Exploring Complexity in Bronze Age Exchange Networks by Revisiting the Bronze Mirrors of Central Asia and China

Rebecca O'Sullivan & Huiqiu Shao

The ever-growing body of research on trans-Eurasian exchange during the third–first millennium BCE continues to improve understanding of mechanisms that facilitated the movement of objects, materials, ideas, and even people. However, whether bronze mirrors in Central Asia and China represent the exchange of technological knowledge or movement of the objects themselves remains unresolved, as researchers require extensive knowledge of huge quantities of data generated during the Soviet Central Asia campaigns of the mid twentieth century. The often confusing, impenetrable excavation reports, combined with required knowledge of Chinese, Russian and English, have caused much confusion about dates and contexts. This article presents and compares data published in Russian and Chinese reports. By clarifying the chronology for mirrors in Central Asia and China, we challenge simplistic theories of object diffusion and spread that persist in studies of trans-Eurasian exchange. We argue that the early second-millennium BCE appearance of mirrors in western and northwestern China resulted from different exchange mechanisms specific to each local socio-cultural context. This demonstrates not only the complexity of interactions at the group and individual levels, but also how these factors can be integrated with data-driven analyses to explore the role they played in large-scale Bronze Age exchange networks.

Introduction

Disc-shaped mirrors appear in what is now western and northwestern China in the early second millennium BCE, and they are considered to be the precursors of later examples made by the Chinese dynasties and exported across Eurasia, to the extent that they were formerly known as the 'Chinese mirror' in English-language research (Dohrenwend 1964; Juliano 1985; Rubinson 1985). Like other bronze objects with earlier parallels in Central Asia, these early mirrors are considered by many as evidence for far-reaching networks of trade and exchange that existed across early Bronze Age Eurasia. Understanding of where these mirrors came from and how they arrived in western China still relies, however, on data of varying qualities from the ambitious Soviet campaigns in Central Asia during the mid twentieth century (Jaang 2011; Mei 2006; Rubinson 1985; Wu 2017). The often impenetrable nature of the excavation reports and language barriers between Chinese-, Russian- and English-speaking researchers (Shao 2018, 150) means that misconceptions about the dates and locations of these Central Asian mirrors exist, which has ramifications for understanding not only how mirrors reached the Central Plain, but also causes issues for the ever-growing body of research on connectivity between peoples of the Eurasian Steppe, Central Asia and northwestern and northern China (Grigoriev 2021a; Guo 2012; Li 2011; Li 2009; Lin 2019b; Linduff 2018; Rawson 2015; Rawson *et al.* 2020; Shao 2018; Shao & Yang 2013; 2015; Wu'en 2002; Yang *et al.* 2016; Zhang 2018). By revisiting the data published in Russian and Chinese reports, this article seeks to clarify the chronology for mirror

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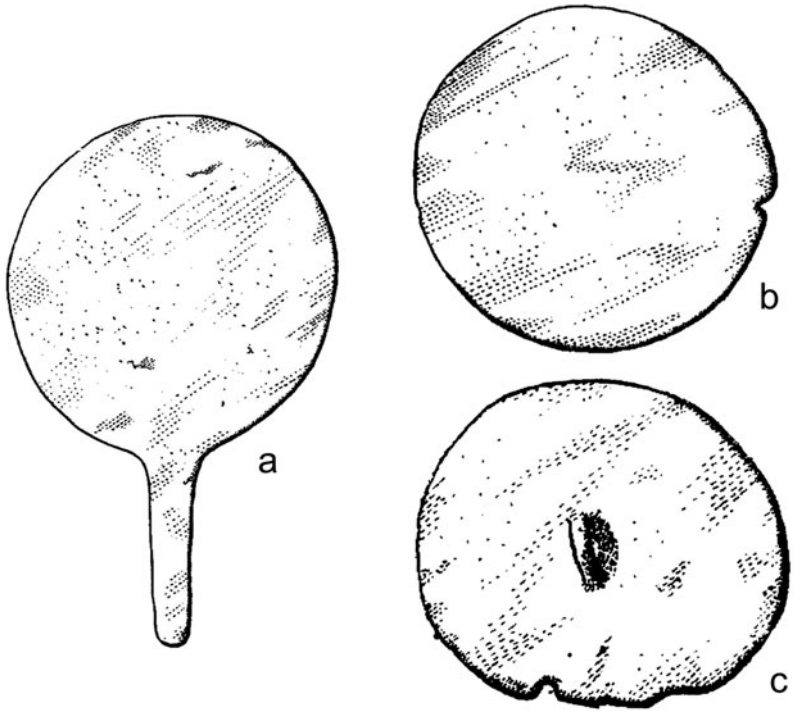

Figure 1. *The three main types of bronze mirror found in central and eastern Eurasia from the third millennium* BCE. *(a) mirror with handle, Sokoluk, Kyrgyzstan, early first millennium* BCE*; (b) disc mirror, Burial 102 km along the Tejen-Serakhs road, Turkmenistan, early third millennium* BCE*; (c) disc mirror with loop on the reverse side, Burial 1, Muminabad, Uzbekistan, mid to late second millennium* BCE. *(After Kuz'mina 1966, pls XIII.9, XIII.11 & XIII.7.)*

finds in Central Asia and China, allowing them to be more reliably compared with each other and other metal artefacts from eastern Eurasia. This allows more concrete statements about the nature of exchange networks to be made, beyond generic statements about object diffusion or spread. Relatively few mirrors have undergone scientific analyses, and the quality of results can be highly variable (e.g. Kuz'mina 1966, 103–9), which makes meaningful comparison of their compositions quite difficult. As a result, this article focuses on the mirrors' chronological and typological features to examine connections, integrating scientific analyses to explore metallurgical and technical choices where available. To facilitate comparison, this article uses numerical dates rather than regional or global chronological terminology, as what is referred to as the Late Bronze Age in Central Asia is known as the Early Bronze Age in neighbouring northwestern China. Where available, radiocarbon dates are given priority, otherwise date ranges from relative chronologies are used. For details, the study's dataset is provided as Supplementary Material.

What is a mirror?

Mirrors are objects that reflect light and thus also an image of whatever is in front of them. Though a huge variety of objects could feasibly be described as 'mirrors' based on this definition, archaeologists working in central and eastern Eurasia typically designate three main categories of object as mirrors: a disc with no apparent handle attachment; a disc with a loop in the centre; and a disc-shape with a long handle (Fig. 1).

Countless typologies have been created to classify mirrors across Eurasia, with various types and subtypes identified (e.g. Karimova 2013; Kuz'mina 1966, 67–9; Liu & Kong 2001; Pan & Jing 2020; Wang & Cao 1979; Zhang 1986). While typology is a useful tool for sorting material for further analyses (Hein 2016, 50), this level of detail is unnecessary when examining phenomena at such a huge geographic scale. This is because most subtypes overlap in time and space, as illustrated in a recent study of pre-Han mirrors in Xinjiang by Guo (2022). They also seem to achieve little in counteracting broad-stroke conclusions about the distributions of types, such as the erroneous but persistent idea among Chinese researchers that handled mirrors are only found west of China (e.g. Chen *et al.* 2018, 132; for a critique, see Mei 2006, 247). We thus follow previous studies that have emphasized a combination of date and region to analyse finds (Gao 2015; Jaang 2011; Wei 2017; Wu 2017). Mirrors that cannot be clearly assigned to a particular period, such as ones in museum collections with unknown provenances, are thus excluded.

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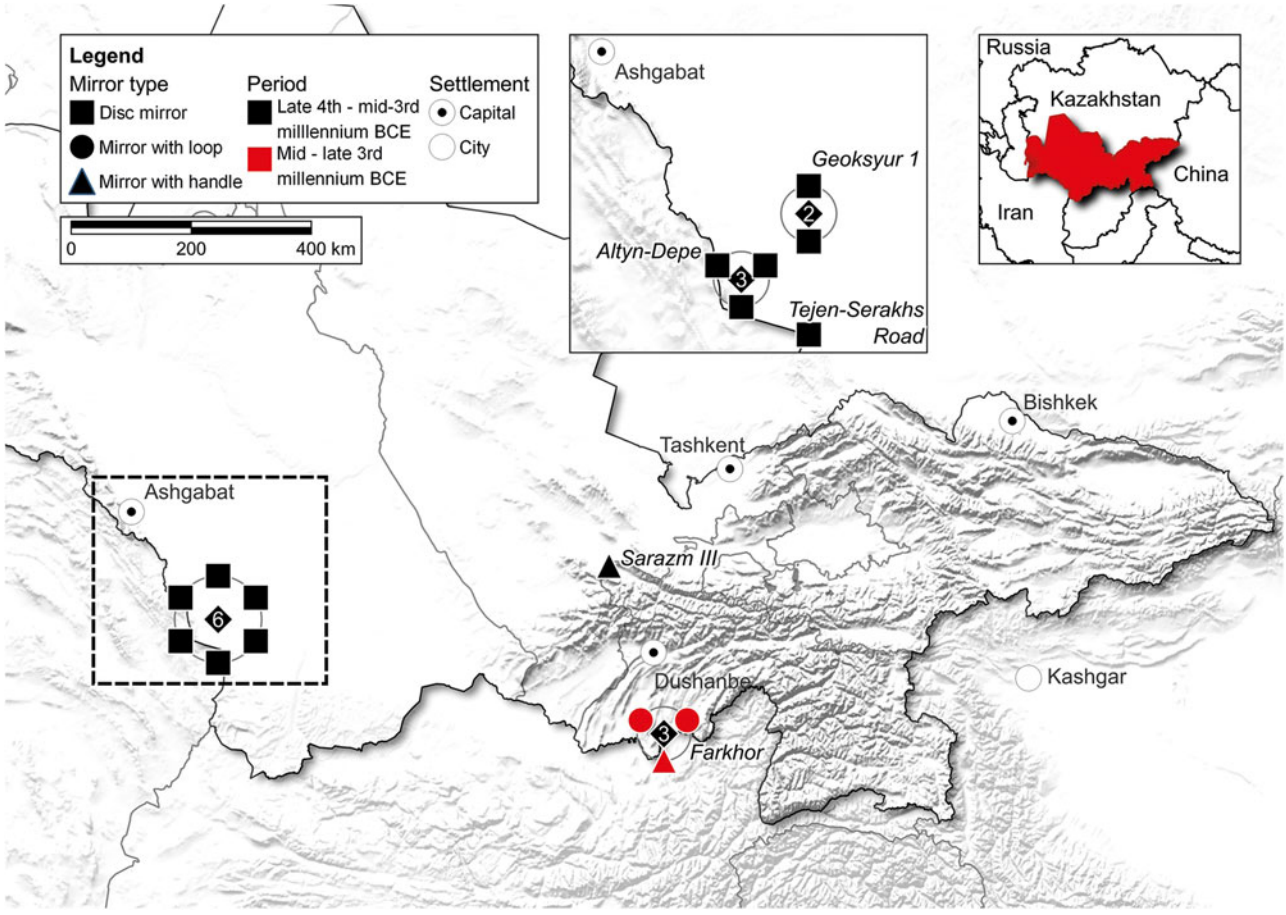

Figure 2. *Mirror finds in Turkmenistan, Uzbekistan, Tajikistan, and Kyrgyzstan from the late fourth to late third millennium* BCE.

Chronology and geography

Central Asia

The seemingly clear division between western and eastern Eurasian mirrors fades under closer scrutiny. Although it is possible to highlight handled mirrors at the expense of other types to support the divide between west and east and thus emphasize Egypt's influence on western Asia (e.g. Pan & Jing 2020, 46), most finds of early mirrors as far west as north-central Iran have no handle or attachment. For the late fourth to early third millennium, for example, two disc mirrors were excavated from Sialk period IV (*c.* 3400–2900 BCE) (Albenda 1985, 2; dates per Fazeli Nashli & Nokandeh 2019, 6), whereas a handled mirror does not appear until much later at Hissar, period III (*c.* 2400–1900 cal. BCE) (Schmidt 1933, 401; dates per Voigt & Dyson 1992, 173–4). Further east in Turkmenistan, mirrors of *c.* late fourth to early third millennium BCE similarly lack handles or attachments (Fig. 2), with two disc mirrors excavated from an isolated burial on the Tejen–Serakhs road and Geoksyur 1 respectively (Kuz'mina 1966; Masson & Merpert 1982). Although what is thought to be a handled mirror has been found at Sarazm III (Isakov 1994), its trapezoidal shape distinguishes it from earlier and later mirrors, while the vague chronology for the site of Sarazm III also makes it questionable to compare this mirror with others.

Further issues with Central Asian chronologies (see Kohl 2007, 202) are evident in the way that very few mirrors can be securely dated to the mid or late third millennium. A larger number of finds can be more reliably dated to the second millennium (Fig. 3), and this also seems to reflect an actual increase in frequency, most of which are discs with only a few mirrors with handles. Of the three mirrors from Farkhor (*c.* 2000 BCE), two have no handles, similar to Altyn-Depe, where three mirrors were excavated from phase Altyn 0 (*c.* 1900–1800 BCE), only one of which has a very short handle (Kircho

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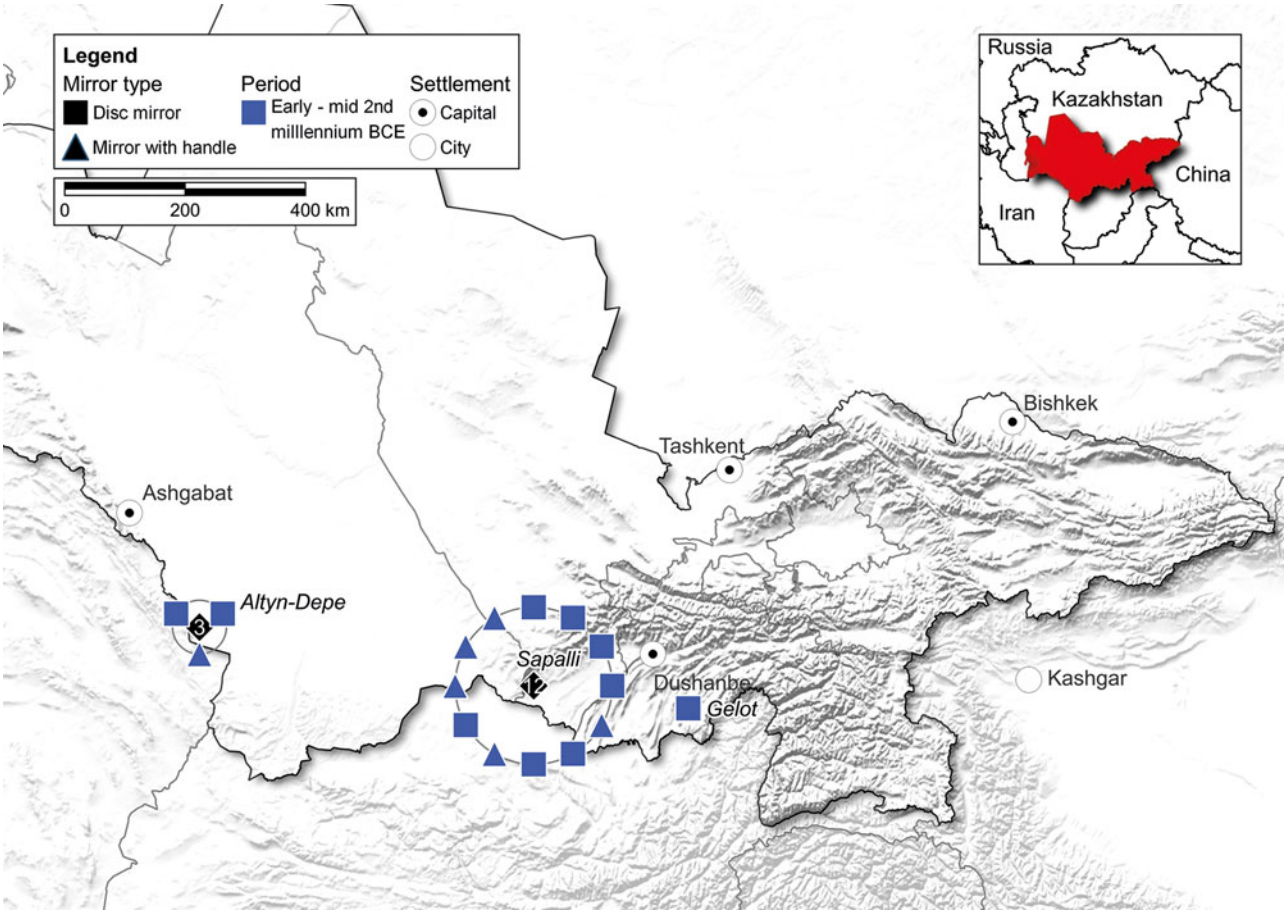

Figure 3. *Mirrors in southern Central Asia for the period early to mid second millennium* BCE.

2000, 72; Kircho & Alekshin 2005, 294; Masson 1981, 146). This mix of discs with and without handles continues into the mid second millennium, though the proportion with handles increases, as represented by five handled mirrors among 12 in total from Sapalli (*c.* 1700–1500 BCE) in Uzbekistan (Askarov 1977, 201).

The first disc mirrors with loops on the back appear in Central Asia around the mid to late second millennium BCE (Fig. 4), substantially later than the earliest examples in Xinjiang and Qinghai that can be dated to the early/mid second millennium BCE (see below). This is significant, because an assumption endures that the disc mirror with a loop appears first among the societies of Central Asia (Wu 2017, 7; Zhang 2018, 80). Theoretically, the mirror was developed in regions that later became known as Bactria and Margiana, then spread north to the Eurasian Steppe and east into Xinjiang via societies often loosely referred to as 'Andronovo', a term that has been critiqued for lumping together distinctive cultures across a vast region spanning the entire second millennium BCE (Grigoriev 2021b). Significantly, however, current archaeological data do not support the proposed dispersal route or even the fact that this type of mirror appeared in Central Asia first. Suggestions that they appear at Sarazm (Mei 2006, 247) or Muminabad (Jaang 2011, 36) are misleading —the former has yielded only one disc mirror with no loop or handle (Isakov 1994, fig. 64.2) and the disc mirrors with loops from the latter were actually excavated from two burials dated *c.* 1200–1100 BCE (Askarov 1969, 62). Similarly, the 'Andronovo' mirrors from Shamshi, Borovoe and Kara-Kuduk—the supposed evidence for a link between Central Asia and Xinjiang's Tianshan—date to the same period, i.e. the late second to early first millennium BCE (Kuz'mina 1994, 153), several centuries later than those in northwestern and western China.

By the end of the second millennium BCE, all three types of mirrors—discs with no attachments, discs with loops and discs with handles—are found in Central Asia. Despite the smaller number of handled mirror finds, stone moulds for mirrors

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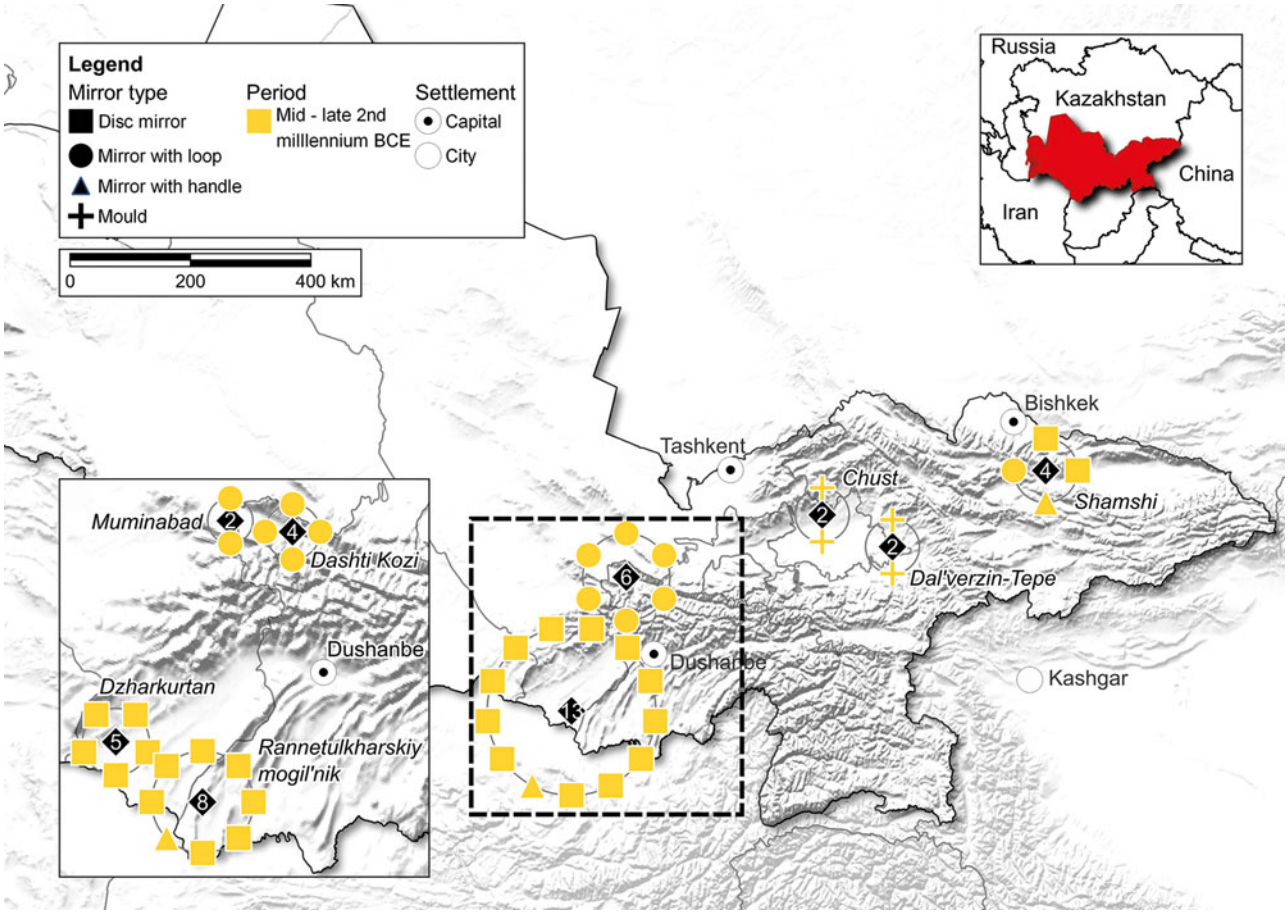

Figure 4. *Mirrors in southern Central Asia for the period mid to late second millennium* BCE.

with short handles from Chust and Dal'verzin-Tepe (*c.* late second–early first millennium BCE) attest to their continuing production (Kuz'mina 1966, 143; Zadneprovskiy 1962, 267).

Northwest and western China

Disc mirrors with loops appear in Xinjiang and Qinghai provinces and neighbouring regions in the early second millennium BCE (Fig. 5). The similarities between the geometric patterns on the reverse of a mirror from the Qijia culture site of Gamatai (*c.* 1800–1700 BCE; Fig. 6a) and those of mirrors found at the late Shang dynasty (*c.* 1200–1050 BCE) capital of Anyang (see below) have led to the theory that Qinghai, or the Qijia culture of the Qinghai–Gansu area, was the source of the Shang mirrors (Li 1997; Song 1997, 161–2; Zhang 2017, 19). Another loop mirror, albeit undecorated, was similarly excavated from Qijiaping (An 1981, 278), another Qijia culture site dated relatively to the same period. As Gamatai was excavated rather rapidly before being flooded by the Longyangxia Dam reservoir and its materials went unpublished for 38 years (Qinghai sheng wenwu kaogu yanjiusuo & Beijing daxue kaogu wenbo xueyuan 2015, 10), the reliability of the site chronology has been questioned. Pan and Jing (2020, 38) instead suggest that the chronology for the Tianshanbeilu cemeteries is far more reliable, and the three loop mirrors from Phase 3 (1700–1600 BCE), two undecorated and one with a 'sun' motif, should be considered the earliest examples within China. They point to the metallurgy industry of Gansu province during the early second millennium BCE as evidence that the region, centred on Xichengyi (*c.* 2150–1550 BCE; Chen *et al.* 2014, 16), had the technological potential to produce mirrors. A stone mirror mould dating to *c.* 1700 BCE has been excavated from the site (Chen 2017, 40), which suggests that loop mirrors were produced there.

For the mid second millennium onwards, there are two loop mirrors from Tianshanbeilu Phase 4 (1500–1200 BCE), both decorated with patterns of radiating lines that parallel those on the earliest mirrors from the Central Plain (Fig. 6b; Chen *et al.* 2018,

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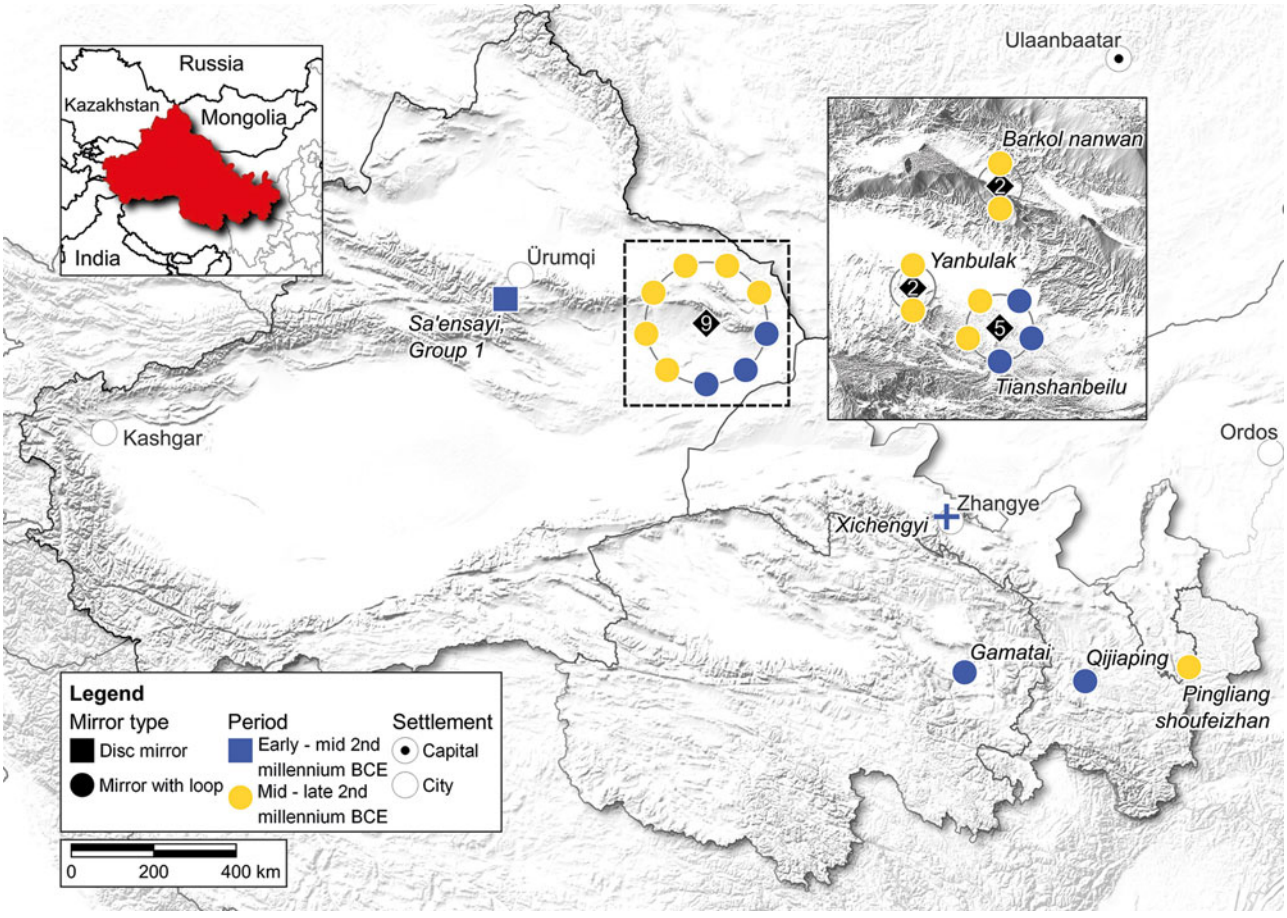

Figure 5. *Mirrors in Xinjiang, Qinghai, Gansu, and Ningxia provinces for the period early to late second millennium* BCE.

132). Undecorated loop mirrors have also been excavated elsewhere in eastern Xinjiang, including Yanbulak cemetery, the earliest coming from a burial radiocarbon dated to 1480±40 cal. BCE and another two[1] dated at 1285±135 cal. BCE (Liu 1993, table 1). Similarly, undecorated loop mirrors have been excavated from Barkol nanwan cemetery, both of which date *c.* 1200 BCE (Liu 1993, table 2), roughly the

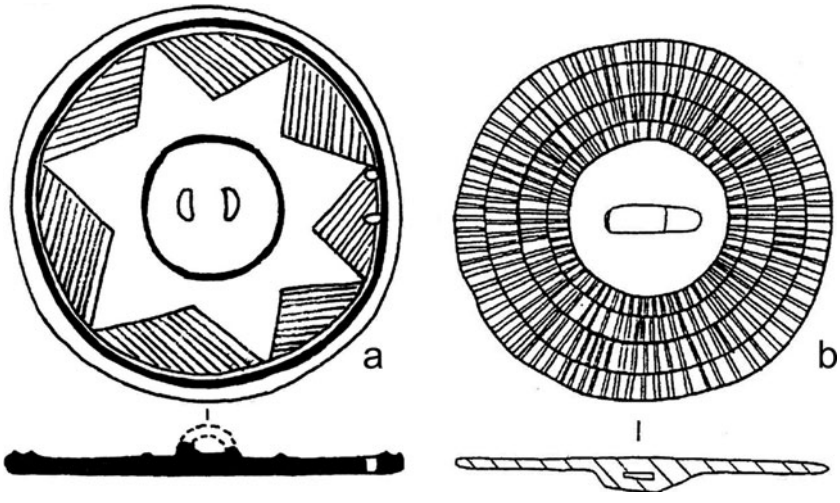

Figure 6. *(a) disc mirror with loop from Gamatai (M25:6). Two holes were drilled into the edge, presumably after the central loop broke (after Qinghai sheng wenwu kaogu yanjiusuo and Beijing daxue kaogu wenbo xueyuan 2015, fig. 116); (a) disc mirror with loop from Tianshanbeilu, Phase 4 (after Lü* et al. *2001, fig. 18.1).*

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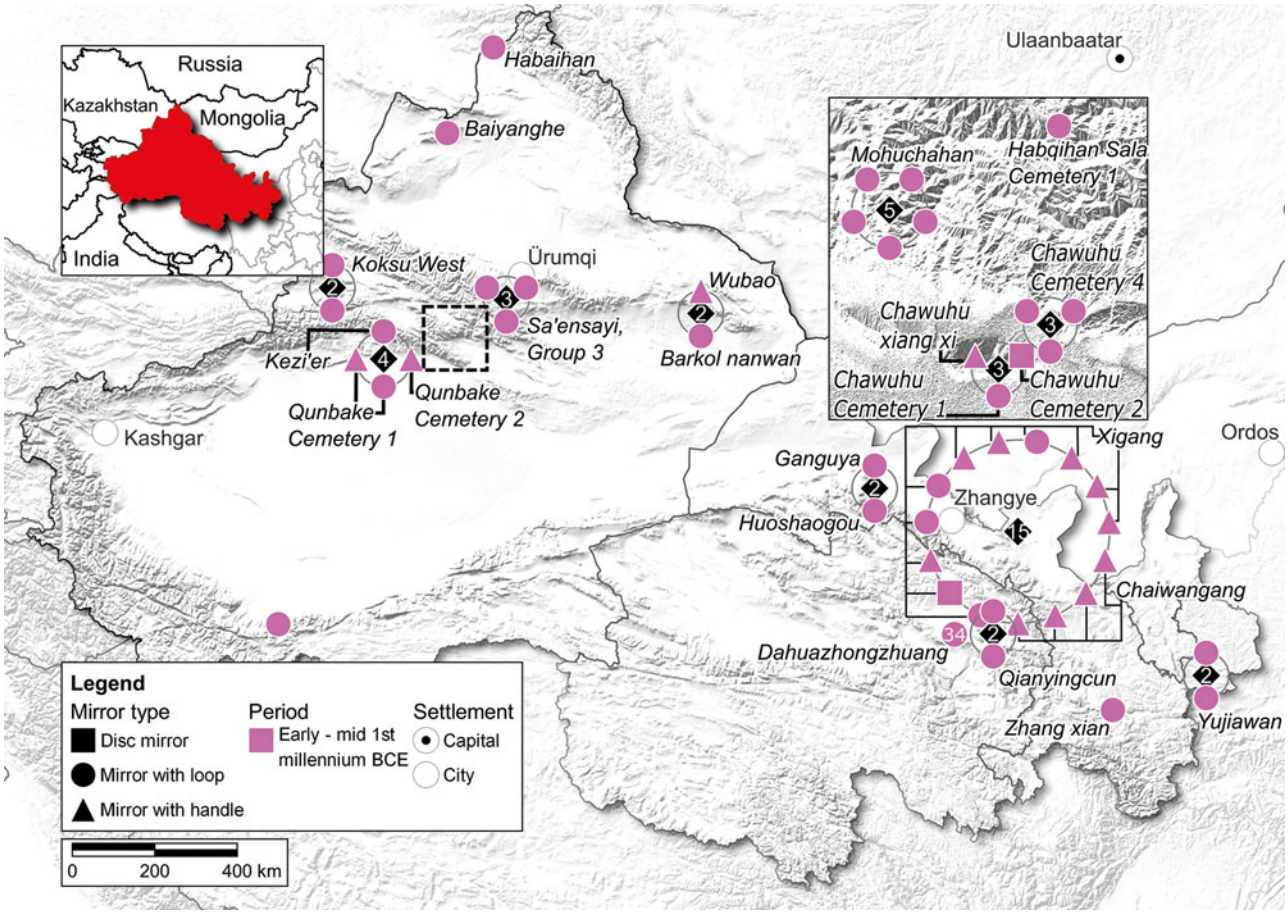

Figure 7. *Mirrors in northwestern and western China for the early to mid first millennium* BCE.

same time as the loop mirror appears in Central Asia and the Eurasian Steppe (see above). Despite suggestions that no loop mirrors have been found in the western Tianshan until 'around 500 [BCE]' (Guo 2022, 70), a loop mirror was excavated from M47 at Koksu West that dates to 815±40 cal. BCE (Ruan *et al.* 2012, 13; Fig. 7). Similarly, loop mirrors from western Xinjiang at Baiyanghe, Sa'ensayi, Mohuchahan and Chawuhu culture sites are dated variably throughout the first half of the first millennium BCE (see Supplementary Material). Though this does not demonstrate an unequivocal link between the loop mirrors of eastern Kazakhstan and eastern Xinjiang, it by no means supports the definitive division between the two traditions that Guo suggests.

Central Plain

Mirrors appear in the Central Plain and neighbouring regions in the late second millennium BCE at the earliest, around the late Shang dynasty (Fig. 8). The largest number—a total of four—was excavated from the tomb of Fu Hao, a royal consort and military general (Zhongguo shehui kexueyuan kaogu yanjiusuo 1980), with another two each found at Dasikong's M25 and Xibeigang's M1005. The four mirrors from Fu Hao's tomb are similar in size, have central loops on their backs and are decorated with geometric designs, notably perpendicular lines, triangular shapes and concentric circles (Figs 9a–c). While the sparsity of mirrors in the Central Plain led some researchers to suggest that they were introduced from outside quite early on (e.g. Umehara 1936), the similarities in design between those from Fu Hao's tomb and those found in the Eurasian Steppe, as opposed to other Shang bronzes, lent support to this theory (Wu 2017, 3). In particular, the designs are strikingly similar to a mirror from Gamatai in eastern Qinghai (Fig. 6a). Though the quality of the Gamatai excavation means that this bronze mirror's status as the earliest within China's modern borders has been questioned, the notably higher frequency of mirrors in eastern Qinghai, Gansu and

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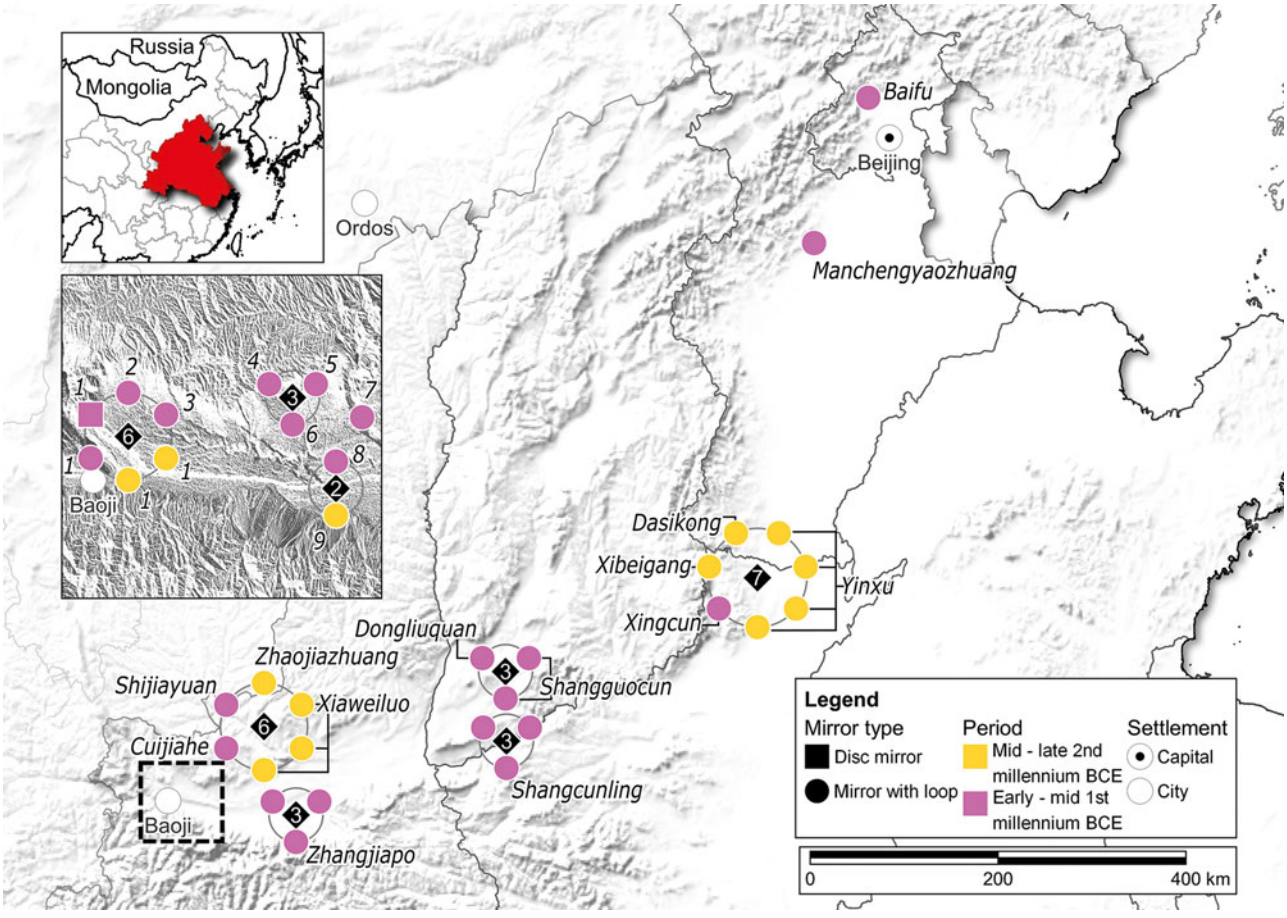

Figure 8. *Mirrors in the Central Plain and neighbouring areas for the period mid second to mid first millennium* BCE. *(1) Nanzhihui xicun; (2) Qingong 1 hao damu; (3) Baoji City outskirts; (4) Wangjiazui; (5) Liujia beituhao; (6) Huangdui; (7) Huangjiahe; (8) Bailong; (9) Beilu.*

Xinjiang provinces means that Bronze Age mirrors in the Central Plain are generally accepted as having originated with groups to the west or northwest (Gao 2015, 21–3; Mei 2006, 248; Song 1997, 155), i.e. Qinghai or Xinjiang, though the exact location remains debated.

Mirrors were not immediately adopted by the Shang, as suggested by the fact that no other examples have been found outside of the Anyang ones. When compared to objects that appear repeatedly in Shang assemblages and those of earlier periods, such as *ding*-tripods and *yue*-axes, this strongly supports the idea that mirrors were introduced from an outside source. Thus, while the Shang valued these specific mirrors highly enough to bury them with a royal consort, this was not because mirrors were important objects in Shang society in general, but these specific examples were of import because they represented characteristics of another cultural group (Jaang 2011; Wu 2017, 16).

These early, sporadic mirror finds are notably distinct in form and style from those that appear in Western Zhou (1046–771 BCE) tombs, with the earliest finds generally concentrated along the Wei River valley within the territory of what later became the Zhou royal house to the west of the Shang. Wu Hsiao-yun (2017, 17–18) has pointed out that, compared to mirrors in western and northwestern China and those that the Shang received, Zhou mirrors are undecorated, relatively small (Figs 9e & f), and their loops are narrow with tapered ends (sometimes called the 'olive-shape', Fig. 9d), features that have strong parallels in mirrors from the Karasuk culture (1400–900 BCE) in southern Siberia, as well as the eastern Gobi Desert in Mongolia. Wu suggests that the clear distinction between Shang and Zhou mirrors in terms of style and form shows that mirrors were introduced separately to each dynasty by different societies. A clear picture of the groups which provided the mirrors is, however, currently lacking.

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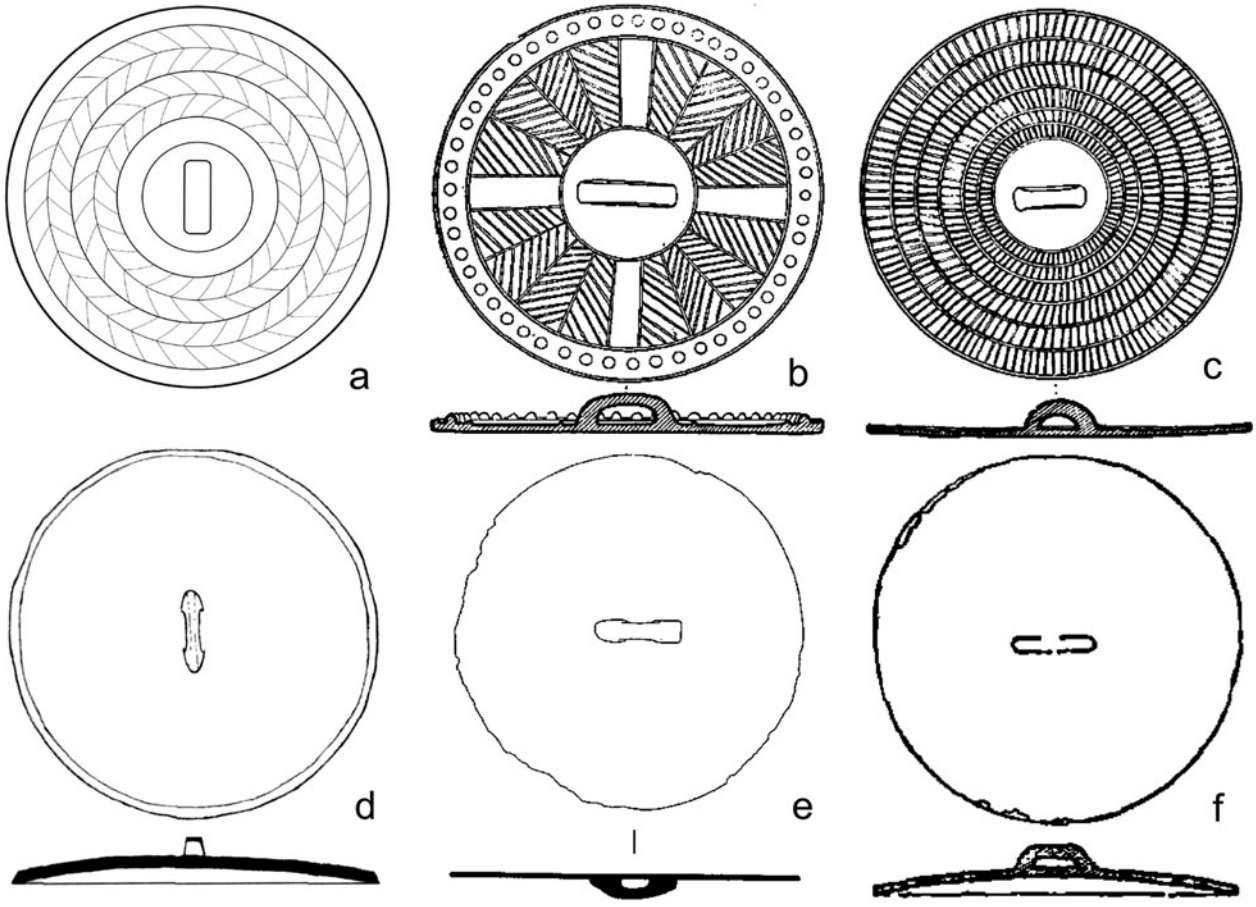

Figure 9. *Mirrors with loops from the Shang and Zhou dynasties. (a) late Shang, Yinxu, M5:41 (after Jaang 2011, fig. 7); (b) late Shang, Yinxu, M5:786 (after Zhongguo shehui kexueyuan kaogu yanjiusuo 1980, fig. 65.1); (c) late Shang, Yinxu, M5:45 (after Zhongguo shehui kexueyuan kaogu yanjiusuo 1980, fig. 65.2); (d) the so-called 'olive-shape' loop, early Western Zhou, Huangdui, 95FHM60:7 (after Luo & Wei 2005, fig. 29); (e) late Shang to early Western Zhou, Xiaweiluo, M1:19 (after Xie* et al. *2006, fig. 30.3); (f) early Western Zhou, Baifu, M3:30 (after Beijing shi wenwu guanli chu 1976, fig. 20.4).*

Same data, varying views

The number of Bronze Age mirrors found in Central Asia has not changed substantially since the Soviet campaigns of the mid twentieth century, and yet the examples highlighted by English- and Chinese-language research to support a Central Asian origin of mirrors in China varies considerably. This may be attributed to issues of language, data presentation and data quantity that are commonly encountered when working in this region. The relevant excavation reports and syntheses not only require a command of Russian, but many also present the reader with hundreds of pages of densely packed text unbroken by either figures or headings, such as the report on Altyn-Depe (Masson 1981). This makes sifting through the huge piles of data they contain a time-consuming task that many researchers are very likely not undertaking. This is further exacerbated by the complex pictures presented by these site reports in terms of chronology and relations between contexts. Altyn-Depe is once again a good example, as 71 radiocarbon dates were later published for the site (Kircho & Popov 2005, table 1); however, the dates for each phase not only span huge periods but also overlap with each other significantly (Kircho and Popov 2005, table 4; see also Kohl 2007, 202). Understanding how a mirror from a Central Asian site relates temporally to one within China can thus require extensive background research beyond the initial site report and subsequent radiocarbon dates into unresolved debates of regional and site chronologies. It is perhaps not unsurprising, therefore, that researchers outside the Russian language sphere

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Table 1. *Chronology of major archaeological cultures in southern Siberia, northern Central Asia and northern Xinjiang during the second millennium* BCE.

	Archaeological culture	Date range	Source
Southern Siberia and northern Central Asia	Seima-Turbino	2150–1600 cal. BCE	Chernykh *et al.* 2017, 53
	Fedorovka (Andronovo)	2000–1700 BCE (Upper Ob and Altai) 1900–1500 BCE (Minusinsk Basin) 1800–1500 BCE (Baraba forest-steppe) 1870–1574 cal. BCE (Aduun Chuluu)	Molodin *et al.* 2014, fig. 2 Cong *et al.* 2013, 32
	Karasuk	1400–900 cal. BCE	Svyatko *et al.* 2009
Altai (Xinjiang)	Chemurchek	2500–1500 BCE	Shao 2018, 31
	Kuxi (Karasuk)*	1300–1000 BCE	Shao 2008, 65
Tianshan (Xinjiang)	Tianshanbeilu	2000–1500 BCE	Shao 2018, 48
	Sa'ensayi	1800–1500 BCE	Shao 2018, 83
	Yanbulak	Phase 1: 1300–1000 BCE	Shao 2018, 64
		Phase 2: 1000–500 BCE	
		Phase 3: after 500 BCE	

*Considered to either be related to or even a branch of the Karasuk culture (Shao 2008, 65; Han 2018, 134).

have been critiqued for citing either outdated work or unilateral views (Grigoriev 2021b, 5). These issues contribute strongly to the long-standing dispute regarding the validity of the 'Western Hypothesis' and its alternatives highlighted in this article.

Metallurgy in Bronze Age Central Asia and Xinjiang

The theory that mirrors reached Qinghai or Xinjiang from Central Asia or the Eurasian Steppe is not new. As their appearance in western China coincides with the broad social and technological developments seen in wider Eurasia, it is understandable why it remains an attractive idea. During the late third to early second millennium BCE, herding subsistence strategies focusing on goat, sheep, cattle and horse flourished among the societies of the Eurasian Steppe, and the geographic range of these activities grew exponentially with the development of horse-riding. These societies are associated with the spread of various technologies, ideas, objects, and even people across central and eastern Eurasia in the second millennium BCE (Anthony 2007; Chen *et al.* 2018; Doumani Dupuy 2016; Kohl 2007; Kuz'mina 2007; Matsumoto 2021; Shao 2018). Against this background of growing cross-continental exchange and the development of the nascent bronze industry further east in the Hexi Corridor, bronze mirrors suddenly crop up in Gamatai and Tianshanbeilu. The pattern on the Gamatai mirror does not correspond to anything else seen at the site and was almost certainly obtained from an outside group or individual. While the first Tianshanbeilu mirrors, with their lack of decoration, could in theory have been made locally, there is no strong evidence for local metallurgical production, and even proponents of the local manufacture theory point to broader developments in Eurasian Steppe metallurgy as the catalyst for the mirror's appearance. In this context, it is thus significant that disc mirrors, albeit with no loop or handle, are present at major sites in Central Asia much earlier than in the eastern Tianshan or Hexi Corridor/eastern Tibetan Plateau.

The only distinction between these early Central Asian mirrors and those from Tianshanbeilu is the absence of a loop, and it seems highly probable that, provided one already had access to the technology and infrastructure necessary to cast a disc mirror, a loop would not be too difficult to add. Typologically this distinction is very important, and chronologically it is also significant that all presently known Central Asian loop mirrors date significantly later than those in Qinghai and Xinjiang. Mirrors cannot, however, be treated as isolated finds and must be considered within the broader context of contemporary events across Eurasia.

In addition to an intensification of long-distance contacts across Central Asia (i.e. Middle Asian Interaction Sphere: see Lume Pereira 2017; Possehl 2002), the second half of the third millennium BCE saw the rapid spread of bronze metalwork across southern Siberia and northern Central Asia in a process attributed to the Seima-Turbino phenomenon (Table 1). Seima-Turbino refers to a style of widely scattered artefacts, predominantly metal, that is

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hypothesized as having spread both west and east from an indeterminate origin in southwestern Siberia via metallurgists or craftspeople who travelled throughout the forest-steppe and steppe ecozones (Chernykh & Kuzminykh 1989; Chernykh *et al.* 2017; Koryakova & Epimakov 2007, 109–10; Marchenko *et al.* 2017). The interactions between these craftspeople and the different cultures they encountered is thought to have been critical in the development of this highly distinctive style of metalwork. Beginning slightly later in the early second millennium BCE but otherwise broadly contemporary with Seima-Turbino (Table 1), settlements known to archaeologists as Fedorovo culture settlements appear in eastern Kazakhstan and southwest Siberia in the beginning of the second millennium BCE (Kuz'mina 1994; Stefanov & Korochkova 2000). Federovo remains are found across a large area, leading to theories of large-scale migration (Kuz'mina 2007; Zakh 2014), though features from earlier and contemporary cultures further west in the Eurasian Steppe—such as Abashevo, Catacomb, Petrovka and Sintashta—have also been observed in Fedorovo ceramics; thus the questions of *who* moved *where* and *how* remain debated (Grigoriev 2021b, 18–19).

Evidence in the archaeological record for the intensification of connections between different groups across vast geographic areas does not stop at the border of modern-day Xinjiang. Indeed, the Seima-Turbino phenomenon and Fedorovo culture (usually just referred to as 'Andronovo' in Chinese-language studies) are considered as having been instrumental in spreading not only metalwork, but more significantly the technological process of bronze metal production along the Tianshan, through the Hexi Corridor, and into northern China (Li 2011, 246–51; Lin 2019a; Lin & Liu 2017; 2019, 5; Mei & Shell 1999; Mei *et al.* 2015). While the exact extent of these 'Andronovo' societies in Xinjiang continues to be questioned (Chi & Festa 2020; Grigoriev 2021a; Han & Shu 2004, 168–9; Koryakova & Epimakov 2007, 126), particularly as most radiocarbon dates tend closer to the middle of the second millennium BCE and later (see Chan & Cong 2020, table 1), technological influences from the Eurasian Steppe are evident in eastern Xinjiang by the early second millennium BCE. Not only was arsenical bronze, widely considered an indicator of steppe metallurgy, used for the sparse metal finds at Tianshanbeilu (Mei 2009, 13–14; Qian 2006, 42–5), but also various other alloys, such as lead and tin introduced from the ore. In addition, re-use and re-smelting of metal objects can further alter the composition (e.g. Wang *et al.* 2019), producing a varied metal dataset typically seen in steppe assemblages (Cheng *et al.* 2020, 598).

It should be noted that the overview of Bronze Age exchange networks presented here does not do justice to the complexity evident in the archaeological data and increasingly described in the literature. Despite the general lack of objects associated with the steppe in the western Hexi Corridor prior to 2000 BCE, they are plentiful in the eastern part, suggesting the existence of a developed north–south route connecting the societies of Mongolia and Siberia to northern China (Linduff 2015; Linduff & Mei 2009) with an interaction zone focused on the Ejin Gol valley (Jaang 2015, 199) via the Ordos Plateau (Ge 2019). In addition to the Tianshan route outlined above, a southern route from Central Asia through the Tarim Basin into eastern Qinghai has also been proposed (Han 2021, 325), most likely following the Kunlun Mountains eastwards. The present state of research demonstrates that, contrary to studies that theorize Bronze Age interactions as being concentrated along a single route (similar to the much later medieval Silk Road), exchange was conducted via complex webs comprising varied local, regional and long-distance links.

Different life histories

The broader events of the second millennium BCE perhaps explain why so many researchers have looked to Central Asia and the Eurasian Steppe for the source of mirrors. In the 1980s, it was already recognized that disc mirrors with loops found within China's borders predated any Central Asian and Siberian examples, with Karen Rubinson (1985, 48) expressing the hope that the 'unidentified center' from whence the mirror came would become evident as excavations progressed. No such evidence has appeared, however, with researchers instead relying predominantly on the very distinctive decoration of the Gamatai mirror to posit connections. Noting the lack of parallels within China for the star design, Diane O'Donoghue (1989, 21) suggested that it may be linked to so-called 'sun symbols' on ceramics and metalwork excavated from sites in southern and western Siberia. Aside from the issues inherent with the identification of 'sun symbols',[2] the most likely parallel O'Donoghue identified was a pattern on a disc excavated from Berezhnovka cemetery far to the west on the Volga River in southern Russia (see Gimbutas 1965, fig. 380.10), which was dated notably later than Gamatai to *c.* 1450–1300 BCE, i.e. the Pokrovsk phase of the Srubnaya culture. Not

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only was there little visual similarity between the two motifs, but the temporal and spatial relationship was also tenuous.

Louise Fitzgerald-Huber (1995, 59) thus turned to southern Turkmenistan and Bactria as the potential origin, based on the fact that star designs and cross patterns were more commonly found among remains of the so-called Bactria-Margiana Archaeological Complex (*c.* 2250–1700 BCE). This theory was accepted by many researchers (Qinghai sheng wenwu kaogu yanjiusuo & Beijing daxue kaogu wenbo xueyuan 2015, 153), perhaps not in part because it fits nicely with the general route posited by diffusionist theories of objects spreading across Asia from west to east. Earlier, Elena Kuz'mina (1966, 87–9) had charted the appearance of disc mirrors as starting in Iran before reaching Central Asia, spreading from southern Turkmenistan east to the Zeravshan in Uzbekistan and Tajikistan. Later, she also suggested that the mirrors from Yanbulak cemetery in eastern Xinjiang '[helped] to resolve the problem of the mirror's genesis in China' (Kuz'mina 1999, 174), even though the mirrors excavated here date even later than examples from nearby Tianshanbeilu, to the middle of the second millennium BCE at the earliest (Liu 1993, table 1). As outlined in the previous section, tracing the route of mirrors' diffusion east across Central Asia then along the Tianshan corresponds with theories that bronze metalwork and metallurgical technologies spread along the Tianshan from northern Asia, which is perhaps why this theory has persisted, particularly in English-language research (Jaang 2011, 36).

The current state of research supports the spread of metallurgy into Xinjiang from the Eurasian Steppe, potentially via the Semirechye region (Linduff 2018, 50). Although no mirrors have been found in Central Asia that can be dated earlier than those in Xinjiang or Qinghai, the fact that metalwork and/or metal production technologies were spread across Central Asia by travelling craftspeople at approximately the same time strongly suggests that the appearance of mirrors was a direct result of these trans-Eurasian events. Indeed, Wu Hsiao-yun (2017, 13) has pointed to the Gamatai mirror having originated with Seima-Turbino craftspeople, as, compared to other parallels suggested in earlier research, the star design with diagonal lines is incredibly similar to the triangle designs with diagonal lines seen on socketed axes and dagger handles from Seima-Turbino sites in southwestern Siberia and the Urals (Molodin & Neskorov 2010, fig. 9). Not only are the visual links striking, but this is entirely plausible based on the chronological span and geographic range of Seima-Turbino finds. In addition, the sparse, small-sized metal artefacts at Gamatai and the repairs conducted on the mirror are more suggestive of objects obtained through trade rather than local production.

Proponents of the theory that the mirror originated within China's borders typically focus on the example from Tianshanbeilu in the eastern Tianshan (Guo 2022; Liu 1999; Pan & Jing 2020). This is because there is more evidence for a burgeoning metal industry to the east in neighbouring Gansu and potentially even local production in eastern Xinjiang, which makes it more feasible that the mirror could have been produced there rather than brought in from outside. Additionally, the mirror is undecorated and shows no explicit stylistic connection to Seima-Turbino or even Fedorovo material culture. The existence of a stone mould for a disc mirror with a loop from Xichengyi dated to approximately 1700 BCE is further evidence for local production. Finally, recent chemical analyses of the bronze from Tianshanbeilu have shown that there was a mixture of alloying processes more typical of steppe metallurgical production and the ore was procured from local sources (Cheng *et al.* 2020). This does not preclude the possibility that the mirror was made locally, but it does suggest that early Tianshanbeilu metallurgy was not as closely linked to Gansu's as suggested by supporters of the local origin theory. If the Tianshanbeilu mirror were made locally, either by craftspeople from the area or outside the region, it represents a very different social and cultural context to the Gamatai mirror, which arrived via exchange.

Conclusion

In contrast to simplistic narratives of mirrors spreading from Egypt to western Asia and across Central Asia into western China, the exchange mechanisms leading to the appearance of the disc mirror with a loop in western and northwestern China were multidirectional and involved various groups. The two earliest mirrors from Gamatai and Tianshanbeilu can be dated to around the early second millennium BCE, and although there are no earlier examples from Central Asia or the Eurasian Steppe, it is clear that both reflect the crystallization of broader processes involved in the spread of bronze metallurgy across Eurasia. The distinctive star design on the Gamatai mirror is strikingly similar to designs on Seima-Turbino metalwork, suggesting that the mirror arrived in Qinghai from northern Central Asia via

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indirect trade networks or mobile craftspeople and traders. The Tianshanbeilu mirror, though dated to approximately the same period, appears in a very different context, as the mirror may have been made locally using metallurgical techniques brought from the steppe. The two mirrors thus potentially represent two separate processes within different socio-cultural contexts.

Despite ever-improving data on the development of metallurgical industries in northern China, the production and exchange mechanisms leading to the appearance of mirrors ever further east are less clear. The late Shang had the technological capacity to produce bronze objects, yet loop mirrors were not something they chose to make. Instead, the mirrors buried with Fu Hao were clearly obtained from outside the Shang cultural sphere, and the decorations speak strongly to a link with the one from Gamatai. Whether the Shang acquired them from Qijia societies or both groups obtained mirrors from the same craftspeople or metal-producing societies remains unclear. Although Qijia remains are located geographically nearer to the Central Plain, the fact that the Gamatai mirror is unlikely to have been made locally means that it cannot be taken as evidence for direct connections between the two societies.

In collating data on mirrors for Central Asia and China, this article has sought to clarify misunderstandings concerning the dates and locations of the three main types of mirror in central and eastern Eurasia during the second millennium BCE. Even focusing only on mirrors and metalwork, it demonstrates the fallacy of simplistic theories of exchange where inanimate objects are treated as 'spreading' from west to east across the continent. In studying the formal attributes of an artefact, the goal is to illuminate the decisions made by people, as well as the socio-cultural and politico-economic contexts leading to these. It is hoped that, by sorting through the extensive publications and scholarship on this topic in multiple languages for such a huge area, it has managed to highlight the complexity of mechanisms underlying inter-group connections in Bronze Age trans-Eurasian networks of exchange.

Notes

1. Both are listed in a 1999 overview as coming from M64 (Xinjiang weiwu'er zizhiqu wenwu shiye guanliju *et al.* 1999, fig. 0293), though the excavation report only lists one mirror among the burial inventory (Zhang *et al.* 1989, 344).
2. The theory that Bronze Age societies migrating across the vast Eurasian Steppe shared common spiritual and cultural aspects, such as belief in a sun cult, relies primarily on broad-stroke evidence (see e.g. Anthony 2007) that does not tally with archaeological data. Not only are motifs considered explicitly to represent 'suns' limited to only a few sites in southern Central Asia (Rozwadowski 2001, 67), but most motifs claimed to represent the sun are: 1) geometric; 2) abstract; or 3) depict subjects that are merely argued to symbolize the sun, such as deer or horse. It has long been observed, however, that concrete evidence for these associations is lacking (Jacobson 1993, 30), meaning that most so-called evidence supporting the existence of the sun cult requires an *a priori* belief that a sun cult existed, i.e. circular logic.

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Supplementary Material

Supplementary material may be found at https://doi.org/10.1017/S0959774323000343

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