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# Some pigment identifications for objects from Persepolis

> [The pigments were] everywhere at the sculpture which had been buried under the soil. (Herzfeld, quoted by Schmidt 1953, 82, n.90)

> It is difficult to believe that all traces of pigments could have disappeared in spite of the fact that the preserved lower parts of the sculptures were protected by mud-brick debris soon after the destruction.
>
> (Schmidt 1953, 162)

> Coloured designs on plaster [were found] above a tiled skirting … but since the designs had been carried out on thin sheets of white plaster, which had fallen when the buildings decayed, and had been spoilt by the rain, we could not collect any pieces worth preserving.
>
> (Ali-Sami 1970, 24-25)

The use and impact of colour in antiquity, not just on architecture, but also on dress, soft furnishings and other arts and crafts, has often been under-estimated owing to the

vagaries of weathering, the fragility of painted wall-plaster, and the perishability of organic materials. In terms of the Achaemenid period, written sources add little of direct relevance other than the statement in Darius' building inscription from Susa that "the men who adorned the wall, those were Medes and Egyptians" and allusions in the Book of Esther to "hangings of white and blue linen, fastened with cords of white linen and purple material" or "a mosaic pavement of porphyry, marble, mother-of-pearl and other costly stones" (Esther 1:6). Corresponding archaeological sources are equally poorly preserved, yet glazed bricks, painted wall and floor surfaces, painted and gilded columns, and coloured textiles doubtless transformed palatial interiors in ways which we can barely imagine. In the case of Persepolis, a number of the early excavators from at least the 1890s have not only commented on the occasional presence of coloured pigments on freshly exposed surfaces, but occasionally also on their tendency to fade soon after their contact with light. Specifically, traces of black, brownish-red, green, blue, white and yellow or golden pigment have been noted on reliefs on the east face of the Apadana, as well as on reliefs, column-bases and doorways in the Central Building, the Hall of a Hundred Columns, the Treasury and the Palace of Darius (Tilia 1972; Tilia 1978, 31-69; Lerner 1971; Lerner 1973; Roaf 1983, 8; Schmidt 1953, 82 n. 90, 116, 160, figs. 68, 72; Weld 1892, 541, 556-58). In addition, the tongues and nostrils of the figural capitals of the Apadana porches were highlighted with red pigment (Schmidt 1953, 81), and Wilber (1969, 79) states that "red paint still clings to the lips of guards" whereas "the

slightly rough surfaces left by the use of toothed chisels were more suitable for the retention of applied colors than were highly polished surfaces. The point is made to support the belief that color filled in areas between figures". Lumps of scarlet and carmine red, emerald green and ochreous yellow pigment, pigment-encrusted sherds, and even a bowl containing a congealed mass of blue pigment have been found at various spots, including the south-west corner of the Terrace wall, in and near the tripylon and on the north stairway of the Apadana (Tilia 1972, 245-46, pl. CXXXII: fig. 22; Tilia 1978, 68-69). Analyses indicate the black to be asphalt, the red to be opaque red glass, the blue to be 'Egyptian Blue', the yellow to be ochre, and the red floor in the Treasury to be lime-plaster coloured with red ochre (Tilia 1978; Lerner 1973; Matson 1953, 287). Published analyses of wall-paintings from the Chaour palace at Susa also indicate the use of Egyptian Blue, hematite and cinnabar as the source of blue and red pigments (Boucharlat & Labrousse 1979, 67-8). Remains of green pigment, interpreted as being for the repair of similarly coloured floors and walls in the Apadana, were found inside a bowl in a storeroom on the southern side of the Apadana (Schmidt 1953, 74). Finally, the use of vegetable dyes has also been suggested although unproven (Wilber 1969, 77-79).

In the case of the Persepolis sculptures in the British Museum, the surfaces have unfortunately suffered from lengthy exposure and weathering in antiquity as many derive from the uppermost section of the north façade of the Apadana; in a few cases the carving is somewhat fresher, notably on a

sculpture of a sphinx from another part of the site (see below), which is known to have been first exposed in 1826 and removed soon afterwards. In yet other instances, however, the surfaces now either appear to have a dark brownish colour which is not the colour of the original stone but which instead closely resembles the effect of oiling also carried out on plaster casts in the 19th century. Other sculptures have been retouched with light brown paint during earlier conservation, seemingly in an effort to simulate the effect of the weathering seen on uncleaned pieces. However, even the sculptures at the site vary in appearance. The sculptures on the east stairway of the Apadana which were discovered in 1932 were coated by the Iranian Archaeological Service "with a layer of wax in order to protect them against the varying atmospherical conditions" although this was later removed (Tilia 1972, 4; 1978, 68); by contrast, there are extensive traces of strongly adhering lichen on the equivalent north stairway which have been attributed to its relative dampness and reduced exposure to direct sunlight (Tilia 1972, 46). Few traces of such lichens survive on the fragments in the British Museum, implying that they have been removed at some stage, although they do survive on a joining fragment which had been removed in 1811 but remained in the collection of St.Michael's College, Tenbury, until its acquisition by the Miho Museum in Japan in 1990 (Curtis 1998; cf. Umehara *et al.* 1997, 75-77).

A small number of Achaemenid sculptures in old collections and museum storerooms have nevertheless revealed traces of what are believed to be original colour, notably on winged

figures in the Fogg Art Museum and Persepolis Museum (Lerner 1971; 1973; Tilia 1978, 33), and most recently reddish-brown paint spots have been noted on the statue of Darius in the National Museum in Tehran (Razmjou 2002). With these points in mind, Achaemenid objects in the collections of the British Museum have been closely examined for colour, and traces of pigment found on three objects from Persepolis analysed. In two cases hematite, representing original red ochre, was found, whilst in the third case a green pigment was shown to be of modern origin.

## 1 Analysis

The analysis was carried out using a Raman microprobe specifically adapted for work on art and archaeological objects. This instrument allows rapid non-destructive or minimally destructive identification of most of the pigments used in antiquity and has greatly increased the amount of pigment identification work which can be carried out by the Museum. Details on the method are described on **www.thebritishmuseum.ac.uk/science/techniques/sr-tech-raman.html** and by Smith & Clark (2001).

# 2 The Objects

1 ANE 1861-5-24,11 (118851) is a stone relief fragment, showing the reins, tasselled rein-guide and part of the harness of a chariot horse, from the uppermost register of the east wing of the north stairway of the Apadana, and originally part of a sequence showing two charioteers (cf. Curtis 1998). It was presented to the Museum in 1861 by the Fifth Earl of Aberdeen (1816-1864) but was acquired at Persepolis in 1811 by his predecessor George Hamilton Gordon (1784-1860), the Fourth Earl of Aberdeen (Barnett 1957, 61; Mitchell 2000, 52).

*Fig. 1: Persepolis sculpture (BM ANE 118851) with arrow indicating the position of original hematite pigment on the right vertical edge*

It is discoloured and blackened, apparently due to deliberate oiling of the piece. Despite this, clear traces of red pigment can be seen along the original trimmed right edge of the piece (**Fig. 1**). This face of the stone was subsequently concealed as it was encased within a stone mount, presumably made for display purposes during the 19th century, and the pigment was only rediscovered when the object was removed during conservation prior to installation in the new "Enlightenment" display in the refurbished King's Library of the British Museum (cf. Simpson 2003). The presence of colour on this edge supports an earlier observation made by Tilia (1972, 180) that red paint was applied to the smoothed *anathyrosis* edges of sculpted stone blocks at Persepolis, the purpose presumably being to facilitate precise fitting of the vertical edges. A small sample of a few grains was taken from the coloured area and examined under the Raman microprobe. Although sparsely distributed, a small number of red crystals could be seen in this material. When subjected to analysis with a near infrared (735 nm) laser these gave a Raman spectrum which matched our reference spectrum for hematite (**Fig. 2**). Hematite ($\alpha$-$Fe_2O_3$) is the chief colourant present in red ochre, a widely available natural material commonly used as a pigment in antiquity.

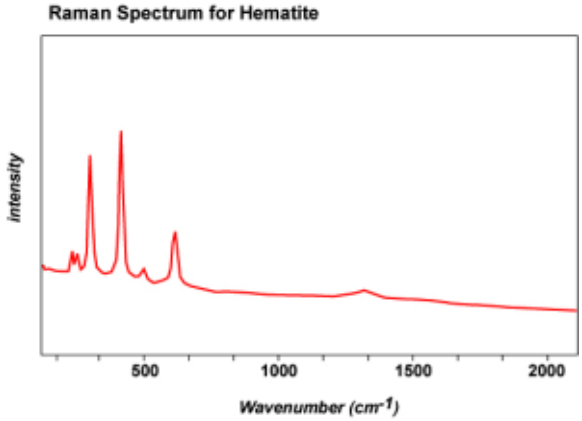

*Fig. 2: Raman spectrum for hematite*

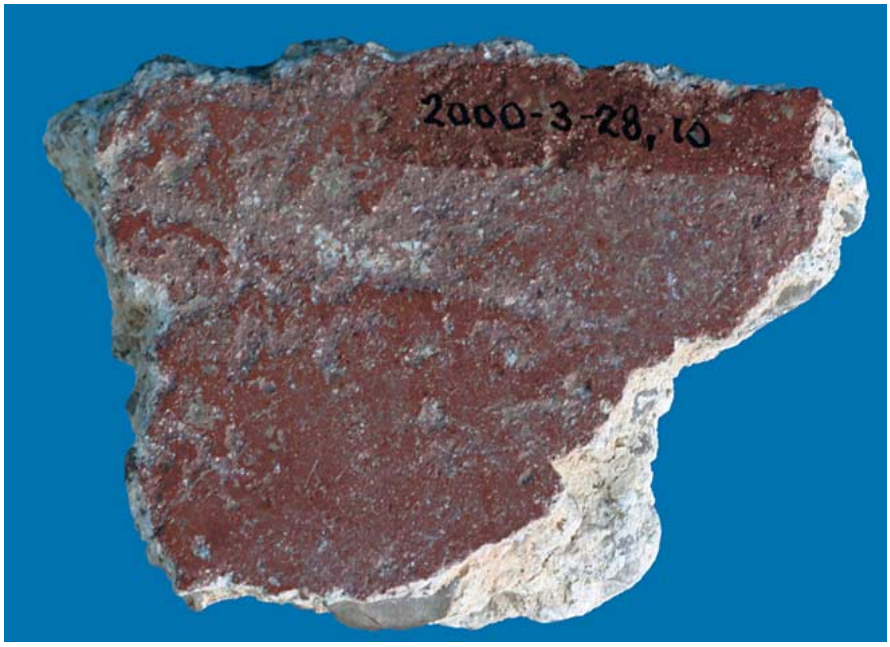


*Fig. 3: Small fragment of floor plaster (BM ANE 2000-3-28,10) coloured red with hematite*

2 ANE 2000-3-28, 10 is a small fragment of red surfaced floor-plaster found at the site (**Fig. 3**). Analysis directly on the surface of the piece again produced a spectrum matching that of hematite, confirming the suspicions of Weld (1892, 557), and the analyses by Matson (1953) who identified the presence of red ochre on a similar fragment of lime-plaster from Room 73 in the Treasury. Similar red-plastered floors were also found in the Palace of Darius and one or more buildings south of the Terrace (Schmidt 1953, 159, 222), whereas the floors of the Apadana and "Harem" consisted of greyish-green gypsum-plaster and plain white plaster was used in the Hall of a Hundred Columns (Schmidt 1953, 72, 132, 255; *contra* Ali-Sami 1970, 13, 53, 62 and Wilber 1969, 61). Analyses of additional

floor fragments found in the Northern Palace at Babylon and the "Palace of Darius" at Susa confirm the widespread use of hematite as a source of red floor colouring although the floor matrix differed between the Neo-Babylonian and Achaemenid buildings at those sites (Stoops & Stoops 1994).

**3** ANE 1938-1-101 (129381) is a stone relief fragment of a seated bearded male sphinx facing right, which was discovered in June 1826 during excavations by Lieutenant-Colonel John Macdonald (1782-1830). This discovery was first noted by a junior officer in Macdonald's delegation, one James Alexander (1827, 140), but the sculpture was removed soon afterwards by Sir John McNeill and was finally acquired on the Museum's behalf by the National Art Collections Fund (Simpson in press). It was thereafter published as probably coming from Palace H (Barnett 1957, 62-63, pl. XXI.4), but instead may derive from the south façade of Palace G, part of which had been later reused in a late or post-Achaemenid reconstruction of the north façade of Palace H (cf. Verdi ed. 2003, 123, cat. 53). If this identification is correct, it would imply that the present partial restoration of the upper section of this façade is incorrect, as Schmidt (1953, 280) half acknowledged before concluding that "there was no central motive – such as the image of Ahuramazda flanked by sphinxes – on its outer face". However, it certainly does not derive from the southern stairway of the Palace of Darius for, although Flandin & Coste (1976, vol. III, pl. 136) show the equivalent right-facing sphinx as missing by the time of their visit in 1840/41, the sphinxes on this façade were constructed from two joining slabs rather than

one, and the details of treatment of the hair and wings differ from those on the extant left-facing example (Curtis 1989, 2; cf. Schmidt 1953, pl. 127). The same differences of detail apply to the antithetical sphinxes on the stairways of the Apadana, Palace of Xerxes and the "Central Building", and for this reason it must be assumed that the sphinx in question derives from a different location. Traces of a bright green pigment, similar in appearance to malachite, were found trapped within the carved earring of the sphinx, and to which our attention was kindly drawn by Shahrokh Razmjou. Close examination showed this green to extend downwards from the earring as if washed down, and also the presence of a single spot above the earring. A few grains were removed and analysed by Raman microprobe using a green (532 nm) laser. This produced a complex spectrum which included anatase, a form of titanium oxide (**Fig. 4**). While anatase can occur as a natural mineral, it is not common and does not seem to have been used as a painting pigment until the discovery of an artificial manufacturing process in around 1920 AD made it readily available. Titanium oxide now forms a major component of many modern paints. This spectrum is interpreted as representing a modern pigment based on

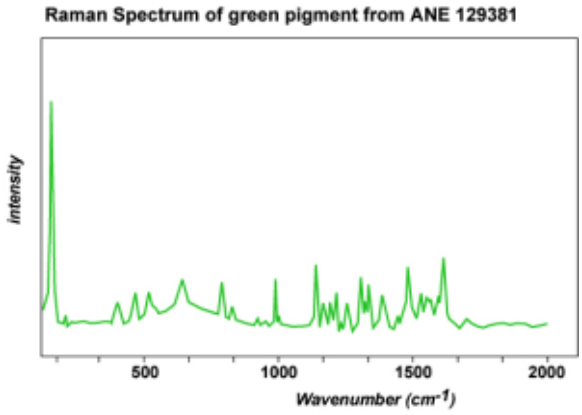


*Fig. 4: Raman spectrum for green pigment from Persepolis sculpture (BM ANE 129381)*

titanium white, but with the green colour resulting from an additional unidentified component. The identification of this modern paint fleck highlights the extreme care with which preliminary observations on the possible colouration of sculptures ought to be treated prior to scientific analysis.

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