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(Re)sources: Origins of metals in Late Period Egypt

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ABSTRACT

Metal trade and access to raw materials during the Late Bronze Age—roughly covering the New Kingdom in Egypt—have received substantial attention from past and present scholarship. Despite copper and lead remaining essential commodities afterwards, our knowledge about their supply during the Iron Age and later periods, in contrast, remains limited, even if it has improved recently. This paper presents the results of a pilot project investigating the possible sources of lead and copper available to Egypt during the Late Period (664–332 BCE), a period of intense contact and exchange between Egypt and the Mediterranean world.

In the context of this research, a wide range of artefacts from Naukratis, a major cosmopolitan trading hub in the Western Nile Delta founded in the late 7th century BC, were analysed to determine their chemical composition and lead isotope ratios. They mostly consist of metal finds—including a crucible slag—but also some locally produced faience objects which used lead and copper to colour the glaze. Additional samples include metal objects and lead ores from Tell Dafana, a Late Period settlement in the Eastern Delta, and contemporary Egyptian or Egyptianizing bronzes from Cyprus.

A total of 39 objects were analysed with a combination of lead isotope and elemental analysis, yielding surprising results for the likely origins of the copper. While Cyprus, an expected source for copper, is identified for one object, the copper deposits from Faynan or from northwestern Anatolia offer the best match for most finds, including those found in Cyprus.

The lead analysed seems to originate from a variety of mines, particularly from Laurion in Attica, and mines in the northern Aegean and/or northwestern Anatolia, with one example possibly from a lead-silver mine located in central Iran. The multiplicity of lead sources reflects the complexity of international trade in the Eastern Mediterranean at the time.

The study offers a valuable insight into the trade networks of Egypt and, by extension, the whole of the ancient Mediterranean. A larger-scale project investigating objects from a wider range of sites in the Eastern Mediterranean world could revolutionize our understanding of metal trade and concomitant economic, political and social developments in the first millennium BC.

1. Introduction

Unlike for the Late Bronze Age (LBA), textual and archaeological evidence is scarce when it comes to the trade and distribution of metals during the Iron Age and later periods (for a general survey of Iron Age evidence: Kassianidou, 2012; for additional evidence and discussion concerning the metal trade in Egypt in the later periods: Masson, 2015a). Lead isotope analyses (LIA), however, offer an appropriate means of discussing the origin of copper and lead ores, since a good deal of comparative data from ore deposits and raw copper and lead of the eastern Mediterranean and the Near East are now available. Few analyses so far have tried to address the question of the provenance of the ores of metal objects in Egypt dated to the Late Period (664–332 BCE), a period roughly covering the Archaic and Classical Greek periods that was characterized by a steep rise in the production especially of copper alloy statuettes for votive and ritual purposes (Roeder, 1937, 1956; Ogden, 2000; Hill and Schorsch, 2007; Weiss, 2012). Due to their particular deposition context, these statuettes proliferate in the material record in Egypt, but other types of copper alloy objects (weapons, vessels, furniture elements…) were also produced in large quantity during this period in the Mediterranean world (van Alfen, 2002). A sharp increase of the production of copper and that of

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lead (as a by-product of silver) in the Mediterranean world in the Archaic period was also measured by atmospheric pollution by copper and lead (de Callataÿ, 2005). An investigation, conducted more than thirty years ago, analysed 16 finds from Kawa and Sanam — Upper Nubian sites in modern Sudan — dated to the 25th dynasty (760–656 BCE), alongside four Late Period finds from Memphis, the ancient capital of Egypt (Fleming and Crowfoot-Payne, 1979; Fleming, 1982). A more recent study on numerous Late Period leaded bronze statuettes (Schulze and Lehmann, 2014) presents some methodological problems and resulted in unsupported interpretations (already discussed in Schwab and Willer, 2016). Finally, the results of LIA carried out on ten leaded bronze statuettes from Qubbet el-Hawa (Schwab and Willer, 2016), the necropolis of Elephantine (modern Aswan, in southern Egypt), and on eight unprovenanced lead curse tablets bought in Egypt and certainly originated in that country (Vogl et al., 2016) have recently been published and offer some insight into lead import to Egypt. No scientific investigation has yet addressed the provenance of the copper and lead ores used in the glazing of the Late Period faience despite its mass-production at the time (Guichard and Pierrat-Bonnefois, 2005). This is in stark contrast with the situation for LBA objects, on which numerous LIA have been carried out, both on copper alloy finds from Egypt and on copper ingots from the Mediterranean region (e.g. Stos-Gale et al., 1995; Gale and Stos-Gale, 2000; Begemann et al., 2001; Rademakers et al., 2017), as well as on faience and glass artefacts (Shortland, 2006).

This paper represents a first step in addressing the current gap in knowledge and opening up new avenues of research, investigating the origin of copper and lead used in Late Period Egypt. It presents the results of chemical and LIA carried out on 39 objects. They comprise a wide array of Late Period finds (Table 1), including copper alloy statuettes, faience objects, lead ores and a crucible slag. The results are discussed in the context of a critical review of previous research and their wider historical implications are considered.

The core of this investigation is a corpus of 31 metal and faience objects found at Naukratis, an Egyptian-Greek trading port founded in the 26th dynasty (664–525 BCE), more specifically in the final third of the 7th century BC. This harbour town of the western Nile Delta was strategically located on the Canopic branch, the most navigable branch of the Nile during the Late Period, between the seaport Thonis-Heracleion guarding its Mediterranean entry point and Memphis at the apex of the Delta (Möller, 2000; Villing and Schlotzhauer, 2006; Demetriou, 2012, 105–152; Villing, 2015; Villing et al., 2013–19) (Figs. 1 and 2). It probably functioned as the international port for Sais, the 26th dynasty capital of Egypt. As such, Naukratis formed a major bridge between Egypt and many countries across the Mediterranean region. These cross-cultural and economic connections are reflected by the wealth of imports discovered at the site, originating particularly from Eastern Greece, Cyprus and the Levant. Egyptian, and particularly Lower Egyptian, material culture is nonetheless predominant at the site and Naukratis should not be seen as a simple Greek venture in Pharaonic land (Villing et al., 2013–19). By Pharaonic decree, taxes on 'all goods that appear at Naukratis' were due to the Royal Treasury during parts or potentially all of the Late Period (Agut-Labordère, 2012; von Bomhard, 2015). Since Naukratis was a major entry point for imports into Egypt and departure point for exports into the Mediterranean world during the Late Period, alongside Thonis-Heracleion and prior to the foundation of the seaport of Alexandria in 331 BCE, the material from this site is ideally suited for this type of investigation.

Naukratis was not only a place of consumption and redistribution of imports, but also a centre of production of a variety of objects, meant for local, regional and/or international markets. Numerous workshops were active from the Late Period to the Roman period, with production of metal, faience, pottery, terracotta and possibly glass objects documented at the site. Petrie identified important metallurgic activities or groups of metal finds in Naukratis. On his plan of the town (Petrie, 1886, pl. XLV; Masson, 2015a, 84), he indicated several areas where he discovered evidence for silver working and copper 'smelting', as well as significant finds of iron tools, iron slags and iron ore (Fig. 2). Petrie also specified that the latter originated from the 'low strata of the town' which includes the stratum of the 'scarab factory', a workshop where scarabs and other faience amulets were produced in the first half of the 6th century BC (Masson, 2018a). Although Petrie went as far as defining Naukratis as a 'great centre of the iron trade' (Petrie, 1886, 39), he neglected to say anything of the size and significance of the 'copper smelting' activities he recorded on his map. It seems, however, dubious that smelting operations were undertaken at Naukratis, a site located far from any sources of raw materials. Nonetheless, there is a high probability that fresh supplies of metal would have been used in the various workshops active at the site given how vibrant an international hub it was – all the more so as large quantities of raw metals — tin, iron and copper — are recorded as having been imported into Egypt in the 5th century BCE in customs accounts found at Elephantine (discussed with references in Masson, 2015a, 79).

The analysed objects were discovered during the late 19th and early 20th century explorations of the site conducted by W. M. Flinders Petrie, Ernest Gardner and David Hogarth, and are today kept in the British Museum, the Ashmolean Museum, Oxford, and the Petrie Museum, University College London (Figs. 3 and 4). The necessary historical and chronological framework for the wider assessment of the results was facilitated by the fact that this study is embedded in the British Museum's Naukratis Project. This project has not only been re-analysing the findings from the early explorations (Villing et al., 2013–19), but has also been investigating the site again with survey and excavations since 2012 (Thomas, 2015a). From the early excavations were collected at least 1118 objects in copper alloy and 42 finds in lead. However, the majority of these finds are difficult to date with accuracy. As Table 1 reveals clearly, some of the finds selected for analyses are insufficiently dated to conform exclusively to the Late Period (formally ending 332 BCE). This is due to the lack of specific context associated with the persistence of some types of objects into the early Ptolemaic period. The general interpretations and conclusions on metal trade for Late Period Egypt are therefore preliminary and, when it comes to the ill-dated finds, tentative.

To provide some comparative data for the Naukratis assemblage, four samples were taken from finds discovered at Tell Dafana (Fig. 5), an eastern Nile Delta settlement excavated by Petrie (Petrie, 1888). The dating and context of the finds, kept at the British Museum, have recently been reassessed (Leclère and Spencer, 2014). Metallurgical activities involving copper and iron were observed at the site, with the evidence pointing more towards metalworking rather than smelting (Craddock in Leclère and Spencer, 2014, 142–143). From that site two lead ores were selected, for which we had no example from Naukratis, and two metal objects, all belonging to the 26th dynasty. Four samples were taken from objects found on Cyprus (Fig. 6). They include one mirror of Cypro-Achaic date (which can be compared with a mirror found at Naukratis that we analysed within the broader framework of this project), one ritual instrument (sistrum) probably made in Egypt and dated to the Late Period, and, two Egyptianizing statuettes dated to the Cypro-Archaic period.

2. Sample selection and archaeological assessment

Selecting the most comprehensive range of material containing copper and/or lead was essential as it increases the probability of revealing distinct chemical compositions and metal origins. The following archaeological overview of the analysed finds, in metal and faience, includes a precise re-contextualising whenever possible.

2.1. Metal

Beside the slag which results from local metallurgical activities (Fig. 3, cat. no. 1), Egyptian votive or ritual bronzes found at Naukratis (Fig. 3, cat. nos. 2–13) were probably produced locally or at least in the