A4057-ME-Luristan-Statue-Zebu-Bronze-2500 BCE





A000-ME-Luristan-Statuette-Ram-Bronze-2500 BCE

**Case no.:4**

**Accession Number:**

**Formal Label:** ME-Luristan-Statuette-Ram-Bronze-1000 BCE

**Display Description:**

Luristan Province (Persian: استان لرستان‎, Loristan, or Lorestan) is a province of western Iran in the Zagros Mountains. Western Luristan comprises a series of parallel fertile valleys running high in the Zagros mountains. The Pusht-i Kuh region is in the western foothills of the Kabir Kuh range. The Pish-i Kuh region lies to the east of Kabir Kuh. Luristan had human settlements during the Bronze Age as early as the mid–3rd millennium BCE. The [Kassites](https://en.wikipedia.org/wiki/Kassites), an ancient people who spoke neither an [Indo-European](https://en.wikipedia.org/wiki/Indo-European_languages) nor a [Semitic language](https://en.wikipedia.org/wiki/Semitic_languages), originated in Luristan. They controlled [Babylonia](https://en.wikipedia.org/wiki/Babylonia) after the fall of the [Old Babylonian Empire](https://en.wikipedia.org/wiki/Old_Babylonian_Empire) c 1531 BCE to 1155 BCE.

Parts of Luristan were invaded and settled by the Iranian [Medes](https://en.wikipedia.org/wiki/Medes) in the 2nd millennium BC. The Medes absorbed the indigenous inhabitants of the region, primarily the [Kassites](https://en.wikipedia.org/wiki/Kassites) as well as the [Gutians](https://en.wikipedia.org/wiki/Gutians), by the time the area was conquered by the [Persians](https://en.wikipedia.org/wiki/Achaemenid_Empire) in the 1st millennium BC. In February 2017, archeological discoveries related to the [Achaemenid](https://en.wikipedia.org/wiki/Achaemenid) era were made in Lorestan for the first time.[[8]](https://en.wikipedia.org/wiki/Lorestan_Province#cite_note-8)



[Cave painting](https://en.wikipedia.org/wiki/Cave_painting) in Doushe cave, Lorestan, Iran, 8th millennium BC

**Luristan bronze**[[edit](https://en.wikipedia.org/w/index.php?title=Lorestan_Province&action=edit&section=4)]



Zoom of a disc-headed pin (pin, female figure). Found in Lorestan, [Rietberg Museum](https://en.wikipedia.org/wiki/Rietberg_Museum), [Zürich](https://en.wikipedia.org/wiki/Z%C3%BCrich)

Small [Luristan bronze](https://en.wikipedia.org/wiki/Luristan_bronze) artworks, usually dated about 1000 to 650 BC, reached the outside world from the late 1920s and are found in museums all over the world, where they are valued for their vigorous style, with many representations of animals. But actually, the beginning of this bronze-making tradition goes back to the mid–3rd millennium B.C.

Archaeologists characterized these techniques by the metallurgical analysis of different artifacts,

We have characterized these practices by the compositional and metallurgical analysis of grave goods from several cemeteries in the region including six dating to different phases of the Bronze Age ([Early Dynastic](https://en.wikipedia.org/wiki/Early_Dynastic_Period_(Mesopotamia)) I to [Ur ED III](https://en.wikipedia.org/wiki/Ur-III), circa 2900–2000 B.C.)—Kalleh Nisar, Bani Surmah, Chigha Sabz, Kamtarlan, Sardant, and Gulal-i Galbi—and four dating to different phases of the Iron Age (circa 1300 B.C.–600 B.C.)—Bard-i Bal, Kutul-i Gulgul, Sar Kabud, and War Kabud.[[9]](https://en.wikipedia.org/wiki/Lorestan_Province#cite_note-9)

Technically, the term 'Luristan bronze' usually refers only to the later bronze objects, although they have many similarities. The earlier bronze objects were made during the [Elam](https://en.wikipedia.org/wiki/Elam) period.

In southwestern Iran, the first half of the Early Dynastic period corresponded with the [Proto-Elamite](https://en.wikipedia.org/wiki/Proto-Elamite) period. This period was characterized by indigenous art, a script that has not yet been deciphered, and an elaborate [metallurgy](https://en.wikipedia.org/wiki/Metallurgy) in the [Lorestan](https://en.wikipedia.org/wiki/Lorestan_Province) region. This culture disappeared toward the middle of the third millennium, to be replaced by a less [sedentary](https://en.wikipedia.org/wiki/Sedentism) way of life. Due to the absence of written evidence and a lack of archaeological excavations targeting this period, the socio-political situation of Proto-Elamite Iran is not well understood. Mesopotamian texts indicated that the Sumerian kings dealt with political entities in this area. For example, legends relating to the kings of Uruk referred to conflicts against [Aratta](https://en.wikipedia.org/wiki/Aratta). As of 2017 Aratta had not been identified, but it is believed to have been located somewhere in southwestern Iran.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

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| Western Luristan, in northwestern Iran, comprises a series of parallel fertile valleys running NW-SE, through the high terrain of the Zagros mountains. The region is subdivided as the Pusht-i Kuh, which lies in the western foothills of the Kabir Kuh; and the Pish-i Kuh, which lies to the east of that range.  Bronze-making certainly flourished in that region early in the 1st millennium B.C., but a lack of copper ores there would imply some technological influences may have arisen from the contemporary trade network which linked Anatolia, Mesopotamia, and the Iranian Plateau. But the characteristic ornate "lost wax" castings (often with zoomorphic motifs) are without parallel amongst neighboring cultures. (This may reflect the physical isolation imposed on Luristan by the Kabir Kuh mountain range.) It now seems likely that the roots of this novel bronze-making tradition lie in Luristan itself, in metalworking practices developed as early as the mid–3rd millennium B.C. We have characterized these practices by the compositional and metallurgical analysis of grave goods from several cemeteries in the region including six dating to different phases of the Bronze Age (Early Dynastic I to Ur ED III, circa 2900–2000 B.C.)—Kalleh Nisar, Bani Surmah, Chigha Sabz, Kamtarlan, Sardant, and Gulal-i Galbi—and four dating to different phases of the Iron Age (circa 1300 B.C.–600 B.C.)—Bard-i Bal, Kutul-i Gulgul, Sar Kabud, and War Kabud.  This analytical program is an ongoing collaboration between MASCA and the Dept. of Near Eastern Archaeology of Ghent University. Its findings will be published as appendices to the primary series of publications of each of these sites in Acta Iranica, and in related conference proceedings (see below). | | |
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|  |  | Map of the Pusht-i Kuh region, showing the nature of the terrain and the various archaeological sites under study.   Graphic: Lauren Sankovitch, MASCA |
|  | | |
| ABSTRACT:  Fleming, S.J., Pigott, V.C., Swann, C.P. and Nash, S.K., in press: "Bronze in Luristan: Preliminary Analytical Evidence from Copper/Bronze Artifacts Excavated by the Belgian Expedition in Iran."  The archaeological research of the Belgian expedition in Luristan directed by the late Prof. Louis Vanden Berghe provided ample evidence that copper-alloy metallurgy flourished in Luristan from the 3rd into the 1st millennium B.C. The lack of copper ores in Luristan proper implies that some technological influences may have arisen from the contemporary contacts, including trade networks, which linked metalworking traditions extant along western periphery of the Iranian Plateau as well as with Elam, Mesopotamia and Anatolia. However, the distinctively ornate "lost wax" castings, often with zoomorphic motifs, are without parallel among neighboring cultures. It is possible that the roots of this novel bronze-making tradition may lie within Luristan itself, in metalworking practices developed as early as the mid-3rd millennium B.C. In our on-going efforts to understand the nature of Luristan metal and its production, we have characterized metallurgical practices by compositional and microstructural analysis of copper alloy grave goods from the Bronze Age site of Kalleh Nisar (circa 3200–2000 B.C.), and the Iron Age sites of Kutal-i Gulgul (Iron IA, circa 1300–1150 B.C.), Bard-i Bal (Iron I-III; circa 1300–650 B.C.), and War Kabud (Iron III; circa 800–650 B.C.). We also have considered the extent to which the alloy recipes and metalworking practices used in the production of these artifacts may be linked to their function (see micrographs: KN axe head and BB bracelet). | | |



Map detailing the approximate locations of regions and kingdoms that are known from Mesopotamian written evidence of the [third millennium BC](https://en.wikipedia.org/wiki/Third_millennium_BC).

In the middle third millennium BC, [Elam](https://en.wikipedia.org/wiki/Elam) emerged as a powerful political entity in the area of southern Lorestan and northern [Khuzestan](https://en.wikipedia.org/wiki/Khuzestan_Province).[[28]](https://en.wikipedia.org/wiki/Early_Dynastic_Period_(Mesopotamia)#cite_note-28)[[19]](https://en.wikipedia.org/wiki/Early_Dynastic_Period_(Mesopotamia)#cite_note-frayne2008-19) [Susa](https://en.wikipedia.org/wiki/Susa) (level IV) was a central place in Elam and an important gateway between southwestern Iran and southern Mesopotamia. [Hamazi](https://en.wikipedia.org/wiki/Hamazi) was located in the [Zagros Mountains](https://en.wikipedia.org/wiki/Zagros_Mountains) to the north or east of Elam, possibly between the [Great Zab](https://en.wikipedia.org/wiki/Great_Zab) and the [Diyala River](https://en.wikipedia.org/wiki/Diyala_River), near [Halabja](https://en.wikipedia.org/wiki/Halabja).[[19]](https://en.wikipedia.org/wiki/Early_Dynastic_Period_(Mesopotamia)#cite_note-frayne2008-19)

This is also the area where the still largely unknown [Jiroft culture](https://en.wikipedia.org/wiki/Jiroft_culture) emerged in the third millennium BC, as evidenced by excavation and looting of archaeological sites.[[29]](https://en.wikipedia.org/wiki/Early_Dynastic_Period_(Mesopotamia)#cite_note-29) The areas further north and to the east were important participants in the international trade of this period due to the presence of [tin](https://en.wikipedia.org/wiki/Tin) (central Iran and the [Hindu Kush](https://en.wikipedia.org/wiki/Hindu_Kush)) and [lapis lazuli](https://en.wikipedia.org/wiki/Lapis_lazuli) ([Turkmenistan](https://en.wikipedia.org/wiki/Turkmenistan) and northern [Afghanistan](https://en.wikipedia.org/wiki/Afghanistan)). Settlements such as [Tepe Sialk](https://en.wikipedia.org/wiki/Tepe_Sialk), [Tureng Tepe](https://en.wikipedia.org/wiki/Tureng_Tepe), [Tepe Hissar](https://en.wikipedia.org/wiki/Tepe_Hissar), [Namazga-Tepe](https://en.wikipedia.org/wiki/Namazga-Tepe), [Altyndepe](https://en.wikipedia.org/wiki/Altyndepe), [Shahr-e Sukhteh](https://en.wikipedia.org/wiki/Shahr-e_Sukhteh), and [Mundigak](https://en.wikipedia.org/wiki/Mundigak) served as local exchange and production centres but do not seem to have been capitals of larger political entities.[[25]](https://en.wikipedia.org/wiki/Early_Dynastic_Period_(Mesopotamia)#cite_note-aruz2003-25)[[30]](https://en.wikipedia.org/wiki/Early_Dynastic_Period_(Mesopotamia)#cite_note-30)[[31]](https://en.wikipedia.org/wiki/Early_Dynastic_Period_(Mesopotamia)#cite_note-31)

**LC Classification:**

**Date or Time Horizon:**

**Geographical Area:**

**Map:**

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| **Lorestan Province** استان لرستان |
| Location of Lurestan Province in Iran  After https://upload.wikimedia.org/wikipedia/commons/thumb/7/77/IranLorestan-SVG.svg/500px-IranLorestan-SVG.svg.png |
| Counties of Lorestan Province in Iran  After https://upload.wikimedia.org/wikipedia/commons/9/97/Lorestan.svg |

**GPS coordinates:** Coordinates: [33.4871°N 48.3538°E](https://tools.wmflabs.org/geohack/geohack.php?pagename=Lorestan_Province&params=33.4871_N_48.3538_E_region:IR_type:adm1st)



**Cultural Affiliation:**

**Media:**

**Dimensions:**

**Weight:**

**Condition:**

**Provenance:**

**Discussion:**

The most comprehensive typological studies of a large corpus of Iranian copper-base artifacts from the region between the Indus and the Danube have been published by Deshayes (1958; 1960; 1963; 1965; De­shayes and Christophe). They include extensive dis­cussions of techniques of fabrication and evolution of forms, as well as of the general development of metal­lurgy in various culture areas of southwestern Asia and adjacent regions.

**References:**

* Amiet, P., *Les Antiquités du Luristan. Collection David-Weill*, Paris, 1976 (many items now in the Louvre)
* Fleming, S. J., V. C. Pigott, C. P. Swann, and S. K. Nash. *Bronze in Luristan: Preliminary analytical evidence from copper/bronze artifacts excavated by the Belgian mission in Iran*. Iranica Antiqua: 2005.
* Ghirshman, R. *Iran: from the earliest times to the Islamic conquest*. Penguin Books: 1954.
* Meier-Arendt, W. *Bronzen and Keramik aus Luristan und anderen Gebieten Irans im Museum für Vor- and Frühgeschichte*. Frankfurt am Main: 1984.
* Moorey, P. R. S., *Catalogue of the Ancient Persian Bronzes in the Ashmolean Museum*, Oxford, 1971.
* Moorey, P. R. S. *Ancient Bronzes from Luristan*. British Museum: London, 1974.
* Overlaet, B. "Luristan Metalwork in the Iron Age", *Persia's Ancient Splendour: Mining, Handicraft and Archaeology*, Deutsches Bergbau-Museum: Bochum, 2004.
* Rickenbach, J. *Magier mit Feuer und Erz, Bronzekunst der frühen Bergvölker in Luristan, Iran.* Museum Rietberg: Zürich, 1992.
* Zahlhaas, G. *Luristan: Antike Bronzen aus dem Iran*. [Archäologische Staatssammlung München](https://en.wikipedia.org/wiki/Bavarian_State_Archaeological_Collection), Museum für Vor-und Frühgeschichte: München, 2002.

 At any rate, tin “bypassed” the plateau en route to Mesopotamia (Beale, p. 144; Moorey, 1982, p. 88). Iranian metallurgi­cal traditions can thus be characterized as technologi­cally conservative, for, though copper artifacts were manufactured in quantity and in a variety of forms, simple smelted or melted arsenical copper was the main material used. At Tepe Hissar, for example, the quan­tities of slag, fragments of furnace lining, and molds suggest large-scale production of arsenical copper: tools, weapons, and elaborate ornaments (Schmidt, 1937; Pigott et al.). There is also evidence of lead and silver production. Bronze, however, was found only very rarely in the analysis of metal artifacts from the site (Pigott et al., p. 230; Berthoud et al., 1982, p. 50 n. 66; Reisch and Horton apud Schmidt, 1937, p. 359). Assemblages from Shahr-i Sokhta to the southeast, Tepe Yahya to the south (Heskel and Lamberg-Karlovsky, 1980; 1986; Heskel, 1982, pp. 73-97; Tylecote and McKerrell, 1971; 1986), and probably Shahdad, also to the south (Vatandoost-Haghighi; Moorey, 1982, pp. 83, 90-91; Salvatori; Salvatori and Vidale), consist primarily of arsenical copper artifacts, with rare bronzes (Heskel 1982, pp. 97-120; Hauptmann; see also Tosi, 1993). An arsenical-copper shaft-hole axe from a burial at Khurab (Ḵᵛorāb; Stein, 1937, p. 121) in Baluchistan has been the subject of several studies (Maxwell-Hyslop; Zeuner; During Caspers), including a detailed metallurgical analysis of its composition and manufacture (Lamberg-Karlovsky, 1969; Lechtman). Farther west at Tall-i Malyan in Fārs province artifacts from the late 4th- and early 3rd-millennium Banesh (Baneš) phase (Nicholas, 1980; forthcoming) are exclu­sively of arsenical copper, but preliminary analyses of finds from the subsequent Kaftari phase (early 2nd millennium) indicate that several are of bronze (Pigott, 1980, pp. 107; unpublished analyses of the Museum of Applied Science, Center for Archaeology/MASCA). Slags with entrapped metal prills from Malyan have been shown by analysis to be derived from copper/bronze production (Carriveau, pp. 63-66). Unpublished analyses from the site of Godin indicate that a number of bronze artifacts occur in period III contexts, about early 3rd to early 2nd millennium B.C. (Godin Project Archives). Thus the Godin III and Kaftari Malyan contexts may be the earliest on the plateau to contain bronze with some frequency, probably reflect­ing the geographical and cultural proximity of these sites to the lowlands of Mesopotamia and Ḵūzestān.

The suggestion of Afghanistan as an early locus of bronze metallurgy, though attractive, cannot yet be fully substantiated archeologically. The only well-­documented artifacts in bronze from the region were excavated at Mundigak (Mondīgak), in levels dating from the mid-4th through the 3rd millennium (Shaffer, p. 144; Jarrige, p. 291; see also Lamberg-Karlovsky, 1967, pp. 146-48). A few were of bronze, principally axes and a single adze, and their occurrence over a long span of time may indicate regular use of the alloy (Stech and Pigott, p. 47). Unfortunately, the bronze artifacts from Ghar-i Mar (Ḡār-e Mār “snake cave”) in northern Afghanistan cannot be firmly dated (Caley, 1971, 1972, 1980; Shaffer, p. 89; cf. Moorey, 1982, p. 99 n. 62).

In Turkmenistan bronze is not recorded at all until the late 3rd millennium (Terekhova, p. 319). Artifacts from Anau (Anāv; see [anaw](http://www.iranicaonline.org/articles/anaw)) include at least four bronzes and six arsenical-copper artifacts from Bronze Age deposits (Gooch, pp. 238-39; see also Chernykh). Analyses of bronzes of this period from Sarazm on the Zeravshan (Zarafšān) river in Tajikistan revealed only unalloyed copper (Isakov et al.), particularly significant in view of the proximity of known tin sources in the Zeravshan valley (Stech and Pigott, p. 44) southwest of Samarkand and along the Köksu river in Uzbekistan (Ryzanov).

The most comprehensive typological studies of a large corpus of Iranian copper-base artifacts from the region between the Indus and the Danube have been published by Deshayes (1958; 1960; 1963; 1965; De­shayes and Christophe). They include extensive dis­cussions of techniques of fabrication and evolution of forms, as well as of the general development of metal­lurgy in various culture areas of southwestern Asia and adjacent regions.

The Iron Age (ca. 1400-600 B.C.). Among copper-­base artifacts from Iron Age sites that have been analyzed bronze is by far the most common alloy: from Geoy (Gūy/Gök) Tepe (Burton Brown, pp. 179-97; Crawford, pp. 26-27; Eaton and McKerrell), Tepe Giyan (Halm, 1935, pp. 135-38), Sialk (Halm, 1939, pp. 205-08), and several sites in Deylamān (Egami et al.; Sono and Fukai; Fukai and Ikeda). As a result it is assumed that most Iron Age copper-base artifacts were of bronze and that the use of arsenical copper had waned significantly.

Bronze is not necessarily functionally superior to arsenical copper, and it has the disadvantage of requir­ing imported tin. On the other hand, whereas the amount of arsenic in a copper alloy is determined by the amount present in the copper ore and on smelting conditions, in bronze the proportions of copper and tin can be controlled to a useful degree by the metalworker. Products of predictable color and mechanical properties became possible after the innovation of bronze metallurgy. There are indications that in the Iron Age alloying techniques produced bronzes of controlled composition, close to the optimum 10 percent tin and 90 percent copper, which were then hardened by working. Mesopotamian texts of the 2nd millennium record alloying proportions for bronze (see Muhly, 1973, pp. 243-44, and 1983, p. 350). Mesopotamia, particu­larly Assyria, strongly influenced western Iranian craft traditions, including metalworking. A desire to emulate attractive items from neighboring lands in “local styles” (Winter, 1977) has been argued from stylistic similarities and must also have influenced the techniques of working materials such as copper and bronze.

Whereas in earlier periods settlements had been spread across the Iranian plateau, by the Iron Age evidence of settled occupation is limited primarily to western Iran, in and along the Zagros mountains and in Ḵūzestān (see Hole, 1987). Most Iron Age sites in these areas have yielded copper or bronze artifacts and from the 10th-9th centuries onward both bronze and iron (for discussions of iron on the Iranian plateau see Pigott, 1980, 1981 [see bibliog., p. 41], 1984; Moorey, 1982, pp. 92-93). A primary indicator of the transition from bronze to iron in the region is the occurrence of bimetallic artifacts, for example, iron objects with cast-­bronze decoration or bronze rivets (Moorey, 1971, p. 315; Pigott, 1981, p. 181).

Among the large number of excavated Iron-Age sites several are of particular archeometallurgical interest. From Haft Tepe (Middle Elamite period, ca. 13th century) in Ḵūzestān an unusual pyrotechnological installation was associated with a craft workroom containing such materials as mosaics of colored stones framed in bronze, a dismembered elephant skeleton used in manufacture of bone tools, and several hundred bronze arrowpoints and small tools. “Situated in a courtyard directly in front of this workroom is a most unusual kiln. This kiln is very large, about 8 m long and 2 and one half m wide, and contains two long compart­ments with chimneys at each end, separated by a fuel chamber in the middle. Although the roof of the kiln had collapsed, it is evident from the slight inturning of the walls which remain in situ that it was barrel vaulted like the roofs of the tombs. Each of the two long heating chambers is divided into eight sections by partition walls. The southern heating chamber contained metallic slag, and was apparently used for making bronze objects. The northern heating chamber contained pieces of broken pottery and other material, and thus was apparently used for baking clay objects including tablets . . .” (Negahban, 1977; and forthcoming).

Recent examination of the archeological evidence for bronze suggests that the district of Gīlān on the Caspian littoral was a production center (Haerinck). A number of graves excavated in the necropolis at Marlik (Mārlīk; very late 2nd-early 1st millennium; Negahban, 1964) produced abundant evidence of metalworking: a diverse array of bronze artifacts, including human figurines (1979a), vessels (1983), stamp seals (1977; 1979b­-c), and weapons (e.g., maceheads, Negahban, 1981; see also Muscarella, 1984, for a discussion relating to fibulae and chronology). Iron was not common at Marlik. Analyses of finds from Deylamān (Egami, et al.; Sono and Fukai; Fukai and Ikeda), as well as analyses of Marlik metal by Vatandoost-Haghighi (1978), con­tributed to the following assessment of the metalwork industry in Gīlān: “Arsenical copper and relatively pure coppers were still used, but a fully fledged tin-bronze production is evident. Even with the small existing group of analyses, a pattern has begun to emerge that correlates with comparable results from other parts of the Near East at the end of the second millennium B.C. The average Iranian tin-bronzes of the period have 5%-7% tin. Arrowheads fall generally below this range, spearheads and simpler dagger blades into it, or just above, whilst some of the fine swords of Iron I in northwest Iran may have tin percentages up to and above 12%. A double-headed hammer from Marlik weighing 1080 grammes, was at the top of the scale (13.5% Sn), suggesting that the smith knew the effective limits for an annealed and work-hardened alloy that would not be dangerously brittle . . . . With wax rather than clay as their medium . . . modelers easily found a cast metal counterpart foṛ . . . vessels and figures. Their lost-wax castings are not as accomplished as those of Luristan at this time. In Gilan, the wax parts of which the figure was built up are much more evident. But, as in Luristan, there seems to have been no appreciation that the controlled use of lead would have facilitated casting; only the tin content seems to have been controlled, usually below the average for tools and weapons” (Moorey, 1982, pp. 94-95; see also Tylecote, 1972).

The adjacent region of Azerbaijan also produced distinctive bronzes in the Iron Age (de Schauensee, 1988). The Hasanlu (Ḥasanlū) project (see bibliography in Levine and Young) has provided the major portion of excavated bronze artifacts from the region. Aside from Hasanlu itself, the type site, Iron Age graves at Dinkha (Denḵā) Tepe to the southwest (Muscarella, 1974) yielded a number of bronzes, as did the Urartian occupation level at Agrab (ʿAqrab) Tepe (Muscarella, 1973).

The best indications of Iron Age bronze working come from the 9th-century levels at Hasanlu, where at least three distinct metalworking areas were found (Muscarella, 1973, pp. 46, 55-56). Sir Aurel Stein’s 1936 sounding on the north side of the citadel mound produced a cache of artifacts, including some possible bronze bar ingots, strips, and at least three stone molds for small artifacts (1940, pp. 390-404, pl. 26). More recently excavations at the Artisan’s House in the outer town have yielded remains of intense burning, crucible fragments, a possible ingot, a shaft-hole axe mold, and an open flat-axe mold, as well as other mold fragments, clearly suggesting a workshop. Heavy modules of hematite or magnetite also found there were probably used for working and planishing sheet bronze (Pigott, 1981, p. 48). In Burned Building III on the citadel mound crucible fragments, a pair of bivalve sandstone molds for a ribbed-bladed shaft-hole axe, and frag­ments of a similar mold in clay were excavated (Pigott, 1981, pp. 138-39).

Altogether Hasanlu produced more than 2,000 cop­per and bronze artifacts in the following major categories: equestrian gear, architectural and domestic decoration, vessels and handles, personal ornaments, tools, weapons and armor (de Schauensee, 1988, pp. 47­-55; see also Lamberg-Karlovsky, 1965). Many were ornamental and were themselves decorated. Very fre­quently artifacts in bronze had counterparts in iron. Only hoes, sickles, knives, and saws were exclusively made of iron (de Schauensee, p. 47). In fact, at Hasanlu the number of iron artifacts was approximately equal to that of copper and bronze.

Emission-spectrographic analyses of twenty Hasanlu artifacts indicates that they are of bronze with a tin content ranging from 2 to 9 percent (Hasanlu project archives). Proton-induced x-ray emission spectroscopy of a lion-shaped pin (12.7 Percent tin) and a snaffle bit (4.7 percent tin) further corroborates the existence of bronze at the site (de Schauensee, p. 58 no. 9). Stylistic analyses of bronze artifacts from Hasanlu have been undertaken by Irene Winter (a decorated bronze horse breastplate, 1980), Oscar White Muscarella (a fibula, 1965), and Maude de Schauensee and Robert H. Dyson, Jr. (horse trappings). The type of pointed bronze helmet found at Hasanlu and also worn by Assyrian and Urartian soldiers has been discussed by B. J. Overlaet (1979). Such studies have helped to define a “local style” of artistic bronze production at Hasanlu, as well as influences from the north and west. The elaborate decoration suggests a sophisticated understanding of the properties of bronze and the technology of its production.

According to current opinion, Hasanlu was de­stroyed in about 800 B.C. by Urartian invaders from strongholds in northwestern Iran. The 7th-century fortress at [Besṭām](http://www.iranicaonline.org/articles/bestam-2)(Elamite Rusa-i URU.TUR) is the largest Urartian site in Iran to have undergone major excavation (Kleiss). The use of bronze there parallels that at sites elsewhere in western Iran, includ­ing both personal ornaments like rings, beads, bracelets, and fibulae, domestic decorations like bronze furniture fittings, bosses, and vessels, and bronze weaponry including trefoil and two-bladed arrowpoints. Unfortunately, none of the Besṭām finds has been analyzed (for discussion of bronzeworking in Urartu, see Seidl).

Perhaps the region that has received the most atten­tion in the study of Iron Age bronze artifacts is Luristan (see [bronzes of luristan](http://www.iranicaonline.org/articles/bronzes-of-luristan); Muscarella, 1988), particu­larly ornate bronze lost-wax castings. Although most of these have no provenience, some have been found at Surkh Dum (Sorḵdom; Schmidt, 1938; Muscarella, 1981; Van Loon et al.), Baba Jan ([Bābā Jān](http://www.iranicaonline.org/articles/baba-jan-tepe); Goff, pp. 38-39, 56, 63-65), and the cemeteries excavated by Louis Vanden Berghe (see references in Vanden Berghe, 1979; Vanden Berghe and Haerinck). The bronzes of Luristan apparently represent the culmination of a long tradition of bronze casting and sheet-metal working lasting from the 3rd millennium to the 7th century B.C.

Datable to the 7th-6th century B.C., are the finds from a neo-Elamite tomb at Arrajān in Ḵūzestān (Tawḥīdī and Ḵalīlān). A lidded bronze coffin was found together with a stand, a lamp, a jar, a cup, and ten cylindrical vases, all in bronze, and artifacts in gold and silver (Alizadeh; see Curtis, 1983). Another bronze coffin, possibly from Ziwiye (Zīwīya), may also belong to this period, though its context is still in dispute (Wilkinson; Dyson, 1963; Muscarella, 1977b). Finally, evidence from the ca. 6th-century B.C. Median fortress at Nush-i Jan (Nūš-e Jān) near Malāyer includes a small corpus of bronze fibulae (one of them bimetallic), pins, earrings, beads, “buttons,” bosses, a Pazuzu (apotropaic demon) head, a spatula, a kohl stick, and nine arrowpoints. Iron is not common at the site, and no analyses of the bronze artifacts have yet been undertaken. A discussion of the bronze arrowpoints served as the basis for a thorough review of the origin and occurrence of this type of artifact throughout western Iran (Curtis, 1984, pp. 26-­35). Important related studies of Iranian copper and bronze arrowpoints include those by S. Cleuziou and I. N. Medvedskaya (1980). The recent collection of papers edited by J. Curtis (1988) has opened the way for more detailed assessment than has previously been possible of bronze in the Iron Age, not only in western Iran but also in Assyria, Urartu, and beyond.

The Achaemenid period (ca. 6th-3rd centuries B.C.). With the rise of the Achaemenid dynasty in Fārs in the 6th century B.C. and the expansion of its empire to the east and west of the Iranian plateau, ancient metalwork­ing traditions continued, with considerable stylistic elaboration. The inventory of copper and bronze arti­facts from the period is considerable, though published accounts have tended to focus only on the most elaborate examples of the metalworker’s craft. As the materials are from all over the far-flung empire and often without provenience, it is difficult to characterize the industry (Moorey, 1982, pp. 856-57). These prob­lems are compounded by the proliferation of forgeries of Achaemenid objects (Muscarella, 1977; 1978; 1980).

The largest Achaemenid sample from the Iranian plateau comes from the treasury at Persepolis, clearly a very particular assemblage (Schmidt, 1957; see also Muscarella, 1977a, pp. 193-96). Not only highly dec­orated functional artifacts are included; there are also many that are purely decorative. The inventory includes a bronze plaque, a bimetallic tripod with three lions in the round, the cast leg of a quadruped, a pair of felines, a pair of horses cast in one piece, and fragments of wings, bands, rosettes, disks, moldings, and sheet metal. Personal ornaments in bronze were also found, includ­ing earrings, finger rings, pins, and gilded buttons. Functional categories include pulley wheels(?), a mor­tar and pestle, a mirror, and a duck weight. Military equipment is not well represented; though almost 4,000 bronze arrowpoints were excavated, the only other distinctly military artifacts were a battle axe, several sword hilts, and bowstrap guards (Schmidt, 1957, p. 9).

The most comprehensive assemblage of Iranian mili­tary equipment from the period was excavated in the cemeteries at Deve Hüyük in Syria (Moorey, 1980). Copper and bronze vessels, lamps, ladles, equestrian gear, domestic and personal ornaments, and weapons were found. Most of the weapons were of iron, but certain categories of distinctively Achaemenid military equipment, such as trilobate arrowpoints and battle axes, were of bronze. It is believed that certain categories, for example, the trilobate arrowpoints, battle axes, and iron akinaki (daggers), actually originated in Transcaucasia (Sulimirski, pp. 10-11). The trilobate points are thought to have originated with the Scythians and to have been adopted later by the Medes. They are usually interpreted as a hallmark of Median troops in the Achaemenid army (Curtis, 1984, p. 28; see also Gorelick on Median and Persian defensive armor).

Other major Achaemenid sites in Iran are Pasargadae and what Ghirshman called the “Persian Achaemenid village” at Susa. The assemblages from these sites include much the same basic categories of bronze for military and decorative purposes, as well as a few other implements. From Pasargadae there are a model of a ram, buckles, signet rings, fibulae, trilobate arrow­points, and scale armor (Stronach). At Susa (Ghirsh­man, 1954) a small group of bronze artifacts from a context not connected with a court (Moorey, 1980, p. 130) included trilobate arrowpoints, javelin points, pins, needles, and items of personal ornament (Moorey, pp. 31-34; see Muscarella, 1977; 1979; 1980, for the few remaining classes of Achaemenid bronze artifacts from controlled contexts in the empire; Besenval).

Few bronze artifacts from the Achaemenid period have been analyzed: Some of the more elaborate pieces, for example, a bimetallic tripod and complex forms like the trilobate arrowpoints must have been cast. Four Persepolis artifacts have been analyzed: a bronze arrow­point; a pin shaft of copper, silver, and iron; a fragment of copper or bronze slag; and an iron arrowpoint (Howell, apud Schmidt, 1957, p. 136). A thorough study of a possibly Achaemenid bimetallic mirror (bronze with iron rivets) has also been conducted; x-ray fluorescence indicated a tin content of 10.3 percent. It is assumed that the mirror was cast; metallography revealed a cold-worked and annealed structure in the vicinity of the rivet holes, which may have been made in the final stages of shaping. Tool marks suggest that the mirror was decorated long after it had been manu­factured (Meyers apud Muscarella, 1977a, pp. 196-98; cf. p. 183 n. 84).

One important clue to the technology of Achaemenid metalwork actually comes from a post-Achaemenid Egyptian tomb. In the late 4th-century tomb of Pedusiri (Petosiris), an official buried in the necropolis of Hermopolis Magna, there are reliefs depicting a metal workshop in which Achaemenid-style vessels are being shaped (cf. Wulff, pp. 24-28): hammering of sheet metal, hammering to shape a bowl over a stake (cf. Wulff, figs. 23-24), chasing of details on vessels (including rhyte, probably in gold and silver), and working of other objects in metal are shown (Moorey, 1980, p. 127; Muscarella, 1977, p. 194 n. 100; 1980, pp. 28-29).

Because the sample is skewed, it is difficult to draw conclusions about the impetus behind Achaemenid metalworking technology. The evidence suggests production for a luxury market and military needs. Although unique and elaborate artifacts are character­istic, bronze military equipment tended to be standard­ized. Given the geographic scope of the empire, organizational control of metallurgical production must have been centralized, as was control over the army itself. In this period, too, innovations in metalwork­ing are in the realm of decorative techniques rather than in obvious technological changes.

The Parthian and Sasanian periods (ca. 250 B.C.-A.D. 642). During this period bronze was used primarily for ornament and for projectile points and other military hardware. As in the Achaemenid period, little is known about the sources of ore and the composition of copper-base artifacts. Stylistic analyses dominate the literature, and they are often focused on metal artifacts from various Asian sites, rather than from the Iranian plateau itself. One of the most useful studies of bronze in this period is Parthian Art by M. A. Colledge, whose classifications are followed here. The art of this period is characterized by diversity of style and influences: “Although the Parthians were the politically dominant ethnic group in the Near East, their ruling dynasty, the feudal Arsacids, did not maintain uniform control over their vassals. Parthian art echoes this diversity . . . . In contrast to Sasanian art, Parthian art was not the product of a strongly centralized monarchy. Rather, it reflects the social and political complexity of the time” (Kawami, 1979, p. 473).

For decoration bronze was used in a number of ways. Personal ornaments were the most frequent, but there were also statues, often used as architectural adornment, and figurines, utensils, vessels, and even some coins of low denomination (Colledge, pp. 80, 103-09). An important characteristic of the period is the prevalence of Hellenistic and Roman imports and influences. It is clear that a great deal of traffic crossed the empire. For example, Roman goods have been excavated as far east as Kāpiśī, the capital of the Kushan dynasty (250­-50 B.C.) in Afghanistan (Colledge, p. 83). Indigenous bronze craftsmanship must have been influenced by Hellenistic and Roman traditions, and it is likely that the practice of casting large statues by the lost-wax method spread from the west, though the technique itself was already well known in the Near East in earlier millennia (for description of lost-wax casting, see Untracht, pp. 338-77). Shrines at Seleucia on the Tigris are known to have contained statues in clay with imported bronze extremities (Colledge, p. 82).

Western influence is most visible in a large number of figurines found throughout the Parthian empire. At Nehāvand in western Iran bronze figurines of deities, including Zeus, Apollo, Minerva, and Isis Fortuna have been found (Colledge, p. 82, pl. 3a); they are presumed to be imports, arguably of late Parthian date (Kawami,

1979, p. 472). Other figurines, probably cast within the empire, are listed by Colledge (p. 88), including an image of Hercules from Aï Khanum ([Āy Ḵānom](http://www.iranicaonline.org/articles/ay-kanom-or-a-khanum-tepe-a-local-uzbek-name-lit)) in Afghanistan; an Eros and a statue of a kneeling youth from Babylonia; a griffin from Nisa (Nesā) in Turkmenistan; images of Hercules, Hermes, Eros, Nike, and an eagle from Hatra in northern Iraq; the bust of a ruler from Kurdistan; a warrior and a god with cornucopia from Bard-i Nishandeh ([Bard-e Nešānda](http://www.iranicaonline.org/articles/bard-e-nesanda-a-complex-of-ancient-ruins-in-kuzestan-situated-18-km-northwest-of-the-town-of-masjed-e-solayman-wher)) and a piper, a dancer, and comic animals from Masjid-i Suleiman (Masjed-e Solaymān), both in Ḵūzestān; a nude goddess from Iran; and images in local costume from the Gandhara region. Large figural sculpture was also produced in bronze. At Hatra a bronze acroterion representing Victory (Nike) on a globe (A.D. early 3rd century) adorned the “Hellenistic” Temple E (Colledge, p. 70, pl. 10b). In the Baḵtīārī (Bakhtiari) mountains of northeastern Ḵūzestān at the dynastic shrine of Shami (destroyed ca. A.D. 50), a life-size standing male statue, possibly of a Parthian prince or vassal was found, as well as a headless bronze statuette of a standing male and two bronze arms (Kawami, 1987, pp. 64-65, 169-74; see also Stein, 1940, pp. 141-59, fig. 11).

Bronze plaques with figural representations in re­poussé were another medium of decoration. At Masjid-i Suleiman two such plaques were found in the Parthian temple (ca. A.D. 200), and another is known from Hatra (Colledge, p. 101). Bronze also had functional uses in architecture, as in the bronze clamps that held blocks of stone together. Early Hellenistic column bases at Aï Khanum were held by such clamps, and in the colonnade of the temple of Bel at Palmyra, there was a bronze capital ornament (Colledge, p. 29).

Smaller bronze objects of the Parthian period also tended to be elaborate. From Parthian Nisa there are bronze platters decorated in relief, from Taxila and sites in Iran and Mesopotamia trays from perfume burners, from Masjid-i Suleiman lamps, ladles, and bowls (Col­ledge, p. 114). Unique small bronze finds include a lion-headed door knocker and a belt plaque (see [belts ii](http://www.iranicaonline.org/articles/belts#pt2)). Such plaques are depicted on the sculptures from Hatra and Shami, and at Masjid-i Suleiman an actual example was recorded (Colledge, p. 112). This site also produced what may be a musical instrument, a bronze triangle (Colledge, p. 135). Bronze bells from the period have been studied (Keiko).

Bronze mirrors, though found across central Asia (Frumkin, pp. 41, 69) and in Iran (Egami et al., II, p. 10, pl. XLIX no. 29), may be linked technologically to China. Of particular interest are mirrors from Susa and Masjid-i Suleiman with handles in the form of nude female figures (Colledge, p. 111).

During the Parthian period traditional methods of casting, turning, chasing, and hammering (over molds) were applied in the production of jewelry and table wares of bronze and precious metals (Colledge, p. 124). The use of raised metal flanges to hold cloisons was common on table wares and other items, and on fine pieces figures were represented in repoussé. Among so-called “Bactrian bowls” such figures were formed separately and attached by means of hammered metal flanges. This technique was to become characteristic of Sasanian metalwork. Small metal figurines were cast in both solid and hollow examples. The lost-wax method was used for larger bronze statues.

Because few Sasanian sites have been excavated, none comprehensively (Harper, 1986), Sasanian bronzes from the Iranian plateau are quite rare. The principal evidence comes from Ctesiphon and Kish in Iraq and from Tepe Hissar in northeastern Iran, Takht-i Sulei­man (Taḵt-e Solaymān) in Azerbaijan, and a number of sites in Fārs: [Bīšāpūr](http://www.iranicaonline.org/articles/bisapur-town), Fīrūzābād, and Qasr-i Abu Nasr (Qaṣr-e Abū Naṣr; possibly old Shiraz) in Fārs. Some of the best evidence for the use of bronze in the Sasanian period comes from the fortress at Qasr-i Abu Nasr, where a relatively large, well-dated assemblage was excavated (Whitcomb, pp. 16-19, 160-76). These objects are assumed to be of bronze, though no analyses have been conducted. They contrast sharply with those of the Parthian period in that most are items of daily use, but this contrast probably reflects a biased sample, rather than specific sociocultural differences, for studies of artifacts other than bronzes indicate that Sasanian material culture was as elaborate and as luxurious as that of the Parthians.

The artifacts from the fortress area at Qasr-i Abu Nasr include a more diverse array of tools and utensils than in earlier periods, among them a dipper, a ladle, bowls, plates or lids, closed vessels, handles, ringstands, forks, spoons, tongs, needles, awls, a fish hook, cru­cibles, and a mirror. Decorative artifacts cast in bronze are well represented: buckles, attachments, hooks, pendants in the shapes of animals, a seal, fibulae, bells, and pins. Bronze jewelry includes earrings, pendants, an amulet case, fragments of chain, finger rings, bracelets, buttons, bosses, and guards (Whitcomb, p. 176). Indi­vidual parallels for some of these objects have been identified at such sites as Pyandzhikent in Sogdia and Istakhr (Eṣṭaḵr), Nīšāpūr, Susa, Tal-i Malyan, Qaleh Yazdigerd (Qaḷʿa-ye Yazdegerd), and Mālamīr (Malāmīr) in Iran (Whitcomb).

Such military hardware as spear points, lance points, and arrowpoints, most often tanged, were also found at the fortress; they are “indicative of diverse chronological, and perhaps cultural associations . . .” (Whitcomb, p. 168). Of eight types one is exclusively made of iron and seven usually of bronze. Large points are rare. Parallels for many weapon types are recorded at such sites as Tureng (Tūrang) Tepe, Besṭām, Persepolis, Pasargadae, Istakhr, Susa, and Tepe Yahya (Whit­comb, p. 168). A piece of armor is composed of thirteen iron scales and a single bronze spacer scale. Scale armor is also known from Pasargadae and Pyandzhikent (Whitcomb, p. 169).

From this assemblage it is clear that copper and bronze occurred in a variety of forms, many of them decorative, at Qasr-i Abu Nasr. The finest specimens are cast. A rare group of stucco molds excavated at Khokhe in southern Mesopotamia (Negro Ponzi) is evidence of the casting methods used in the Sasanian period. It has been suggested that terracotta models could have been produced from such stucco molds and distributed to workshops all over the empire, which would permit standardization in decorative bronze work (Harper, 1978, p. 87). Several detailed studies confirm increasing elaboration of bronze artifacts in the Sasanian period: a trimetallic helmet (bronze, iron, and gold; Granscay; Overlaet, 1982), ox-headed maces (Harper, 1985), a bronze plate (Eghbal), belts (Ghirshman, 1979), and horse trappings (Ghirshman, 1977).

The introduction of high-tin bronze. Toward the end of the Sasanian period high-tin bronze artifacts began to appear; they became common in early Islamic Iran (see ii below). These objects represent a technical apogee in the alloying of copper with tin. Only the earliest documented appearance of this particular kind of bronze and the possible sources of the technology are addressed here.

A bronze with a tin content of 20 percent or higher can easily be produced by means of smelting together cassiterite (the common tin ore, SnO2) with copper ore in proper proportions. Early in this century W. Gow­land demonstrated this point by smelting 15 pounds of malachite with 10 pounds of cassiterite, 7.5 pounds of limestone (flux), and 10 pounds of charcoal (Gowland, 1912). The resulting bronze had a tin content of 22 percent. Though such an alloy can easily be produced by smelting, proper working of the metal requires a sophisticated understanding of its properties (Goodway and Conklin). The technology required has been de­scribed by Cyril Stanley Smith: “A copper-tin alloy with a content of c. 22% tin becomes plastic at c. 550 C, melts at 725 C, and is very plastic between those two temperatures. Fully molten at 800 C, it is easy to cast. It can be red-hot forged; if cooled slowly it will shatter if hammered; if quenched it becomes moderately hard and reasonably malleable, though not as malleable as ordinary bronze. With time it acquires a black patina” (apud Allan, p. 46; see also Melikian-Chirvani, p. 124). The most significant aspect of this process is the danger that the alloy will become brittle. Castings break easily, with sharply defined, rectilinear edges not unlike those of shattered pottery, unless quenched. Artifacts made from this alloy usually have simple forms, for example, hemispherical and stem bowls, which can be hammered to shape. More complex contours would be difficult to produce, because the metal must be forged at red heat (Allan, p. 47). Whether forging and quenching have in fact occurred can be ascertained only by metallography, the study of the microstructure of polished and etched samples of metal (e.g., Goodway and Conklin, 1987, figs. 4-7).

Perhaps the earliest example of a high-tin bronze artifact of possibly Iranian origin is a “Luristan bronze” of unknown provenience in the Ashmolean Museum, Oxford (Moorey, 1976, p. 359; 1971, no. 205). Three artifacts from Ghar-i Mar in Afghanistan have been dated to ca. A.D. 300 and another to ca. A.D. 500 (Dupree; Caley, 1971, pp. 108-09). The earliest artifacts of high-tin bronze actually excavated in Iran are a bowl and a mirror from a tomb in Deylamān dated by the excavator to the latter half of the Parthian period (Egami et al., II, pp. 9-10, 18, pls. 43, 49; Allan, p. 47, has suggested A.D. the 4th century). The composition of the bowl is recorded as including 21.4 percent tin, 1.2 percent lead, and 0,7 percent iron (Dōno, pp. 112, 217, fig. 66; Melikian-Chirvani, p. 135 n. 40). However, it is not until the late Sasanian period that artifacts of high­-tin bronze, primarily bowls and vessels, begin to appear with any frequency (Harper, 1978, p. 86).

By the early Islamic period the technology was sufficiently evolved to permit manufacture of standard­ized hemispherical and stem bowls in high-tin bronze. Unfortunately, no metallographic studies of well-dated pieces have been undertaken, but radiography of seven early Islamic bronzes revealed changes in wall thickness consistent with the conclusion that these artifacts had been forged, rather than simply cast (Van Zelst and Meyers apud Melikian-Chirvani, pp. 149-50).

It is clear that high-tin bronze artifacts were difficult to make and were relatively rare until the later Sasanian and early Islamic periods. It has been argued that in the Sasanian period, when silver was the preferred metal for luxurious display, high-tin bronze, with its character­istic silvery hue, may have provided a cheaper alterna­tive for lower social strata (Harper, 1978, pp. 86-87, 95). Its color is also close to that of unoxidized iron or steel, however; furthermore, both high-tin bronze and iron or steel develop a black surface coating when oxidized. Perhaps most significant is that both steel and high-tin bronze can be quenched and that quenching produces marked transformations in the physical and mechanical properties of both: Steel becomes markedly harder, whereas high-tin bronze becomes more malleable and gives a ringing sound when struck (Goodway and Conklin). Craddock (1979) has noted that the 4th/10th-­century Islamic alchemist Jāber b. Ḥayyān included ḵārṣīnī“chinese iron” among the seven metals, the others being gold, silver, lead, tin, copper, and iron (see EI2, s.vv. Djābir b. Ḥayyān, Khārṣīnī). Other sources reported that ḵārṣīnī was used for mirrors in China, and analyses of early Chinese mirrors have shown that they are indeed made of high-tin bronze (Allan, 1979, pp. 49­-51). Craddock has equated ḵārṣīnī in turn with haftjūš (lit. “boiled seven times”), which he interprets as referring to the necessity of reheating the alloy re­peatedly during manufacturing (p. 74). Modern arti­facts from Kermān identified by their craftsmen as of haftjūš have been shown by analysis to be high-tin bronzes (Allan, p. 51; Craddock, pp. 74, 77; Wulff, p. 18).

It is thus possible that high-tin bronze was being imported from China in the Parthian period and later and that this alloy was perceived in the West as a form of iron. During the Sasanian period, with the desire to emulate silver and perhaps to imitate imported wares, standardized production of cheaper high-tin bronze may have begun, reaching its full development in Iran in the early Islamic period (see ii below).

Bibliography:

A. Alizadeh, “A Tomb of the Neo-Elamite Period at Arjan, near Behbahan,” AMI 18, 1985, pp. 49-73.

J. W. Allan, Persian Metal Technology 700-1300 AD, London, 1978.

P. Amiet, “Archaeological Discontinuity and Ethnic Duality in Elam,” Antiquity 53, 1979, pp. 195-204.

Idem et al., “La spectrométrie de masse éclaire et les chemins de la métallurgie,” in La vie mystérieuse des chefs­ d’œuvre. La science au service de l’art, Paris, 1980, pp. 85-87.

D. Bazin and H. Hübner, “Copper De­posits in Iran,” Geological Survey of Iran, Report 13, Tehran, 1969.

T. W. Beale, “Early Trade in Highland Iran. A View from a Source Area,” World Archae­ology 5, 1973, pp. 133-48.

T. Berthoud, Étude par l’analyse de traces et la modélisation de la filiation entre minérai de cuivre et objets archéologiques du Moyen-Orient (IVème et IIIèmemillénaires avant notre ère), unpublished Ph.D. thesis, Paris, 1979.

T. Berthoud et al., Étude sur la métallurgie iranienne aux IVème-IIIème millénaires, Paris, 1975.

T. Berthoud et al., Les anciennes mines de cuivre en Iran, Paris, 1976.

T. Berthoud et al., Les anciennes mines d’Afghanistan, Paris, 1977.

T. Berthoud et al., Les anciennes mines de cuivre du sultanat d’Oman, Paris, 1978.

T. Berthoud et al., “The Early Iranian Metallurgy Analytical Study of Copper Ores from Iran,” in Proceedings of the 18th International Symposium on Archaeometry andArchae­ological Prospection, Cologne, 1979, pp. 68-74.

T. Berthoud et al., “Data Analysis. Towards a Model of Chemical Modification of Copper from Ores to Metal,” in Scientific Studies in Early Mining and Extractive Metallurgy, ed. P. T. Craddock, British Museum Occasional Papers 20, 1980a, pp. 87-102.

T. Berthoud et al., “Production, échange et utilisation des métaux. Bilan et perspectives des recherches archéométriques récentes dans le domaine oriental,” Paléorient 6, 1980b, pp. 99-127.

T. Berthoud et al., “Cuivres et alliages en Iran, Afghanistan, Oman au cours des IVᵉ et IIIᵉ millénaires,” Paléorient 8, 1982, pp. 39-54.

T. Berthoud and J. Françaix, Contribution à l’étude de la métallurgie de Suse aux IVᵉ and IIIᵉ millénaires. Analyse des éléments-traces par spec­trométrie d’émission dans l’ultra-violet et spectro­métrie de masse à étincelles, Rapport CEA-4-5033, Gif-sur-Yvette (France), 1980.

R. Besenval, “Un mors achéménide en provenance du Gorgan,” Iran 20, 1982, pp. 177-79.

G. M. Bulgarelli, “The Lithic Industry of Tepe Hissar at the Light of Recent Excavation” in South Asian Archaeology, 1977, ed. M. Taddei, Naples, 1979, pp. 39-54.

C. Burney and D. M. Lang, People of the Hills, New York, 1972. T. Burton-Brown, Excavations in Azerbaijan, 1948, London, 1951.

J. R. Caldwell, ed., Investigations at Tal-i-Iblis, Illinois State Museum Preliminary Re­ports 9, Springfield, 1967.

Idem, “Tal-i-Iblis and the Beginning of Copper Metallurgy in the Fifth Millen­nium,” Archaeologia Viva 1, September-November 1968, pp. 145-50.

Idem and S. Malek Shahmirzadi, Tal-i-Iblis. The Kerman Range and the Beginning of Smelting, Illinois State Museum Preliminary Reports 7, Springfield, 1966.

E. R. Caley, “Analyses of Some Metal Artifacts from Ancient Afghanistan,” in Science and Archaeology, ed. R. H. Brill, Cambridge, 1971, pp. 106-13.

Idem, “Chemical Examination of Metal Artifacts from Afghanistan,” in L. Dupree, ed., Prehistoric Research in Afghanistan, 1959-66, Transactions of the American Philosophical Society, N.S. 62, Philadelphia, 1972, pp. 44-50.

Idem, “Chemi­cal Composition of Some Early Copper Alloys Found in Afghanistan,” Vijnana Parishad Anusan­dhan Patrika 23/3, 1980, pp. 223-33.

G. W. Carriveau, “Application of Thermoluminescence Dating Tech­niques to Prehistoric Metallurgy,” in Applications of Science to the Dating of Works of Art, ed. W. J. Young, Boston, 1978, pp. 59-66.

E. N. Chernykh, “Nekotorye rezul’taty izucheniya metalla anauskoĭ kul’tury” (Results of the analysis of metal of the Anau culture), Kratkie soobshcheniya Instituta Arkheologii 91, 1962, pp. 30-37.

V. M. Chmyriov et al., “Mineral Resources of Afghanistan,” in Geology and Mines and Industries of the Republic of Afghanistan I, Kabul, 1973.

S. Cleuziou, “Les pointes de flèches "scythiques" au Proche et Moyen Orient,” in Le plateau iranien et l’Asie centrale des origines à la conquête islamique, ed. J. Deshayes, Paris, 1977, pp. 187-99.

Idem and T. Berthoud, “Early Tin in the Near East. A Reassessment in the Light of New Evidence from Afghanistan,” Expedition 25/1, 1982, pp. 14-19.

H. H. Coghlan, “Some Fresh Aspects of the Prehistoric Metallurgy of Copper,” Antiquaries Journal 22, 1942, pp. 22-38.

Idem, Notes on the Prehistoric Metallurgy of Copper and Bronze in the Old World, 2nd ed., Oxford, 1975.

M. A. Colledge, Parthian Art, Ithaca, 1977.

G. Contenau and R. Ghirshman, Fouilles du Tépé Giyan près de Néhavend, 1931 et 1932, Paris, 1935.

P. T. Craddock, “The Copper Alloys of the Medieval Islamic World—Inheritors of the Classical Tradition,” World Archaeology 11/1, 1979, pp. 68-79.

H. Crawford, “Geoy Tepe 1903. Material in the Collection of the Fitz-­William Museum, Cambridge,” Iranica Antiqua 11, 1975, pp. 1-28.

J. Curtis, “Late Assyrian Bronze Coffins,” Anatolian Studies 33, 1983, pp. 85-95.

Idem, Nush-i Jan III. The Small Finds, London, 1984.

Idem, ed., Bronzeworking Centres of Western Asia 1000-539 B.C., London, 1988.

J. Deshayes, “Marteaux de bronze iraniens,” Syria 35, 1958, pp. 284-93.

Idem, Les outils de bronze de l’Indus au Danube (IVᵉ au IIᵉ millénaire), Bibliothèque archéologique et historique 71, 2 vols., Paris, 1960.

Idem, “Haches-herminettes iraniennes,” Syria 40, 1963, pp. 273-76.

Idem, “Nouveaux outils iraniens,” Syria 42, 1965, pp. 91-108.

Idem and J. Christophe, Index de l’outillage. Outils de métal de l’âge du bronze des Balkans à l’Indus II: Commen­taires, Paris, 1964.

T. Dōno, Kodai kinzoku bunkashi (Chemical investigations of the ancient metallic cul­ture), Tokyo, 1967.

R. C. Dougherty and J. R. Cald­well, “Evidence of Early Pyrometallurgy in the Kerman Range in Iran,” Science 153, 1966, pp. 984­-85.

L. Dupree, “Prehistoric Archeological Surveys and Excavations in Afghanistan, 1959-1960 and 1961-1963,” Science 146, 1964, pp. 638-40.

E. C. L. During Caspers, “La hachette trouée de la sépulture E de Khurāb dans le Balouchistan persan. Examen rétrospectif,” Iranica Antiqua 9, 1972, pp. 60-64.

R. H. Dyson, Jr., “Archaeological Scrap. Glimpses of History at Ziwiye,” Expedition5/3, 1963, pp. 32-­37.

Idem, “Problems of Protohistoric Iran Seen from Hasanlu,” JNES 24/3, 1965, pp. 193-217.

E. R. Eaton and H. McKerrell, “Near Eastern Alloying and Some Textual Evidence for the Early Use of Arsenical Copper,” World Archaeology 8/2, 1976, pp. 169-91.

N. Egami et al., Dailaman I-II, Tokyo, 1965-66.

H. Eghbal, “Un plat de bronze sassanide,” Studia Iranica 14/2, 1985, pp. 141-45.

G. Frumkin, Archaeology in Soviet Central Asia, Leiden and Cologne, 1970.

S. Fukai and J. Ikeda, Dailaman IV, Tokyo, 1971. R. Ghirshman, Fouilles de Sialk I, Paris, 1938.

Idem, Suse. Village perse-achéménide, MMAI 36, Paris, 1954.

Idem, “La ceinture en Iran,” Iranica Antiqua 14, 1979, pp. 167-96.

Idem, “L’Iran. La migration des Indo-Aryens et des Iraniens,” in Akten des VII. Internationalen Kongresses für Iranische Kunst and Archäologie. München 7-10 September 1976, AMI, Ergänzungsband 6, Berlin, 1979, pp. 63-66.

C. Goff, “Excavations at Baba Jan. The Pottery and Metal from Levels III and II,” Iran 16, 1978, pp. 38-65.

F. A. Gooch, “The Analysis of the Metallic Implements and Products of Corrosion,” in Explorations in Turkestan. Expedition of 1904. Prehis­toric Civilizations of Anau, Origins, Growth, and Influence of Environment I, ed. R. Pumpelly, Washing­ton, D.C., 1908, pp. 235-40.

M. Goodway and H. Conklin, “Quenched High-Tin Bronze from the Philippines,” Archeomaterials 2/1, 1987, pp. 1-27.

M. V. Gorelik, “Zashchitnoe vooruzhenie Persov i Midyan Akhemenidskogo vremeni” (Defensive armor of the Persians and the Medes in the Achaemenid period), in VDI 3, 1982-83, pp. 90-106.

W. Gowland, The Metals in Antiquity, London, 1912.

S. V. Granscay, “A Sasanian Chieftain’s Helmet,” Bulletin of the Metropolitan Museum of Art, N.S. 21, 1963, pp. 253-62.

E. Haerinck, “The Iron Age in Guilan. Proposal for a Chronology,” in Bronzeworking Centres of Western Asia 1000-539 B.C., ed. J. Curtis, London, 1988, pp. 63-78.

Idem and B. Overlaet, “Armes et outils miniatures en Afghanistan et en Iran à l’Age du Fer,” in De l’Indus aux Balkans (Recueil à la mémoire de Jean Deshayes), ed. J.-L. Huot et al., Paris, 1985, pp. 389-416.

L. Halm, “Analyse chimique et étude micrographique de quelques objets de métal cuivreux provenant du Tepe-Giyan,” in G. Contenau and R. Ghirshman, Fouilles de Tépé Giyan près de Néavend 1931 et 1932, Paris, 1935, pp. 135-38.

Idem, “Analyse chimique et étude micrographique de quelques pièces de métal et de céramique provenant de Sialk,” in R. Ghirshman, Fouilles de Sialk II, Paris, 1939, pp. 205­-08.

P. O. Harper, The Royal Hunter, Art of the Sasanian Empire, New York, 1978.

Idem, “The Ox-Headed Mace in Pre-Islamic Iran,” in Papers in Honor of Professor Mary Boyce I, Acta Iranica 24, Leiden, 1985, pp. 247-59.

Idem, “Art in Iran v. Sasanian,” in EIr. I/6, 1986, pp. 585-94.

A. Haupt­mann, “Zur frühbronzezeitlichen Metallurgie von Shahr-i Sokhta (Iran),”Der Anschnitt 32/2-3, 1980, pp. 55-61.

G. Herrmann, “Lapis Lazuli. The Early Phases of Its Trade,” Iraq 30, 1968, pp. 21-57.

D. L. Heskel, The Development of Pyrotechnology in Iran during the Fourth and Third Millennia B.C., Ph.D. dissertation, Harvard University, 1982.

Idem, “A Model for the Adoption of Metallurgy in the Ancient Middle East,” Current Anthropology 24/3, 1983, pp. 362-66.

Idem and C. C. Lamberg-Karlovsky, “An Alternative Sequence for the Development of Metallurgy. Tepe Yahya, Iran,” in The Coming of the Age of Iron, ed. T. A. Wertime and J. D. Muhly, New Haven, 1980, pp. 229-65.

Idem, “Metallurgical Tech­nology,” in Excavations at Tepe Yahya, Iran, 1967-1975, ed. C. C. Lamberg-Karlovsky and T. W. Beale, Cambridge, Mass., 1986, pp. 207-14.

F. Hole, Studies in the Archaeological History of the Deh Luran Plain. The Excavations of Chogha Sefid, University of Michigan Museum of Anthropology Memoir 9, Ann Arbor, 1977.

Idem, ed., The Archaeology of Western Iran. Settlement and Society from Prehistory to the Islamic Conquest, Washington, D.C., 1987.

H. F. Holzer and M. Momenzadeh, “Ancient Copper Mines in the Veshnoveh Area, Kuhestan-e-Qom, West Central Iran,” Archaeologia Austriaca 49, 1971, pp. 1-22.

A. Isakov et al., “Metallurgical Analysis from Sarazm, Tadjikistan SSR,” Archaeometry 29/1, 1987, pp. 90-102.

J.-F. Jarrige, “A propos d’une forêt à tige hélicoïdale en cuivre de Mundigak,” in De l’Indus aux Balkans (Recueil à la mémoire de Jean Deshayes), ed. J.-L. Huot et al., Paris, 1985, pp. 281­-92.

T. S. Kawami, review of M. A. Colledge, Parthian Art, in The Art Bulletin 61/3, 1979, pp. 471-73.

Idem, Monumental Art of the Parthian Period in Iran, Acta Iranica 26, Leiden, 1987, chap. IV.

I. Keiko, “Bronze Belts from Iran,” Bulletin of the Ancient Orient Museum 3, 1981, pp. 103-13. W. Kleiss, Bastam I, Berlin, 1979.

P. Knauth, The Metalsmiths, New York, 1974. G. Ladame, “Les ressources métallifères de l’Iran,” Schweizerische mineralogische und petro­graphische Mitteilungen 25, 1945, pp. 167-303.

C. C. Lamberg-Karlovsky, The Development of a Metallurgical Technology. Documented Early Finds of Metals in the Near East and the Evidence from Hasanlu, Iran, Ph.D. dissertation, University of Pennsylvania, 1965.

Idem, “Archaeology and Metal­lurgical Technology in Prehistoric Afghanistan, India and Pakistan,” American Anthropologist 69, 1967, pp. 145-62.

Idem, “Further Notes on the Shaft-­Hole Pick-Axe from Khurāb, Makrān,” Iran 7, 1969, pp. 163-68.

Idem and T. W. Beale, Excavations at Tepe Yahya, Iran 1967-1975, Cambridge, 1986.

H. Lechtman, “Corrigenda to the Technical Appendix [of Lamberg-Karlovsky, 1969],” Iran 8, 1970, p. 173.

L. D. Levine and C. Hamlin, “The Godin Project. Seh Gabi,” Iran 12, 1974, pp. 211-13.

L. D. Levine and T. C. Young, Jr., eds., Mountains and Lowlands. Essays in the Archaeology of Greater Mesopotamia, Bibliotheca Mesopotamica 7, Malibu, 1977.

M. Maczek at al., “Beiträge zum Problem des Ursprunges der Kupfererzverwertung in der Alten Welt,” Archaeologia Austriaca 10, 1952, pp. 61-70.

R. Maddin at al., “Distinguishing Artifacts Made of Native Copper,” Journal of Archaeological Science 7/3, 1980, pp. 211-26.

Idem, ed., The Beginning of the Use of Metals and Alloys, Cambridge, Mass., 1988.

Y. Majidzadeh, “An Early Prehistoric Coppersmith Workshop at Tape Ghabristan,” in Akten des VII. Internationalen Kongresses für Iranische Kunst und Archäologie. München 7-10 September 1976, AMI, Ergänzungsband 6, Berlin, 1979, pp. 82-92.

S. J. Maréchal, “Étude sur les propriétés mécaniques des cuivres à l’arsénic,” Métaux. Corrosion-Industries 33, 1958, pp. 377-83.

K. R. Maxwell-Hyslop, “Note on a Shaft-Hole Axe-Pick from Khurab, Makran,” Iraq17, 1955, p. 161.

I. N. Medvedskaya, “Metalli­cheskie nakonechniki strel perednego vostoka i ev­raziĭskikh stepeĭ II-pervoĭ poloviny I tysyacheletiya do n. è.” (Metal arrowheads of the second to the first half of the 1st millennium B.C. from the Near East and the Eurasian steppes), Sovetskaya arkhe­ologiya 4, 1980, pp. 23-37 (with English summary).

Idem, Iran. Iron Age I, tr. S. Pavlovich, British Archaeological Reports, I.S. 126, Oxford, 1982.

A. S. Melikian-Chirvani, “The White Bronzes of Early Islamic Iran,” Metropolitan Museum Journal 9, 1974, pp. 123-51.

P. R. S. Moorey, “Prehistoric Copper and Bronze Metallurgy in Western Iran,” Iran7, 1969, pp. 131-54.

Idem, Catalogue of the Ancient Persian Bronzes in the Ashmolean Museum, Oxford, 1971.

Idem, “Parthian and Sasanian Metalwork in the Bomford Collection,” Burlington Magazine, June 1976, pp. 358-61.

Idem, Cemeteries of the First Mil­lennium B.C. at Deve Hüyük Near Carchemish, Salvaged by T. E. Lawrence and C. L. Woolley in 1913, British Archaeological Reports I.S. 87, Oxford, 1980.

Idem, “Archaeology and Pre-Achaemenid Metal­working in Iran. A Fifteen Year Retrospective,” Iran 20, 1982, pp. 81-101.

Idem, Materials and Manufac­ture in Ancient Mesopotamia. The Evidence of Archae­ology and Art, British Archaeological Reports, I.S. 237, Oxford, 1985.

J. D. Muhly, Copper and Tin, Transactions of The Connecticut Academy of Arts and Sciences 43, Hamden, 1973.

Idem, Supplement to Copper and Tin, Hamden, Conn., 1976.

Idem, “The Copper Ox-Hide Ingots and the Bronze Age Metals Trade,” Iraq 39, 1977, pp. 73-82.

Idem, “Kupfer. Archäologisch,” in RIA VI, pp. 348-64.

Idem, “Sources of Tin and the Beginnings of Bronze Metallurgy,” AJA 89, 1985, pp. 275-91.

Idem, review of Penhallurick, in Archeomaterials 2, 1987, pp. 99­-107.

O. W. Muscarella, “A Fibula from Hasanlu, Northwestern Iran,” AJA, 2nd ser., 69/3, 1965, pp. 233-40.

Idem, “The Excavations at Agrab Tepe, Iran,” Metropolitan Museum Journal 8, 1973, pp. 47-76.

Idem, “The Iron Age at Dinkha Tepe, Iran,” Metropolitan Museum Journal 9, 1974, pp. 35-90.

Idem, “Unexcavated Objects and Ancient Near East­ern Art,” in Mountains and Lowlands, Essays in the Archaeology of Greater Mesopotamia, ed. L. D. Le­vine and T. C. Young, Jr., Bibliotheca Mesopotami­ca 7, Malibu, 1977a, pp. 153-207.

Idem, “"Ziwiye" and Ziwiye, Forgery of a Provenience,” Journal of Field Archaeology 4, 1977b, pp. 197-219.

Idem, “Iranian Art and Archaeology,” Journal of Field Archaeology 5, 1978, pp. 241-45.

Idem, Unexcavated Objects and Ancient Near Eastern Art, Addenda, Monographic Journals of the Near East, Occasional Papers 1/1, Malibu, 1979.

Idem, “Excavated and Unexcavated Achaemenian Art,” in Ancient Persia. The Art of an Empire, ed. D. Schmandt-Besserat, Malibu, 1980, pp. 23-42.

Idem, “Surkh Dum at The Metropolitan Museum of Art. A Mini-Report,” Journal of Field Archaeology 8, 1981, pp. 327-59.

Idem, “Fibulae and Chronology, Marlik and Assur,” Journal of Field Archaeology11/4, 1984, pp. 413-19.

Idem, “The Background to the Luristan Bronzes,” in Bronzeworking Centres of Western Asia 1000-539 B.C., ed. J. Curtis, London, 1988, pp. 33-44.

E. O. Negahban, A Preliminary Report on Marlik Excavation, Gohar Rud Expedition, Rudbar 1961-62, Teh­ran, 1964.

Idem, A Guide to the Haft Tepe Excavation and Museum, Tehran, 1977.

Idem, “Pottery and Bronze Human Figures of Marlik,” AMI 12, 1979a, pp. 157-73.

Idem, “Seals of Marlik,” in Akten des VII. Internationalen Kongresses für Iranische Kunst und Archäologie. München 7-10 September 1976, AMI, Ergänzungsband 6, Berlin, 1979b, pp. 108-37.

Idem, “The Seals of Marlik Tepe,” JNES 36, 1979c, pp. 81-102.

Idem, “Maceheads from Marlik,” AJA 85, 1981, pp. 367-78.

Idem, “Metal Vessels from Marlik,” Prähistorische Bronzefunde, Abt. 2, III, Munich, 1983.

Idem, Excavations at Haft Tepe, Iran, University Museum Monograph 70, Philadelphia (forthcoming).

M. Negro Ponzi, “Some Sasanian Moulds,” Mesopotamia 2, 1967, pp. 57-92.

I. M. Nicholas, A Spatial/Functional Analysis of Late Fourth Millennium Occupation at the TUV Mound, Tal-e Malyan, Iran, Ph.D. dissertation, University of Pennsylvania, Philadelphia, 1980.

Idem, The Proto-­Elamite Settlement at TUV, University Museum Monograph 69, Malyan Excavation Reports 1, Phila­delphia (forthcoming).

B. J. Overlaet, “Pointed Helmets of the Iron Age from Iran,” Iranica Antiqua 14, 1979, pp. 51-65.

Idem, “Contribution to Sasanian Armament in Connection with a Decorated Helmet,” Iranica Antiqua 17, 1982, pp. 189-206.

R. D. Panhallurick, Tin in Antiquity. Its Mining and Trade throughout the Ancient World with Particular Ref­erence to Cornwall, London, 1986.

V. C. Pigott, “Research at the University of Pennsylvania on the Development of Ancient Metallurgy. Research at MASCA,” Paléorient 6, 1980a, pp. 105-10.

Idem, “The Iron Age in Western Iran,” in T. A. Wertime and J. D. Muhly, eds., The Coming of Age of Iron, New Haven, 1980b.

Idem, The Adoption of Iron in Western Iran in the Early First Millennium B.C. An Archaeometallurgical Study, Ph.D. dissertation, Uni­versity of Pennsylvania, 1981.

Idem, “Āhan,” in EIr. I/6, 1984, pp. 624-33.

Idem et al., “Pyrotechnology and Culture Change at Bronze Age Tepe Hissar (Iran),” in T. A. Wertime and S. F. Wertime, eds., Early Pyrotechnology. The Evolution of the First Fire-­Using Industries, Washington, 1982, pp. 215-36.

W. Rostoker et al., “Direct Reduction to Copper Metal by Oxide/Sulfide Mineral Interaction,” Archeoma­terials (forthcoming).

V. D. Ryzanov, “O neko­torykh drevnikh olovorudnykh istochnikakh na ter­ritorii Uzbekistana” (On some ancient sources of tin ore in Uzbekistan), Istoriya material’noĭ kul’tury Uzbekistana 15, 1997, pp. 98-104.

S. Salvatori, “Problemi di protostoria iranica. Note ulteriori su di una ricognizione di superficie a Shahdad (Kerman, Iran),” Rivista di Archeologia 2, 1978, pp. 5-15.

Idem and M. Vidale, “A Brief Surface Survey of the Protohistoric Site of Shahdad (Ker­man, Iran). Preliminary Report,” Rivista di Archeologia 6, 1982, pp. 5-10.

J. Shaffer, “The Later Prehistoric Periods,” in The Archaeology of Afghani­stan from the Earliest Times to the Timurid Period, ed. F. R. Allchin and N. Hammond, New York, 1978, pp. 71-86.

M. de Schauensee, “Northwest Iran as a Bronzeworking Center. The View from Hasanlu,” in Bronzeworking Centres of Western Asia 1000-539 B.C., ed. J. Curtis, London, 1988, pp. 45-62.

Idem and R. H. Dyson, Jr., “Hasanlu Horse Trappings and Assyrian Reliefs,” in Essays on Near Eastern Art and Archaeology in Honor of Charles-Kyrle Wilkinson, ed. P. O. Harper and H. Pittman, New York, 1983, pp. 59-77.

E. Schmidt, Excavations at Tepe Hissar, Iran, 1931-33, Philadelphia, 1937.

Idem, “The Sec­ond Holmes Expedition to Luristan,” Bulletin of the American Institute for Persian Art and Archaeology 5/3, 1938, pp. 205-16.

Idem, Persepolis II, Chicago, 1957.

H. Schurenberg, “Über iranische Kupfererz­vorkommen mit komplexen Kobalt-Nickelerzen,” Neues Jahrbuch für Mineralogie, Abh. 99/2, 1963, pp. 200-30.

U. Seidl, “Urartu as a Bronzeworking Center,” in Bronzeworking Centres of Western Asia 1000-539 B.C., ed. J. Curtis, London, 1988, pp. 169-­76.

M. Shahmirzadi, Tepe Zagheh, A Sixth Millennium B.C. Village in the Qazvin Plain of the Central Iranian Plateau, Ph.D. dissertation, University of Pennsylvania, Philadelphia, 1977.

Idem, “Copper, Bronze, and Their Implementation by Metalsmiths of Sagzabad, Qazvin Plain, Iran,” AMI 12, 1979, pp. 49-66.

A. Shareq et al., Mineral Resources of Afghanistan, Afghan Geological and Mines Survey, United Nations Development Support Project, AFG/74/012, 2nd ed., Kabul, 1977.

C. S. Smith, “The Interpretation of Microstructures of Metallic Artifacts,” in W. J. Young, ed., Applications of Science in the Examination of Works of Art, Boston, 1965, pp. 20-52.

Idem, “Metallographic Study of Early Artifacts Made from Native Copper,” in Actes du XIᵉ Congrès international d’histoire des sciences, Warsaw VI, 1968, pp. 237-43.

Idem, “Analysis of the Copper Bead from Ali Kosh,” in Prehistory and Human Ecology of the Deh Luran Plain. An Early Village Sequence from Khuzistan, Iran, ed. F. Hole et al., Ann Arbor, 1969, pp. 427-28.

Idem, “Techniques of the Luristan Smith,” in Science and Archaeology, ed. R. H. Brill, Cambridge, Mass., 1971, pp. 32-52.

Idem, “Art Technology and Science. Notes on their Historical Interaction,” Technology and Culture 11/4, 1970, pp. 493-549.

Idem, “On Art, Invention and Technology,” Technology Review 78/7, 1976, pp. 2-7.

R. Solecki, “A Copper Mineral Pendant from North­ern Iraq,” Antiquity 43, 1969, pp. 311-14.

T. Sono and S. Fukai, Dailaman III, Tokyo, 1968.

T. Stech and V. C. Pigott, “The Metals Trade in Southwest Asia in the Third Millennium B.C.,” Iraq 48, 1986, pp. 39-64.

M. A. Stein, Archaeological Reconnais­sance in Northwestern India and Southeastern Iran, London, 1937.

Idem, Old Routes in Western Iran, London, 1940.

J. Stöcklin et al., Central Lut Reconnaissance, East Iran, Geological Survey of Iran, Report 22, Tehran, 1972.

D. Stronach, Pasargadae, Oxford, 1978.

T. Sulimirski, “The Background of the Ziwiye Find and Its Significance in the Development of Scythian Art,” Bulletin of the Institute of Archae­ology 15, 1978, pp. 7-33.

F. Talton, Métallurgie susienne, 2 vols., Paris, 1987.

N. Terekhova, “The History of Metalworking Production among the Ancient Agriculturalists of Southern Turkmenia,” in The Bronze Age Civilizations of Central Asia. Recent Soviet Discoveries, ed. P. L. Kohl, Armonk, N.Y., 1981, pp. 313-24.

M. Tosi, “The Lapis Lazuli Trade across the Iranian Plateau in the Third Millennium B.C.,” in Gururājamañjarikā. Studi in onore di Giusep­pe Tucci, Naples, 1974, pp. 3-22.

Idem, “A Bronze Female Statuette from Shahr-i Sokhta. Chronological Problems and Stylistical Connections,” in Prehistoric Sīstān I, Rome, 1983, pp. 303-17.

F. Tawḥīdī and A. M. Ḵalīlīān, “Gozāreš-e barrasī-e ašyāʾ-e ārāmgāh-e Arrajān—Behbahān,” Āṯār 7-9, 1982, pp. 232-86.

R. F. Tylecote, “Early Metallurgy in the Near East,” Metal and Materials 4, 1970, pp. 285-93.

Idem, “A Metallurgical Examination of Some Ob­jects from Marlik, Iran,” Bulletin of the Historical Metallurgy Group 6, 1972, pp. 34-35.

Idem, “Can Copper Be Smelted in a Crucible?” Journal of the Historical Metallurgy Society 8/1, 1974, p. 54.

Idem and H. McKerrell, “Examination of Copper Alloy Tools from Tal y Yahya, Iran,” Bulletin of the Historical Metallurgy Group 5/1, 1971, pp. 37-38.

Idem, in Excavations at Tepe Yahya, Iran, 1967-1975, ed. C. C. Lamberg-Karlovsky and T. W. Beale, Cambridge, Mass., 1986, pp. 207-14.

O. Untracht, Metal Techniques for Craftsmen, London, 1969.

L. Vanden Berghe, La nécropole de Khurvin, Istanbul, 1964.

Idem, “La chronologie de la civilisation des bronzes du Pusht-i Kuh, Luristan,” in Proceedings of the 1st Annual Symposium of Archaeological Research in Iran 1972, Tehran, 1973, pp. 1-6.

Idem, Bibliographie analytique de l’archéologie de l’Iran ancien, Leiden, 1979.

Idem and E. Haerinck, Bibliographie analytique de l’archéologie de l’Iran ancien. Supplement 1, 1978-­80, Leiden, 1981.

Idem, Bibliographie analytique de l’archéologie de l’Iran ancien, Supplement 2, 1981-85, Leiden, 1987.

M. Van Loon, Urartian Art, Istanbul, 1966. Idem et al., The Holmes Expedition to Luristan, Oriental Institute Publication 108, Chicago (forth­coming).

A. R. Vatandoost-Haghighi, Aspects of Prehistoric Iranian Copper and Bronze Technology, Ph.D. dissertation, Institute of Archaeology, Lon­don, 1978.

T. A. Wertime, “Man’s First Encounters with Metallurgy,” Science 146 (3649), 1964, pp. 1257-­67.

Idem, “A Metallurgical Expedition through the Persian Desert,” Science 159 (3818), 1968, pp. 927-­35.

Idem, “The Beginnings of Metallurgy. A New Look,” Science 182 (4115), 1973, pp. 875-87.

D. S. Whitcomb, Before the Roses and Nightingales, New York, 1985.

C. K. Wilkinson, “More Details on Ziwiye,” Iraq 22, 1960, pp. 5ff.

I. J. Winter, “Perspec­tive on the "Local Style" of Hasanlu IVB. A Study in Receptivity,” in Mountains and Lowlands. Essays in the Archaeology of Greater Mesopotamia, ed. L. D. Levine and T. C. Young, Jr., Malibu, 1977, pp. 371-86.

Idem, A Decorated Breastplate from Hasanlu, Iran, Philadelphia, 1980.

H. E. Wulff, The Traditional Crafts of Persia, Cambridge, 1966.

F. E. Zeuner, “The Identity of the Camel on the Khurab Pick,” Iraq 17, 1955, pp. 162-63.

(Vincent C. Pigott)

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ii. CHRONOLOGY OF LURISTAN AS REPRESENTED IN COLLECTIONS

A few stray Luristan bronzes were acquired by European museums as early as the second half of the 19th century. At that time, however, their origin was unknown and scholars attributed them to various regions and cultures in the Near East. It was not until the late 1920s, when they started to appear *en mass* in the antiquities markets of Tehran, Paris, London, and New York, that it became established that they originated in Luristan. Private collectors as well as museums started building their own collections of bronzes, although reliable information remained scarce. For several decades, one had to depend largely on the study of the objects themselves and on information provided by the antiquities trade.

The first documented Luristan bronze acquired by a European museum, “a master of animals idol,” was purchased in 1854 by the British Museum (Moorey, 1974, p. 7). The first publication about a Luristan bronze in a scholarly journal dates from 1918. It attributed a Luristan horse bit with decorated cheek pieces to Armenia. The item, acquired by the British Museum, came from a Parsee family in Bombay (Read, 1918, pl. A/Moorey, 1974, pl. VIIA). In 1922, Michael Ivanovich Rostovtzeff ascribed a series of idols in the British Museum and in the Louvre to the Cimmerians or Scythians and claimed that they had been found in Cappadocia (Rostovtzeff, 1922, pp. 11, 40, 56, pl. II, V.3), an unsupported claim that was still accepted as credible as late as 1963 by some leading scholars (Portratz, 1963, pp. 124-25). Large-scale plundering of Luristan graveyards is thought to have started in the late 1920s, and by 1930 Luristan was widely recognized as the source of the bronzes (Potratz, 1963, pp. 124-25; Muscarella, 1988, p. 113). Nevertheless, other attributions continued to be suggested, mainly as a result of the confusion concerning the precise definition of Luristan bronzes or by reliance on dubious information. Most of these so-called Luristan bronzes from other regions are simply not of Luristan style (e.g. Smith, 1952, from Arabia). In other cases, unconfirmed claims of finds of Luristan style bronzes in other regions were at the origin of far-fetched conclusions. An iron sword in Luristan style, for example, which was said to come from the Pontus area of the Black Sea, instigated Ernst Herzfeld to ascribe all swords of this type to the Pontus (Herzfeld, 1941, pp. 134-36, fig. 252), an idea later picked up by [Roman Ghirshman](http://www.iranicaonline.org/articles/ghirshman). Well aware of the fact that such swords, of which nearly ninety specimens are known, were found in Luristan, he suggested that they were produced in the Pontus but came with the Cimmerians to Luristan (Ghirshman, 1983, p. 29, 76-78, 83-85, pl. I-II; Muscarella, 1989, p. 352-53).

In the late 1920s, when the looting of Luristan graveyards started, the region was still strongly dominated by its tribal structure and the central Iranian government had only a limited control on local overlords. The looting and commercialization of the antiquities trade was a well-organized clandestine business. Local khans controlled the activities and it was dangerous to interfere in their affairs, as it is evident from a report on the looting of a graveyard at Cheshmeh Māhi (Čašma māhi) in 1959, witnessed by Louis Vanden Berghe, and Yolande Maleki (Maleki, 1964; Overlaet, 2003, pp. 31-33, fig. 19-21). Archaeologists like Aurel Stein, eager to excavate in Luristan, were lured away from sites of interest (Demandt-Mortensen, 1993, pp. 72, 74, note 11, pp. 382-84, fig. 6, 443). The information on the place and circumstances of the discovery of Luristan bronzes generally came from the antiquities dealers. At a time when it was common practice for leading art historians like Arthur Upham Pope and archaeologists like [André Godard](http://www.iranicaonline.org/articles/godard), Roman Ghirshman, Friedrich Sarre, and [Ernst Herzfeld](http://www.iranicaonline.org/articles/herzfeld-ernst) to build up private collections of their own, and therefore to be in close contact with the antiquities trade, hearsay information could easily find its way into scientific literature.

Luristan bronzes were already widely sought as collectible from the first years when the looting started. Reports in popular periodicals such as the *Illustrated London News* (9 contributions by Herzfeld, Pope, and Stark between 1929 and 1932) and exhibitions like the famous International Exhibition of Persian Art in 1931 at the galleries of the Royal Academy of Arts at Burlington House, London, further promoted the interest of the general public and scholars alike. Several of the bronzes exhibited at the Burlington House Exhibition were acquired by the Royal Museums of Art and History in Brussels (Speleers, 1931, pp. 59-60, fig. 26). Museums and private collectors competed in strengthening their collections. With little or no first-hand information available from field research, scholars had to turn to private and public collections to study the Luristan culture. In the first volume of his bibliography on the archaeology of Iran until 1977, Louis Vanden Berghe lists no fewer than 138 publications of 54 private and museum collections (Vanden Berghe et al, 1979, pp. 212-23). It must be clear that the present survey can only indicate tendencies in this research and cannot provide a full survey of all the studies and methodologies used. Many of the earlier and most extensive private collections were later wholly or partially acquired by museums. One of the most important collections, many of whose items were published by prominent scholars, belonged to Mohsen Foroughi (See [FORŪḠĪ MOḤSEN ii. ART COLLECTION](http://www.iranicaonline.org/articles/forugi-mohsen#pt2)). He donated some of his objects to the Louvre Museum and the remainder was transferred after the 1979 Revolution from his Tehran residence to the National Archeological Museum in Tehran.

Different approaches can be distinguished in the early studies, each with its own specific merits and flaws. Some studies concentrated on a particular type of object, others on complete collections or on the general chronology.

When Godard published his survey of Luristan bronzes (Godard, 1931), there existed no clear definition of what a Luristan bronze was. His work presented canonical Iron Age bronzes next to general west Iranian and third millennium bronzes. At the time, he ascribed the Luristan bronzes to Kassites who would have retreated from Babylonia to Luristan and would have led a nomadic lifestyle similar to that of the Luristan nomads of his day (Godard, 1931, pp. 13-18). Other scholars such as Ghirshman would later ascribe the Luristan bronzes to Cimmerians. These ethnic and lifestyle attributions all remained unsubstantiated, and although criticized by many (for a survey see Muscarella, 1988, pp. 116-17; Overlaet, 2003, pp. 233-34), were often repeated uncritically in later literature on the subject.

In spite of the above reservations, various detailed studies focusing on specific objects or groups of objects have made it possible to place these objects in a more precise chronological and cultural setting and have enhanced our general understanding of the concept of canonical Luristan bronzes. Particularly noteworthy are Hanns Albert Portratz’s studies on Luristan idols (Potratz, 1955), and horse-bits with decorated cheek-pieces (Potratz, 1941, 1941-42, 1966), in which he proposed stylistic and chronological developments that were largely confirmed later by evidence from excavations. The general tendency was to date canonical Luristan bronzes such as idols and horse-bits to the late second and the first half of the first millenniumBC.E. Against this general consensus, Claude Schaeffer in his *Stratigraphie Comparée et Chronologie de l’Asie Occidentale* (1948), proposed a Bronze Age date between 1500 and 1200BC.E. (“Luristan Récent”) for all canonical bronzes. He only accepted a minimal continuation into the Early Iron Age to explain the presence of bimetallic weaponry (Schaeffer, 1948, pp. 479-82, fig. 263-67). It illustrates the difficulties involved in stylistic comparative studies in the absence of data from excavations. Nevertheless, when Edith Porada presented another survey of the Luristan chronology based on an art historical analysis, she placed the Luristan bronzes in four stylistic phases, starting before 1000BC.E and lasting until about 600/650BC.E (Porada, 1964).

Luristan antiquities from unknown provenances continued to flood the antiquities markets in large quantities after World War II. There was, however, a growing awareness of the problems associated with the general methodology used by most scholars. For many years, one had depended on the study of individual objects with dubious information culled from the antiquities market. The trade, however, had resorted to various solutions to meet the dwindling supply and the growing demand for Luristan bronzes. As early as the 1930s, bronze objects of other regions and periods had been increasingly sold as objects “from Luristan.” Fragments or parts of one and the same object were sometimes sold separately and became dispersed among various collections. One such case concerns the quiver plaques in the Musée du Louvre (former David-Weill collection), and in the Royal Museums of Art and History, Brussels (former E. Graeffe collection). Recognized by Pierre Amiet as of the same style (Amiet, 1976, pp. 84-87, cat. 197), they are in fact part of one large quiver plaque ([FIGURE 1](http://www.iranicaonline.org/app/webroot/uploads/files/Luristan/Luristan-Bronzes-Fig1-complete.jpg)), comparable in size and pattern to others whose provenance cannot be verified. The presence in many collections of single decorated cheek pieces of horse-bits instead of matching pairs also indicates that the breaking up of objects was common practice. At the same time, copies, forgeries, and pastiches were sold as genuine Luristan bronzes to meet the ever-increasing demand. Some of the pastiches were relatively naive. Idols were, for example, systematically mounted on bottle shaped supports with clothing pins (Godard, 1931, pl. LII-LVII; [FIGURE 2](http://www.iranicaonline.org/img/ot_grp11/luristan_ii_fig_2.jpg)). It was a simple and easy way of presenting them but it took the evidence of excavated finds to disprove such a combination. Other pastiches were more sophisticated and elaborately deceitful. For example, a metal bowl, exhibited at the 1931 Burlington House exhibition, was mounted on a stand and decorated by adding to it parts of broken-up idols ([FIGURE 3](http://www.iranicaonline.org/uploads/files/luristan_ii_fig_3.jpg); Potratz, 1963, p.144, pl. XLIII; Calmeyer, 1969, p. 138, fig. 145). Among the forgeries, one can distinguish between after-casts, genuine objects to which fake decorations were added to enhance their value, and modern made objects created in the “Luristan style.” When studying a fake decorated cheek-piece in the New York Metropolitan Museum of Art, Oscar White Muscarella was able to trace ten more in various collections and museums which suggests that eight after-casts were made from a set of two original cheek-pieces (Muscarella, 1982).

One of the first scholars to emphasize the extent of these problems was Potratz. He listed a series of bronzes in major museums and collections that he considered to be forgeries or pastiches (Potratz, 1963, pp. 131-45). In his opinion, anything with a unique character that deviated from the already known corpus of Luristan bronzes had to be treated suspiciously, an approach that led him to erroneously list some objects from other cultural areas as forgeries. Inspired by the approach of the *Corpus Vasorum Antiquorum*series of ancient Greek pottery, he proposed to start a *Corpus aerum luristanensium*, which would illustrate all Luristan bronzes in public and private collections (Potratz, 1963, pp. 145-47). His already cited studies on horse-bits and idols from Luristan depended largely on such a corpus as he had already started assembling on his own. A more complete and internationally organized *corpus* should in his mind have been the instrument to evaluate new arrivals available on the art market and thus “to close off the Luristan entity from alienation by the growing influx of forgeries” (“...den Gesamtkomplex der Luristania gegen die Verfremdung durch die sich häufende Flut der Falsifikate abzusichern.” Potratz, 1963, p. 147). Although his Corpus never materialized, the attention he had drawn to the presence of fakes and pastiches (FIGURE 2) in almost all Luristan collections, even those dating back to the 1930s, could from then on no longer be neglected or minimized. At the same time, however, it was clear that art historical studies alone could never completely resolve the issue, and analytical studies of the metal and its corrosion have since become important in establishing authenticity (on Luristan copies, forgeries and pastiches, see Muscarella, 1977, pp. 171-78, pl. XI-XIII; 1988, p. 141; 2000, pp. 81-119, 378-419; Calmeyer 1969, pp. 137-42, Abb. 145).

A new methodological approach was used by Peter Calmeyer just a few years later (Calmeyer, 1969). He selected only those bronzes that could be securely dated, either by inscriptions or by typological comparison with Mesopotamian and Iranian excavated finds. It allowed him to make a reliable chronological survey of bronzes dating from the third to the first millennium, placing them within their proper cultural context. In the main part of his book, the author discussed 53 types of objects, considering their date, geographical distribution and cultural origin. Separate chapters on forgeries and pastiches (“Manipulierte Bronzen”), and inscribed bronzes completed his work. While his work went far beyond the scope of the Luristan bronzes, the drawback of his approach was that several groups of canonical Luristan bronzes (“master of animals” type idols, whetstone handles, etc.) could not be discussed as there were none or insufficient datable comparisons available. Nevertheless, by dating specific groups like the spike butted axe heads, of which three from the Foroughi collection with 12th century royal inscriptions had been published only a few years before (Dossin, 1962; Ghirshman, 1962), he was able to define the chronological limits of the canonical Luristan style. Calmeyer’s study was one of the first that could also make use of new data deriving from the Belgian excavation project directed by Louis Vanden Berghe. Within a few years, two more catalogues of large collections were published, one by Peter Roger Stuart Moorey on the bronzes in the Ashmolean Museum at Oxford (Moorey, 1971), and the other by Amiet on the private David-Weill collection (Amiet, 1976) of which 27 items were donated to the Louvre Museum as compensation for his work (Amiet, 1972; 1976, p. xi). Both catalogues provided an elaborate survey of the complete range of bronzes as known from the art markets. They incorporated the growing information from excavations with the earlier object directed studies, and were able to provide clear distinctions between canonical Luristan bronzes of the Iron Age date, and general west Iranian, Elamite, and so-called Amlash (q.v.) or North Iranian bronzes. Both catalogues thus became essential works of reference for all subsequent publications on Iranian bronzes.

*Bibliography:*

P. Amiet, *Les Antiquités du Luristan. Collection David-Weill*, Paris, 1976.

P. Calmeyer, *Datierbare Bronzen aus Luristan und Kirmanshah*, Berlin, 1969.

G. Dossin, “Bronzes inscrits du Luristan de la collection Foroughi,” *Iranica Antiqua*II, 1962, pp. 149-64, pl. XIII-XXXIV.

R. Ghirshman, *Iran, from the Earliest Times to the Islamic Conquest*, Harmondsworth, U.K., 1954.

Idem, “A propos des bronzes du Luristan de la Collection Foroughi,” *Iranica Antiqua* II, 1962, p. 165-79.

Idem, *Le Manuscrit R.G., Les Cimmériens et leurs Amazones*, ed. Thérèse de Sonneville-David and Tania Ghirshman, Mémoire (éditions recherche sur les civilisations), 18, Paris, 1983.

A. Godard, *Les Bronzes du Luristan*, Ars Asiatica XVII, Paris, 1931.

Y. and A. Godard, *Bronzes du Luristan, Collection E. Graeffe*, The Hague, 1954.

E. Herzfeld, *Iran in the Ancient East*, London and New York, 1941.

Y. Maleki, “Une fouille en Luristan,” *Iranica Antiqua* 6, 1964, pp. 1-35, pl. I-XII.

P. R. S. Moorey, *Catalogue of the Ancient Persian Bronzes in the Ashmolean Museum*, Oxford, 1971.

Idem, “Towards a chronology for the “Luristan Bronzes,” *Iran* 9, 1971, p. 113-29, 9 fig.

Idem, *Ancient Bronzes from Luristan*, London, 1974.

O. W. Muscarella, “Unexcavated Objects and Ancient Near Eastern Art,” in Louis D. Levine and T. Cuyler Young, Jr. eds., *Mountains and Lowlands: Essays in the Archaeology of Greater Mesopotamia*, Bibliotheca Mesopotamica 7, 1977 pp. 153-207, pl. XI-XIV.

Idem, “An aftercast of an ancient Iranian bronze,” *Source, Notes in the History of Art* 1:2, pp. 6-9.

Idem, *Bronze and Iron, Ancient Near Eastern Artifacts in The Metropolitan Museum of Art*, New York, 1988.

Idem, “Multi-piece iron swords from Luristan,” *Archaeologia Iranica et Orientalis miscellanea in honorem Louis Vanden Berghe*, ed. L. De Meyer and E. Haerinck, Ghent, 1989, pp. 349-66, 1 pl.

Idem, *The Lie Became Great. The Forgery of Ancient Near Eastern Cultures*, Groningen, 2000.

B. Overlaet, *The Early Iron Age in the Pusht-i Kuh, Luristan*, (Luristan Excavation Documents IV), Acta Iranica 40, Leuven, 2003.

E. Porada, “Nomads and Luristan Bronzes: methods proposed for a classification of the bronzes,” in M. Mellnik ed., *Dark Ages and Nomads c. 1000BC.*, Istanbul, 1964, p. 9-31, 3 fig., pl. I-VIII.

P. Potratz, “Stangen-Aufsätze in der Luristankunst,” *Jahrbuch für Kleinasiatische Forschung* III-1, 1955, p. 19-42, pl. II-XV.

Idem, “Die Pferdegebisse des Zwischenstromländischen Raumes,” *Archiv für Orientforschung* XIV, 1941, pp. 1-39, 50 fig.

Idem, “Die Luristanischen Pferdegebisse,” *Praehistorische Zeitschrift* 32-33, 1941-1942, pp. 169-234, 84 fig.

Idem, “Uber ein Corpus Aerum Luristanensium,” *Iranica Antiqua* 3/2, pp. 124-47, 4 fig., pl. XXIX-XLIV.

Idem, “Die Pferdetrensen des Alten Orients,” *Analecta Orientalia* 41, Rome, 1966.

Idem, *Luristanbronzen: Die einstmalige Sammlung Friedrich Sarre, Berlin*, Istanbul, 1968.

CH. H. Read, “Two bronzes of Assyrian type,” *Man* 18, p. 1-3.

M. I. Rostovtzeff, *Iranians and Greeks in South Russia*, Oxford, 1922.

Cl. Schaeffer, *Stratigraphie Comparée et Chronologie de l’Asie Occidentale, IIIe et IIe millénaires*, London, 1948.

S. Smith, “Two Luristan Bronzes from Southern Arabia,” in G. C. Miles, ed., *Archaeologica Orientalia in Memoriam Ernst Herzfeld*, Locust Valley, N.Y., 1952, pp. 203-207, 2 fig.

L. Speleers, “Nos bronzes perses,” *Bulletin des Musées Royaux d’Art et d’Histoire*3/2, 1931, pp. 56-63, fig. 26-27.

L. Vanden Berghe,B De Wulf and, E. Haerinck, *Bibliographie analytique de l’archéologie de l’Iran ancien*, Leiden, 1979.

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