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# Etruscan women's clothing and its decoration: the polychrome gypsum statue from the 'Isis Tomb' at Vulci

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**SUMMARY** The gypsum figure from the so-called Isis Tomb at Vulci (Italy) represents a woman or goddess with one hand extended to give or receive an offering (British Museum 1850,0227.1). Dating probably to about 575–550 BC, the figure wears a long tunic with the remains of a painted border at the hem, a belt that was once gilded, a cloak and sandals that were originally painted red. Evidence of very fine painted decoration survives on the borders of the garments, in particular towards the base of the figure, and is partially visible to the naked eye. In an attempt to reconstruct the painted border of the tunic, technical imaging (infrared-reflected, ultraviolet- and visible-induced luminescence imaging) and Raman spectroscopic examination of microscopic samples were undertaken. The visualization of the inverted lotus embroidery on the hem of the tunic using technical imaging suggests a new interpretation of its pattern. The results of the analysis are discussed in light of the contemporaneous archaeological evidence for Etruscan clothing. Finally, a reconstruction of the shape and pattern of the cloak is suggested.

## Introduction

Lucien Bonaparte, Prince of Canino and brother of Napoleon, opened many Etruscan tombs on his estate near Vulci, which had been given to him by Pope Pius VII, Figure 1 [1]. Only objects of financial value were kept and the remainder, particularly local pottery, was abandoned or destroyed. In 1839 Prince Lucien found a rich tomb in the Polledrara cemetery that dated to the sixth century BC and contained both rare foreign imports and work of the best local production [2–5]. The tomb soon became known as the 'Isis Tomb', as it included the upper part of a hammered bronze statue holding a horned bird, which was then thought to represent the goddess Isis (British Museum 1850,0227.15), as well as other objects of Egyptian origin. It is more likely, however, that the statue represents a native fertility goddess or priestess. It appears that at least one man and one woman were buried in the tomb, which comprised a number of burials in two chambers. Unfortunately, no plan or inventory made at the time of discovery survives. Several lists were made later in an attempt to reconstruct the contents of the tomb, but none corresponds exactly [4]. After the removal of material from the excavation, the tomb was probably filled with rubble and



Figure 1. Etching by Samuel James Ainsley, 1845 showing the Ponte della Badia at Vulci, Lazio (British Museum 1874,0711.2266)





Figure 2. The Polledrara statue (British Museum 1850,0227.1): (a) front; (b) back; (c) proper left side; and (d) proper right side

the exact location of the site is now lost. Much of the material found in the tomb was displayed in Bonaparte's villa at nearby Musignano.

In 1844, the prince's widow Alexandrine Joubertou sold over 70 objects that were said to be from the tomb to Dr Emil Braun of the Archaeological Institute at Rome, a dealer and antiquarian who, in turn, sold the objects to the British

Museum in 1850. All of the items from this group probably come from Vulci and date mainly to about 625–550 BC. Some are undoubtedly from the Isis Tomb, but the provenance of others is less certain, as the tomb contents seem to have become mixed with other material kept at Bonaparte's villa. The statue discussed in this contribution certainly seems to have originated in the Isis Tomb.

### The statue

This statue from the Isis Tomb (British Museum 1850,0227.1) is carved in gypsum, represents a standing woman and is about half life-size, standing 87.5 cm high including the plinth [4–8]. She wears a cloak, sandals and a tunic held at the waist by a belt. Figure 2 shows four views of the sculpture, which is substantially complete; the main reconstruction is limited to the upper proper right side of the back of the head and a portion of the plinth. The figure holds out her right hand in a gesture of offering, but the object she once held is now missing; the clenched left hand was also originally holding an object. The statue may represent one of the deceased, a priestess or goddess: there is little way of knowing, but whatever her identity she is apparently represented wearing contemporary clothing, as discussed later. The dress is typically Etruscan, as is the arrangement of the hair at her back, with plaits tied loosely at the waist. The locks at the front are typical of Syrian hairstyles, much copied further west in archaic times. The figure is essentially Etruscan, although influenced by Greek prototypes, particularly from Crete and



Figure 3. Details of the footwear: the sandals are painted with red ochre, a naturally occurring hematite-containing pigment

**Table 1. Appearance and identification of pigments from the Polledrara statue**

Sample	Description	Appearance under microscope	Identification (Raman spectroscopy)
1	Red area of sandal under the proper right big toe	Red and yellow crystals	Hematite ( $\alpha$ -Fe <sub>2</sub> O <sub>3</sub> ) and goethite ( $\alpha$ -FeO.OH)
2	Green area on proper left of robe	Bright green crystals	Mixture of malachite (Cu <sub>2</sub> CO <sub>3</sub> (OH) <sub>2</sub> ) and clinoatacamite (Cu <sub>2</sub> (OH) <sub>3</sub> Cl)
3	Blue from broad band on cloak	Light blue angular crystals	Egyptian blue
4	Black from decorative band at edge of cloak	Black particles	Carbon
5	Coloured band around tunic edge	Red crystals and black particles	Hematite ( $\alpha$ -Fe <sub>2</sub> O <sub>3</sub> ) and carbon
6	Black from hair plait on back of figure just above tie	Black particles	Carbon
7	Material from face between proper right eye and bridge of nose	Red crystals	Hematite ( $\alpha$ -Fe <sub>2</sub> O <sub>3</sub> )

the Peloponnese, of Daedalic style with this same characteristic hairstyle, inverted triangular face, large almond eyes and slight so-called archaic smile. The sculpture was, however, undoubtedly made by a local sculptor in the area of Vulci. There is no indication that the source of the stone was Egypt, where gypsum was not in wide use in the first millennium BC, or that the sculpture is of Phoenician origin [7; pp. 21–24]. This latter suggestion arose from a comparison of the material from which the sculpture is carved to that found at several Phrygian sources of gypsum, but there is no evidence that these were in use in antiquity [9], see below.

Large-scale stone sculpture first appears in Etruria in the sixth century BC and this is one of the finest examples to survive. Unlike the Greeks, the Etruscans did not have access to marble quarries and instead made use of local stone, which varied from region to region. Again in contrast to Greek custom, the Etruscans tended to reserve stone statues for tombs, otherwise using bronze or terracotta for their statuary.

From the belt upwards the statue seems to have been subjected to water damage at some stage, showing black crusts, powdery surfaces and ‘waxy’ deposits, especially concentrated at the elbow, Figure 2c. These features had previously been thought to result from fire damage. The lower part of the sculpture preserves clear traces of polychromy, the remnants of which are partially visible with the naked eye. The hem of the tunic is painted with an elaborate lotus-flower pattern in black, red and blue, while the front part of the hem of the cloak is painted in blue. Both sandals show clear remnants of a bright red colour, Figure 3. Additionally, there is an area of green towards the bottom of the proper left of the robe, although the edges of this area are poorly defined and appear to have a ‘tide mark’, Figure 2c. A small amount of green also occurs on one of the toes directly under this area. Although there is no evidence for the deliberate application of green colour in this area, it may be worth noting that the figure of Larthia Seianti reclining on her sarcophagus in the Museo Archeologico Nazionale, Florence, wears green stockings and green-studded gold sandals [10; plate 10].

### Scientific examination

A series of studies was undertaken to investigate the stone from which the sculpture was made, to identify the pigments used and to verify the accuracy of the reconstruction of the

lotus-flower pattern on the hem of the tunic presented by Pryce [11]. In addition, the black crusts and the ‘waxy’ deposits on the upper part of the sculpture have been analysed to investigate the hypothesis that they resulted from fire damage.

Small samples taken from the stone support were analysed by X-ray diffraction (XRD) [9]. The surviving polychromy of the sculpture was first investigated using visual examination, with and without magnification, and by a number of imaging techniques (visible-, infrared- and ultraviolet-reflected, and ultraviolet- and visible-induced luminescence) [12]. Samples from the sculpture were analysed by Raman spectroscopy [13], gas chromatography-mass spectrometry (GC-MS) and Fourier transform infrared (FTIR) spectroscopy [14].

While ultraviolet-induced luminescence (UIL) imaging can reveal the presence of certain organic materials (such as lake pigments, binding media, coatings or conservation materials), visible-induced luminescence (VIL) imaging can be used to reveal the presence of Egyptian blue, a calcium copper tetrasilicate that shows photo-induced luminescence properties in the infrared range [15, 16]. In a VIL image, Egyptian blue shows up as white or pale areas against a black or grey background. Infrared-reflected imaging in the 800–1000 nm range was undertaken to reveal the presence of any preparatory drawings or carbon-based pigment [17]. Raman spectroscopy was used to identify the inorganic pigments and GC-MS and FTIR to characterize the black crusts and deposits. Details of the methods and equipment used in this study can be found in the experimental appendix.

### The stone

XRD analysis of the stone plinth, carved in one with the figure, confirms the sculpture to be of gypsum (CaSO<sub>4</sub>·2H<sub>2</sub>O) of uncertain provenance. In modern times, gypsum of this quality is often referred to as alabaster, although it should be noted that in antiquity the term alabaster was more frequently used to refer to calcite (CaCO<sub>3</sub>). According to Freestone:

So-called Egyptian alabaster is calcite (CaCO<sub>3</sub>) and it has been suggested that the alabaster stone of the Greeks is often calcite also [18]. Lukas and Harris [19; p. 413] record a few examples of gypsum vessels from Egypt, none of which appear to date to the first millennium B.C. The closest typological parallels to the vessels





Figure 4. The areas sampled for Raman spectroscopy on: (a) the front of the statue; and (b) the back

found in the Polledrara tomb are in Phrygia; sources of gypsum in this area have been exploited in the last few decades. However, it is unclear as to whether these gypsum deposits outcrop at the surface and thus were exploitable in antiquity. These deposits occur at Sazilar and Bicer, which lies between Ankara and Eskisehir (Dorylaeum), ten miles or so from Gordium [9].

According to Middleton [20], other sources include Cyprus and Egypt [21; p. 559]. Further possibilities include mainland Greece, Crete and the Ionian islands of Zakynthos and Kephallonia [22]. Geological research in Italy has, however, revealed outcrops of gypsum scattered across the country, which should perhaps also be considered as possible sources for the stone [23]. Unfortunately, analysis is currently unlikely to be able to confirm the source with certainty.

### The paint layers

As previously indicated, the identification of the coloured materials was undertaken using Raman spectroscopy and VIL imaging, the latter specifically used for the identification of Egyptian blue. Seven small samples were taken for Raman spectroscopy; their locations are shown in Figure 4 and the result summarized in Table 1.

- *Skin*: Close observations under magnification suggested that the skin of the figure might have been painted. Small red crystals, identified as hematite ( $\alpha\text{-Fe}_2\text{O}_3$ ), were found in a sample from the area between the proper right eye

and the bridge of the nose (sample 7). The face may have been polychromed with a paint containing red ochre but, given the level of damage to the face, it is not possible to be certain that this is original. VIL imaging revealed particles of Egyptian blue scattered across the face and the proper right ear. Although Egyptian blue is known to have been used in antiquity mixed with other pigments to produce realistic skin tones [24], there is no evidence for this custom in Etruria to date, possibly because of a lack of investigation. Moreover, VIL imaging is a highly sensitive technique, which can reveal even single particles of Egyptian blue [25]. In this case, the absence of a clear and meaningful distribution of the pigment suggests that the pigment was not used intentionally on the face and is the result of contamination from other areas.

- *Hair and hairband*: A sample of black paint, identified as an amorphous carbon-based black, was taken from the hair plait on the back of the sculpture, just above the tie (sample 6). The most likely carbon-based black is lamp black, the soot deposited by burning oils. The headband on the proper right of the figure shows some traces of Egyptian blue. An example of the use of Egyptian blue on a headband has been reported on the Hellenistic portrait of Queen Berenike II [26].

- *Cloak*: Figure 5 shows the VIL images of the front, back and sides of the sculpture, with the white or pale areas giving an accurate distribution of the Egyptian blue that remains on the figure. While no clear evidence for pigments could be found in the main body of the cloak, three different patterns are clearly visible in the hem:

- 1) two large bands at the front of the cloak were probably painted solid blue using Egyptian blue (sample 3 and Figures 5a, 5c and 5d) surrounded by a black outline (Figures 6a, 6c and 6d);
- 2) the inner hem, from the innermost edges of the large blue bands up to the neckline, was decorated with a ladder pattern in carbon-based black (sample 4) over a blue border. See Figure 5a for the use of Egyptian blue and Figures 6a and 6c for the black outline of the ladder pattern;
- 3) the outer hem, extending from the outermost edges of the large blue bands, up to the arms and to the back of the sculpture, was painted with a double ladder pattern (Figure 6), probably also executed using carbon-based black. Unlike the ladder pattern at the front, the double ladder pattern is not painted on a blue border.

The green area on the proper left of the cloak (sample 2) contains a mixture of malachite ( $\text{Cu}_2\text{CO}_3(\text{OH})_2$ ) and clinoatacamite ( $\text{Cu}_2(\text{OH})_3\text{Cl}$ ). While these could have been used deliberately as pigments, both are typical deterioration products of copper and copper alloys so that, given their distribution and their occurrence as an intimate mixture, they seem most likely to result from close proximity to deteriorating copper-based objects (many bronze objects were found in the tomb).

- *Tunic and belt*: Egyptian blue was also used abundantly in the hem of the tunic. Figures 7a and 7b show the visible

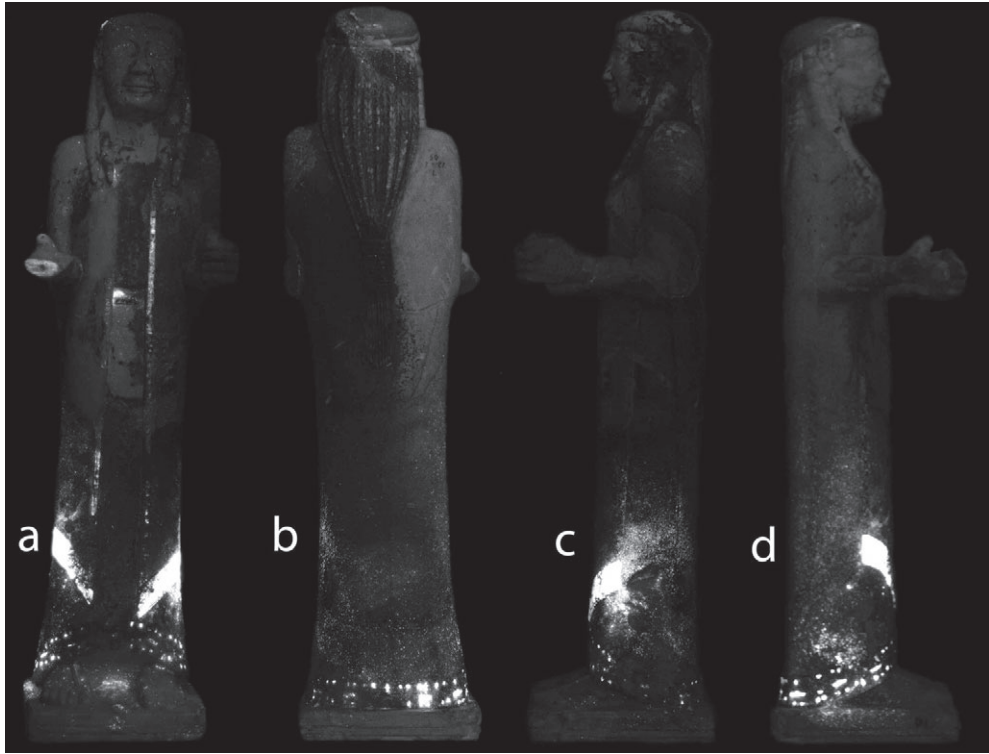


Figure 5. Visible-induced luminescence (VIL) images of the Polledrara statue in which areas of Egyptian blue appear white or very pale: (a) front; (b) back; (c) proper left; and (d) proper right

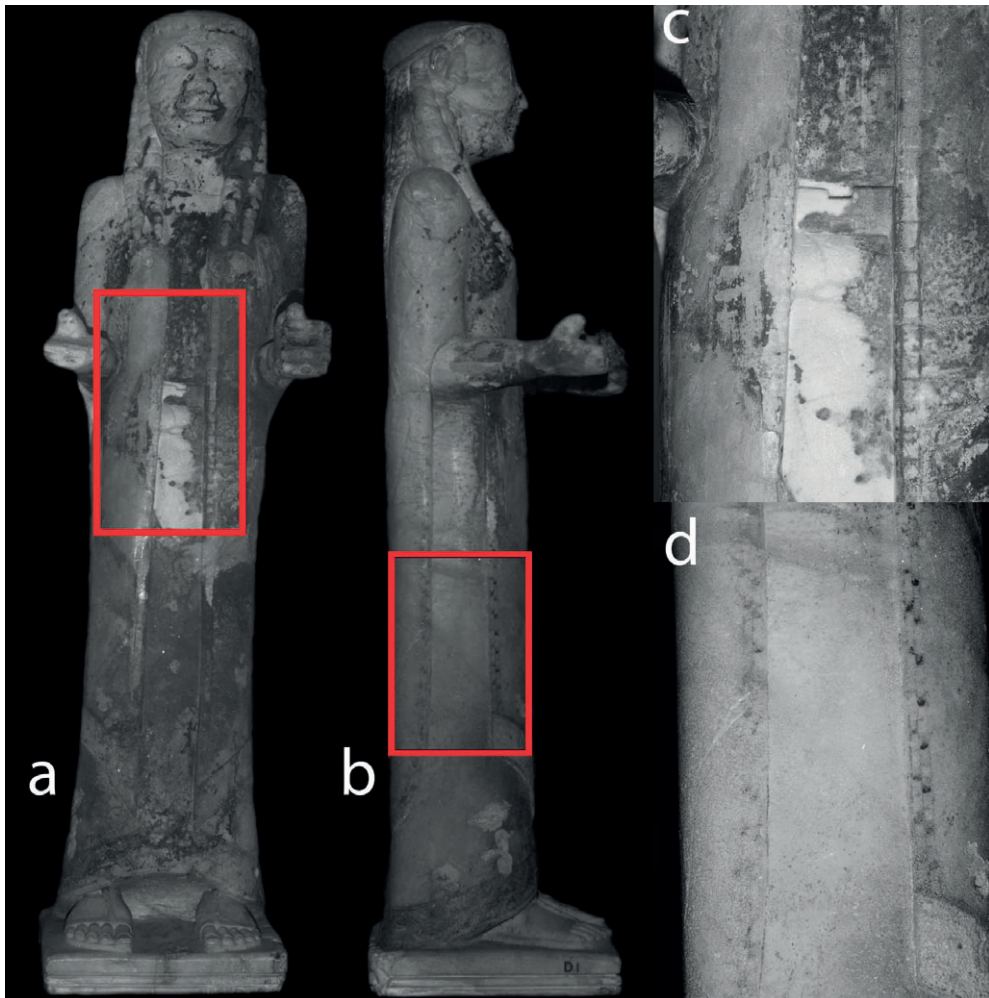
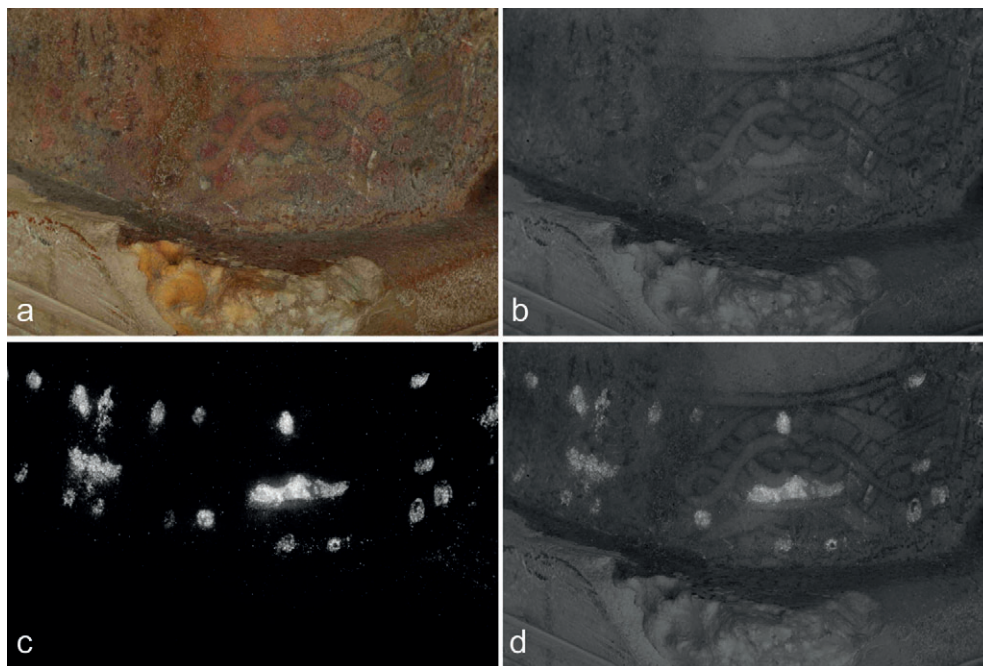


Figure 6. Infrared-reflected images of the Polledrara statue: (a) front; (b) proper right; (c) a detail from image 6a showing the ladder pattern on the inner edges of the cloak; and (d) a detail from image 6b showing the double ladder pattern on the outer edges of the cloak





**Figure 7.** A detail of the back of the tunic: (a) visible image; (b) infrared-reflected image in the 800–1000 nm region; (c) VIL image recorded in conditions that eliminate stray infrared radiation; and (d) VIL image from which stray infrared radiation has not been excluded

and infrared-reflected images of a detail of the back of the sculpture. The edge of the tunic is painted with an elaborate intertwined, inverted lotus-flower pattern enclosed between parallel black lines; the black outline of the flower pattern is executed using a carbon-based black and the background of the pattern is painted using red ochre (sample 5). In the infrared-reflected image, the carbon-based outline of the pattern shows clearly against the light background, Figure 7b. The VIL images show that the central band and some of the lotus petals are painted using Egyptian blue, Figures 7c and 7d. The presence of a little stray infrared radiation in Figure 7d makes it possible to see with great precision where within the lotus-flower scheme the surviving Egyptian blue is located. Using the combined information provided by these images it is clear that the

reconstruction given by Pryce [11] is not entirely accurate and a new reconstruction is therefore proposed here. Figure 8 was obtained by merging the visible, infrared-reflected and VIL images and by digitally reinforcing the colours using image-processing software. Other colours may have been present in this painted border, but none was identified with the investigative techniques available for this study.

- *Sandals:* Both hematite and goethite were found in the sample taken from the red area of the sandals under the proper right big toe. Hematite and goethite are the chief colourants in red and yellow ochre respectively and indicate the use of natural ochre as a pigment; small amounts of goethite are often found in natural red ochre [27 p. 141].

Some of the pigments noted above have been observed widely on classical sculpture [28], and Egyptian blue, hematite and ochre pigments have also been reported on the Etruscan sarcophagus of Seianti Hanunia Tlesnasa of about 200–150 BC [29, 30]. Hematite and ochre would have been readily available from the widespread exploitation of the iron deposits in Etruria.

#### **Conservation-related issues**

The VIL images in Figure 5 also show the presence of particles of Egyptian blue on the base of the sculpture and on the modern wooden support, indicating that some pigment has been displaced, possibly during handling. In addition, particles of Egyptian blue are scattered across the surface of the sculpture, including the head and the upper portion of the hair. A considerable amount of pigment was also found above the hem of the tunic and on the cloak. As mentioned above, although this may correspond to an intentional application of paint containing Egyptian blue, the absence of any distinctive features seems to suggest that its presence is due to accidental displacement of blue paint from the hem and the large bands of the cloak.



**Figure 8.** Colour reconstruction of the lotus-flower pattern of the hem of the tunic, produced by overlaying the visible, infrared-reflected and VIL images and by copying and extending the existing colours to areas where the paint has disappeared. This reconstruction is not intended as the recreation of the original appearance of the sculpture, but as an indication of the colour scheme

Figure 9 shows the UV-induced luminescence (UVL) image of the front of the sculpture. UVL generally occurs in the presence of organic materials such as plant- and animal-derived pigments, binders or modern organic conservation materials. It was hoped that UVL imaging might reveal the presence of original luminescent materials, such as organic colourants or binders, but no such evidence was found. This does not prove that such organic materials were not originally present as the appearance of UVL is highly dependent on localized conditions and the degradation of original material, so that its lack cannot be interpreted as a proof of the absence of organic materials.

Some luminescence, related to past restoration and conservation treatments, could be observed. In Figure 9, the proper right hand and the wrist of the proper left hand show a white/blue emission from a quite strongly luminescent material. This is present only in damaged areas and therefore presumably relates to unidentified conservation materials such as adhesives and consolidants. In addition, another unidentified material, possibly a pigment used for retouching the cloak or a consolidant such as shellac, shows a weak red luminescence.

The black crust and 'waxy' deposits present on the upper sections of the sculpture had suggested that the sculpture might have been damaged by fire in antiquity. Five small samples were taken from the deposits on the hair and proper left arm and analysed by GC-MS and FTIR spectroscopy to investigate whether they were the remains of a burnt varnish or other organic coating [14]. All were found to be extremely low in organic material and while two samples contained fatty acids at a level above background levels, these were most likely derived from fingerprint contamination rather than any original surface treatment, since no components indicative of varnish or burnt organic compounds could be found.

### Analysis of the clothing

Numerous iconographic sources, including the tomb paintings of Tarquinia, illustrate the variety and splendour of Etruscan garments [31, 32]. Etruscan clothing depicted on figurines, statues, vases and tomb paintings has been studied extensively by Larissa Bonfante in her seminal *Etruscan dress* [33]. Both sexes were represented wearing rectangular and semicircular cloaks (*tebennae*) and tunics of various lengths, pointed hats and pointed shoes or sandals. The costume of the Polledrara statue appears to fit well within the repertoire of Etruscan fashion of the sixth century BC as depicted in various works of art. Despite being highly stylized, the elements of dress of the Polledrara statue are likely to represent a real-life fashion.

### The tunic

The figure wears a long dress or tunic, often described using the Greek term *chiton* [33; p. 48], although its precise construction is difficult to discern. The tunic is held in place by a belt with a buckle, which was originally gilded, suggesting that it was intended to resemble bronze or gold. The tunic is longer at the back than at the front. If the tunic is indeed shaped like a *chiton*, the uneven length at the hem suggests that the garment is gathered at the waist above the girdle at the front, but not at the back. The raised front hem could also be due to the fibulas or buttons, which held the front and back of the garment together at the shoulders, falling to the back.



Figure 9 Ultraviolet-induced luminescence image showing a bright blue luminescence on the damaged areas at the hand and wrists, probably associated with modern conservation materials, and a weak red luminescence in the middle of the figure, again probably associated with conservation materials such as shellac



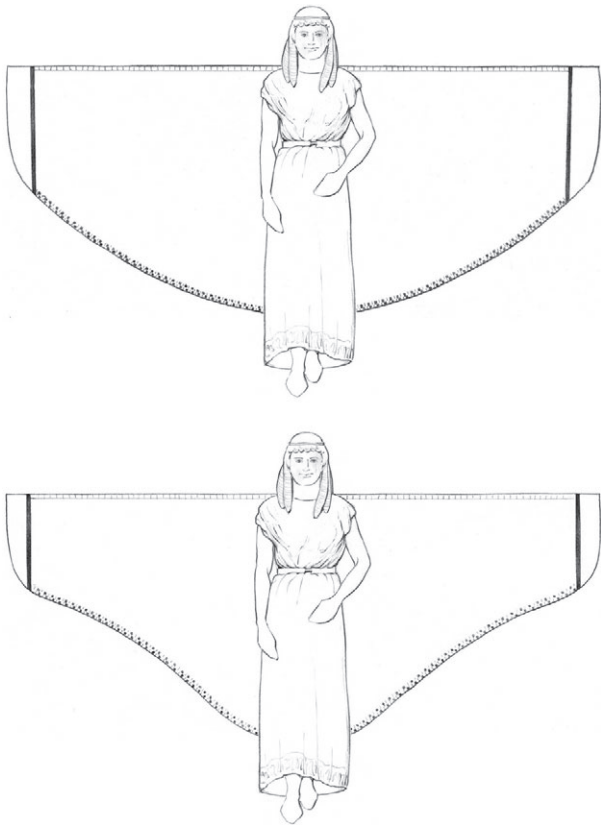


Figure 10. Two conjectural patterns for the cloak showing possible interpretations of the three borders used – the ladder decoration along the straight top edge, and the broad blue bands and double ladder decoration along the curved edges: (a) in a semicircular shape; and (b) a lobate shape. Illustration: Kate Morton

An indication of a deep, broad fold is present at the front just above the waist; this observation confirms that the elements of the dress are indeed stylized.

### The cloak

Some textile elements of the cloak worn over the tunic are also difficult to interpret. Nevertheless, recent work on extant Etruscan textiles is beginning to provide more direct evidence for the appearance and construction of Etruscan garments [34]. The spectacular finds from Verucchio in north east Italy provided, for the first time, direct archaeological evidence for the appearance of Etruscan garments. One of the richest is Tomb 89, the so-called Tomba del Trono (tomb of the throne), a chieftain's burial from around 700 BC [35]. In addition to numerous small fragments surviving on the funerary pyre, it contained two semicircular cloaks, a tunic-like garment with lobate or curved edges and a small, almost square textile with stitched hems on all four sides [34, 36]. The large semicircular cloaks, which were decorated with a tablet-woven border running around their edges and originally measured approximately 270 × 80 cm, were dyed and preserved traces of further decoration, with amber buttons and other appliqués evidenced by the stitching holes. A tantalizing glimpse of the female garments is provided by the yet-to-be-analysed textiles discovered in Tomb 26/1969 at Verucchio, which are woven in diamond twill binding and have a checked pattern [37; p. 128]. Such checked textile designs are frequently depicted on Etruscan monuments [33; pp. 12–14], but only with the discovery of extant textiles has



Figure 11. Illustrations showing how cloaks of the two shapes shown in Figure 10 would drape on a figure. The semicircular pattern creates a large number of folds at the elbow (upper three illustrations), while the lobate shape generates fewer and more contained folds (lower three illustrations). The woman is shown as mature since the statue seems to represent an older individual. Illustration: Kate Morton

their complexity and sophistication become apparent. The textiles discovered at Verucchio demonstrate not only that garments known from iconography reflect the reality of Etruscan dress in terms of shape, colour and decoration, but also that these garments date to a considerably earlier period than previously thought.

A cloak similar to that of the Polledrara sculpture appears for example on one of the female figures depicted on a relief from Chiusi now in Palermo [38; p. 67 and plate 7.1]. In her book on Etruscan dress, Bonfante proposes two possible alternative shapes for the cloak of the Polledrara sculpture: that such cloaks were rectangular with the front panels added separately [33; pp. 47–48] or that the cloak had a concave, crescent shape [33; p. 186 and plate 94.F]. However, a closer inspection of the cloak of the woman from Polledrara appears to indicate that the cloak was of roughly semicircular or lobate

shape, as in the archaeological finds in Verucchio discussed above. The strongly curved edge at the back of the cloak and the curved, pointed ends at the front suggest rather a shape like that of the *tebenna*, the characteristic Etruscan cloak with rounded edge that was the forerunner of the Roman toga. The cloak would have been very large, judging by the fact that it reaches below the knees. If semicircular, such a large cloak would, therefore, form a considerable volume of folds by the elbows, not at all represented in the sculpture. While this omission is consistent with the highly stylized representation of the garment, the lobate alternative provides another possible explanation for the complete absence of folds at the elbow. The lobate option reduces considerably the quantity of fabric gathered at the elbow and is possibly closer to the original shape of the cloak. Figure 10 shows two possible schematic reconstructions of the pattern based on the archaeological examples from Verucchio and Figure 11 shows how the two different patterns would have gathered at the elbow.

Some other aspects related to the position of the borders of the cloak remain difficult to decipher. A possible explanation of the observations from the sculpture is illustrated in Figure 10. The straight edge of the cloak is decorated with a ladder pattern, while the curved edge seems to have two different borders: the wide blue border at the front on the curved edge immediately adjacent to the vertical straight edge and a double ladder pattern along the rest of the curved edge. The way in which the two patterns on the curved edge of the cloak would have met remains unclear.

### **The sandals**

The sandals of the Polledrara statue have thick soles, straps encircling the toes and the instep, and another strap joining these two that is fixed to the sole between the first and second toe, Figure 3. Bonfante [33; p. 59] has connected this type of footwear to so-called Etruscan sandals, imported and imitated by the Athenians in the fifth century BC. They had thick wooden soles and gilded straps, but what most likely distinguished them from other contemporary footwear was that they had soles with hinges at the instep, allowing the back section to move. Remains of such sandals have been found in Etruscan tombs of the seventh and sixth centuries BC, including an example from Vulci now in the University of Pennsylvania Museum of Archaeology and Anthropology [39, 40].

### **Borders: patterns and techniques**

Decorative borders are a distinctive Etruscan dress element illustrated by iconographic sources [33; p. 15]. Examples can be found at Verucchio on both male and female tunics, cloaks and other garments [34], and at other Etruscan and Italic sites where textile fragments have been preserved. Usually the patterns of such borders consist of simple geometric elements such as bands or triangles, so that the ladder border of the cloak of the Polledrara statue finds direct comparisons in Etruscan art, see [31; plates 93, 95 and 119]. In contrast, the lotus-flower pattern on the Polledrara statue is quite complex and appears to derive from Near Eastern sources, as closely analogous designs are found on, for example, Assyrian ivories [7; p. 20, 41]. These Near Eastern sources influenced Greek artists who used such patterns on both textiles and pottery. A lotus-palmette pattern is observed on a border on the Sophilos



Figure 12. The Sophilos Dinos (British Museum 1971,1101.1) showing a painted floral pattern similar to that of the Polledrara statue



Figure 13. A detail from the Sophilos Dinos. The central figure of Leto wears a tunic with a pattern at its hem almost identical to that on the Polledrara statue

Dinos at the British Museum (BM 1971,1101.1: Figure 12), while the figure of Leto on the same vase (Figure 13) has an almost identical border depicted on her peplos [42; p. 24 and figure 27]. While the lotus-flower pattern might have reached the attention of Etruscan artists via Greek artefacts, it is not



impossible that the Near Eastern influence might have reached both Etruria and Greece directly and perhaps independently. The pattern may well have been inspired by various objects of the Orientalizing (eighth to seventh century BC) style, but may also represent a real textile pattern, which could have been created using a variety of techniques.

The most common ancient technique used to produce complex decoration in a textile was tapestry. In tapestry, there are several coloured wefts, which do not pass from selvedge to selvedge but are woven into blocks of colour. The Polledrara statue border would have been woven separately as a tapestry band and then sewn onto the garment. An alternative technique could have been that similar to brocade, in which a supplementary, i.e. non-structural, weft is used to produce a pattern in addition to the ground weave weft that holds the warp threads together. At present, however, there are no extant examples of borders woven in tapestry or by the supplementary weft techniques anywhere in the Mediterranean region from this period.

Another technique that might have been used to achieve complex figural decoration is embroidery, where the pattern is mechanically attached to the ground weave using a needle and a variety of coloured yarns. The ancient use of embroidery is generally associated with the Near East and the earliest example of embroidery in the Mediterranean region is a linen fragment originally embroidered with striding lions found at Koropi in Athens and dated to the fifth century BC [43; p. 195]. The Oriental, indeed Persian, nature of the motif and the material (the embroidery was executed in metal thread) has prompted its identification as an import, since no other examples of embroidery are known in Europe until later periods.

The last and most likely technique that could have been used to create the Polledrara border is tablet weaving. The technique involves passing threads through holes in the corners of (usually) square tablets (sometimes called cards) that, when rotated forward or back, force the threads to form different sheds [44]. By combining different sequences of rotation of the card, it is possible to achieve numerous and often quite complex patterns including, for example, those from the Iron Age finds at Hallstatt and Dürrenberg in Austria [45]. This method is suitable for weaving narrow bands such as belts, heading bands for the warp of a warp-weighted loom or decorative borders for a base textile. The last of these uses for the tablet technique is aptly demonstrated by the Verucchio cloaks, where 36 tablets were utilized to create a triangular pattern [44]. Fragments with even more complex tablet-woven borders from Santa Palomba near Rome [46] and Sasso di Furbara near Cerveteri [47], both dating to the eighth century BC, demonstrate that the method was well developed and used in Italy by the Early Iron Age.

Tablet weaving in Etruria is attested not only by the presence of such borders on textiles but also by finds of tablets, metal clasps, bone spacers with pegs and, in particular, by terracotta spools or *rocchetti* [48; pp. 138–153]. The tablets themselves, because they were made of wood, bone or hardened leather, rarely survive, but in the Etruscan region a set has been found in Tomb 284 at Cerveteri-Sorbo, dated to the late eighth century BC [49; p. 79]. Two bone tablets are known from the Casa di Ricovero necropolis of the Venetic site of

Este: a complete example from Tomb 83/1989 dated to the end of the eighth or beginning of the seventh century BC and a fragmentary tablet from Tomb 44/1989 that dates to the last quarter of the seventh century BC [50; p. 47]. A bronze tablet was found in the Lippi Tomb 76/1972 at Verucchio, dated to the end of the eighth or beginning of the seventh century BC [35; p. 181, No. 126]. Several tablets are also known from settlement sites, including an almost complete bone tablet from a late-eighth-century BC context at the Latial site of Ficana, and several wood and bone tablets from the waterlogged Iron Age site of Longola di Poggiomarino, north east of Pompeii [48; p. 139]. Most of the tablets are quite small, measuring only about 2 × 2 cm, and practical experiments suggest that such small tablets are particularly suited to producing integrated tablet borders as they do not slide, making it easier for the weaver to control the direction of individual tablets in a set [51; p. 153].

Spools, probably used as weights in tablet weaving [48; pp. 138–152], appear in female burials in central Italy from the Final Bronze Age until the Archaic period. The vast majority of the burials containing spools are quite rich, suggesting that only elite women possessed the skill and/or the right to use these tools to make special ceremonial garments with tablet-woven borders. Indeed, the largest set of spools recorded in a burial – 130 – comes from the Polledrara Tomb itself, echoing the complexity of the lotus border on the statue. The distribution of spools in Early Iron Age burials in Italy and the ubiquitous representation of borders on Etruscan garments further argue that these borders were not purely decorative but communicated a very clear and important message of status not only to the Etruscans, but also to other European Early Iron Age cultures.

Iconography provides evidence for the use of decorative borders outside Etruria. Some of the geometric patterns on the so-called Daunian stelae of south east Italy have been interpreted as representations of tablet-woven bands [52]. Archaic sculptures from the Athenian Acropolis also boasted elaborately patterned borders, and the reconstruction of the colour scheme of the so-called Peplos Kore revealed palmette patterns on the top and bottom parts of her peplos [28; p. 25].

Italian tablet weaves also show parallels with the frequent finds of tablet borders in western and central Europe [44, 53; p. 123]. Among the more significant finds are those from Hallstatt in Austria [45], Altrier in Luxembourg [47], Vix in France [54], El Cigarralejo in Spain [55; p. 191], and Hochdorf and Hohmichele in Germany [56]. Apart from Hallstatt, where textiles have been recovered from secondary contexts in salt mines, most of the other tablet weaves originate from princely burials. The making of these tablet borders, which were almost certainly added to the garments when the base textile was already finished, was technically complex, extremely labour-intensive and time consuming. These factors suggest that the textiles must have served as indicators of social rank or as ‘ceremonial’ clothes, with the border serving as the distinguishing element, characterized by technique, pattern and colour [36; pp. 194 and 208]. The toga, the Roman descendant of the Verucchio cloaks, retained the border as the status symbol, in this case dyed purple [33; pp. 15, 39, 45, 48–55 and 102, 57].

Iconographic sources and archaeological evidence of tablet borders and the tools used to create them indicate that tablet weaving is the most likely technique for the border represented on the Polledrara statue. The depiction of decorative borders on her garments furthermore underlines the high status of the woman portrayed by the statue as well as those buried in the tomb where the statue was placed.

### **Dyes and colour**

The question arises as to whether the colours used to paint the statue's clothing are an attempt by the artist(s) to represent accurately the colours of dyes used on Etruscan textiles. As discussed above, the large hem of the cloak is shown painted in blue, while the elaborate lotus-flower pattern on the hem of the tunic is painted in black, red and blue, and both sandals show clear traces of bright red.

Red, blue and black are not unusual in Etruscan contexts and Etruscan tomb paintings illustrate garments and utilitarian textiles resplendent in reds, blues, greens, yellows and purples. A variety of plants and animals could have been used to create dyes of these hues [58]. Dye analyses of surviving textiles from Verucchio [34] and Sasso di Furbara [59] demonstrate the popularity of reds, blues and purples. At both sites, traces of indigotin were identified, indicating that the blue colour was obtained from woad (*Isatis tinctoria* L.), while traces of purpurin suggest that the red is most likely derived from a type of madder (for example *Rubia tinctorum* sp.), while the purple was probably achieved by combining the two. At least some of the colours on the Polledrara statue are, therefore, likely to illustrate the real colourants used to dye Etruscan garments, while the red of the sandals may reflect the frequent practice of dyeing leather red.

### **Conclusions**

Scientific investigation of the polychrome decoration of the Polledrara female statue provided an opportunity better to understand Etruscan women's dress. The gypsum figure from the Isis Tomb is wearing elaborate clothing comprising a tunic and a cloak. The tunic is possibly rectangular in shape and has a rich border with an inverted lotus-flower pattern, probably executed using tablet weaving. Scientific investigations allowed the shape and colour of the complex pattern at the hem of the tunic to be reconstructed and compared with painted artefacts, such as the garments depicted on the Sophilos Dinos. Because of the lack of gathered folds at the elbow of the sculpture, the cloak is probably semicircular and lobate in shape and has three different painted borders: a wide blue band, a single, large ladder pattern and a small, double ladder pattern. While the exact shape of the cloak is not entirely certain, lobate or semicircular cloaks have been found in archaeological excavations in Verucchio, Italy. Therefore, it is likely that the stylized cloak, as well as the ornaments, correspond to real-life fashion of the sixth century BC in Etruria.

### **Experimental appendix**

#### **X-ray diffraction (XRD)**

A small, finely powdered sample, mounted on a gelatine filament, was analysed by powder X-ray diffraction (XRD) using a Philips PW1012/90 Debye-Scherrer camera with Cu

K $\alpha$  radiation and the standard ICDD database for crystallographic pattern matching.

#### **Technical imaging**

All images were made using a Canon 40D camera body modified by removal of the inbuilt UV-IR blocking filter, allowing use of the full range of the CMOS sensor (*c.*300–1000 nm), and a Canon EF 50 mm f/1.8II lens. The wavelengths used were controlled by placing a filter or a set of filters in front of the lens. Illumination for visible and infrared imaging was provided by two Classic Elinchrom 500 xenon photographic flashlights equipped with a diffuser and symmetrically positioned at approximately 45° with respect to the focal axis of the camera.

- *Infrared-reflected imaging*: the Elinchrom 500 lamps described above were used but the visible range was blocked by a Schott RG830 cut-on filter, with 50% transmission at 830 nm giving an illumination range of *c.*800–1000 nm.
- *Ultraviolet-induced luminescence imaging*: excitation was provided by two Wood's lamps (maximum output at 365 nm) filtered with Schott DUG11 bandpass interference filters (280–400 nm). The camera was fitted with a Schott KV418 cut-on filter (50% transmission at *c.*418 nm) and an IDAS-UIBAR bandpass filter (*c.*400–700 nm).
- *Visible-induced luminescence imaging*: excitation was provided by two sets of red, green and blue LEDs (*c.*450–650 nm) and the camera was fitted with a Schott RG830 filter.

#### **Raman spectroscopy**

Raman spectroscopy was carried out on seven samples using a Jobin Yvon LabRam Infinity spectrometer with green (532 nm) and near infrared (785 nm) lasers. Spectra were collected for between 20 and 100 seconds, with at least five scans used to produce each spectrum. Identifications were based on comparisons with a British Museum in-house database.

#### **Gas chromatography-mass spectroscopy (GC-MS)**

GC-MS analysis was carried out on five samples from the hair and proper left arm. Samples were extracted with dichloromethane (DCM) before being derivatized with bis(trimethylsilyl)trifluoroacetamide (BSTFA) + 1% trimethylchlorosilane (TMCS). Analysis was carried out using an Agilent 6890N gas chromatograph coupled to an Agilent 5973N mass spectrometer. Injection was in splitless mode at 250°C and 7.96 psi (54.88 kPa), with a purge time of 0.8 minutes. An Agilent HP5-MS column (30 m × 0.25 mm, 0.25 mm film thickness) fitted with 1 m × 0.32 mm retention gap was used. The carrier gas was helium in constant flow mode at 1.0 mL per minute. Acquisition was in scan mode (50–600 amu per second) after a solvent delay of 7.8 minutes. System control and data collection/manipulation were achieved using G1701DA Chemstation (G1701DA) software. Mass spectral data were interpreted manually with the aid of the NIST/EPA/NIH Mass Spectral Library version 2.0.

#### **Fourier transform infrared (FTIR) spectroscopy**

FTIR spectroscopy was performed using a Thermo-Nicolet Avatar 360 spectrometer with a beam condenser. The sample was flattened in a diamond micro-compression cell. The



spectra were acquired in transmission mode over the range 4000–650 cm<sup>-1</sup> at a resolution of 4 cm<sup>-1</sup> and with automatic gain. The spectra were identified by comparison with reference spectra.

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