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Andronovo Mobility Revisited: New Research on Bronze Age Mining and Metallurgical Communities in Central Asia

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Introduction: aspects of mobility and migrations in the Central Asian steppe region during the Andronovo period and beyond

RECENTLY, MODERN GENOME studies have provided insights into population relationships between the Eastern European plains and the Central Asian forest steppe and steppe zone since the late 4th and early 3rd millennia BC (Allentoft *et al.* 2015; Haak *et al.* 2015; Mathieson *et al.* 2015; Narasimhan *et al.* 2019). These relationships were explained by expected early pastoral economic cycles of the Pit Grave or Yamnaya culture or the Corded Ware groups integrated into the dynamics since the early 3rd millennium BC (e.g. Czebreszuk 2004; for a more differentiated argumentation see Kaiser 2010; 2016; also Frachetti 2011). According to this line of interpretation, Eastern European and Caucasian-European populations and their genomes spread to Central Asia and there partly replaced other more Central Siberian-Asian populations, whose specific genetic pattern remained clearly determinable until the end of the 3rd millennium BC (e.g. Afanasievo: Mathieson *et al.* 2015; Narasimhan *et al.* 2019).

From a bird's-eye view, this gene flow with supposedly light-pigmented European-Caucasian populations looked like a great wave of migration that finally spread to Central Asia by the end of the 3rd millennium BC, and a little later to the Tarim Basin, the southern areas of Central Asia, and the Minussinsk Basin (Kuzmina 1994; Mallory and Mair 2008; Narasimhan *et al.* 2019). This is where the older conceptions of a dispersal of Indo-European-speaking people met with ideas of the formation of the so-called Andronovo culture in the 2nd millennium

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BC (e.g. Gimbutas 1970; Mallory 1989; Anthony 2007) (Figure 6.1). The use of wagons and certain elements of riding by a militarily dominant elite were ultimately viewed as an element of identity and ideology that would have connected the Indo-European societies within wider Central and Western Asia. Kuzmina (1994; 2007) also spoke of the spread of elements of material culture to the south and east, mainly based on archaeological evidence. She linked this with the implementation of metallurgy and an intensification of metal extraction as a whole (Kuzmina 1991).

In Central Asia, the Bactria-Margiana-Archaeological Complex (BMAC) developed in the middle of the 3rd millennium BC and was often viewed as a transformation area (overviews: Masson and Sarianidi 1972; Kohl 2007; Vidale 2017). This would have passed cultural (including possible linguistic) traditions to the Indus and Ganges valleys, as well as to the Iranian central plateau on the southern side of the Kopet Dagh Mountains. Mallory even developed a 'culture bullet' (*Kulturkugel*) theory of cultural diffusion in order to be able to connect the clearly different cultural elements of these areas with the steppe nomads (Mallory and Adams 1997: 73). Such leaps are problematic, especially when we consider that the North Indian and Iranian Iron Ages (and also the Yaz cultural phenomenon)

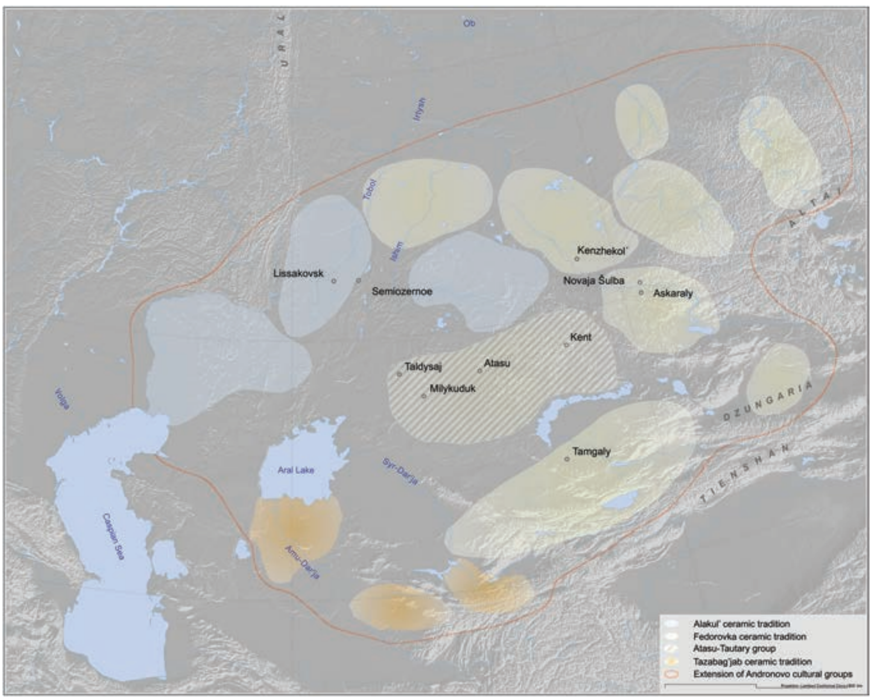

Figure 6.1 Andronovo phenomenon – distribution of different cultural units within Central Asia (after Parzinger 2006; Kuzmina 2007; mapping: DBM, A. Hornschuch, J. Garner, and T. Stöllner)

are at least 300 to 500 years younger (see Narasimhan *et al.* 2019 for the genetic ancestry of North Indian populations). Additionally, genetic sequences showed a different genetic ancestry for the BMAC communities as compared with Yamnaya populations, and gene flow towards the steppe regions (Narasimhan *et al.* 2019).

Even against the background of genetic relationships, such conclusions have to be doubted. Current genetic data from the regions concerned are not linked as closely as desired, e.g. from graves of the Hindustan/Swat culture dating to the late 2nd and early 1st millennia BC (Narasimhan *et al.* 2019). Nor do sufficient genomic data exist from the Iranian central plateau for the late 2nd millennium BC, which earlier researchers saw as the destination of Iranian-speaking immigrants from the north (Ghirshman 1964; 1977; Young 1967; for a recent summary see Potts 2016). Those who saw the Indo-Aryan ancestry in the Andronovo complex (Kuzmina 2007) connected these ideas on a conceptual level.

Research of the Bronze Age archaeological cultures has long pursued fundamental problems of the chronological classification and geographical delimitation of the various regional forms of 'Andronovo' (e.g. Kuzmina 1994; Parzinger 2006, 356–441; Varfolomeev and Evdokimov 2013). The main focus of observation was the Bronze Age pottery of the steppe, its ceramic technology, and its variegated decorative systems. Researchers termed them Fedorovka, Alakul', or Atasu-Tautary tradition and determined their spatially different distribution areas. Some concepts followed a chronological sequence of individual ceramic styles (e.g. for the temporal priority of Alakul' ceramic tradition in the west) or assumed that these styles were spread through migration events. The traditional view that migration can be recorded by the spread of characteristics of material culture (e.g. ceramics), however, has recently been contradicted in the sense of a 'pots as people' concept (for arguments see Frachetti 2011: 201–3). Such interpretations are paired with the idea that particular regional and group-specific characteristics and identities are reflected in the ceramic decoration in particular, but this is by no means certain (Varfolomeev and Evdokimov 2013). Kuzmina (1991) regarded the metallurgical and mining activities closely connected with the Andronovo cultures as an interpretative background. In the search for metal ores, individual groups would have moved, e.g. to Central Asia (Tazabag'jab variant of the Andronovo complex), into the Minussinsk Basin (Fedorovka variant), or even to Xinjiang via the Tien Shan Mountains and the Dzungarian Gate (Kuzmina 1991; 1994; see also Tkacheva and Tkachev 2008). If we consider the significant intensification of metallurgical activities or the fact that certain metal forms are found widely spread throughout Central Asia at the time (see Chernykh 1992), this interpretation may have its value.

One important aspect is the widespread Sejma-Turbino phenomenon (Černych 2013) (Figure 6.2) and the introduction of tin bronzes into the forest steppe regions and, to a minor extent, also to the steppe regions. Tin ores from east Kazakhstan may have played an important role within this exchange, as the recent lead isotope investigation of a bronze object, found in the tin-bronze free Sintashta complex of Konopljanka in the Central Urals, has demonstrated (Krause 2013). Tin bronzes themselves were introduced from the late 3rd millennium BC Minussinsk Basin and were common across the Altai Mountains in eastern Kazakhstan (Okunev, Krotovo, Samus’, Elunino, and Kanaj Group: Chernikov 1960; Parzinger 2002; 2006: 324) to the middle Urals. In the west, there was also a possible connection between the Black Sea region and Troy, which can be seen best by the metalwork in the famous Borodino Hoard (Shishlina and Loboda 2019) that also displays connections to the metalwork of the Sejma-Turbino phenomenon. The lead isotope similarities between the early tin bronzes from Troy and the East Kazakh tin bronzes and their regional origin (Pernicka *et al.* 2003; Stöllner *et al.* 2011: 247–9) might possibly raise the question of whether the steppe itself was the connective background for exchange relations. The early use of tin bronze, especially in the regions between the upper Irtysh River, the Altai Mountains, and the Minussinsk Basin, provides good arguments for seeing one possible origin of this technology in these regions. The Sejma-Turbino phenomenon makes it more than clear that tin ore extraction and alloying were already developed before the start of the Andronovo phenomenon (for a new radiocarbon chronology: Marchenko *et al.* 2017).

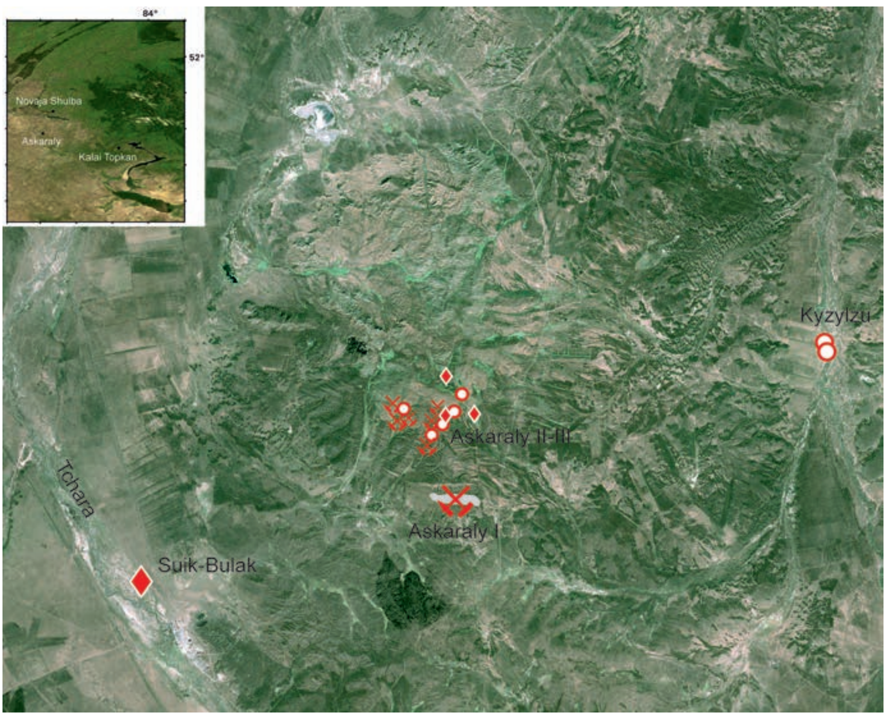

Figure 6.2 East Kazakhstan, Delbegetey (Askaraly) Mountains: Bronze Age sites in the surroundings of tin mines (pick/hammer symbols): rhomboids=graves; dots=settlements (mapping: DBM, Hornschuch and Stöllner)

This also becomes clear when looking at the Early Bronze Age steppe connections that ran towards the later Tazabag'jab group at the fringe of the BMAC in Middle Asia. Avanesova (2013) and Parzinger (2006: 329–35) referred to the importance of metal processing and the relations to the steppe regions further north in the late 3rd millennium BC, but also for earlier time horizons, e.g. the Zaman-Baba culture in Bukhara, which has not yet been well researched. The site of Tugaj near Samarkand, Uzbekistan, however, demonstrates already for the period of the late 3rd millennium BC close ties to the northern Kazakh Petrovka culture (Avanesova 1996; 2015). Like the later communities of the Tazabag'jab culture, these groups might have visited the higher summer pastures and mining areas (e.g. those of Mushiston: Parzinger and Boroffka 2003; for early dates: Garner 2014) of the western Tien Shan and Pamir Mountains (for the Inner Asian Mountain Corridor see Frachetti 2012; Spengler *et al.* 2014). Ore deposits in low mountain ranges at the foot of the high mountains were probably seasonally exploited, as illustrated by the Andronovo settlement of Sichkonchi near the Karnab tin deposit in Uzbekistan (Parzinger and Boroffka 2003).

From an archaeological point of view, interpretation must be focused on the social and economic practices in the steppe region, especially the different levels of the cultural sphere (language, material culture, ideology) involved in the formation of ethnic identities. Biomolecular archaeology can direct our attention to new questions, but a detailed archaeological analysis must follow. Mobility in its various forms (up to larger migration events) is an important factor here. One can ask what caused this increasing mobility. Metals and their exchange probably only represented an economic background for the increasing patterns of movement in Central Asia. In the Eurasian forest steppe and steppe zone, semi-mobile or mobile herding can form an important background. However, it is still not fully clear how the pasture management systems ultimately took shape (Ventresca Miller *et al.* 2019; 2020). Numerous research contributions assume that Bronze Age societies still persisted in smaller-scale pastoral systems and that an extensive nomadisation of societies would only have been a phenomenon of the subsequent Iron Ages (Frachetti 2008; 2012). Therefore, another aspect must also be considered: Central Asia is essentially characterised by east–west-oriented environmental corridors, which in turn have contributed to extensive exchange networks. Apart from the actual grass steppes, the northern forest steppes, and the southern zones each have their own ecosystem, e.g. the desert steppe areas (Pott 2005: 521–38; Boroffka 2013).

The progressive aridisation southwards towards the Central Asian desert areas led, especially in the southern zones, to important connecting corridors along the major rivers, as well as along the mountainous areas. The river valleys (similar to the climatically favourable mountain valleys of the large mountain ranges) could have served as winter quarters, while the spring and summer pastures were also associated with mining and metallurgical activities. Ethnographic evidence for pastoral transhumance from the early 20th century shows that distances of many hundreds of kilometres are not unusual in the context of seasonal pasture movements (Khazanov 1994; Stasevič 2013). It is therefore obvious that material goods could also spread widely as a result. Therefore, it is ultimately impossible to clearly separate goods that were spread by a single migration from those distributed through permanent pasture-related mobility. So, the main point in this chapter will be to find arguments for the different kinds of mobility patterns required for understanding the Andronovo complex as a network of mobility rather than the result of unidirectional migration events.

The Bochum Kazakhstan project: goals and methods

By the early 2nd millennium BC, metal practice was already established in Central Asia, a process that began well before the actual Andronovo culture (e.g. Chernykh 1992; Grigoriev 2015). Bronze played a central role in this, e.g. in the Sejma-Turbino phenomenon. While copper is available in many places within the deposit zones of the Central Asian Tethyan-Eurasian Metallogenic Belt (TEMB) and north of it (e.g. Seltmann 2013), tin deposits are much rarer (see the overview in Garner 2014). Bronze occurs in numerous and sometimes large metal associations, such as large deposits in southern and eastern Kazakhstan (Chernykh 1992; Černych 2013; Stöllner *et al.* 2013a; Grigoriev 2015; Stöllner and Gontscharov 2021). It was therefore rewarding to investigate the question of mobility and migration on the basis of evidence for tin extraction and the distribution of the oldest tin bronzes.

In 2003 a long-term cooperation project with the Archaeological Institute A.Ch. Margulan of the Republic of Kazakhstan began, which continued with field research until 2010 and resulted in an exhibition (Stöllner and Samašev 2013) and other projects that processed part of the collected data in dissertations (Naumann 2016; Gontscharov 2019; Özyarkent 2019).[1] The central question of

[1] The project was generously supported by the Gerda Henkel Foundation in three successive projects between 2003 and 2008; I have to express my gratitude to the foundation's officials and boards for the uncomplicated and effective collaboration, especially to Dr A.-M. Lauter (special programme Central Asia), Dr A. Kühnen, and the chairman, Dr M. Hansler. The project itself was initiated by Sergej Berdenov†, Jan Cierny†, Dr Zeinolla Samaschev, and Dr Thomas Stöllner during a first field trip in 2003. The programme was supported by many Kazakh and German colleagues: A. Gorelik took over many of the responsibilities and supported the project with his expertise. We would like to thank M. Doll, J. Garner, A. Gorelik, A. Hauptmann, R. Herd, G.A. Kushtch, V. Merz, T. Riese, A. Kuczminski, B. Song, and B. Zickgraf, but also G. Suvorova, A. 'Sascha' Kolmogorov, J. Digon, and Director Djusupov of the Kraevedcheskij Museum in Ust-Kamenogorsk. Also former students I. Merz, J. Kazizov, A. Tschotbajev, A. Alpamys Zhalgasuly, and O. Balyk, as well as K. Malek, M. Rabe, A. Kramer, N. Löwen, P. Thomas, and B. Sikorski from Bochum. For this article the authors were provided access to the fascinating metals of Nurataldy; we especially thank Dr V. Loman and Dr I. Kukushikin (Karaganda).

the projects funded by the Gerda Henkel Foundation and the Leibniz Association (RITaK project) ultimately aimed at researching the economic foundations of the metal-producing Bronze Age communities of the Andronovo culture, their predecessors, and successors in central and eastern Kazakhstan. In the course of the project, surveys and excavations were carried out on Bronze Age tin- and copper-producing communities in north-east and eastern Kazakhstan. The excavations in the Delbegetey Massif (Askaraly) in the Kalba-Narym zone of eastern Kazakhstan identified a Bronze Age landscape with mining evidence, settlements, grave finds, and ritual sites (Stöllner *et al.* 2011; 2013a). The mineralisation in Askaraly is of cassiterite-tourmaline type. It is known that producing bronze from cassiterite is easier and can be sufficiently co-melted in a crucible. Therefore, this ore has the potential to be used within rather simple metallurgical techniques. Indeed, there are hints (i.e. Elunino-type sherds) that indicate the Askaraly tin ore might have been used already during the Early Bronze Age (Naumann 2016: 42, plate 20). By being rich in valuable tin deposits and situated on the transition zone between the true steppes and the semi-desert steppes and between central and eastern Kazakhstan, Askaraly had the potential to be used as a major tin source during the Bronze Age.

The archaeological site of Askaraly II is of great importance in this context because a community of the Andronovo culture engaged in tin mining can be examined here through a settlement site, a burial ground, and a tin mine, which is unique for the steppe and forest steppe regions. The burials at Mastau Baj/Chernogorka, many of which contained hammerstones as grave goods, were seemingly directly related to the mining and possibly represent part of the mining community (Stöllner *et al.* 2010) (Figure 6.3; Table 6.1). A settlement, partly excavated nearby at Mastau Baj, allowed insight into daily pastoral and metallurgical practices and subsistence activities. Besides meat consumption and pastoral activities (Doll 2013; Özyarkent 2019) (Table 6.2), there is also indication of some crop planting activities (Stöllner *et al.* 2011: 245, Figure 14).

A second subject of investigation included the question of the exchange of metals and metal objects. The German-Kazakh project has been able to investigate numerous Bronze Age metals from different parts of Kazakhstan since 2006. Among other things, the focus was on exchange processes between different Bronze Age groups and the question of whether and how the tin deposits of eastern Kazakhstan contributed to the bronze supply of Bronze Age steppe communities. This question will be discussed here on the basis of findings from the Nurataldy cemetery. The study is based on nearly 400 metal analyses, of which only a small selection will be discussed here. Gontscharov will present those results in full in the planned printed version of his dissertation (Gontscharov 2019; for the methods see Stöllner and Gontscharov 2021).

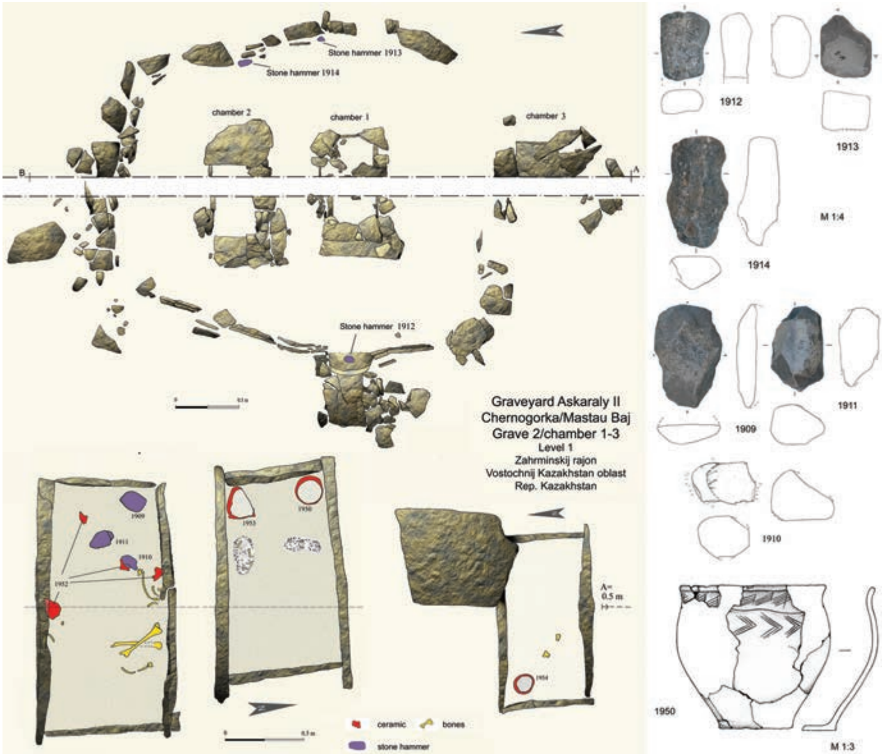

Figure 6.3 East Kazakhstan, Delbegetey (Askaraly) Mountains: cemetery, Chernogorka/ Mastau Baj I, grave 2 (mapping/photos/drawings: Institut Margulan/Vostochnij Kazakhstan Museum/DBM, Garner, Cierny, and Digon)

Table 6.1 Askaraly II, Mastau Baj/Chernogorka, stone circle 2, anthropological and archaeological data (source DBM/RUB)

Askaraly II, Mastau Baj/Chernogorka, stone circle 2, elliptic, 6.8 x 5.5 m							
Cist	**Orientation**	**Robbed/ reopened**	**Burial rites**	**Sex**	**Ceramic**	**Metal finds**	**Stone artefacts**
							6 hammers deposited in stone circle
1	E-W	X	inhumation	male, mature	fragments	ring fragments	3 stone hammers
2	E-W	X	cremation	female (?)	1 pot, 1 bowl		
3	E-W	X	inhumation	unclear	1 vessel in NW-corner		

Table 6.2 East Kazakhstan, Delbegetey (Askaraly) Mountains: species composition of the faunal remains found in the settlement of Mastau Baj I (after Doll 2013)

Species	NISP	NISP (%)	Weight	Weight (%)
Unidentified fragments of middle-sized species	1022	68.6 %	1285.4 g	44.7 %
Unidentified fragments of large-sized species	466	31.3 %	1590.7 g	55.3 %
Total of unidentified species	1488	100.0 %	2876.1 g	100.0 %
Cattle (*Bos taurus*)	1062	50.0 %	20937.7 g	70.8 %
Sheep (*Ovis aries*)	90	4.2 %	2077.9 g	7.0 %
Goat (*Capra hircus*)	10	0.5 %	295.0 g	1.0 %
Sheep or goat (*Ovis / Capra*)	890	41.9 %	4858.5 g	16.4 %
Dog (*Canis familiaris*)	2	0.1 %	7.4 g	0.0 %
Wild or domestic horse	69	3.2 %	1405.7 g	4.8 %
Unidentified bird	1	0.1 %	0.8 g	0.0 %
Total of identified specimens	2124	100.0 %	29570.0 g	100.0 %
Total share of identified specimens	2124	58.8 %	29570.0 g	92.4 %
Total share of unidentified specimens	1488	41.2 %	2876.1 g	7.6 %
Total of specimens	3612	100.0 %	32446.1 g	100.0 %

Multiple isotope analysis at Askaraly: a tin-mining community and its mobility

The goal of the research was to investigate movements on the landscape, especially regarding the provenance, diet, and climatic signals. The method of investigation developed for this research can be labelled as multiple isotope analysis cross-validation. Multiple isotope studies in our case meant the combination $^{86}Sr/^{87}Sr$ in order to detect the geological background of human and animal samples, as well as $\delta^{13}C/^{15}N$ to discuss the background of predominant nutrition patterns, and this in combination with $\delta^{18}O$ isotope ranges to get a climate signal involved. Here, we only present some results selected from a larger sample series that was collected and investigated within the context of a PhD study (Özyarkent 2019). Similar studies have already been performed for western Siberia and northern Kazakhstan (Motuzaite Matuzeviciute *et al.* 2015; Ventresca Miller *et al.* 2018; 2020) and for southern Kazakhstan and the Inner Asian Mountain Corridor (Spengler *et al.* 2014; Hermes *et al.* 2019; Wang *et al.* 2020), but not for central and eastern Kazakhstan.

The main sample group consisted of herd animals since they would be the main resource for a moving pastoral community. In Central Asia, changing pastures according to the climatic and ecological conditions during the seasons and moving to nurture the herd in better pastures is a characteristic subsistence strategy and lifestyle. Moreover, from a methodological point of view, the incrementally mineralising enamel of the hypsodont tooth of herbivores is a better medium for observing temporal isotopic changes, given the current state of isotope research and the results from laboratory experiments based on controlled feeding. Since the aim of the investigation was the entire community, the dataset was enlarged by two human samples in the first step. These two individuals were miners, as suggested by their grave goods (see above). The cemetery in total represents a household occupation consisting of variously aged adult men, women, and infants (Kunter 2009).

One part of the study is based on the results of strontium isotope analysis. The investigation of strontium isotopes from the hydroxyapatite of the bone/tooth of animals and humans for examining their provenance is an established method and has proved itself in the last decades with numerous archaeometry studies, first, by Ericson (1985) and followed by Sealy *et al.* (1991), Sillen and LeGeros (1991), Price *et al.* (1994), Ezzo (1997), Grupe *et al.* (1997), Sillen *et al.* (1998), and recently, Knipper (2017). Strontium is an alkaline earth element that incorporates into crystal structures of bone and teeth, as well as other materials (i.e. shell, antler, hair, etc.) in the place of calcium due to the similarity in the atomic valence of both elements. Strontium isotope ratios show variation in nature, and to a great extent this is related to the age and origin of the rocks. The strontium element then travels into the habitat by the weathering of rocks and other processes (i.e. meteoric water, soil formation, etc.). The observed variations in the ratio of two strontium isotopes, a less-occurring radiogenic isotope (^{87}Sr) and a more common stable isotope (^{86}Sr), provide a tool for investigation within the landscape. By comparing the isotope ratios, it is possible to connect the organism or the organic material to the bedrock where the organism took its food.

The Askaraly archaeological sites (including Askaraly II) are situated on a granitic hill (Delbegetey), and the lowland around the hill is a carboniferous oceanic sea basin which continues southwards (Chara Basin). This geological setting, with higher radiogenic values on the hill (due to the granitic rocks) and lower values in the lowland (due to substrates of carbonate and shale), provides a suitable isotopic background for investigating the mobility in question with strontium isotope analysis (see below). According to the results of the strontium isotope analysis, it was possible to distinguish a foreign signal among the herd animals from Askaraly (Figure 6.4). The local strontium isotope value range is determined by calculating the confidence interval from the local non-migrating animals, used for comparison (Özyarkent 2019: 220–2). Outliers such as most of the cows and some sheep/goats are outside this designated local range and, in this case, mainly have low radiogenic values.

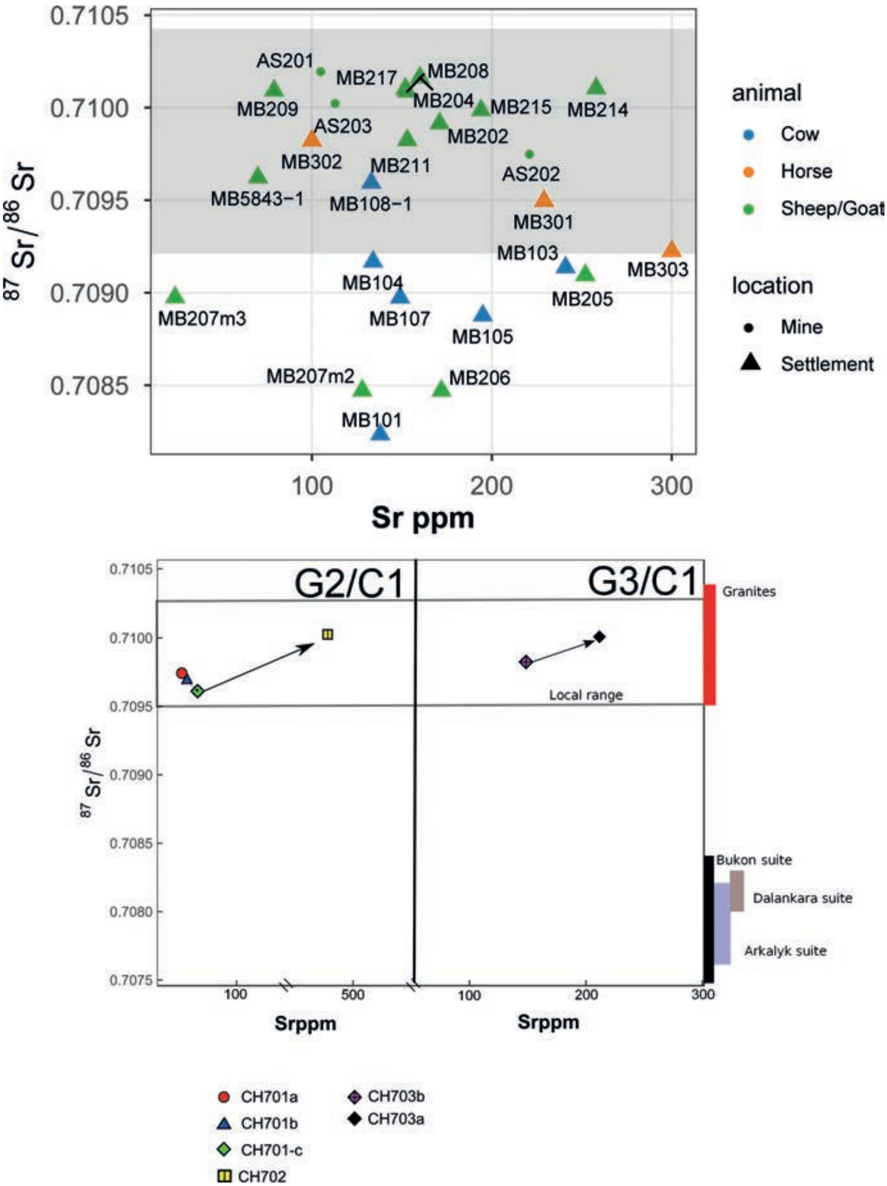

Figure 6.4 Top: Plot for the Sr isotope and Sr elemental abundance measured on the animals from Askaraly. Grey area indicates the value range between upper and lower limits of the 95 per cent CI from the local range calculated using the non-migrating local animals. Bottom: Human (miner/metallurgist) 87Sr/86Sr investigation on different teeth and bones from two Andronovo grave structures. The samples of two human individuals show regional mobility during their lifetime: CH701a: M1; CH701b: canine; CH701c: M3; CH702: tibia of the same individual; CH703a/b: teeth; note the higher elemental abundance of Sr in bone regarding the teeth (after Özyarkent 2019)

Another method used in this research is oxygen isotope analysis, which is used to indicate seasonal temperature changes. Variation of $\delta^{18}O$ in the food cycle is biased towards the oxygen isotopic values of meteoric water, which is determined by various factors but to a large extent by seasonal temperature changes (Dansgaard 1964; Sponheimer and Lee-Thorp 1999: 723–4; Gat 2001). These variations can be correlated to the meteoric water in other food sources (i.e. tree leaves, plants, fish, etc.), and when an organism consumes these while its bone and tooth enamel apatite is formed, the $\delta^{18}O$ of CO_3 in the matrix of their hard tissues would be biased towards the value of these food and water sources (Longinelli 1984; Luz *et al.* 1984; Iacumin *et al.* 1996; Koch 2007). With this premise, it is possible to detect temperature changes based on the oxygen ratios derived from food and water (e.g. summer–winter). In the case of herbivores, the water from plant consumption is the most determinant factor for the $\delta^{18}O$ values, and to a lesser extent (despite obligatory drinking) the meteoric drinking water affects the overall oxygen isotope value (Bryant and Froelich 1995: 4527–8). Carbon isotope $\delta^{13}C$ values were measured and calculated together with the $\delta^{18}O$ values in order to compare different plant sets typical of specific habitations (e.g. C3 and C4 plants) and climatic zones, on the same sample and in accordance with the growth structure of the enamel, from the tip to the cement enamel junction (for the method see Balasse 2002; Balasse *et al.* 2012). Using these means, it was possible to examine both diet and climatic conditions from the same sample in a temporal resolution.

Humans are omnivores, and the dietary isotope values from the human samples reflect the mixture of plants, meat, and other dietary components (e.g. fish, dairy products). There are two main sources for obtaining dietary values. One is from the carbonate phase of the hydroxyapatite of humans and other mammals that originates from the blood carbonate pool and thus reflects the carbon isotope values of the whole diet (Lee-Thorp *et al.* 1989; Jim *et al.* 2004). A second analysis on collagen/gelatine extracted from bones reflects only the protein part of the diet (DeNiro and Epstein 1978; 1981; Ambrose and DeNiro 1986). Carbon isotope ratios measured and calculated from the collagen/gelatine extraction from bone indicate variations related to the components of the diet derived from dietary organic compounds (e.g. amino acids in the case of meat and cellulose in the case of plants, etc.). Nitrogen isotope ratios, which are also measured on the same extracted collagen samples, demonstrate the trophic level of the organism by enrichment in every step of the trophic level (Peterson and Fry 1987). Nitrogen isotopes also indicate the aridity and salinity conditions indirectly related to the degree of intensity of bacterial activity in the soil where the plants originated (DeNiro and Epstein 1981; Ambrose and DeNiro 1989; Ambrose 1991; Koch 1998).

As an example of the combination of methods applied, we will discuss the cow tooth MB105, an M3 tooth, which is mineralised when animals are 9–22 months old (Hillson 2005: Table 3.3) (Figure 6.5 left). According to its Sr isotope ratio, the cow likely came from abroad, as the mineralisation of the tooth certainly had occurred long before it was slaughtered (Figure 6.5 top). The animal was slaughtered at

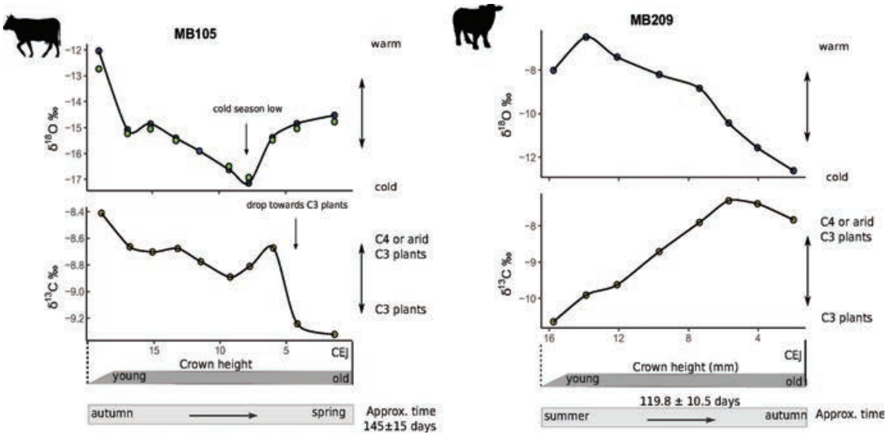

Figure 6.5 Askaraly: oxygen and carbon isotope values from the cow sample MB105 (left) and the sheep sample MB209 (right); oxygen isotope values are calculated to show the meteoric water values using equations from D'Angela and Longinelli (after Özyarkent 2019)

approximately 3.5–6 years old according to the tooth wear stage approximation (beginning of stage G with the cement enamel junction in q position after the scheme by Grant 1982; Jones and Sadler 2012). The slaughter age of the animal suggests that it was used for dairy production, rather than meat (see below and Doll 2013). The results show values from a time interval beginning at the end of the warm season (autumn, October/November) and continuing to the next one (spring, March/April) (see also Hermes *et al.* 2019: 3). According to the mineralisation pace calculation, this period equals approximately 145±15 days (Zazzo *et al.* 2010; Kierdorf *et al.* 2013). The $\delta^{13}C$ values are in negative correlation with the $\delta^{18}O$ values. At the end of winter, the values from carbon isotopes show increased C4 plant diet (e.g. dried grass), and in spring more C3 plants in the diet (e.g. herbs and leaves). The Sr isotope ratio of this sample is outside of the local range (0.70888).

Another sample from the site comes from sheep enamel (MB 209), sampled using the same method as the previous one (Figure 6.5 right). Based on the mineralisation pace of sheep enamel, this M2 tooth reflects a time period of approximately 119.8±10.5 days, and thus the first-year isotopic history of the animal. The Sr isotope level of this tooth indicates that the sheep lived in the region during this time (cf. Figure 6.4 above). The mineralisation period shows a warm season/summer peak and cold season, with the beginning of autumn. In the case of the diet, the results of $\delta^{18}O$ and $\delta^{13}C$ indicate a pattern similar to the previous one (cow) with regards to seasonality and nutrition differences. The summer months show negative $\delta^{13}C$ values, which indicate more C3 plants. Towards the winter months, especially in autumn, C4 plants increased in the diet of the animal.

Among the human samples, the foreign signal was less easily determined than it was in the herd animals. This is a known issue, as in humans the enamel formation has a slower pace when compared with herbivores. This extended mineralisation period and the yet undetermined mineralisation direction lead to a masking effect in the enamel samples of humans (Hillson 2005; Simmer *et al.* 2010). Therefore, the temporality cannot be ascertained at this state of research, and it should be further investigated and interpreted. On the other hand, human Sr isotope results have shown a pattern similar to the animals, even though the analysed samples are within the designated local range. An analysed tibia from one of the miners (grave 2, chamber 1, 40–60-year-old) has a higher radiogenic isotope ratio when compared with the analysed teeth of the same individual. The miner's teeth values show a variation from his early to later years, manifested in the M1 (sample CH701a), canine (sample CH701b), and M3 (sample CH701c) (cf. Figure 6.4 bottom). Since human teeth mineralise in time spans of approximately four years, with M1 spanning 0–4 years, C 4 months–6 years, and M3 8–14 years (White and Folkens 2005: Figure 19.2), the $^{87}Sr/^{86}Sr$ values represent these time intervals for the individual's isotope accumulation in the apatite of bone and teeth. The early years of this individual have a higher isotope value than found in the M3, which is formed in later childhood. The canine tooth, on the other hand, has a lower radiogenic value as compared with M1. This difference might be due to the two-year period (from the 4th to the 6th year of the individual) between the mineralisation of M1 and M3. In contrast, the tibia sample (CH702) exhibits a higher radiogenic isotope accumulation than that from later childhood. The second individual (grave 3, chamber 1) was sampled by an incisor CH703b (crown formation *c*. 3.5–8 years) and a molar CH703a. This individual showed a similar variation pattern within the local range as did the first individual. These variations observed among different periods of life in both individuals will be investigated in more detail.

The diet investigation results from the carbon and nitrogen analyses show that the first miner (grave 2, chamber 1) did not directly consume C4 plants (Figure 6.6). For later periods, studies have shown a C4 plant diet for both humans and animals. However, a slight inclination towards lower $\delta^{13}C$ values can occur indirectly via animals that have consumed C4 plants, since the human collagen values are in line with the mixture of the animals represented in the sample dataset. Likewise, the $\delta^{15}N$ values are in line with the offset of the trophic level, as it is known that, in the trophic chain, every step up equals + 3 to +5 per mille or ‰ enrichment (Peterson and Fry 1987). Another interesting result was the difference between apatite–collagen spacing (Lee-Thorp *et al.* 1989). These spacings are related to the trophic level of mammals, and in the case of the miner, the values are close to observations from carnivores (Lee-Thorp *et al.* 1989). Therefore, with these results from the miner sample from the Askaraly mining complex, it is possible to infer that the human diet was based mostly on meat consumption, and most likely a higher amount of sheep meat was consumed as opposed to beef. Moreover, an archaeozoological study on the animal remains from the site suggests that cows were kept especially for dairy production, and sheep/goats for meat, because of the age/slaughter pattern (Doll 2013). This will be further investigated by amino acid and stable isotope analyses on residues from ceramics in the near future.

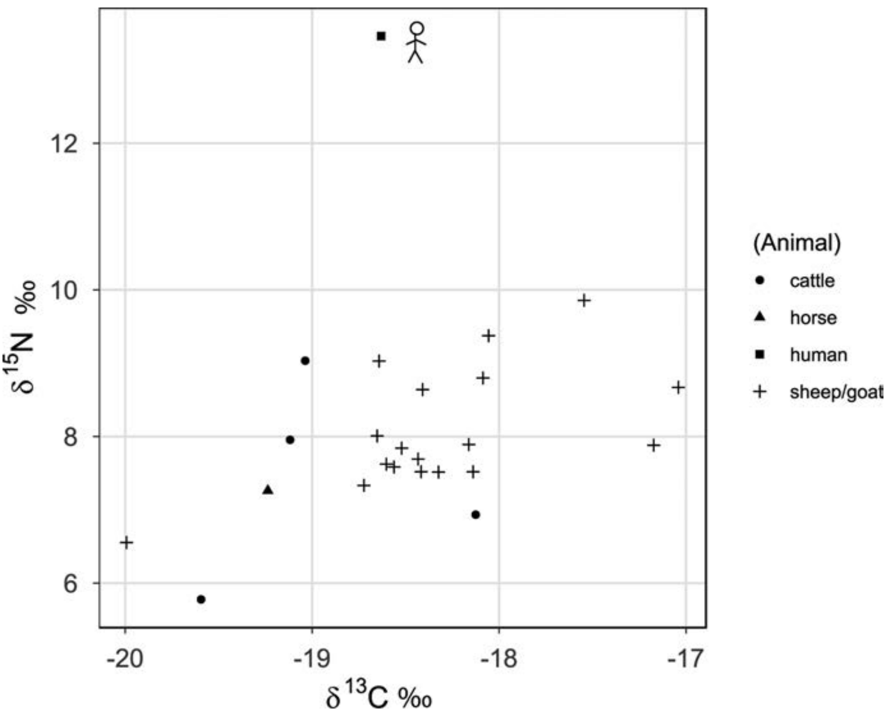

Figure 6.6 Distribution of the isotope results performed on the bone collagen of animals and humans. Error bars in both axis directions represent the reproducibility of the samples. The clustered samples are also from the animals that are in the local range with Sr isotope ratios. The outliers on the right with higher carbon isotope ratios and generally higher nitrogen isotope ratios indicate aridity and a high proportion of C4 plants in their diet. The sample on the left of the plot (MB201) is a goat and its position reflects its diet based on grazing, which was mostly C3 plants (after Özyarkent 2019)

Askaraly is situated in the transition zone from grass steppes to the dry steppes, but it is in a location with close connections to the Irtysh River and its tributaries (Figure 6.7). In modern times, people in the Askaraly region practise village-based animal husbandry, collect hay for winter, and practise rain-fed agriculture. However, there are debates on ethnographical sources for the Semei region, as to whether rain-fed agriculture was possible in historical times. The adoption of agriculture, under the influence of Russia, especially since the 19th century AD, led to a gradual immobilisation and a semi-mobile lifestyle, keeping animals in stalls (see more in Tairov 2017). Agriculture is not unusual, even for the pastoral nomad lifestyle, but its solutions are more eclectic. This is a characteristic of steppe pastoral nomadic communities, because flexibility is an important strategy to cope with possible subsistence catastrophes (like *dzhud*=the great famine) that could deplete the herds upon which people are dependent (Khazanov 1994). It is possible, however, to use the wild progenitors of cereals, which are abundant in the grass steppe zone. Even with the inclusion of plants, the pastoral routes, and especially

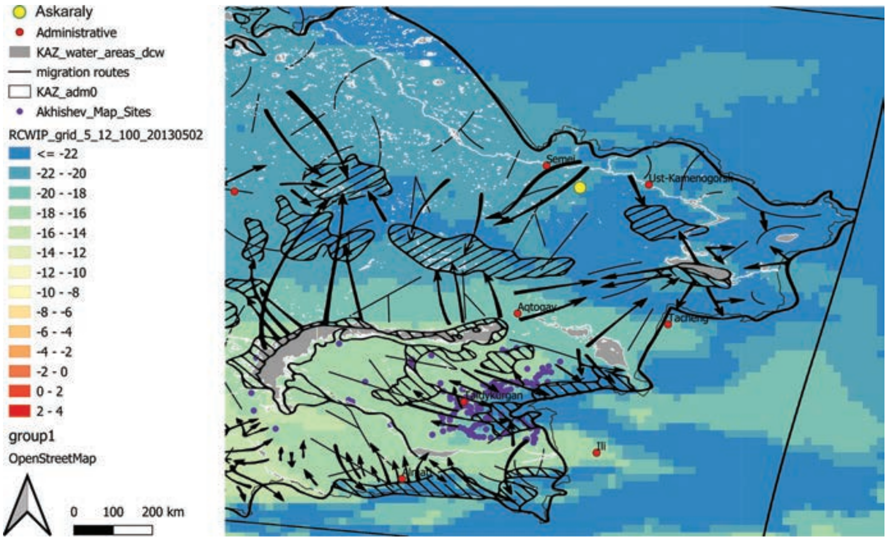

Figure 6.7 A combined map of oxygen isotope modelled values from Terzer *et al.* 2013, Akhishev. Iron Age sites, nomadic pasture massifs of 1926–30 with summer and winter camps (after Tairov 2017: Figure 37, after Federovich; prepared by Özyarkent)

the summer and winter camps, were chosen for specific ecological features (warm winter habitations with nutritious pastures and water; cool summer habitations with grass steppe ecology) (Asanov *et al.* 1992).

In the case of Askaraly (and other sites, in preparation), the results have shown that there is mobility towards southern latitudes for arid climate ‘winter’ pasturing. The cow presented as an example here plots outside the local range of Sr isotope values and is considered to have a foreign signal. The climate and temperature indications from oxygen isotope results also show that the lowest signal from this cow is higher than the modelled value for Askaraly, which is -23.5 per mille or ‰ for February (modelled after Terzer *et al.* 2013) (cf. Figure 6.7). These warm winter temperatures are accompanied by the increased C4 plant consumption in the animals’ diets. Similarly, the isotope values obtained from the sheep sample is in line with the results for the cow, but the image that could be obtained from the enamel piece is limited and also belongs to the summer values. This is due to the difference in the birthing time of cows and sheep. As a result, it seems the cow was born in autumn while the sheep was born in spring. Thus, the data reflects different parts of the year. The representation in the enamel is also restricted by the ablation of the hypsodont tooth. Since the teeth of herbivores mineralise from the use surface towards the cement enamel junction, the ablation in time erases the earliest mineralisation phases. In the summer peak the diet was high in C3 plants, and towards the cold months, at the beginning of autumn, an increase in C4 plants can be observed in the diet.

The low winter values for oxygen isotopes obtained from the cow point to southern latitudes. The closest location with similar oxygen isotope ratios and C4 plants in meadows is the Ayaguz region, and this landscape continues towards Taldy Kurgan and its surroundings. The Semirechye region, which is located between Lake Balkhash and the Tien Shan Mountains, is thought to have been a preferred winter camp location for nomads of later periods (Saka-Iron Age, 1st millennium BC), due to the intensity of evidence for kurgans and petroglyphs (Parzinger 2006; Gass 2014; Tairov 2017; cf. also the Akhishev map). Therefore, it is possible to connect the regions through aspects of material culture. The Andronovo-Semirechye type has similarities to central Kazakhstan and east Kazakhstan Andronovo, as can be seen by rectangular and oval grave constructions with a cist in the centre or with soil burials, both as inhumations and cremations (Parzinger 2006; Bendezu-Sarmiento 2007; Gass 2014; for a later occupation by Mukri people with elements similar to central Kazakhstan see Frachetti *et al.* 2010). Askaraly also has similar grave types and other cultural finds in comparison with the central Kazakh Atasu group. This indicates connections between regions north of the Kazakh borderlands and the winter pastures in the south.

‘Mobile metals’: tin bronzes and the Nurataldy case

Chemical and lead isotope data from approximately 400 metal objects, metallurgical educts (i.e. slag), and ores from eastern and north-east Kazakhstan were collected between 2006 and 2014 (Stöllner *et al.* 2013a; Gontscharov 2019; Stöllner and Gontscharov 2021: Figure 8) (Figure 6.8). Lead isotope data from the Tien Shan, Ural, and Altai Mountains, as well as central Kazakhstan, were gathered from the literature (Syusyura *et al.* 1987; Chiaradia *et al.* 2006; Box *et al.* 2012). Chemical analyses have been performed in the laboratories of the Deutsches Bergbau-Museum Bochum (DBM) with Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) until 2008 (cf. Prange 2001: 98, Figures 83–4 for procedure) (laboratory numbers /06), and from 2009 onwards with ICP-Mass Spectrometry (ICP-MS) (cf. Kiderlen *et al.* 2016: 305 for procedure). Detection limits of both methods are shown in Prange (2001: 24, Table 4). Lead isotope analyses from 2006–9 were done with Thermal Ionisation Mass Spectrometry (TIMS) in the Institut für Mineralogie, Zentrallabor für Geochronologie in Münster (cf. Bode *et al.* 2009: 186–8 for procedure) (laboratory numbers /06), and from 2009 onwards with Multi-Collector-ICP-MS (MC-ICP-MS) at the Institut für Geowissenschaften in Frankfurt am Main (see Klein *et al.* 2009: 62–4).

Concerning the analytical interpretation of such data, there are limitations related to methodological aspects in general, as well as the way of sampling and developing the database. In Central Asia there is a generally high variation of deposits from different geological ages (cf. Seltmann 2013). There are the Ural Mountains and the comparatively old Altai Mountains in the east, as well as the

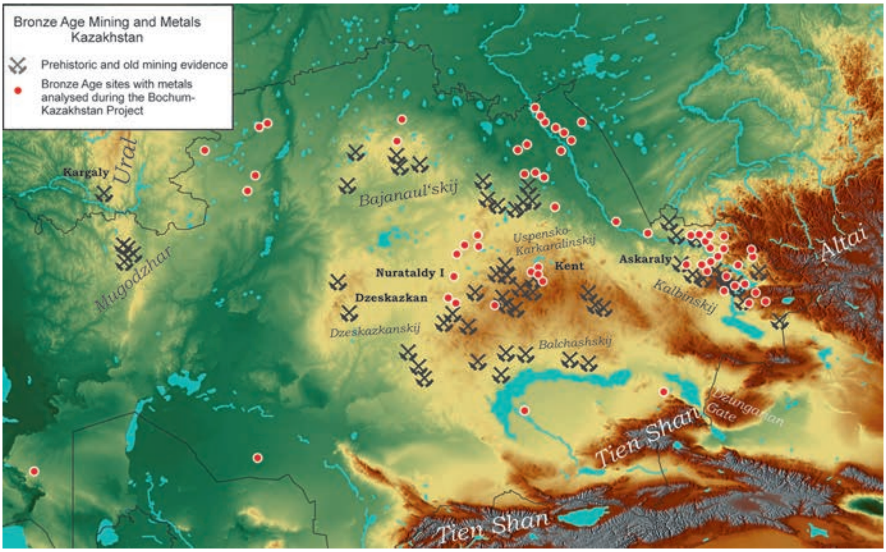

Figure 6.8 Central, south, and east Kazakhstan and its mining and metallurgical evidence of the later Bronze Age (2nd millennium BC) (source: DBM/RUB, Stöllner based on Stöllner and Samashev 2013; Garner 2014, after Stöllner and Gontscharov 2021)

aforementioned TEMB-girdle in the south including the Tien Shan and Pamir Mountains (Seltmann *et al.* 2011); here we find a great variety of Proterozoic and Palaeozoic cratons that were mobilised during the Variscan orogeny. Such geological basements stretch from the Southern Urals to central and east Kazakhstan, such as the Kalba-Narym zone in the north-east, the Valerianov zone in the west, the Altai-Sayan Uplands in the east, and the central Kazakhstan/Karakum zone in the centre (Zonenshain *et al.* 1990; Nikichenko 2002).

Various preconditions make it difficult to unambiguously interpret geochemical patterns. Lead isotopes, for instance, provide only negative evidence, while positive matching is a mere indication of the possibility but not proof. As the geology is complex and shows remobilisation of host rocks and ores, it is important to know the exact location of a sample within a deposit (Stöllner and Gontscharov 2021: Figure 4). Unfortunately, not all the mining districts were sampled with a comparative level of detail. According to work carried out so far by Russian and Kazakh colleagues, as well as American and German scholars (e.g. Degtjareva 1985; Chernykh 1992; Hanks and Doonan 2009; Černych 2013; Krause 2013; Stöllner *et al.* 2013b; Grigoriev 2015), there is a reasonable amount of data available that we are able to discuss.

The bronzes of the so-called Sejma-Turbino phenomenon are a perfect example of exploring a large sphere of exchange and mobility (Chernykh and Kuzminych 1989; Parzinger 2002; 2006; Schwarzberg 2009; Serikov *et al.* 2009; Černych

2013; Chernykh *et al.* 2017). After decades of discussion, it is now widely accepted that most of the artefacts belong to a period from the end of the 3rd to the first half of the 2nd millennium BC (Marchenko *et al.* 2017). As Chernykh and Kuzminykh (1989) already stated, they seldom occur in graves, but instead in hoards and ritual contexts where the depositional character can be observed, particularly by putting them to the ground or burying them at selected topographical sites. It has been further stated that they display delicate casting technologies and often a high amount of tin, which is outstanding in itself, especially for the typologically earliest examples.

Considering the Sejma-Turbino 'mode of deposition' (weapons plunged vertically into the soil), it has to be mentioned that the hoard of Nurataldy is the first case in which such a deposition mode is combined with Eurasian types (Kukushkin and Loman 2014: 584–7). Two spearheads and three daggers were stuck into the ground together with an arrowhead, three pieces of metal, a wrapped metal sheet, a casting piece, and a broken metal fragment (Figure 6.9). The hoarded items of Nurataldy I are the best contexts for understanding the social dimension of an artefact assemblage in early Andronovo culture. The graveyard consisted of four slab cists, three of which were disturbed, but one remained untouched. Two horse burials were discovered nearby. The complex, which remains unpublished so far, has been dated by the excavators Kukushkin and Loman (2014) to the early phases of the Andronovo/Alakul' culture. The burial of two horses can be understood as a reference to the wagon symbolism, characteristic of the Nurtaj group in central Kazakhstan that was in close chronological relation with the Petrovka group (Tkachev 2002: 147 [part 2]; Kukushkin 2013). What stresses this cultural classification is the mode of deposition of the bronzes that were stuck into the earth near the north-western corner of slab cist 2. Although the deposition mode clearly relates the Nurataldy I deposition to the Sejma-Turbino phenomenon, there are no Sejma-Turbino objects sensu strictu but rather objects that belong to the Eurasian component of the phenomenon (Chernykh and Kuzminykh 1989: Table 17).

All daggers (KZ 651–3) contained a high percentage of tin (Table 6.3), but when looking more carefully at their Lead Isotope Analysis (LIA) ratios, it is clear that two daggers, the rolled metal sheet, and one spearhead did not come from central Kazakhstan (KZ 651–652, 680, 694) (for the chemical/isotope data see Stöllner and Gontscharov 2021: Table 2, 4) (Figure 6.10; Table 6.3–4). One spearhead and one dagger are very close to each other (KZ 652, 694) and were made using east Kazakh copper. The metal was most likely alloyed with tin from there as well. This fits also with the elevated Bi and Pb contents that are known from east Kazakh ores and metals (Stöllner *et al.* 2013b: 388–9, Figure 5). On the other hand, there are objects whose LIA ratios and trace elements would instead fit the LIA reference data from the 'Kent' field of central Kazakhstan (KZ 653, 682, 695, 731): dagger, spearhead, arrowhead, and metal cast.

The metal cast, maybe a small ingot, perhaps best resembles regional copper. It is a relatively pure copper with very low impurities and contains nearly no tin, as it is unalloyed (cf. Table 6.3). It is different from the spearhead with the short socket, which had a low tin level and some antimony and lead that do not really

Figure 6.9 Nurataldy I, objects from metal deposition near grave 2 (source: DBM/RUB, photo A. Gontsharov, by courtesy of Loman and Kukushkin, Karaganda)

match levels found in the east, but perhaps rather in central Kazakhstan. Two other striking facts can be mentioned: the arrowhead KZ 731 has a rather high lead content and was thus likely alloyed. It is therefore impossible to make clear statements as to its origin on the basis of the LIA ratios. The opposite is the case for the metal fragment KZ 681. The LIA ratios indicate a composition that must be from completely outside central Kazakhstan. They would perhaps better correlate with Uralian and north Kazakh deposits: Ag, Co, and especially As are represented in higher values (for the ores, especially type 4, see Tkačev *et al.* 2013: 475–7).

The differentiation between a central Kazakh and an east Kazakh group within the deposit can also be supported by typological considerations. If looking at the typological and chronological investigations by Avanesova (1991: 23–4, Figure 22), it becomes clear that the daggers are part of a larger typology, in which not all objects date to the same time period: whether the east Kazakh dagger and spearhead were synchronous is difficult to assess. The dagger, KZ 652, can be identified as a rather ‘eastern’ Andronovo-Fedorovka dagger type (type 3/4 after Avanesova 1991), while the spearhead belongs to the Sejma-Turbino phenomenon sensu lato. On the other hand, the second ‘outsider’ (KZ 651) and the central Kazakh tin bronze dagger KZ 653 show the rather early feature of long lateral indentions (central Kazakh Nurtaj group: Tkachev 2002: 158–287). With this information combined, there is reason to believe that the deposit was a roughly synchronous assemblage with objects of varying origins. If so, one could assume that this was the case not only for the objects, but also for the bearers. Is it possible that one dagger/spearhead

Table 6.3 Central Kazakhstan, hoard of Nurataldy: elemental concentrations from various copper-based alloys (source: DBM/RUB, M. Bode; analytical data have been normalised to 100 per cent: see Stöllner and Gontscharov 2021)

Lab.-Nr.	*Inv.-Nr.*	*Site*	*Artefact*	*Sn*	*As*	*Pb*	*Fe*	*Zn*	*Ag*	*Au*	*Sb*	*Bi*	*P*	*S*	*Co*	*Ni*	*Se*	*Te*	*Hg*	*Cu*	*sum*
Nurataldy 1, hoard, early Andronovo period (beginning of 2nd millennium BC)																					
4395_14	KZ-651	Nurataldy 1	dagger	8.48	0.03	0.36	0.004	0.003	0.019	0.0001	0.009	0.013	0.00005	0.016	0.0002	0.004	0.0004	0.002	0.0001	91.11	100
4396_14	KZ-652	Nurataldy 1	dagger	11.5	0.17	0.16	0.005	0.005	0.039	0.0002	0.017	0.018	0.00005	0.041	0.001	0.01	0.0023	0.003	0.0001	88.16	100
4397_14	KZ-653	Nurataldy 1	dagger	10.03	1.57	0.03	0.228	0.016	0.05	0.0001	0.004	0.027	0.00005	0.067	0.005	0.014	0.0004	0.004	0.0001	88.14	100
4399_14	KZ-680	Nurataldy 1	sheet metal/ ingot	17.83	0.26	0.22	0.002	0.003	0.165	0.0002	0.005	0.034	0.033	0.219	0.001	0.005	0.0004	0.003	0.0001	81.68	100
4400_14	KZ-681	Nurataldy 1	ingot	0.2	1.01	0.004	0.503	0.011	0.047	0.0002	0.004	0.013	0.00005	0.112	0.011	0.039	0.0004	0.005	0.0001	98.28	100
4401_14	KZ-682	Nurataldy 1	ingot	0.01	0.1	0.05	0.026	0.025	0.022	0.0002	0.003	0.001	0.001	0.112	0.004	0.006	0.0008	0.004	0.0001	99.82	100
4393_14	KZ-694	Nurataldy 1	spearhead	15.19	0.02	0.1	0.02	0.045	0.026	0.00004	0.006	0.003	0.002	0.049	0.001	0.003	0.0011	0.003	0.0001	84.67	100
4394_14	KZ-695	Nurataldy 1	spearhead	1.62	0.01	0.16	0.002	0.003	0.077	0.00004	0.75	0.003	0.00005	0.009	0.0001	0.007	0.0011	0.002	0.0001	97.45	100
4398_14	KZ-731	Nurataldy 1	awl	10.47	0.07	1.54	0.007	0.005	0.017	0.0005	0.017	0.014	0.00005	0.006	0.0001	0.004	0.0008	0.003	0.0001	87.9	100

Table 6.4 Central Kazakhstan, hoard of Nurataldy: Pb isotope data (source: DBM/RUB, M. Bode; see Stöllner and Gontscharov 2021)

Lab-Nr.	Inv.-Nr.	Site	artefact	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{206}Pb$	$^{208}Pb/^{206}Pb$
Nurataldy, early Andronovo period, around 2000 BC						
4400_14	KZ-681	Nurataldy 1	ingot	18.59021	0.84166	2.08558
4401_14	KZ-682	Nurataldy 1	ingot	18.06612	0.86206	2.10580
4395_14	KZ-651	Nurataldy 1	dagger	17.86462	0.87120	2.12577
4396_14	KZ-652	Nurataldy 1	dagger	17.79648	0.87212	2.11867
4397_14	KZ-653	Nurataldy 1	dagger	18.04660	0.86176	2.10413
4399_14	KZ-680	Nurataldy 1	tin/ingot	17.95412	0.86733	2.11326
4393_14	KZ-694	Nurataldy 1	spearhead	17.80066	0.87169	2.11741
4394_14	KZ-695	Nurataldy 1	spearhead	18.16330	0.85949	2.10007
4398_14	KZ-731	Nurataldy 1	awl	18.04366	0.86333	2.10994

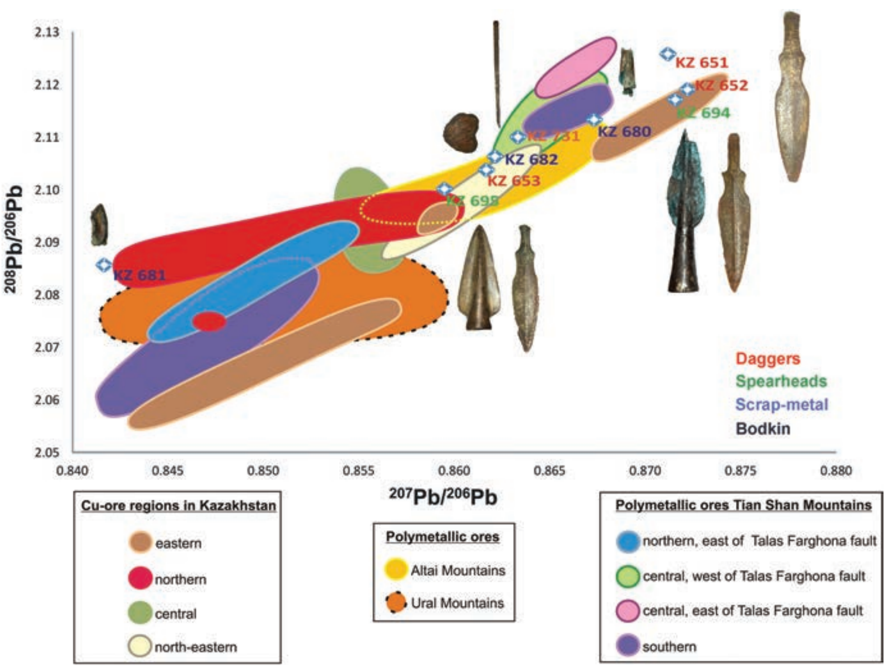

Figure 6.10 Lead isotope ratio of ore samples from Nurataldy I, hoard of Sejma tradition (source: DBM/RUB, Bode and Stöllner)

assemblage (KZ 652, 694) came with a person from east Kazakhstan while another assemblage (KZ 653, 695, 731) might have been fabricated with copper from central Kazakhstan and perhaps tin from east Kazakhstan?

The Nurataldy I deposit thus also displays social realities during the earlier 2nd millennium BC in the steppe and forest steppe zone of Central Asia: metal objects and their origins were of importance within social interactions. It can only be assumed that the foreignness of materials (tin) and objects helped to memorise the actions and people involved when the Nurataldy I deposit was buried, most likely until the end of the ritual activity in the Nurataldy I graveyard. If following these ideas, we may certainly find traditions of handling artefacts in a memory context over a longer time, thus bridging the centuries from the end of the 3rd to the middle of the 2nd millennium BC (which is possibly characteristic of the Sejma-Turbino phenomenon). Therefore, it was informative to look at other artefact groups of the Andronovo culture (for instance 'Srubnaya daggers') in more detail (see Gontscharov 2019; Stöllner and Gontscharov 2021).

The example of the early Andronovo complex of Nurataldy I and other widespread artefact groups (such as daggers of the Srubnaya type) show that metals were distributed in the early 2nd millennium BC by means of individual exchange processes. One possibility is that mobile communities obtained the necessary metals from different locations – the other that mobile craftspeople moved from place to place with their moulds (e.g. Minasjan 2013). These artisans might have been involved in pastoral groups and moved with them to rich summer pastures. Of course, entire prestige outfits with their porters could have travelled between the individual areas. If we compare this mobility pattern with the one caused by animals (e.g. demonstrated mobility in Askaraly), then this movement could have occurred over long distances between the winter locations and the summer pastures. Groups from different regions may have met and negotiated pasture and usable areas (e.g. for raw material extraction), especially during the major changes in weather and temperature in spring and autumn. Celebrations and the exchange of gifts could have been important social forms of negotiation. It is certainly worthwhile to analyse the pasture quality of individual mining areas in more detail. The gentle mountain range of the Delbegetey with its valleys of the Chara and Kyzylzu Rivers can be described in any case as a favourable grazing zone (cf. Figure 6.3). It would be conceivable that many objects were manufactured in the winter pasture season, while raw materials were procured and products were exchanged during pastoral activities in the warm season.

The wider context of our datasets: mobility or migrations of 2nd millennium BC communities and their consequences for the Andronovo concept

It is possibly too early to judge all the variants of mobility of steppe communities during the Bronze Age. While the research team of Frachetti discussed seasonal herding patterns within the Inner Asian Mountain Corridor down to the south Kazakh plains (for a general discussion see Frachetti 2012; Hermes *et al.* 2019), the results of our research support further mobility patterns. The examples discussed in this chapter make clear that herding activities included longer-distance movements between summer and winter pastures crossing the Kazakh borderlands. For Askaraly and its mountainous landscape, it is likely that communities used the region as summer pastures, while also taking part in mining and metallurgical activities. This would also include single animals that were coming to the summer pastures from their winter pastures (such as cattle), as well as others (such as sheep) that were born in the spring and possibly killed after the colder season already had begun. The pattern is complex as winter pastures could have been situated either in protected valley grounds in the nearby Altai or in the climatically favourable plains south of the Kazakh borderlands (Tairov 2017: Figure 7). As for Askaraly, but most likely also for other mining districts, it may be supposed that areas which provided favourable grazing and mining potential were visited by different groups, possibly from different winter camp origins.

Complex enterprises like mining and metallurgy – even when carried out only by smaller communities – would probably have required assembling larger cooperative groups. In the settlement of Mastau Baj (Askaraly II) we can follow such different regional traditions in the pottery styles. Naumann (2016) was able to analyse these pottery styles and their making. Her stylistic analysis identified regional Marinka and Kyzyltas pottery styles as well as styles from abroad, such as the central Kazakh Nurtaj and Atasu type wares. The pottery production partly took place regionally, as is demonstrated, for example, by the use of regional temper. One should also mention that the settlement was presumably reused several times, as indicated by the chronologically different ceramic record in the half-pit house.

The house itself was rebuilt at least once (Stöllner *et al.* 2013a: 373; Naumann 2016: 78). There is also clear evidence of a later Bronze Age phase to which a piece of wheel-thrown pottery most likely belongs. Pieces of foreign wheel-thrown ceramics of a Southern Central Asian pottery tradition indicate that groups also carried whole vessels to Askaraly, possibly from regions where such prestigious vessels were used to a larger extent, e.g. the Altai steppe zones, Kyrgyzstan, and central Kazakhstan (Kuzmina 2007: 365, 418; Varfolomeev 2013: 486, Figure 5). Taking other pieces of evidence into account, e.g. a rock art depiction of a Sejma-style horse (Stöllner *et al.* 2011: 247, Figure 16), it may be a surmisable conclusion that the Delbegetej/Askaraly region was used as a seasonal meeting place to which various groups came in order to use the pastures and the tin deposits during warmer seasons.

This reconstruction largely differs from older concepts that were favoured for over a century. In this chapter, we are not looking at the migrations of Andronovo groups through the pottery tradition (e.g. the Alakul or Fedorovka types). It is not yet possible to observe a mass migration event just before or during the Bronze Age. According to the archaeological record, we rather observe a gradual development of technological innovations and a pastoralism-based subsistence strategy with diverse mobility solutions. It is even possible to assume that this kind of mobility as well as the rise of metallurgical traditions (such as the tin bronze technology) was a connecter for the groups in Central Asia before some kind of Andronovo 'unity' ever occurred after 2000 BC.

As the Nurataldy I case showed in a nutshell, there was a high range of social interrelation and hybrid social practices connecting Sejma-Turbino groups of the forest steppe with steppe communities of early Andronovo. Sets of prestigious goods were exchanged using jointly understood social practices, which certainly created, in cases like Nurataldy I, a shared memory and identity (Gontscharov 2019). This would explain metals more as a means of social interrelation and an expression of connectedness between those vast areas. The foreignness of objects from different origins was certainly considered and even valued (such as at Nurataldy I) as an expression of social prestige and connectedness between the groups involved (see Stöllner and Gontscharov 2021). Therefore, the cultural system of the Andronovo groups can likely be understood as enabling this kind of interconnectivity between different groups that were active in metallurgy and pastoralism. In light of this interpretative concept, it becomes more understandable how the vast cultural and economic networks called Andronovo could evolve. Constant mobility was part of the everyday life of these communities, and the spread of such a lifestyle is what one would possibly call a larger unit like Andronovo. It is therefore important to understand their extended mobility as a whole and not only to use selected search for single migration events either by genetic, isotopic, or typological argumentation.

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