. 2.0 cm; Dm. 22.0 cm; 550 gr. (no further information).
294. Bushing; W. 3.7 cm; Th. 2.9 cm; Dm. 15.0 cm; 903 gr. (no further information).
295. Bushing; W. 3.4 cm; Th. 1.9 cm; Dm. 22.0 cm; 655 gr. (no further information).
296. Bushing; W. 3.9 cm; Th. 2.6 cm; Dm. 16.0 cm; 1065 gr. (no further information).

Group B, Type B.1, Variation B.1a

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by MDKE-KAR 2, 1999–2005)

297. Wheel-bushing, fragment, 2/5; W. 4.2 cm; Th. 0.5–2.1 cm; Dm. 10.0 cm; 125 gr. (MDKE-KAR 2/492; LH 17/17, 5).

Group B, Type B.1, Variation B.1b

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by Soviet-Mongolian expedition 1948/49; based on the registration list of the Institute of Archaeology, MAS)

298. Wheel-bushing, complete; W. 2.5 cm; Th. 2.2 cm; Dm. 9.3 cm (no further information).

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by Soviet-Mongolian expedition 1948/49; based on the registration list of the National Museum of History)

299. Wheel-bushing, complete; W. 3.6 cm; Th. 0.7–2.2 cm; Dm. 7.0 cm (Trench ?, Sq A 1, Level 5).
300. Wheel-bushing, complete; W. 3.8 cm; Th. 0.7–1.9 cm; Dm. 11.0 cm (Inv. No. NHM 264; Trench ? Sq. A 10, Level 5).
301. Wheel-bushing, complete; W. 4.0 cm; Th. 0.7–2.2 cm; Dm. 9.0 cm (Inv. No. NHM 265; Trench ? Sq. A 13, Level 5).
302. Wheel-bushing, complete; W. 4.2 cm; Th. 0.4–2.1 cm; Dm. 7.0 cm (no further information).

Karakorum, Kharkhorin sum, Övörkhangaï aimag (Excavations by MDKE-KAR 2, 1999–2005)

303. Wheel-bushing, fragment, 2/6; W. 3.6 cm; Th. 0.5–2.1 cm; Dm. 12.0 cm (MDKE-KAR 2/107; LH 18/1, 5).
304. Wheel-bushing, complete; W. 4.0 cm; Th. 0.6–1.3 cm; Dm. 10.0 cm; 860 gr. (MDKE-KAR 2/805; LH 17/19, 6).
305. Wheel-bushing, fragment; W. 3.4 cm; Th. 0.7–1.9 cm; Dm. 10.0 cm; 210 gr. (MDKE-KAR 2/4634; LH 87/84, 5).
306. Wheel-bushing, fragment; W. 4.5 cm; Th. 1.0–2.5 cm; Dm. 10.0 cm; 205 gr. (MDKE-KAR 2/4827; LH 16/76,90, 5, F. 1648).

307. Wheel-bushing, complete; W. 3.3 cm; Th. 1.4–2.6 cm; Dm. 9.0 cm; 870 gr. (MDKE-KAR 2/4931; LH 26/100, Pl. 14).

308. Wheel-bushing, fragment; W. 3.5 cm; Th. 0.6–1.9 cm; Dm. 10.0 cm; 240 gr. (MDKE-KAR 2/4627; LH 87/84, 5).

Kherem II, Khatanbulag sum, Dornogovi aimag

309. Wheel-bushing, fragment; W. 3.5 cm; Th. 1.3–2.2 cm; Dm. 12.0 cm; 335 gr. (no further information).

Without location

310. Wheel-bushing, complete; W. 3.7 cm; Th. 0.5–2.5 cm; Dm. 10.0 cm (no further information).

311. Wheel-bushing, complete; W. 2.7 cm; Th. 1.5 cm; Dm. 10.0 cm (no further information).

312. Wheel-bushing, complete; W. 4.1 cm; Th. 0.9–2.6 cm; Dm. 10.0 cm (no further information).

313. Wheel-bushing, complete; W. 2.5 cm; Th. 1.0–1.2 cm; Dm. 10.0 cm (no further information).

Group B, Type B.1, Variation B.1c

Karakorum, Kharkhorin sum, Övörkhangai aimag (Excavations by MDKE-KAR 2, 1999–2005)

314. Wheel-bushing, complete, 6/6; W. 3.2 cm; Th. 1.3 cm; Dm. 7.8 cm; 1140 gr. (MDKE-KAR 2/?).

Group B, Type B.1, Variation B.1d

Karakorum, Kharkhorin sum, Övörkhangai aimag (Excavations by MDKE-KAR 2, 1999–2005)

315. Wheel-bushing, fragment, 2/6; W. 3.7 cm; Th. 0.9–2.5 cm; Dm. 8.0 cm (MDKE-KAR 2/2078; LH 28/67, Pl. 10).

316. Wheel-bushing, complete, 6/6; W. 5.4 cm; Th. 0.9–4.3 cm; Dm. 11.0 cm; 2840 gr. (MDKE-KAR 2/4854; LH 26/78, 12).

Group B, Type B.2, Variation B.2a

Khermen Denj, Khanbogd sum, Umnugovi aimag, Mongolia (2004)

317. Wheel-bushing, fragment, 4/6 (no further information).

Group B, Type B.2, Variation B.2b

Takhalin us, Deren sum, Dundgovi aimag (1959)

318. Wheel-bushing, complete; W. 4.9 cm; Th. 1.8 cm; Dm. 14.5 cm; 3695 gr. (no further information).

319. Wheel-bushing, complete; W. 3.3 cm; Th. 1.6 cm; Dm. 9.5 cm; 1468 gr. (no further information).

320. Wheel-bushing, complete; W. 4.3 cm; Th. 1.4 cm; Dm. 13.2 cm; 2575 gr. (no further information).

321. Wheel-bushing, fragment; W. 3.9 cm; Th. 1.3 cm; Dm. 10.5 cm; 475 gr. (Inv. No. NHM 995).

322. Wheel-bushing, complete; W. 5.2 cm; Th. 1.5 cm; Dm. 13.2 cm; 2960 gr. (no further information).

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