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Archaeometric study of Etruscan scarab gemstones by non-destructive chemical and topographical analysis

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ABSTRACT

Six scarab-gems found in the Etruscan archaeological site of Gravisca (VT, Italy) have been classified through stylistic and iconographic studies in order to be framed chronologically. The gems have been subsequently analysed using not invasive methods (XRD, XRF, mid-FTIR, Raman spectroscopy) to discover their chemical features and to understand the kind of material used by the artisan. With the help of the optical microscopy it has been possible to analyse the carvings that characterize the artefacts and to go through all the manufacturing phases, allowing the identification of the employed tools. Collection of data coming from the different techniques permitted to disclose the presence in Gravisca, during the 4th century BCE, of a centre of glyptic production.

1. Introduction

The investigations of the emporic sanctuary of Gravisca brought to light six scarabs (described in Table 1), five of which in the so-called northern sanctuary, while only one was in the southern area, near the Aphrodite's cell [Colivicchi, 2004].

The site of Gravisca represents one of the most important harbours of antiquity. It was a crossroad of goods and people in the centre of the Mediterranean area between the end of the 7th century BCE and the Roman period. The harbour was situated about ten kilometres from Tarquinia (the ancient Tarkna), one of the most relevant Etruscan metropolises. Gravisca's location remained unclear until 1969 when Mario Torelli and the Soprintendenza Archeologica dell'Etruria Meridionale began systematic excavations [Southern Sanctuary: Torelli, 1971, Torelli, 1977, Torelli, 1982, Torelli, 1986, Fiorini, 2005a, Fiorini and Torelli, 2007; Northen Sanctuary: Fortunelli, 2001, Fiorini, 2005b, Fortunelli, 2007, Fiorini and Fortunelli, 2011, Fiorini and Mercuri, 2014] and nowadays this area is still under investigation through new excavations campaigns carried out by the University of Perugia and the Soprintendenza dell'Etruria Meridionale e del Lazio.

This discovery constitutes extraordinary evidence of an emporic sanctuary, similar to Naukratis in Egypt, created as a protected area where Greek merchants from the far shores of the eastern Mediterranean Sea could exchange their products in the Etruscan territories, under the protection of divinities who were their guarantors. The analysis of the virgin soil around the *naiskos* of Aphrodite, revealed more than twenty small furnaces used to smelt bronze and iron [Fiorini and Torelli, 2007]: this extremely important discovery has given the key for understanding both the nature of the trade occurring in the sanctuary, the exchange of Etruscan iron with Greek luxury goods, and the reason of the choice of Aphrodite for the cult of the *emporion*: according to the Greek mentality Aphrodite, who not by chance was imagined to be the spouse of Hephaistos, patronized the *mixis*, a word meaning at the same time sexual union and fusion of an alloy.

In this general framework of handicraft connected to the sacred context it is possible to insert the important discovery of a gemstone production which was still active throughout the 4th century BCE. These materials suggest the presence of itinerant artisans specialized in fields other than metallurgy, such as coral and gemstones carving, which from the half of the 6th century BCE seem to accompany the life of the sanctuary of Gravisca until its destruction by the roman soldiers, occurred in 281 BCE. Different methodologies have been applied in order to investigate the gemstones about their chemical-physic composition and

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Table 1
Name, inventory numbers and images of the six scarab gemstones from Gravisca.

Name	Inventory number	Image	
		Beetle side	Flat side
Gem no.1	II/13144	 Beetle side of gem no. 1.	 Base of gem no. 1.
Gem no. 2	0936-01	 Beetle side of gem no. 2.	 Base of gem no. 2.
Gem no. 3	09108-01	 Beetle side of gem no. 3.	 Base of gem no. 3.
Gem no. 4	07RII13-1	 Beetle side of gem no. 4.	 Base of gem no. 4.
Gem no. 5	04155-217	 Beetle side of gem no. 5.	 Base of gem no. 5.
Gem no.6	08RPII7	 Beetle side of gem no. 6.	 Base of gem no. 6.

processing techniques. XRF and mid-FTIR analyses have been carried out by portable and non-invasive instruments to understand the elemental and molecular composition respectively. Micro-Raman and XRD investigations have also been done in a totally non-invasive way without any taking of sample. About the XRD a particular accessory has been used to put the gemstones inside the instrument to allow a correctly investigation. The optical video-microscopy analyses have been carried out to characterize the morphology of the samples in order to understand the processing techniques of gemstones.

2. Materials and methods

2.1. Materials

1. [Colivicchi, 2004]. *Scarab with crested newt* (Table 1, gem no. 1). *Measurements*: 1.4 × 1.0 × 1.1 cm. *Beetle side*: The head is separated from the prothorax and the elytra are divided by a Y-shaped line; there are V-winglets at the edges of the elytra. The legs, set on the plinth, are carved in low relief. *Base*: The base of the scarab is decorated with a crested newt set in a border. The gem is drilled lengthwise and any part results patchy. *Style*: Naukratis production [Gorton, 1996]. *Chronology*: 6th century BCE.
2. *Scarab with quadruped* (Table 1, gem no. 2). *Measurements*: 1.2 × 1.0 × 0.7 cm. *Beetle side*: The head is separated from the prothorax and the elytra are divided by a small line in high relief. The legs are in low relief. *Base*: The base of the scarab is decorated with a formless silhouette that looks like a quadruped, surrounded by two parallel borders; the gem is drilled lengthwise. *Style*: free or transitional [Giovanelli, 2004]. *Chronology*: mid-4th century BCE.
3. *Scarab with warrior* (Table 1, gem no. 3). *Measurements*: 0.9 × 1.0 × 0.7 cm. *Beetle side*: The clypeus is dentate and the head is separated from the prothorax; the legs are made in low relief. *Base*: The base of the scarab portrays a warrior, with a shield and possibly a lance, who is looking back; the picture is surrounded by two parallel lines interconnected by vertical stripes. The gem is drilled lengthwise and is fractured, so we have only a part of it. *Style*: *a globolo* [Giovanelli, 2004]. *Chronology*: 4th century BCE.
4. *Scarab with a man with a club* (Table 1, gem no. 4). *Measurements*: 1.2 × 1.0 × 0.7 cm. *Beetle side*: The head is separated from the prothorax, which in turn is separated from the body by a frame composed of

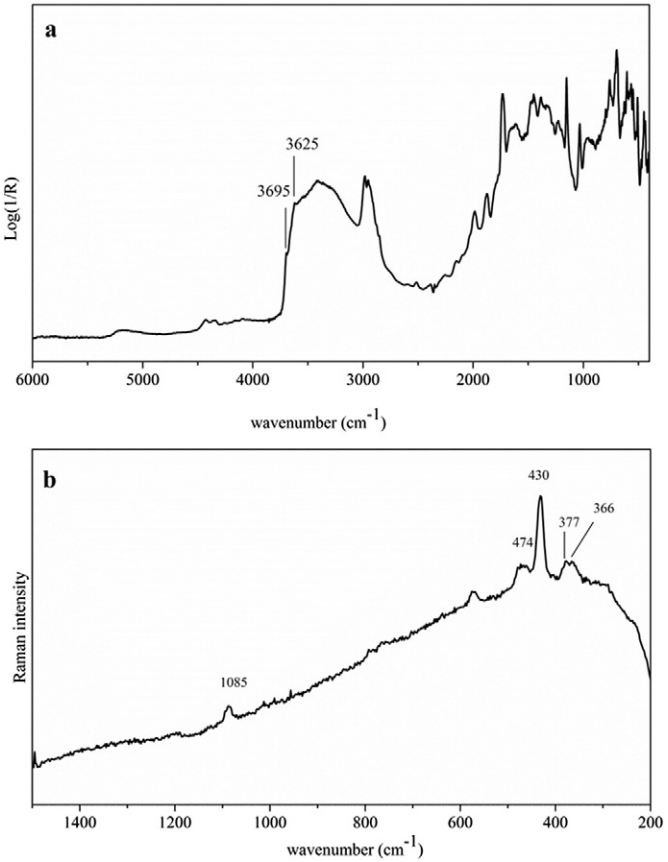

Fig. 1. Reflection mid-FTIR (a) and micro-Raman (b) spectra of blue scarab.