



Four shades of black: Non-invasive scientific studies on the painted potteries from Shahr-i Sokhta, eastern Iran

Negar Eftekhari^{a,*}, Parviz Holakoei^b, Hamed Sayyadshahri^a, Carmela Vaccaro^a

^a Department of Physics and Earth Sciences, University of Ferrara, Italy

^b Department of Archaeometry, Art University of Isfahan, Iran

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ABSTRACT

Shahr-i Sokhta in east of Iran represents different stages of settlements from the fourth to the second millennium BC. A large assemblage of ceramics shards has been unearthed from Shahr-i Sokhta many of which are decorated with different shades of black, yellow and red colours. Micro X-ray fluorescence (μ -XRF) and micro-Raman spectroscopy (μ -Raman) on some seventy painted shards from Shahr-i Sokhta with polychrome, bi-chrome and monochrome decorations showed haematite and goethite as red and yellow decorations, respectively. Black decorations, however, consisted of four main groups including carbon black, magnetite, haematite and jacobsite. This paper represents a successful application of non-invasive spectroscopic methods for identifying pigments on archaeological ceramics.

1. Introduction

Shahr-i Sokhta is located at some sixty kilometres to the south of Zabol and considered as one of the largest Bronze Age archaeological sites in Iran (Fig. 1). Shahr-i Sokhta demonstrates a continuous line of settlement for at least two millennia. Economic development of this ancient city was due to its strategic location along the trade routes of Asian civilizations. There are many evidences which indicate the trade and cultural relations of Shahr-i Sokhta, Mesopotamia and other important prehistoric sites of the region (Biscione, 1974; Salvatori, 2006) (Fig. 1). As a result, excavations at Shahr-i Sokhta revealed wide range of archaeological findings including ceramic objects.

The 150-hectare area of Shahr-i Sokhta encompasses four periods of settlement spanning 3200 to 1800 BCE (namely the period I (ca. 3200–2800 BCE), the period II (ca. 2800–2500 BCE), the period III (ca. 2500–2200 BCE) and the period IV (ca. 2200–1800 BCE)) and consists of eleven structural layers. The main excavated parts of Shahr-i Sokhta are “residential area” (including “central quarters”, “oriental residential area”, “burnt building” and “monumental area”), “industrial zone” and “graveyard” (Tosi, 1976; Sajjadi, 2004) (Fig. 2). Amongst various interesting findings in this site, a large number of potshards testifies not only technical advances of the site, but also indicates trade and circulation of ceramics with neighbouring regions (Mugavero, 2008).

The large number of ceramics retrieved from Shahr-i Sokhta and the general durability of ceramic materials against weathering provide a

unique chance for studying the archaeological findings unearthed from this archaeological site. Pigments and patterns on the potteries from Shahr-i Sokhta are from those important sources of information which can contribute to understanding of the less-known history of Shahr-i Sokhta. On the other hand, different types of ceramics unearthed from Shahr-i Sokhta have always prompted scholars to argue in favour of ceramic imports to the site as an aid for the local production (Salvatori, 2006, p. 32). All these make Shahr-i Sokhta and its pottery assemblage a particular case for study which characterises traditions of pottery-making during the Bronze Age.

Apart from ceramics with no decoration, ceramics from Shahr-i Sokhta include monochrome (black and different shades of brown) and polychrome decoration (white, red, black, yellow and green) over clay body (Mugavero, 2008, pp. 4–5). The polychrome ware, which is found at “graveyards”, is similar to the ceramics from Nal in Pakistan and often is considered as imported objects to Shahr-i Sokhta (Festuccia, 2015, p. 132). Moreover, there are ceramics on which two red and black colours are applied (the so-called bi-chrome ceramics). According to Mugavero (2008), the ceramics from the period I often have rich decorations while simpler decorations on ceramics appeared towards the end of the period III in Shahr-i Sokhta. In fact, the first two periods of the history of pottery-making in Shahr-i Sokhta include almost exclusively painting on pottery while potteries from the period III encompass the shards which sometimes bear no pigment and painted pattern on the body (Festuccia, 2015).

* Corresponding author at: University of Ferrara, Department of Physics and Earth Sciences, Via Saragat 1, Ferrara 44122, Italy.

E-mail address: negar.eftekhari@unife.it (N. Eftekhari).



Fig. 1. Location of Shahr-i Sokhta and some other important archaeological sites (1: Shahr-i Sokhta, 2: Altyn Tape, 3: Mundigak, 4: Tureng Tape, 5: Tape Hissar, 6: Tape Yahya, 7: Shahdad, 8: Susa, 9: Namazga, 10: Muhenju daro, 11: Bampur, 12: Nal and 13: Quatte).

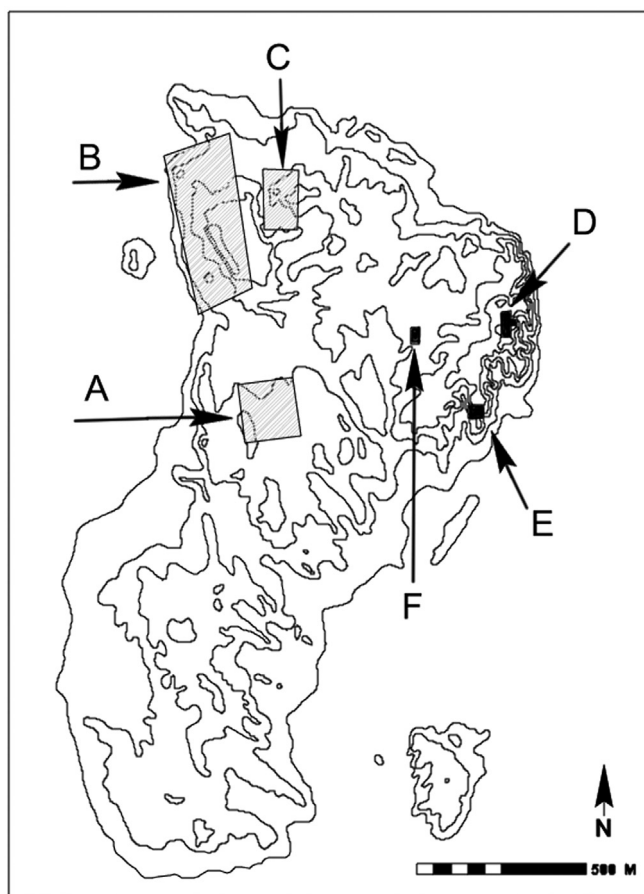


Fig. 2. The main excavated areas at Shahr-i Sokhta (A: Graveyard, B: Industrial Zone, C: Monumental Area, D: Oriental Residential Areas, E: Burnt Building and F: Central Residential Area) (reproduced from the topographic map of the Research Base Centre of Shahr-i Sokhta).

While the buffware painted with black and brownish colours are found within the archaeological findings from all four periods of Shahr-i Sokhta, the greyware from Shahr-i Sokhta with red decoration is exclusively found in the potteries from the period I. Nonetheless, the greywares painted with black colour are popular in the potteries from the periods I and II. Almost all the greywares from Shahr-i Sokhta bear painted decoration on the body. On the other hand, the large occurrence of redware with black decoration is reported from the periods I and II of Shahr-i Sokhta. The redware began to be disappeared by the end of the period III (Festuccia, 2015). As far as the polychrome wares are concerned, they have been retrieved from the layers dated to the period I to period III. The polychrome ware with elaborated forms and graphics, however, belong to the period II (Mugavero and Vidale, 2006). Biscione (1974) believes that there are no remarkable decorated ceramics in the period IV, compared to the ceramics from previous periods, probably because of a sudden decline of the city.

In general, the most delicate iconographic designs are found on the ceramics with monochrome decorations on red- and greywares with natural motifs such as plants, rivers, lakes, fields, leaves, trees and animals. On the contrary, simpler and less refined decorations represent the iconographic designs of monochrome buffware, which is generally decorated with various geometric patterns such as lozenges, triangles and zigzag motifs. These patterns are also used to decorate the polychrome and bi-chrome potteries (Potts et al., 2001, pp. 270–271; Sajjadi, 2005). This essay is an attempt to characterise the colours used over the clay bodies of the ceramics from Shahr-i Sokhta using non-invasive analytical methods. The question of provenance of the painted shards is not however addressed here.

2. Materials and methods

2.1. Samples

Some seventy potshards including both excavated and surface-retrieved potshards (Fig. 3; Table 1) were studied to characterise the colours and pigments used on the ceramics from Shahr-i Sokhta. Painted decoration was found on clay-based bodies of the buff-, red-

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