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Table of Contents

Iran and the Bronze Age Metals Trade in the Persian Gulf

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Abstract: Archaeometallurgical research in the U.A.E. and Oman has demonstrated that local Bronze Age societies undertook copper production on a very large scale, providing solid evidence for the identification of this region as the land of *Magan* known in Mesopotamian sources as a key supplier of copper in the later 3rd millennium B.C. However, consideration of the textual, archaeological and archaeometallurgical evidence from across the greater Persian Gulf region indicates a more complex exchange system conditioned not only by raw material sources and trade routes, but by politics and warfare, by technological traditions of manufacture and recycling, by ideologies of elite consumption, and by the social obligations that created and underpinned exchange relationships. A great deal of work remains to be done to demonstrate the likely contribution of Iranian polities to this system.

Keywords: Persian Gulf, Metal Trade, Bronze Age, Iranian Plateau, Arabian Peninsula, Mesopotamia

Introduction[1]

Political, cultural, and economic interactions between Bronze Age polities in Mesopotamia and the Persian Gulf region have been examined in great detail over the last century (cf. D. T. Potts 1990; T. F. Potts 1994). Since the 1950s, in particular, increasingly intense archaeological research on the southern shores of the Persian Gulf has added a material reality to the outlines of the fragmentary historical record and strongly shaped our current understanding of the Bronze Age trade along the Persian Gulf. Contrastingly, the relative lack of archaeological and historical evidence from the northern shores of the Persian Gulf has meant that the participation of Iranian polities in this exchange network is under-represented.[2] It has even been suggested that in the Bronze Age the overland trade route through highland Iran and the sea route through Persian Gulf were essentially mutually exclusive exchange systems (T.F. Potts 1994: 277-290).

However, a simple consideration of the widespread contacts attested between societies as far afield as Mesopotamia and the Indus would suggest that the Persian Gulf was far more likely to have linked than divided the Bronze Age populations on its northern and southern shores. The relatively recent discoveries in the Jiroft region of south-eastern Iran have certainly added weight to the evidence supporting such a contention (D. T. Potts 2005; Steinkeller 2006; Madjidzadeh 2008, 2003).

With this theme in mind, this article presents a brief foray into the issue of connections between the Bronze Age metallurgical industries to the north of the Persian Gulf in modern-day Iran, and those on the southern side of the Persian Gulf in modern-day Saudi Arabia, Bahrain, the United Arab Emirates and Oman. In the sections below, the evidence for the primary extraction and exchange of copper in the greater Persian Gulf region is examined, a trade that is often thought to have underpinned the Persian Gulf exchange system as a whole (e.g., Edens 1992). Subsequently, the role of the Persian Gulf as a route for the exchange of tin and tin-bronze is investigated, and variations in alloy use on the northern and southern shores of the Persian Gulf are characterised. These approaches underscore the likely participation of Iranian polities in the Persian Gulf metals trade as both producers and consumers, and emphasize the need for future research to delineate the wider role of Iranian products and polities in the Persian Gulf exchange system.

1. Note: This is a recently revised version of a paper originally submitted for publication in 2004.

2. This is not to say that the archaeological evidence for Iranian materials in the Persian Gulf region has been ignored. On the contrary, as noted by Potts (2003a: 156), the issue of interactions between Iran and the Oman Peninsula "was integral to the earliest intellectual development of southeast Arabian archaeology". However, this evidence has not been incorporated into models of Gulf exchange systems to the degree that similar evidence from Bahrain, Oman, or the Indus has been used in conjunction with Mesopotamian texts to talk of "seafaring merchants" of Dilmun, Magan, and Meluhha (c.f. Oppenheim 1954). This lack of attention has been redressed to some degree by recent articles focussing on material links between polities of the southern Persian Gulf shores and those in southern Iran and further afield (e.g. Carter 2003; Potts 2003a, 2005; Pigott *et al*. 2003a; Laursen 2009).

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Copper

According to Mesopotamian economic texts the main entities involved in the trade of copper to the cities of southern Mesopotamia were *Dilmun* and *Magan*. Dilmun occurs in cuneiform texts as early as the Proto-Literate period, at which point it already appears to be associated with copper (Nissen 1986; Englund 1983), and is mentioned throughout the third millennium B.C.E. Dilmun is to be located in eastern Arabia and, especially by the later third millennium B.C.E., on the island of Bahrain (Potts 1983, 1990). However, geological and archaeological evidence is unequivocal in indicating that the copper traded by Dilmunite merchants was not from Dilmun itself, but must have been mined and smelted in regions farther away to the south and east.

The search for the source(s) of Dilmun copper introduces the second major polity of the Bronze Age Persian Gulf metals trade, Magan. This toponym appears in cuneiform texts from the Akkadian period to the end of the Ur III period, at which time it is emphatically associated with the copper trade (Potts 1990; Weeks 2004: 15-16). Magan is somewhat more difficult to locate geographically than Dilmun and there are arguments both archaeological and textual for seeing Magan as a political entity that encompassed lands and peoples on both sides of the Straits of Hormuz (Abdi 2000: 278-9; Glassner 1989, 1996; Heimpel 1987, 1988). In contrast, archaeological evidence for large-scale Bronze Age copper exploitation in the Oman Peninsula gathered since the 1970s has led to very strong claims that Magan was located in the Oman Peninsula (e.g., Weisgerber 1983, 1991).

Regardless of its geographical location, Magan loses prominence in cuneiform sources after the Ur III period, when the trade between Mesopotamia and the polities to the southeast is apparently directed through Dilmun (Potts 1990; Crawford 1998; Carter 2003). The scale of the copper trade at this time is large, with literally tonnes of metal mentioned in individual merchant's texts (Leemans 1960; Oppenheim 1954). Thus, Mesopotamia's copper seems to have come predominantly through Dilmun in both the early to mid-third millennium and the early second millennium B.C.E. It has often been assumed that the Dilmun copper traded in the Persian Gulf at these times actually came from Magan, even though Magan is not mentioned before the Akkadian period or after the Ur III period.

Presently, however, only archaeological evidence is available to support these assumptions. Coinciding with the historical references to Magan, most archaeological evidence points to the later third millennium as the period when copper production in southeastern Arabia really expanded (Hauptmann 1985: 115-7; Berthoud and Cleuziou 1983; Cleuziou 2002: 199-200). Likewise, the earliest currently known primary smelting slags in the region have approximately been dated by thermoluminescence to the mid-third millennium B.C.E. (Yule and Weisgerber 1996: 141). As native copper is a geological rarity in the Oman Peninsula (Goettler *et al*. 1976: 47), it could not have been the foundation of earlier copper exchange in the region.

However, there is now limited (yet growing) indirect evidence from the Oman Peninsula for the primary extraction of copper from its ores in the early third millennium B.C.E. (Weeks 2004: Ch. 2; Carter 2003: 39). Crucibles with copper-rich residues have been reported from contexts dating to the first half of the third millennium B.C.E. at sites including Hili, Bat and Umm an-Nar Island (Cleuziou 1980, 1989; Frifelt 1995; Hauptmann 1995), although most of these artefacts have not been analysed to determine whether they were used for primary copper smelting or subsequent copper working activities such as the refining of raw copper or the melting of copper for casting. Further indirect evidence for copper production in the region at this time occurs in the form of copper-base objects recovered from late fourth/early third millennium settlements, middens, and tombs (Weeks 2004: 54-5; Cleuziou and Tosi 2007: 90-92, Fig. 101). The site of Ra's al-Hadd HD-6, in particular, has produced hundreds of copper-base artefacts and residues dating to the late 4th/early third millennium B.C.E. (Giardino *et al*. 2007; Cleuziou and Tosi 2007: 93). Given the evidence for large scale copper extraction in the Oman Peninsula in the later third millennium B.C.E. and the high Ni and As concentrations of the HD-6 metal remains, such artefacts have been reasonably interpreted as the first products of local copper smelting (e.g. Cleuziou and Tosi 2007: 156, 168), although it must be emphasised that no evidence for metal casting, let alone smelting, has been found at these sites.

From almost the inception of archaeology in southeastern Arabia, the common presence of Mesopotamian Jamdat Nasr pottery in late fourth/early third millennium B.C.E. graves has been used to argue that this possible early local copper smelting was oriented towards exchange with Mesopotamia, or may even have resulted from the presence of Mesopotamian prospectors in the Oman Peninsula (Orchard 1995; During-Caspers 1971; Frifelt 1971, 1975, 1980).

The chronology of primary copper extraction in the Oman Peninsula is also an issue when considering the flourishing copper trade between Mesopotamia and Dilmun in the early second millennium B.C.E. Until recently, there has been very little primary evidence for copper smelting in the Oman Peninsula at this time, known locally as the Wadi Suq period (Carter 2001: 196, 2003: 39; Weeks 2004: 24-25). Whilst "Bronze Age" Omani smelting sites are difficult to date, and may indeed span the later third and early second millennia B.C.E., when slags are found in settlement contexts they have been invariably associated

with pottery of third millennium date. Continued local copper production in the second millennium B.C.E. has been posited based upon the significant numbers of copper-base artefacts found in Wadi Suq period tombs (e.g., Carter 2003: 39). However, as for the Hafit period, such finds provide only circumstantial evidence for contemporaneous local primary copper extraction.

Recently, however, research at the site of Wadi Hilo in the U.A.E. has outlined a possible sequence of third through second millennium B.C.E. copper exploitation (Kutterer *et al*. 2013). Moreover, analyses of the composition and isotopic characteristics of Wadi Suq period metal artefacts from the region (Cuenod 2013; Weeks *et al*., in press) have identified material that appears to be compositionally distinct from third millennium production and yet still characteristically local in terms of its composition and lead isotope characteristics.

Overall, it is clear that there is currently good archaeological evidence for copper production in southeastern Arabia only in the late third millennium B.C.E. Copper extraction in the region outside that period seems likely, both in the early third and the early second millennium B.C.E., but production levels are likely to have been significantly lower, increasing the likelihood of other polities in the greater Persian Gulf region contributing to the pool of metal in circulation at these times (see Carter 2003). In short, not all of the "Dilmun" copper attested in Mesopotamian sources over more than a millennium was necessarily mined and smelted in the Oman Peninsula.

However, whilst textual and archaeological considerations sustain such a conclusion in theory, the results of archaeometallurgical research (summarised in Weeks 2004) have generally supported a much more traditional view of the Persian Gulf copper trade. Early research by Berthoud and colleagues concluded that, although Susa relied predominantly on copper from the Iranian Plateau in earlier periods of its existence, the Oman Peninsula was the most important (but not sole) copper producer in the region by the second half of the third millennium B.C.E. and could therefore be equated with Magan (Berthoud and Cleuziou 1983: 243). This conclusion is supported by the recent publication by Begemann *et al*. (2010: 135), which utilised compositional and lead isotope analyses to assert that:

> "Among Mesopotamian artefacts the signature of Omani copper is encountered during all cultural periods from Uruk at the end of the fourth millennium B.C. to Akkadian 1000 years later. Oman/Magan appears to have been particularly important during Early Dynastic III and Akkadian when about half of the copper in circulation bears the Omani signature".

In regard to the sources of "Dilmun" copper in the early second millennium B.C.E., archaeometallurgical analyses have been undertaken by several scholars (Begemann *et al*. 2010: Fig. 10; Weeks and Collerson 2005; Prange 2001: 103; Prange *et al*. 1999) on material from Oman, Umm an-Nar Island, Bahrain, and Saudi Arabia. These analyses revealed substantial compositional and isotopic uniformity between copper-base artefacts from each of these regions, suggesting that copper from the same metal source region supplied both the central and southern Persian Gulf at this time. Thus, analyses of raw metal and artefact composition have suggested that the Oman Peninsula was the dominant source of copper used on the southern shores of the Persian Gulf from the mid-third to the early second millennium B.C.E.

However, as reviewed by Weeks (2007), the story to be told from these analyses is not only one of the dominance of metal production and exchange from southeastern Arabia. Recent archaeometallurgical analyses of objects from the Persian Gulf support the idea of a more complex and multi-centric metal exchange system. For example, lead isotope analyses of the copper-base artefacts from the northern Emirates suggest that tin-bronze may well have been traded through the Persian Gulf in its alloyed form by the later third millennium B.C.E., perhaps as finished artefacts (see below; Weeks and Collerson 2004; Weeks 2007: Fig. 2). Additionally, several plano-convex copper ingots from Maysar 1 in Oman (Begemann *et al*. 2010; Prange 2001; Prange *et al*. 1999) and the Saar settlement in Bahrain (Weeks and Collerson 2005), have been shown to be isotopically incompatible with known Omani copper ores. The significance of these data is still being debated, and it seems likely that the anomalous ingots may in fact have been produced in the Oman Peninsula from ore sources that have not yet been analysed (Begemann *et al*. 2010: 154; Weeks 2007). Nevertheless, until such future isotopic analyses as might prove this hypothesis are undertaken, the data from Maysar 1 and Saar raise the possibility that copper from non-Omani sources, as well as tin-bronze, was exchanged in the Bronze Age Persian Gulf in the late third/ early second millennium B.C.E.

The possible source areas for the non-Omani metal are numerous, and there is at present no conclusive evidence to suggest any one region as more likely than others. Rather, the following discussion serves to demonstrate that copper from multiple source regions could have been exchanged in the Persian Gulf at different times, or contemporaneously.

The possible contribution of South Asian polities to the Persian Gulf copper trade has already been discussed by Robert Carter (2001), and indeed there are sporadic references in the cuneiform sources to the trade of copper from *Meluhha* (the Indus region) to Mesopotamia (Heimpel 1993). A strong connection between the southern shores of the Persian Gulf and the Indus can be documented in the mature Harappan period and to some extent in the immediately post-Harappan period (Carter 2001; Laursen

2010). Early lead isotope analyses of ores from the Indus region (summarised in Weeks and Collerson 2004: Fig. 7.16) provided little support for the use of South Asian copper in the Bronze Age Persian Gulf. However, more recent work by Law (2007: 700, Fig 12.37, Appendices 12.1-8) has complicated this picture, highlighting in particular the great diversity of metal sources exploited by Indus communities and the geological and/or isotopic similarity between diverse ore deposits in South Asia and those of Oman. Additionally, Begemann and Schmitt-Strecker (2009) have argued that India was the ultimate source of a particular variety of low-arsenic copper imported into Mesopotamia (possibly via Dilmun) in the third millennium B.C.E.[3]

In the context of this article, however, I would like to focus on the possible contribution of Iranian production areas to the Persian Gulf copper trade in the third and second millennia B.C.E. Robert Carter (2003) has discussed this issue in some detail, focussing upon the later end of this time range. Based in part on the presence of a small, plano-convex copper ingot at the Bronze Age site of Tul-e Peytul (ancient Liyan) on the Bushire Peninsula, Carter (2003: 37) argued that Fars could have been a route through which copper entered the Persian Gulf exchange system. However, Fars province has few copper deposits (Pigott 1999a; Momenzadeh 2004) with no evidence for the exploitation of these sites in the Bronze Age, and seems an unlikely source region itself. Moreover, as there is very little evidence for interaction between Fars and southeastern Iran at this time (Thornton and Lamberg-Karlovsky 2004: 54), sites such as Malyan and Tul-e Peytul are unlikely to have been trading copper into the Persian Gulf region from further to the east. A similar lack of evidence for contact between sites in Fars and central Iran can be used to counteract further claims that copper smelting sites in this region may have provided copper to Fars, which was subsequently traded to the Persian Gulf region through Bushire (Carter 2003: 37).

Rather, as recognised by Carter (2003: 37), the abundant copper resources and long history of metal production in Iran would suggest that this region is a more likely source zone for copper exchanged in the Persian Gulf than southwestern Iran (Thornton 2014, 2009; Thornton and Lamberg-Karlovsky 2004; Pigott 1999a, 1999b). Fifth, fourth and third millennium B.C.E. copper production centres have been documented in southeastern Iran, for example at Tal-i Iblis (Caldwell 1967; Pigott 1999a, 1999b; Pigott and Lechtman 2003; Frame 2012), Shahdad (Hakemi 1997), and further to the east at Shahr-i Sokhta (Hauptmann *et al*. 2003). Prehistoric copper extraction sites closer to the Persian Gulf near Sheikh Ali might prove to be even more significant. The Sheikh Ali region has been previously discussed as an important fourth millennium copper source (Berthoud and Cleuziou 1983), and recent research has outlined additional evidence for copper production into the third millennium and later times (Abdi 2000: 279, footnote 18). Furthermore, surveys in the Halil Rud have recorded approximately 70 third millennium B.C.E. sites with surface evidence of metallurgical activities (Madjidzadeh 2008: 73) and other ancient workings of unknown date are noted in southern and eastern areas of the Jazmourian Basin (Momenzadeh 2004: Fig. 3). Although most of these assemblages have not yet undergone archaeometric analysis, a small number of lead isotope analyses show that copper slags from Shahdad and ores from other sites in southeastern Iran (Begemann and Schmitt-Strecker 2009: Tab. A 2) are isotopically compatible with contemporary copper-base artefacts found at sites in the southern Persian Gulf. The full investigation of such sites must be a primary goal of future research.

The discussion of these sites reintroduces the issue of the earliest development of copper extraction in the Oman Peninsula. Some scholars, taking note of the long tradition of metallurgical production in Iran and Baluchistan (e.g., Mille *et al*. 2004) and the close links between Bronze Age southeastern Iranian and Baluchi ceramics and those of the Oman Peninsula (Potts 2005), quite plausibly posit an origin for the copper smelting technology of the Oman Peninsula in southeastern Iran or Baluchistan (e.g., Cleuziou and Méry 2002: 304; Cleuziou and Tosi 2007: 184-5). As noted elsewhere, however (Weeks 2004: 36), demonstrating this connection is difficult due to the lack of detailed archaeometallurgical study of the earliest Omani slags themselves, and of the metallurgical industries in possible technological source regions in Iran at sites such as Shahdad, Sheikh Ali or others in the Halil Rud and Jazmourian Basin. There is a dearth of relevant evidence allowing us to discriminate between models which might suggest independent invention or the transfer of technological ideas through processes of "stimulus diffusion" or the actual movement of craftspeople (Weeks 2004: 36). Regardless, such considerations hint at the underlying technological and cultural links that may have characterised the earliest metallurgy in the greater Persian Gulf region.

In addition to underscoring the need for future archaeometallurgical research on fourth-third millennium B.C.E. copper smelting sites in both Oman and southeastern Iran, the discussion above highlights uncertainties regarding the ultimate source of metals exchanged over the course of the third and second millennia B.C.E. As noted above, while "Dilmun" copper seems to have been reaching Mesopotamia from the Persian Gulf region in the early third millennium B.C.E., as yet there is only very limited evidence for copper production in Oman at this time. Iranian production centres with documented copper extraction activities in the early third millennium, such as

3. The possibility of a copper trade from Dilmun to Gujarat has even been raised by R. Carter (2003: 41).

Shahr-i Sokhta, Sheikh Ali, or sites in the Halil Rud and Jazmourian Basin are alternative candidates for the source of the Dilmun copper traded in the early third millennium (Cleuziou and Tosi 2007: 185). The penetration of other goods from the Jiroft region into the Persian Gulf exchange system is clearly attested by the well-known presence of a great deal of third millennium B.C.E. southeastern Iranian steatite of 'Jiroft' or 'Intercultural' style on Tarut Island (Zarins 1978). In the later third and second millennia B.C.E., potential non-Omani copper sources can be hypothesised over a significantly broader geographical region from southeastern Iran to South Asia. The fact that these possibilities must at present be discussed largely in terms of negative evidence underscores the limits of our archaeological and metallurgical knowledge and the need for further field and laboratory research.

Tin, bronze and other alloys

If the discussion of early copper extraction technology in the greater Persian Gulf region draws out the links that may have existed between technological systems in southeastern Iran and the Oman Peninsula, then the examination of early alloy usage in the region, especially early tin and tin-bronze use, serves equally to highlight the development of regionally- and chronologically-distinct Bronze Age metallurgical traditions. This section begins with a discussion of early tin trade routes, before focussing upon alloy use in various regions to the north and south of the Persian Gulf.

The sources and trade routes by which tin reached Western Asia in the Bronze Age have long been debated. Substantial tin deposits are very rare in the vast region from Eastern Europe to South and Central Asia, and the evidence for their earliest exploitation is only now being assembled (e.g. Muhly 1973; Cleuziou and Berthoud 1982; Yener 2000; Alimov *et al*. 1998; Boroffka *et al*. 2002; Weeks 2004: Ch. 8; Helwing 2009). The only substantial corpus of relevant cuneiform documents dates to the early second millennium B.C.E., describing an overland route whereby the tin exchanged in bulk from Assyria to Anatolia in the 19th and 18th centuries B.C.E. reached Assur from unspecified eastern sources beyond the Zagros Mountains (Larsen 1976). A small number of nearly contemporary texts from Mari provide additional evidence, indicating that its tin was obtained in ingot form from the east via diplomatic gift exchange with Susa and Anshan (Limet 1985; Joannes 1991; Potts 1999a: 169 and Tab. 6.2; although see Reiter 1999: 171). Based upon these references, Larsen (1987: 50) suggested that Assur and Susa represented "the pipes through which tin was channelled into the Middle Eastern system" in the early second millennium B.C.E.

However, it is far from certain whether the tin trade routes of the early second millennium B.C.E. can be transposed onto the preceding millennium. In contrast to the apparent dominance of overland east-west tin trade routes in the old Assyrian trade, the cuneiform texts associated with the Persian Gulf trade sometimes mention the exchange of tin and pre-alloyed tin-bronze artefacts and raise the possibility that a maritime exchange route brought eastern tin into Mesopotamia in the third millennium B.C.E. (Weeks 2004: 180). For example, there are late third millennium references to the "copper and tin of Magan" (Cohen 1975) and third millennium texts from Ebla in Syria refer to the use of Dilmun tin (Pettinato 1983: 77-8). A pre-Sargonic text from Lagash mentions obtaining from Dilmun *27.5 minas* of **an-na zabar** (Foster 1997; Potts 1999b), a phrase which can be translated as "tin bronze". Likewise, there are additional textual references attesting to the trade of finished tin-bronze items from Magan (Limet 1972: 14-17).

The importance of these textual references has generally been downplayed, due to the dearth of tin-bronze recorded in most archaeometallurgical studies of material from the Persian Gulf (e.g., Prange 2001; McKerrell 1977; Andersen and Højlund 2003). However, analyses of material from the U.A.E. indicate that small numbers of tin-bronze artefacts were interred in collective Umm an-Nar burial structures at Al Sufouh and Unar1 by the third quarter of the third millennium B.C.E. By the last two centuries of the third millennium, tin-bronze was the dominant alloy recorded in the analysis of more than 70 copper-base objects from Umm an-Nar period burial and settlement contexts at Unar 2 and Tell Abraq (Weeks 2004, 1997). The tomb at Tell Abraq is also significant in having produced a ring of metallic tin (Weeks 2004: Fig. 3.10). Further support for the textual evidence of a Persian Gulf tin trade is provided by the lead isotope analyses noted above, which indicate that both metallic tin and tin-bronze artefacts were circulating in the Persian Gulf exchange system (Weeks 2007; Weeks and Collerson 2004). There is possible evidence for exotic alloys reaching the southern shores of the Persian Gulf even earlier in the third millennium B.C.E., in the form of zinc- and lead-bearing copper-base artefacts in burials on Umm an-Nar Island (Frifelt 1991: 100; on early brasses in Western Asia see Thornton 2007).

Thus, both the cuneiform sources and metallurgical analyses suggest that the Persian Gulf could have been a route by which tin and tin-bronze were exchanged, and that participation in this trade by polities in southern Iran could have facilitated their access to these metals.

The patterning of early tin-bronze use in Iran is of interest in considering this hypothesis. Recent overviews of this evidence have been provided by Helwing (2009), Thornton and Giardino (2012), Oudbashi *et al*. (2012), and Cuenod *et al*. (2015). The combined analyses of material from Susa (Malfoy and Menu 1987; Moorey 1982), Godin Tepe (Frame 2010; Pigott 1996: 461), the Kalleh Nissar graveyard in Luristan (Fleming *et al*. 2005), Tepe Giyan (Berthoud 1979) and Tal-e Malyan (Pigott *et al*. 2003a)

indicate a possible early 3rd millennium B.C.E. spike in tin use in Luristan, in contrast to a steady but relatively low frequency of tin-bronze use in Khuzestan and at Godin Tepe from the mid-third millennium, peaking in the early second millennium B.C.E. at both Susa and Malyan when tin-bronze becomes common. The later peak in tin-bronze use correlates well with the textual references to the tin trade between Susa, Anshan, and Mari in the Sukkalmah period.

In contrast to western Iran, sites farther to the east such as Tepe Sialk, Tepe Hissar, Shahr-i Sokhta, Shahdad, and Tepe Yahya, show virtually no evidence for tin-bronze use in the third millennium (Pigott 1999a, 1999b; Vatandoust 1999: Tab. 2; Thornton *et al*. 2002; Meier 2008). As for the western Iranian sites, however, the second millennium appears to have heralded an increase in tin-bronze use at Yahya, where tin-bronze first appears in period IVA contexts alongside a number of other unusual alloy types and new approaches to metalworking and object fabrication, that have been linked with Central Asian cultural influences and the movement of new peoples into the region (Thornton *et al*. 2002; Thornton and Lamberg-Karlovsky 2004).

Allowing for the strong possibility that future analyses of copper-base artefacts from sites such as Konar Sandal North and South and others in the Halil Rud (Madjidzadeh 2008: 86) could change this picture,[4] the analytical database as it currently stands indicates a general pattern characterised by earlier and more consistent use of tin-bronze in western rather than eastern Iran (Helwing 2009; Cuenod *et al*. 2015). This is an unexpected pattern if eastern tin sources were being exploited and tin exchanged across the Iranian Plateau, as appears to have happened in the second millennium B.C.E.

One possible new explanation arises from the results of recent archaeometallurgical surveys in Luristan that have identified possible local sources of mixed tin-copper ores at sites such as Deh Hosein (Nezafati *et al*. 2009; Momenzadeh 2004: 13). In theory, such sites may have provided tin and bronze to the early metal industries of western Iran and Mesopotamia, and could potentially have contributed to the Bronze Age Persian Gulf trade as a supplier of tin(-bronze). However, this possibility remains to be proven by archaeometallurgical research that can adequately date the mining activities in the area, reconstruct the mining and smelting activities undertaken there, and characterise the raw materials produced.

An alternative is that in the later third millennium B.C.E. tin was brought from its ultimate eastern sources south to the Arabian Sea via intermediaries in eastern Baluchistan or the Indus Valley, before being traded via the Persian Gulf to polities in southwestern Iran (and Mesopotamia). In this context, it is interesting to note the recent reports of smelting activities at the Harappan site of Khanak in the Tosham mining area in Haryana, India, where preliminary analyses of slags may indicate the smelting of polymetallic ores to produce a natural or 'uncontrolled' copper-tin alloy in the third millennium B.C.E. (Singh *et al*. 2015: 819, Pls. 97.27, 31). These results are particularly interesting when the observations of Begemann and Schmitt-Strecker (2009) on the isotopic composition of early Mesopotamian bronzes and Persian Gulf tin-bronzes are considered.

The archaeological evidence for Bronze Age contact between southwestern Iran and polities of the Persian Gulf region is slim: pottery related to the Kaftari tradition of Fars province has been recorded at a number of sites in the central and southern Persian Gulf, in contexts that can be securely dated to the third millennium or the very early second millennium B.C.E. (see Petrie *et al*. this volume; Carter 2003, 2002; Potts 2003a, 2000: 116-7; Højlund and Andersen 1994: 118-20, Figs. 332-7, 640; Højlund 1987: Fig. 433; Zarins 1989). The evidence suggests the possibility of contact through ports such as Tol-e Peytul (ancient Liyan) on the Bushire Peninsula. Early 20th century excavations at this site by Maurice Pézard (1914) uncovered a large assemblage of Kaftari-related pottery and numerous additional materials of Persian Gulf origin, including pottery of Barbar type and soft stone artefacts typical of the late-third and early second millennium B.C.E. Oman Peninsula.

In addition to pottery and soft stone from Oman and Bahrain, the possibility exists that tin and/or tin-bronze was traded into southwestern Iran through the port at Tol-e Peytul in the late third or early second millennium B.C.E. (c.f. Pigott *et al*. 2003a: 165). Certainly, the tin-bronzes from Malyan (Pigott *et al*. 2003b: Tab. 14.1), even though they may be later in date, are compositionally similar to the tin-bronzes from sites such as Tell Abraq and Unar 2 which show the presence of Kaftari pottery. Such tin and/or tin-bronze could easily have reached Susa overland from Liyan or Malyan.

Additionally, Susa appears to have had its own direct connections with the Persian Gulf exchange system in both the third and the early second millennia B.C.E. (Potts 1999a: 120, 178-81; 1990: 226-8; Carter 2003; Amiet 1986; de Miroschedji 1973), although the evidence is limited. These links could have facilitated Susa's independent acquisition of tin/tin-bronze. Moreover, it is possible that tin, tin-

4. There are some uncertainties in the evidence used to support these discussions. In southeastern Iran, the summary of analyses from the metal workshop in Shahdad area D indicate the production of copper with significant lead (Pb) levels (0.5-3.0%) but generally low arsenic (As) concentrations of less than 1% (Hakemi 1997: 110). However, there is at least one tin-bronze recorded from Cemetery A at Shahdad (Hakemi 1997: 113) and there are additional references to the use of tin-bronze with ca. 10% Sn for the production of some objects, "especially pins", at the site (Hakemi 1997: 59). This claim is not supported by the analyses of pins and other objects from Shahdad presented by Vatandoust (1999). Recent analyses of pins from Shahdad by Meier (2008) have revealed that tin levels were generally low in the artefacts, although two specimens contained just under 1% Sn that might indicate the mixing of different alloys during recycling.

bronze and other materials exchanged in the Persian Gulf also reached Susa indirectly through Mesopotamian centres, given the close cultural ties between Susa and Mesopotamia in the later third millennium (Potts 1999a: Chapters 4 and 5).

If participation in the Persian Gulf trade, either directly or indirectly, is regarded as significant in the acquisition of tin-bronze in southwestern Iran in the later third millennium B.C.E., the evidence for the distribution of southeastern Iranian materials in the Persian Gulf must also be considered. In particular, ceramic evidence indicates persistent contact between southeastern Iran and the Oman Peninsula at this time (Blackman *et al*. 1989; Méry 1996), to the extent that Potts (2005) has suggested the direct movement of Iranian potters to southeastern Arabia. Material from the Central Persian Gulf, for example the Jiroft/Intercultural style steatite from Tarut Island (Zarins 1978; Kohl 2001), further supports the inclusion of southeastern Iranian polities in the Persian Gulf exchange system, as does the presence of a stamp seal of Persian Gulf type at Tepe Yahya period IVB5 (Lamberg-Karlovsky and Potts 2001: Fig. 4.6; Pittman 2001: 238). In short, the proposition that southeastern Iran lay outside the third millennium B.C.E. Persian Gulf exchange system seems demonstrably untrue.

A consequence of this conclusion is that the apparent lack of tin-bronze in third millennium southeastern Iran, when it is found in the northern Emirates and in western Iran, cannot be related to non-participation in the wider Persian Gulf trade. Alternative possibilities could include technological explanations based on the material working properties of arsenical copper in comparison to tin-bronze (e.g., Hauptmann 1987: 217), or explanations which focus on tin/tin-bronze as elite materials more highly demanded by the complex societies of southern Mesopotamia than those in southeastern Iran (Stech and Pigott 1986), or the conservative traditions of metal production and use that characterised the region (Weeks 2004: 194-5; Pigott 1999b: 84). The fact that none of these hypotheses can be confidently offered as "the" explanation for the development of metallurgical alloying practices across Western Asia is a good indication that metal assemblages from sites in the greater Persian Gulf region can only be understood in terms of their position in a matrix of technological, cultural, economic, and political influences.

Discussion

As outlined above, it is clear that the ultimate source(s) of "Dilmun" copper are still open to debate. Whilst the bulk of available analytical data supports the dominance of the Oman Peninsula as a copper supplier from the mid-third to the early second millennium B.C.E., an important result of both the textual and archaeometallurgical studies is the evidence that not only raw copper, but also tin and finished tin-bronze objects were traded through the Persian Gulf.

The assembled data highlight the improbability that the copper trade through the Persian Gulf relied exclusively upon one source region over the more than one thousand years of its existence. A minimalist position would suggest that non-Omani raw copper was more likely to be prevalent in the Persian Gulf region in the early to mid-third millennium, when the evidence for copper smelting in the Oman Peninsula is limited, and perhaps also in the early second millennium B.C.E. However, both the isotopic data and occasional cuneiform references to copper from *Meluhha* provide evidence that non-Omani copper and copper alloys were circulating within the Persian Gulf even at the height of copper production in the Oman Peninsula.

Although the current understanding of the Persian Gulf metals trade allows for little in the way of Iranian participation, this is likely to be an inaccurate picture due to the fact that the basic archaeological and historical data overwhelmingly come from Mesopotamia and the southern shores of the Persian Gulf, and that the Mesopotamian historical references tend, unsurprisingly, to emphasise proximate sources of raw materials (i.e. 'Dilmun' copper) rather than ultimate sources. It seems almost unnecessary to state that future investigations of possible copper source areas in Iran will strongly influence reconstructions of the Persian Gulf metals trade, and possibly the historical geography of the greater Persian Gulf region.

At least one cuneiform document illustrates the impressive geographical scope and complexity of Bronze Age exchange systems in the Persian Gulf region: the Ur version of the myth of "Enki and Ninḫursag", which dates from the end of the third millennium B.C.E., lists eight countries that transported their goods to Dilmun, including Tukrish, Meluhha, Marḫashi, Magan, the Sealand, Zalamgar, Elam and Sumer (Kramer 1977: 59). Although mythological, this document highlights the many interactions that likely comprised the real Persian Gulf exchange system; interactions which lay beyond the immediate interests of Mesopotamian rulers and bureaucrats, and which as a result do not commonly appear in their written records.

It was suggested, based on a variety of evidence, that sites in southwestern Iran which show tin use in the third millennium B.C.E. could have obtained tin and tin-bronze via the Persian Gulf exchange system. However, the strong regional variation in the use of tin-bronze across Bronze Age Western Asia outlined above is one of the most interesting features of the inception of this new alloy, and the fact that many regions which were apparently deeply involved in the Persian Gulf exchange system show no use of tin-bronze is indication enough that ore sources and trade routes alone cannot explain the early use of tin and tin-bronze. Likewise, technology-based explanations

cannot easily account for the ways in which new alloys were exploited in Bronze Age Arabian and Iranian metal industries. Rather, it is likely that the social contexts in which finished metal objects were exchanged are also critical to understanding their subsequent distribution (Weeks 2004).

The social contexts of exchange in the Bronze Age Persian Gulf are difficult to reconstruct. Mesopotamian economic texts are, by their nature, terse documents revealing little beyond the bottom line of exchange relationships. The strict economic focus of these sources in their reference to "Dilmun traders" and to individual merchants working independently or on behalf of the palace or a temple estate (Oppenheim 1954; Leemans 1960) suggest that the interactions that Mesopotamian merchants had with the Persian Gulf region were limited to economic exchanges. But it is unlikely that raw metal and metal objects were produced, exchanged, and used within a system that recognised only their economic value. Anthropological perspectives encourage a much richer view of exchange relationships, suggesting that in ancient societies the exchange of raw materials and objects was inextricably linked to the formation and maintenance of social relationships. Within such a system, early tin-bronze artefacts in the Persian Gulf region may have represented not units of metal to be traded according to their economic value, but material symbols of participation in the web of social, political, and economic relationships that constituted the Bronze Age Persian Gulf exchange system.[5] The distribution patterns of such objects will, as a consequence, vary from that which would be expected if only economic factors operated upon their dispersal.

Moreover, cuneiform sources and anthropological sources both support the observation that deliberate exchange would have represented only one of the ways in which metal circulated within Bronze Age societies. Cuneiform sources attest to the fact that huge amounts of both raw metal and finished metal objects were obtained as the spoils of war and as tribute (e.g., Moorey 1994: 246). Moreover, interdynastic marriages such as those documented between the Ur III state and Marḫashi, Anshan and elsewhere (Potts 1999a: 136-9) were no doubt as concerned with the movement of raw materials as the maintenance of political relationships. With the potential use of raw metal traded from multiple source regions in addition to that obtained via booty, tribute, and interdynastic gift exchange, it seems clear that metal from a multiplicity of sources must have been circulating in the complex societies across the greater Persian Gulf region. Moreover, as new metal was acquired from its ores and transported to metalworking centres, so too old objects were stored and recycled on a significant scale (Zettler 1990), or retrieved through activities such as tomb plundering.

Such considerations further highlight the futility of searching for "the" source of metal used in the greater Persian Gulf region at any particular point in the Bronze Age. The origins of the copper and copper-base alloys used in the complex Bronze Age societies bordering the Persian Gulf would have reflected a highly complex metal circulation system that was conditioned not only by raw material sources and trade routes, but by politics and warfare, by technological traditions of manufacture and recycling, by ideologies of elite consumption, and by the social obligations that created and underpinned exchange relationships.

The people and craft who plied the Persian Gulf in the Bronze Age provided a material and cultural link between developing technologies and economies on its northern and southern shores. As much an axis of integration as a barrier to movement, the Persian Gulf was undoubtedly significant in the development and spread of early metallurgy and a key route in the metals trade of the Bronze Age Near East.

5. The concentration of tin-bronze in funerary contexts in the Bronze Age Oman Peninsula suggests an important symbolic role for the artefacts made of this alloy. Significantly, these tombs are also focal points for the deposition of other foreign artefacts (e.g. the pottery, ivory, linen, silver and gold of the Tell Abraq tomb; Potts 2000), raising the possibility that their "foreignness" and thus the interactions that they symbolised were important aspects of their eventual distribution.

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چکیده: رومیان برای نشان دادن دریای مدیترانه به عنوان بخشی از امپراطوری روم از عبارت *mare nostrum* («دریای ما») استفاده می‌کردند. این مقاله در پی آن خواهد بود که با استفاده از منابع مکتوب و باستان‌شناختی نشان دهد جایگاه خلیج فارس برای پارسیانِ ساسانی به همان صورت دریای مدیترانه، «دریای ما» برای رومیان بود. ساسانیان خلیج فارس را بخشی از امپراطوری خود در نظر می‌گرفتند و از آغاز سلسله‌ی ساسانی در قرن سوم میلادی.، تلاش نظام‌مند و دامنه‌داری برای اِعمال چیرگی خود بر آن داشته‌اند.

واژگان کلیدی: دریای ما، خلیج فارس، ساسانیان، امپراطوری روم

یک توالی در بنادر ایرانی: باستان‌شناسی دوره اسلامی در خلیج فارس

دانلد ویتکامب
دانشگاه شیکاگو

تاریخ دریافت: ۲۰/ ۱۰/ ۱۳۹۲
تاریخ پذیرش: ۵/ ۱۱/ ۱۳۹۶

چکیده: پژوهش‌های باستان‌شناختی در شناخت ما از جغرافیای تاریخی و الگوی استقراری بنادر کرانه‌های خلیج فارس نقش مهمی ایفا کرده‌اند. این مسأله در دوران اسلامی و پیش از اسلام، اثرگذارتر است؛ زمانی که برخی از نوشته‌های جغرافیدانان عرب، استقرارهای این کرانه را گواهی می‌دهند و شواهد باستان‌شناختی را تقویت می‌کنند. مقاله‌ی پیش رو به بررسی این مدارک و دلالت‌ها بر تفوّق سیاسی از سوی شمال، سواحل ایرانی یا به طور خاص از استان فارس می‌پردازد و بی‌ثباتی اقتصادی یا افزون بر آن، بی‌ثباتی زیست‌محیطی که به انتقال تفوّق در میان این بندرگاه‌ها انجامید را بررسی می‌کند.

واژگان کلیدی: خلیج فارس، استان فارس، جغرافی‌دانان عرب، دوران اسلامی و پیش از اسلام

اسناد فارسی در بایگانی ملی (تُرّ دُ.تُمبو) پرتقال و اهمیت این اسناد در تاریخ خلیج فَارس در قرون ١٦ و ١٧ میلادی

نادر نصیری مقدم
دانشگاه استراسبورگ

تاریخ دریافت: ۵/ ۱۱/ ۱۳۹۲
تاریخ پذیرش: ۱۶/ ۱۳۹۳/۷

چکیده: اسناد فارسی قرون ۱۶ و ۱۷ م. در بایگانی‌های ملّی «تُرّ دُ.تُمبو» در لیسبون، به طور کلی در مجموعه‌ای گِرد آمده و نگه‌داری شده‌اند که تا پیش از این «اطلس شرقی» نامیده می‌شد و امروزه «اسناد شرقی» خوانده می‌شود. این مجموعه بخشی از زیربنای «مانوسکریتُس دا کاسا دُس تراتادُس» را تشکیل می‌دهد. برخی از این اسناد مربوط به پرتغالی‌ها هستند که در پی سیاست گستردن قلمرو خود در اقیانوس هند و خلیج فارس در آغاز قرن ۱۶ م.، به جزیرهٔ هرمز دست یافتند که در فاصلهٔ ۶ کیلومتری از ساحل ایران قرار دارد. در آن زمان، این گذرگاهِ بزرگ خلیج فارس جمعیتی تقریباً برابر با ۴۰،۰۰۰ نفر داشت. جزیرهٔ هرمز که تا قرن ۱۳ م. «جارون» خوانده می‌شد، به ایران تعلق داشت و «پادشاهی» ثروتمند این جزیره وابسته به دولت مرکزی ایران بود. چنان که پادشاهان آن که در منابع فارسی «وُلاتِ هرمز» نامیده می‌شدند، خراجگزار پادشاه پارس بودند؛ اما با آمدن پرتغالی‌ها، به تابعان پرتغال تبدیل شدند. این مقاله به برخی از اسناد بایگانی‌های ملّی تُرّ دُ.تُمبو می‌پردازد که دربارهٔ برهم‌کُنش پادشاهی هرمز و پرتغالی‌ها هستند.

واژگان کلیدی: بایگانی‌های ملّی تُرّ دُ.تُمبو، جزیرهٔ هرمز، پرتغالی‌ها

ریشه‌های شیعه در مدرسه عیونی ابو زیدان (مسجد سوق الخمیس) در قرن۱۲میلادی در بحرین

دنیل تی. پاتس
دانشگاه نیویورک

تاریخ دریافت: ۱۱/ ۱۲/ ۱۳۹۳
تاریخ پذیرش: ۲۲/ ۲/ ۱۳۹۴

چکیده: این پژوهش تاریخ آنچه را که به طو سنتی به عنوان قدیمی‌ترین مسجد بحرین شناخته می‌شود، مدّ نظر قرار می‌دهد. علاوه بر بازنگری دانسته‌های مربوط به تاریخ معماری بنا، توجه خاصی به کتیبه‌ها شده است که حدوداً ربع قرن پیش از این به کوشش لودویک کالوس منتشر شده‌اند و بی‌تردید بر ماهیت شیعیِ مسجد دلالت دارند. علاوه بر آن، این نوشته‌ها به وضوح ماهیت شیعیِ سلسلهٔ عُیونی را که درشرق عربستان سعودی امروزی حکومت می‌کردند، نشان می‌دهند.

واژگان کلیدی: بحرین، خلیج فارس، مسجد، مدرسه، تشیّع.

چکیده‌ی مقالات به زبان فارسی

سفال‌های کفتری و مرتبط با کفتری در جنوب غرب ایران و سواحل خلیج فارس

کمرون. ای.پیتری
دانشگاه کمبریج

مژگان سیدین
پژوهشکده‌ی باستان‌شناسی میراث فرهنگی

علیرضا عسکری چاوردی
دانشگاه شیرازی

تاریخ دریافت: ۲۶/ ۹/ ۱۳۹۳
تاریخ پذیرش:۷/ ۱۲/ ۱۳۹۳

چکیده: هموندگان سفال کفتری تاکنون به هزاره‌های سوم و دوم پ.م. تاریخ‌گذاری شده است؛ این تاریخ‌گذاری، بر اساس نتایج بررسی‌ها در حوزه رود کُر و کاوش‌هایی است که در تل مَلیان، یا به عبارت دیگر شهر باستانی اَنشان انجام شده‌اند. کاوش‌های بسیاری نشان داده‌اند که ظروف سفالی کفتری یا مرتبط با کفتری، در گستره‌ی وسیعی پراکنده‌اند که محوطه‌هایی در بخش‌های گوناگون فارس، در شبه‌جزیرهٔ بوشهر و در کرانه‌های خلیج فارس را دربر می‌گیرد. این مقاله به بازنگری شواهد مربوط به مواد فرهنگی کفتری و در ارتباط با کفتری در جنوب‌غرب ایران و حوزهٔ خلیج فارس می‌پردازد. پس از آن، نتیجه‌گیری دربارهٔ اهمیت گاهنگاری و پراکندگی این یافته را مطرح می‌کند؛ اهمیتی که برای درک ما از برهم‌کُنش میان جنوب‌غرب ایران و مناطق دیگر مشارکت‌کننده در سامانهٔ تجاری خلیج فارس دارد. سامانه‌ای که در اواخر هزارهٔ سوم و اوایل هزارهٔ دوم پ.م. فعال بود.

واژگان کلیدی: سفال کفتری، اَنشان، خلیج فارس، تجارت.

ایران و تجارت فلز در عصر آهن در سواحل خلیج فارس

لوید ویکس
دانشگاه نیوانگلند

تاریخ دریافت:۳/ ۷/ ۱۳۹۴
تاریخ پذیرش:۱۲/ ۸/ ۱۳۹۴

چکیده: پژوهش‌های باستان‌فلزشناختی در امارات متحده‌ی عربی و عُمان نشان داده‌اند که جوامع محلی عصر مفرغ تولید مس را در ابعاد بسیار وسیع بر عهده داشته‌اند، که خود مدرک مستحکمی برای شناسایی این منطقه به نام سرزمین مَگَن است که در منابع بین‌النهرینی به عنوان فراهم‌آورنده‌ی اصلی مس در اواخر هزارهٔ سوم پ.م. شناخته شده است. اگرچه نگاهی به مدارک مکتوب، شواهد باستان‌شناختی و باستان‌فلزشناختی از سراسر حوزهٔ خلیج فارس، سامانهٔ بده‌بستان پیچیده‌تری را نشان می‌دهد که نه تنها از منابع مواد خام و مسیرهای تجاری، بلکه از سیاست و جنگاوری، سنتهای فن‌آورانه‌ی تولید و بازیافت، ایدئولوژی‌های مصرفی نخبگان و قواعد اجتماعی که ارتباطات تجاری را ایجاد و از آنها پشتیبانی می‌کنند، تأثیر می‌پذیرفته است. اما همچنان بخش مهمی از کار، اثبات سهم مؤثر احتمالی نظام‌های سیاسی ایرانی بر این سامانه، برای انجام باقی خواهد ماند.

واژگان کلیدی: خلیج فارس، تجارت فلز، عصر مفرغ، فلات ایران، شبه جزیرهٔ عربستان، بین‌النهرین

تجارت دریایی در خلیج فارس: شواهدی از آمفورهای اژدری ساسانی

حسین توفیقیان
پژوهشکده‌ی باستان‌شناسی میراث فرهنگی

فرهنگ خادمی ندوشن
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چکیده: بررسی‌ها و کاوش‌های باستان‌شناختی اخیر در آب‌های نزدیک کرانه‌های خلیج فارس و دریای عُمان صدها قطعه سفال متعلق به دوره‌های پارتی و ساسانی را آشکار کرده‌اند که شاهدی بر بازرگانی دریایی در منطقه هستند. بقایای سفالین بازیابی‌شده، از گونه‌ها و اندازه‌های گوناگون هستند که دیواره داخلی بسیاری از آنها با قیر طبیعی اندود شده است؛ روشی که آنها را در برابر آب عایق می‌کرده است. شکل‌های متمایز آنها نه‌تنها برای انتقال با کشتی به خوبی متناسب‌سازی شده، بلکه برای انتقال مایعات مناسب بوده است. مقاله‌ی حاضر در تلاش است تا به بررسی کوزه‌های اژدریِ به دست آمده از سواحل ایران بپردازد و ارتباط میان این یافته‌ها با فرهنگ‌های همسایه را نشان دهد.

واژگان کلیدی: خلیج فارس، پارتی، ساسانی، آمفورا، تجارت دریایی

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