Journal of Archaeological Science 37 (2010) 1700–1715

Contents lists available at ScienceDirect

Journal of Archaeological Science

journal homepage: http://www.elsevier.com/locate/jas

Metallurgical investigations at Godin Tepe, Iran, Part I: the metal finds

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ARTICLE INFO

Article history:
Received 14 January 2009
Received in revised form
19 January 2010
Accepted 22 January 2010

Keywords:
Godin Tepe
Iranian plateau
Archaeometallurgy
Copper
Bronze Age

ABSTRACT

Godin Tepe, a large tell situated in western Iran along the Silk Road (High Road) and excavated from 1965 to 1973 by T. Cuyler Young, Jr. (Young, 1974, 1972, 1969, 1968; Young and Levine, 1974), yielded over 200 metal artifacts dating to the Early Bronze through Iron Ages. Sixty-nine of these were investigated for this project using traditional metallography and electron probe microanalysis. It was found that the metal objects at Godin Tepe reflect a range of manufacturing techniques and represent multiple producers. In addition, a high degree of variability in production methods is seen for typologically similar aesthetic items like bracelets and pins, but there is uniformity in production of utilitarian items like chisels. The metals from Godin Tepe have provided great insight into the diverse manufacturing methods present on the Iranian Plateau in antiquity, especially during the Bronze Age.

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The Iranian Plateau, rich in raw materials, is home to some of the earliest metallurgy in the world. During the 4th millennium BCE this area became the focus of Mesopotamian city states searching for nearby sources of copper metal, both as raw ore and finished products. Production centers were established early and often in the Iranian highlands, and these centers grew during the 4th millennium BCE partly in response to increased demand for metal goods from the Mesopotamian lowlands. As a major trade center along the High Road, Godin Tepe saw significant transport of these metal goods and materials moving between highland and lowland sites. As the evidence stands, Godin Tepe was not a major metallurgical production center (Frame, 2007; Frame and Molofsky, forthcoming); therefore, the majority of the metal artifacts were produced elsewhere on the Iranian Plateau before finding their way to this site. The locations for the production of specific Godin Tepe metal finds have not been pin-pointed. However, as shown below, these finds represent multiple production styles and workshops, and these artifacts can be used to understand patterns of metal manufacture and use on the Iranian Plateau in general during the Bronze and Iron Ages. This study considers the range of production styles and technologies exhibited in this collection, and it is presented in two parts. Part I focuses on the variability in manufacturing methods as seen through the compositions and microstructures of the metal artifacts from Godin Tepe. Part II (Frame and Molofsky, forthcoming) considers the evidence for small-scale copper production at Godin represented by the technical ceramics, ore fragments, and scraps of copper metal found on the central mound.

1. The sequence at Godin Tepe

Excavations at Godin Tepe (Neolithic through Iron Age) from 1965 to 1973 were led by T. Cuyler Young, Jr. under the auspices of the Royal Ontario Museum, Toronto (Young, 1969; Young and Levine, 1974). The site is positioned in the Iranian highlands along the major East–West trade route, referred to as the High Road, the "Great Khorasan Road," and later, part of the Silk Road (Fig. 1). It is the main route from Baghdad to the Iranian highlands, through northern Iran and to the east. In addition, two North–South trade routes connect the High Road to Susa and possibly to the Persian Gulf and to additional routes through southern Iran that lead East to Tepe Yahya and the Indus Valley. The High Road and the North–South trade routes are shown in Fig. 1 as dotted lines.

Godin Tepe hosts an occupation sequence going back to the 6th millennium BCE (see Gopnik and Rothman, in press, for a re-examination of the Godin stratigraphy and finds). However, this investigation is restricted to the periods with evidence of metallurgical activity: Godin Period VI:1 through Period II. Godin VI:1 (3300–3050 BCE; formerly termed Godin V and contemporary with the Late Uruk Period of Mesopotamia) marks the earliest presence of Uruk material culture, the construction of a large oval outpost at the top of the mound, and the beginnings of intense cultural contact with the Mesopotamian lowlands (Algaze, 1989:580; Frame, in press; Weiss

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doi:10.1016/j.jas.2010.01.030

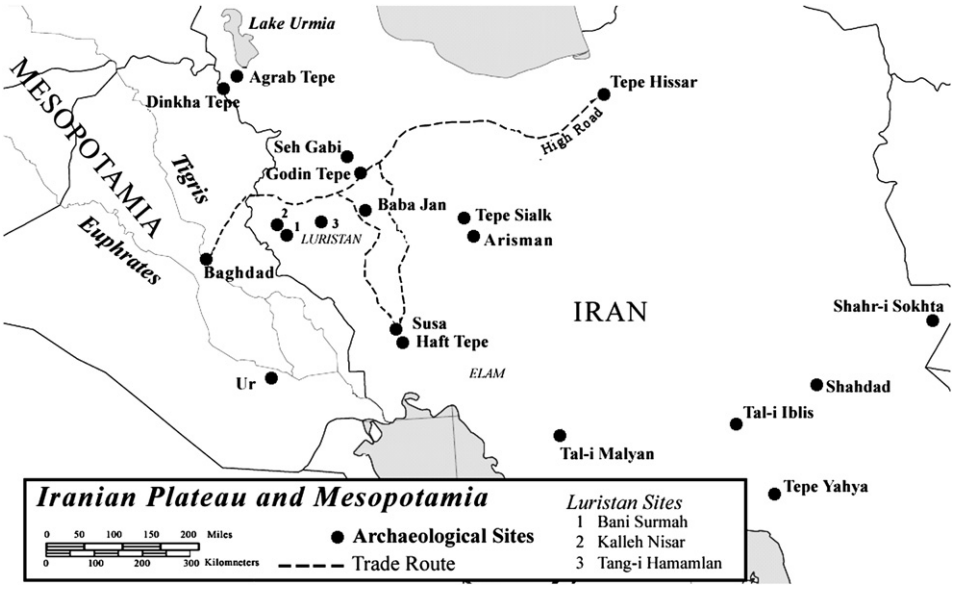

Fig. 1. Map of archaeological sites on the Iranian Plateau and surrounding Mesopotamian lowlands with trade routes and ancient mines indicated (adapted from BYU Geography 2002 maps).

and Young, 1975:1; Young, 2004). More importantly for this study, Period VI:1 marks the earliest appearance of metal at Godin Tepe.

Godin IV (2950–2700 BCE) occupants were Early Transcaucasian migrants. There is evidence for cultural interaction with nearby Luristan during this period (Levine and Young, 1987:48), but this interaction does not appear to extend westward into the Mesopotamian lowlands (Schacht, 1987:177). Further discussion of the evidence for the migration of Early Transcausian groups to Godin Tepe is presented elsewhere (Rothman, in press), and metal finds from this period are rare.

By Godin III (2600–1400 BCE), the trade and interaction network between the highlands and surrounding regions was well established. The material culture at Godin Tepe has parallels to materials from as far as the Indus Valley in the East (Khan, 1968), and southern Mesopotamia in the West. This period lasted over one thousand years with minor gaps between subperiods, and pottery from this period has been linked typologically to sites across the Iranian Plateau, in southern Iran, and throughout the lowlands of Mesopotamia (Henrickson, 1984, 1986, 1987).

After a 500-year hiatus following the end of Godin III, the site was reoccupied during the Iron Age (Gopnik, 2005). Godin II spans 800–600 BCE and corresponds to the Iron III period in northwest Iran and Luristan. Both iron and copper-base metal artifacts were associated with this period.

The metal artifacts excavated from Godin Tepe were produced at multiple production centers across the Iranian Plateau, and therefore, these artifacts provide us with a way to examine the variability in manufacturing methods employed throughout the Plateau. This hypothesis was recently argued (Frame, in press, 2007), and it is strongly supported by three aspects of Godin Tepe: (1) Godin Tepe is located along a major trade route that connects sites situated on the Iranian Plateau and in the Mesopotamian Lowlands, (2) This site is host to ceramic styles and luxury items from all regions of the Iranian Plateau, the Mesopotamian Lowlands, and sites farther East, and (3) The evidence for metal production at Godin Tepe is too limited to account for the hundreds of metal artifacts excavated at the site. The present investigation explores the variability in sixty-nine metal artifacts from Godin Periods VI:1 (3250–3050 BCE) through II (800–600 BCE) by investigating their range of compositions and microstructures.

2. Methods

2.1. Artifact inventory

The Godin Tepe excavation yielded over two hundred metal artifacts including jewelry, pins, needles, tools, weapons, vessels, and other less common artifact types. The majority of these artifacts were kept in Iran at the Iran National Museum in Tehran, but ninety-three metal artifacts were sent to the Southwest Asian Department of the Royal Ontario Museum (ROM) in Toronto, Canada for conservation, study, and storage. These artifacts included seventeen metal items that were collected specifically for scientific analysis and are therefore designated with a "scientific sample" number (ss) rather than a Godin accession number (Gd). The "scientific samples" are referred to here by their square and locus number and, when present, scientific sample (ss) numbers. The metal artifacts from Godin Tepe included in this study are listed in the inventory of Godin metal artifacts (Table 1), which also includes the ROM artifact accession numbers. The full list of all 203 metal artifacts along with their archaeological contexts can be found in the supplemental data online (Supplemental Table A).

2.2. Sampling Strategy

The majority of the metal finds from Godin Tepe are copper-base alloys. Period II contained the only iron objects, and these were heavily corroded, thus only two were sampled. Of the copper alloy artifacts, this study focused primarily on tools, pins, needles, and bracelets. The rings were heavily mineralized, and only a few corroded vessel fragments were present in the ROM collection. However, in light of recent investigations that discuss the presence of zinc in rings from Nuzi (Shortland et al., 2008:219) and in a variety of objects throughout southwestern Asia (Thornton, 2007), I suspect that non-destructive XRF analyses would be useful for screening these unsampled rings for brass alloy compositions. The sixty-nine metal objects in Table 1 were examined and sampled during two visits to the Royal Ontario Museum (ROM) in June 2006 and December 2006. The objects with ROM accession numbers were sampled in Toronto using a jeweler's saw with a 1/0 blade and were subsequently brought to the Department of

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