# SI 1. Sites analysed in the study.

See Fig. 3 for the location map of the sites. In cases where the contexts were disturbed (e.g. plundered burials), only specimens with reliable association were sampled.

*Bestamak* (source of the Ubagan River, Kostanai Region, North Kazakhstan; 52°10'52.32"N 64°32'22.55"E; Logvin and Shevnina 2005, 2008, 2011) is a large cemetery, the total excavated area is 9092 m2. The majority of burials (including all analysed burials) and sacrificial sites belong to the Bronze Age Sintashta Culture, 2nd mil. BC. Pit 111, undisturbed, sub-rectangular, 2.25х1.7 m wide and 1.4 m deep, contained remains of wood, horse and sheep (sampled) bones, and skeleton of 40-50 year old female (sampled) with a number of ornaments, tools and ceramic pots. Pit 123, undisturbed, sub-rectangular, 3.1х2.4 m wide and 1.4 m deep, contained remains of wood, pottery, horse skulls, sheep astragali (sampled), and skeleton of 8-10 year old child (sampled) with a number of ornaments and tools. Pit 130, sub-rectangular, 3.4х2.35 m wide and 1.2 m deep, has been plundered. It contained disarticulated animal bones (herbivore sampled), pottery fragments, a piece of bronze tool and fragments of skull and teeth of likely 30-35 year old female (sampled). Pit 140, undisturbed, rectangular, surrounded by a ditch, 3.44х1.8 m wide and 1 m deep, contained remains of wood, pottery, ornaments, tools, weaponry, sheep astragalus, two horse skeletons (sampled) and sheep bones, and a skeleton of a 35-40 year old male (sampled). Pit 170, undisturbed, rectangular, 3.2х2.5 m wide and 1.6m deep, contained cattle and horse (sampled) skulls, sheep bones, wild boar astragalus, pottery fragments, tools, wood, and skeletons of a 2 month old infant and a 30-35 year old male (sampled).

*Halvai 3* (left shore of the Tobol channel of the Karatomarskoye Reservoir, Taranovski District, Kostanai Oblast, North Kazakhstan; 52°50'13.44"N 62°53'37.33"E) is a Bronze Age Sintashta Culture kurgan 1 m high and 32 m in diameter (including the ditch). Part of the burials, made within the mound, belong to the later periods. Pit 3 located in the northern part of the mound belongs to the Sintashta Culture. It is rectangular in shape, 4.9x3.9 m wide and 3.2 m deep, orientated west-east. Above the burial, on a depth of 0.7-1 m, there was an overlap of pine logs. Above the overlap at a depth of 0.2 m, in the centre, there were two horse skulls and a piece of a flat-bottomed vessel underneath them. On the overlap in the southeast corner at a depth of 1.7-2 m there was the skull of a mare. In the northern corner of the pit there was a plundering hole containing fragments of bronze, pottery, stone tips and human bones. Only the southern part of the pit, at a depth of 2.9-3.2 m, appeared intact. At a depth of 2.9 m, there was grey-brown decay and fragments of wood, birch bark, a small vessel in the birch bark, bronze awl, a knife in fabric sheath, leather and birch bark, two human skulls and five pots, partially preserved human hand bones with bracelets made of bronze beads, bronze adze with a wooden handle and leather braid. The bottom of the pit was covered with birch. Apparently, at least two women (one under 25 years old and another of mature age), a man of no more than 30 years of age, and a child about 10 years old, were buried (Shevnina and Logvin 2015).

*Halvai 5* (left shore of the Tobol channel of the Karatomarskoye Reservoir, Taranovski District, Kostanai Oblast, North Kazakhstan; 52°50'25.07"N 62°53'52.04"E) is a Bronze Age Sintashta Culture kurgan 30 m in diameter, 0.8 m high. Pit 4, located in the central part of the kurgan, is rectangular 5x4.8 m wide and 3.3 m deep. It has been plundered. At the southern wall of the pit there was a horse skull. From the depth of 0.2 m to the bottom of the pit the following objects were found: disarticulated human bones of a 30-40 year old female, horse and sheep bones, stone tips, bronze axe, pebble fragments and a zoomorphic stone altar-grater (Logvin et al. 2017).

*Kamennyi Ambar (*south-east of the Ural Mountains, Trans-Ural peneplain, Kartalinsky District, Chelyabinsk Oblast, Russia; 52°49'47.5"N 60°29'03.0"E; Koryakova and Krause 2013; Rühl et al. 2015, 2016; Stobbe et al. 2015, 2016a,b; Koryakova et al. 2015) is a fortified settlement of the Sintashta Culture, built on the Karagaily-Ayat River terrace, a tributary of the Tobol River. The Sintashta Culture appears in the Trans-Ural peneplain at the turn of the 3rd and 2nd mil. BC (2100–1950 cal. BC (1σ)), with fortified settlements, organized residential areas with rows of buildings, innovations in metallurgical and craft technologies such as spoke-wheeled chariots, and new funerary practices. Kamennyi Ambar is one of three fortified Bronze Age settlements in the Karagaily-Ayat microregion, located only 10 km from each other. The settlement shape is rectangular with rounded corners, subdivided into two different areas by a transverse, up to 8 m wide, inner fortification. The area is 158 x 112 m. More than 40 houses could be identified. The above-ground and slightly deepened buildings were made of wood and clay with internal subdivisions and structures like ovens, small pits, and particularly remarkable well features with excellent wet preservation of organics. The stratigraphy attests successive occupations, a conclusion that is further supported by the existence of up to 15 wells within one house unit. Samples UBA-26187 and UBA-26188 are from the same rubbish layer (depth 200-220 cm) of a well feature. Samples UBA-26185 and UBA-26186 are taken from the same level (140-145 cm) of the ditch from the inner fortification.

*Kenzhekol I* (north-west of the Kenzhekol village, Pavlodar, Kazakhstan; 52°10'59.2"N 77°00'48.2"E; Tkachev et al. 2005; Kazizov and Merts 2006; Merts et al. 2007) is a cemetery of the Andronovo Culture (Middle Bronze Age, 18th-16th c. BC). By today, 116 burials have been investigated. Burial 49 was unplundered and it contained a possibly female skeleton in foetal position (sampled) on its left side headed to the west, fish bones around its forearm (possible elements of the costume; sampled), a pot near its head and bronze earrings. This burial differs by its orientation (the majority of the graves within the cemetery are headed to the east) pottery type (Bishkul type of the Andronovo pots are more common for the North Kazakhstan) and its general placement outlying a row of other burials, suggesting the individual was a migrant.

*Kesken-Kuyuk kala (Juvara)* (island enclosed by the Syr Darya River to the north, Aral Sea to the west and a strip of swamps and flooded marshes to the east, Kazaly District, Kazakhstan; *45°31'00.0"N 61°27'30.0"E*; Tolstov 1947, 1962*),* first discovered in 1946, is the largest of the so-called “marsh towns” (1st mil. AD) located on the southern bank of an ancient delta which is currently dry and thickly overgrown. The size of the site is 840 long to 820 m wide with a total area of over 530,000 m2. The site is structurally divided into three main parts – a central “citadel” and two vast sections surrounded by a ring of irregularly shaped walls. An abundance of osteological material makes this site differ enormously from other marsh towns. The samples were taken from a midden (element 286) from the same level of -15 cm.

*Kharga I* (Buryatia, Russia; 52°50'18.2"N 111°50'23.5"E; Ivashina 1979) is a settlement located on a neck between the lakes of Bolshaya Kharga and Malaya Kharga (Major and Minor Kharga). Originally the site was attributed to the Early Bronze Age (Ivashina 1979), but the latest data suggests that it was used during the Neolithic as well. The majority of pottery found in the settlement belongs to the cord imprinted tradition. The samples were collected from a midden ca. 30-40 cm wide and less than 1 m long, ca. 30 cm deep. The filling of the pit was instantaneous and included fish spine in anatomical order (sampled), fragment of skull of young roe deer (sampled) and fragments of at least two pots of the same type.

*Kuraika* (northern part of the Kuraiskaya intermountain basin, 2 km north-east from the Kurai Village, right shore of the Kuraika River, Kosh-Agachsky District, Altai Republic, Russia; 50°14'47.0"N 87°57'10.8"E) is a cemetery of the Kok-Pash type of the Bulan-Koba Culture of the Hun-Sarmatian time. The cemetery consists of about 100 kurgans. Burials represent wooden boxes with the deceased lying on their backs with their heads orientated to the west or north-west. In most cases burials did not contain grave goods. Kurgan 21 was excavated in 2005-2007 (Slyusarenko et al. 2008). It contained a skeleton of a 40-45-year-old male, bone bead under the skull and sheep vertebrae near the neck. Kurgan 25 was excavated in 1994 (Soenov and Ebel 1998). It was destroyed in the east and north-east part and contained skeleton of a 40-45 year old female with destroyed skull carrying remains of a red dye. Paste bead and sheep vertebra were found near the skull. The graves have not been disturbed.

*Shat* (Bukhar-Zhyrau District, Kazakhstan; 50°38'23.4"N 74°15'02.2"E; V. Varfolomeev, personal communication), structure 1 represents a mausoleum of the Begazy-Dandybai Culture (2nd mil. BC – 8th c. BC) surrounded by two enclosures composed of several rows of granite slabs orientated south-north. The outer rectangular enclosure is 8.4 m long, 8.05 m wide and 0.3 m high, the thickness of the walls is ca. 0.5 m. The inner oval enclosure is 5.7 m long and 5.05 m wide. The burial chamber is a rectangular stone cist 4.1 x 3.3 m wide. The walls are formed by huge granite slabs up to 2 m long, up to 1.2 m high and up to 0.3 m thick. The weight of such slabs is around half a tonne. Around the stone box there were altars represented by horse bone clusters – remains of funeral foods or funeral fest. The burial chamber had been robbed; it contained human and animal (horse, cattle, sheep, two dogs, small deer) bones (human and horse bones sampled), fragments of eight vessels of the Valikovaya and Bagazy types, six bronze beads, bronze needle and plaque, and pieces of azurite and malachite (copper ore).

*Tegiszhol* (left shore of the Nura River 10 km to the west from Temirtau city, Karaganda region, Kazakhstan; 50°05'43.1"N 72°46'00.0"E) is a burial ground of the Bronze and Iron Age Cultures, including Alakul, Fedorovo and Bagazy-Dandybai (Varfolomeev 2011). Mound 27, 12 x 11 m in area and 0.4 m high, was undisturbed, and it belonged to the Early Iron Age Tasmola Culture. In the centre of the kurgan, above the burial, part of horse skeleton was found *in situ* (apparently placed there after grave 1 had been filled and covered with slabs). Also, fragments of a small plate and another pot were found nearby. The mound contained two burials. Burial 1 represented the skeleton of a 25-30 year old male, along with 5 bronze three-bladed arrowheads and a belt with rectangular and (unique) figured rings, two beads and other accessories. Horse vertebrae (sampled for this study) were found near the left knee of the deceased.

*Utinka 2* (55°43'59.9"N 88°19'49.3"E; Utinka Lake, Achinsk-Mariinskaya forest-steppe, Tisul District, Kemerovo Oblast) is an isolated destroyed burial of the Samus Culture (15th-13th c. BC; Bobrov et al. 2010). The burial was located on a hill and contained disarticulated bones of sheep and 6 year old child (sampled), pottery fragments, five sheep astragali (sampled) and flint flake. Beside the burial there were two pits, one of them containing pottery fragments.

*Verkh-Uimon* (right shore of the Katun River, outskirts of the Verkh-Uimon village, Ust-Koksa District, Altai Republic, Russia; 50°12'47.3"N 85°43'32.0"E) is a cemetery of the Pazyryk and Hunno-Sarmatian periods containing more than 70 kurgans. Burials mostly represent oval stone mounds orientated from west to east. Many burials contained skeletons of horses lying on their belly or on the side with legs tucked in, orientated to the west. Human skeletons were located in most cases in stone cists, stretched on their backs, orientated to the west. Grave goods mostly represented armaments and horse harness items, pieces of clothing and ornaments, tools etc. Kurgan 35 (Soenov 2003) represented an intact grave with stone mound, containing horse bones and stones from the grave covering in the southern part of the grave, and stone cist with remains of a male individual orientated to the north-west.

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