Ancient Monuments Laboratory
Report 32/94

IDENTIFICATION OF A GREEN STONE FROM WROXETER ROMAN CITY, SHROPSHIRE

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Summary

A green intaglio, described by the seal specialist as 'plasma', was identified as a chalcedony coloured green by chrome. This is of particular interest as chrome green chalcedony is supposed to have been first discovered in Africa in 1955.

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Wroxeter, classical Viroconium Cornoviorum, was first established as a legionary fort on the Welsh border in the first century AD. The adjacent civil settlement then gradually expanded in the second century until it became the fourth largest city in Roman Britain enclosing a defended area of 73ha. Only part of the site has been excavated.

A green intaglio, AML 8650250, from the Early Civil occupation layers was among the finds sent by the excavator, Dr Graham Webster, to the Ancient Monuments Laboratory for conservation. At that time, it was not realised that it had already been published by Dr Martin Henig who had described it as "Green plasma with black inclusions" (Henig 1978, 319). The material was therefore identified as a matter of routine and discovered to be a mineral of considerable interest.

DESCRIPTION

The stone is a translucent green with black and orange inclusions (see Plates 2-3). The shape is an oval double cabochon, with an intaglio cut on the flatter side showing a lion with its prey under a tree, (see Henig, ibid, for a full description and discussion of the motif, and Plate 1 at the back of this report for a photograph).

AML 8650250, WB84 (109) /4064\

Length: 13mm
Width: 9.7mm
Depth: 4.2mm
Specific gravity: 2.58
Absorption spectrum: typical for chrome

The appearance of the stone and the specific gravity indicated a chalcedony (SiO_2) and examination by transmitted light showed the stippled appearance characteristic of this mineral, but the stone appeared red when viewed through a Chelsea filter, (a characteristic of minerals coloured by chrome), and the absorption spectrum, examined by hand-held spectroscope, was also typical of that for chrome. This 'chrome spectrum', combined with an awareness of what minerals are known to have been available at the time the intaglio was made, suggested an emerald, a beryl coloured green by chrome (see below), but the specific gravity and the black and red inclusions were not characteristic of emerald. The material was therefore analysed by energy dispersive X-ray fluorescence spectroscopy (ED-XRF) and found to be composed almost entirely of silica and chrome; there was no aluminium which would be present in an emerald ($Al_2Be_3(Si_6O_{18})$). (See Figs. 1 and 2, page 4, for a comparison of the ED-XRF spectra of the intaglio and an emerald from the same site).

This result was puzzling as chrome green chalcedony is supposed to have been first discovered in Rhodesia (now Zimbabwe) in 1955 and named mtorolite (Smith 1967, 31-4; CMJ 1967, 30-1). In view of this, the intaglio was sent to the Geological Museum, now part of the Natural History Museum, where the identification as a chalcedony coloured green by chrome was confirmed, the inclusions being chromian spinel fringed with brown iron oxides or hydroxides. This mineral looks quite different to mtorolite, being more homogeneous and a brighter colour green than any specimen of mtorolite seen by the writer. It is also completely different in composition from the mineral nowadays called 'plasma'. This modern plasma is usually described as a chalcedony coloured by chlorite (eg Webster 1975, 192) although Frondel (Dana and Dana, 1962) considers the colour due to disseminated particles of a variety of silicates. Chlorite is an aluminium silicate with ferrous iron and magnesium, and neither it nor the silicates listed by Frondel contain chrome. In practice, the name 'plasma' describes only the appearance of a mineral, and, with 'prase,' is used as a purely visual descriptive term for green minerals, especially by seal specialists. Problems will arise as long as these archaic names continue to be used unsupported by analysis.

It appears from both Henig's Corpus and the catalogue of the Hague Collection (Maaskant-Kleinbrink 1978) that 'plasma' was used for making intaglios from the end of the first century BC to the third century AD, but chiefly in the first and early second centuries. At present it is not known where this mineral came from, although there are some indications that Russia or India may have been the source. Many mineral dealers have been questioned, and much 'ethnic' jewellery examined, especially from areas known to have chrome minerals, but with no success so far.

It has been suggested that the source may have been a single small deposit now worked out, but since the intaglios span over 200 years it is unlikely that the source has disappeared without at least a mention in classical literature and a search is now in progress. The obvious starting place is Pliny's Natural History, and although there is nothing like 'plasma' in Pliny's list of smaragdi, he does mention a green translucent 'iaspis' which resembles a smaragdus and which comes from India (Pliny Nat Hist, XXXVII, xxxvii, 115). Chrome is certainly present in India as it is the colorant both of Indian emeralds and of the aventurine quartz found there, but it also occurs in at least fourteen other Old World countries (see Appendix for list). The amount of chrome in the intaglio, however, suggests a source rich in chrome.

The present writer is not the first person to have noticed the Roman use of chrome chalcedony. In Les Pierres Précieuses, Tardy and Level define prase as a chalcedony coloured by included crystals of actinolite, but then note that Roman prases are different as they exhibit a chrome spectrum. They cite those in the Cabinet de Medailles (Paris) as examples but do not realise the significance of their discovery (Tardy and Level 1980, 379).

APPENDIX - Old World sources of chrome

The chromian spinels are magnesiochromite ($MgCr_2O_4$) and chromite ($Fe^{2+}Cr_2O_4$). Some of the larger Old World deposits of chromite are in Turkey, the Ural Mountains, Zimbabwe, and the Phillipines.

Emeralds (which are coloured by chrome) are found in Spain, Norway, Austria, Bulgaria, the former USSR (Siberia, the Ural Mountains, Ukraine), Afghanistan, Pakistan, India, Egypt, Gambia, Madagascar, ?Mozambique, South Africa, Tanzania and Zimbabwe.

This list has been compiled from Battey (1981, 203-4) and Sinkankas (1981, 359-609) supplemented by personal knowledge.

ACKNOWLEDGEMENTS

I wish to thank Mrs Susan Anderson, mineralogist, formerly of the Geological Survey of Rhodesia (Zimbabwe), Dr Roger Harding, Gem Testing Laboratory of Great Britain, and Ms Frances Wall, Natural History Museum, London.

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(The plasma intaglio is listed in the appendix to the second edition of the Corpus as number 220. Photographs appear as the frontispiece and plate XXXII)

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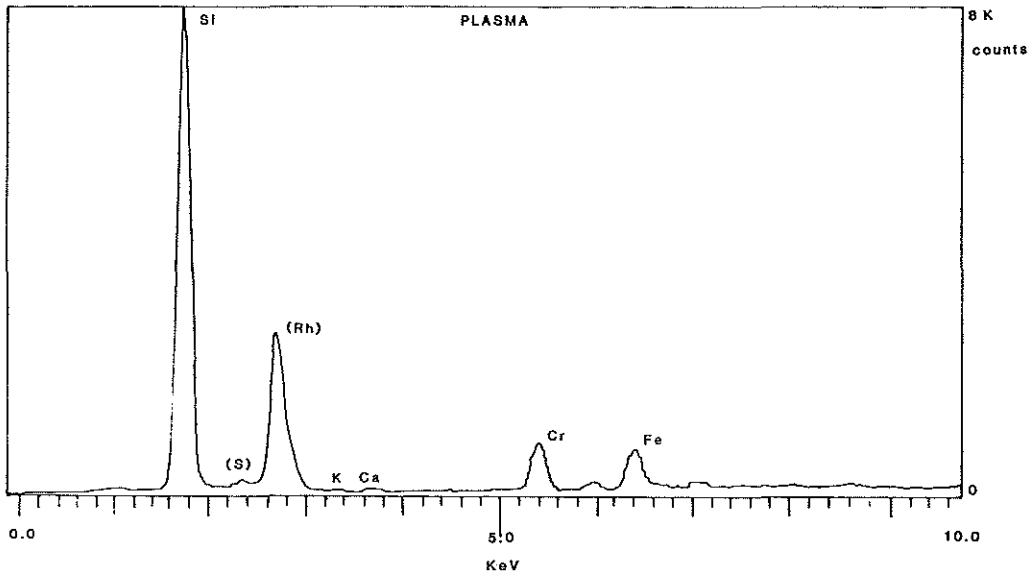

Fig 1. ED-XRF spectrum of AML 8650250, the 'plasma' intaglio.

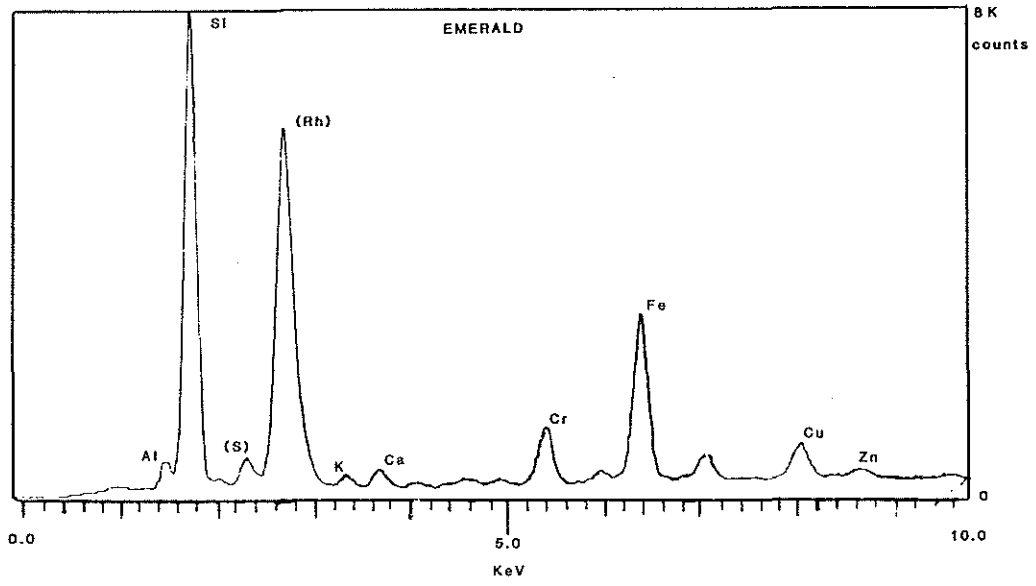

Fig 2. ED-XRF spectrum of AML 788145, an emerald from another part of the same site.

As a rough means of comparison, counting ceased when the silica peak reached the top of the standard graph frame. Note that the aluminium peak is missing on the 'plasma' spectrum. Disregard the elements in parentheses; they either come from the machine itself or from the tape supporting the stone.

PLATE 1. The 'plasma' intaglio, AML 8650250.

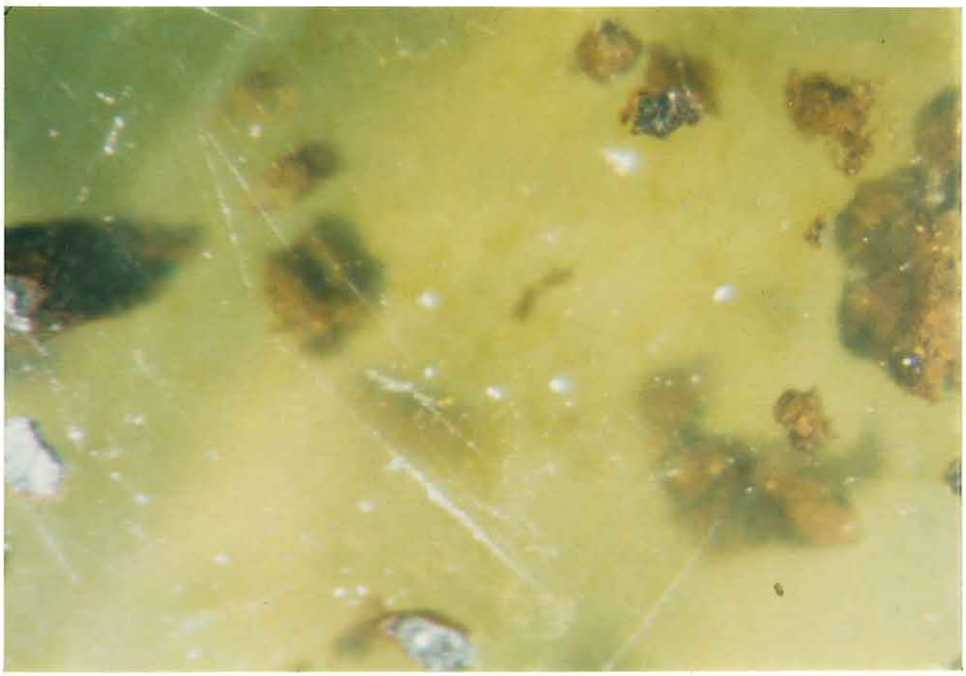

PLATE 2. The inclusions by reflected light. Note their metallic appearance where they cut the surface. (Wild film 35, 27)
Field of view: c 4.1 x 2.8mm

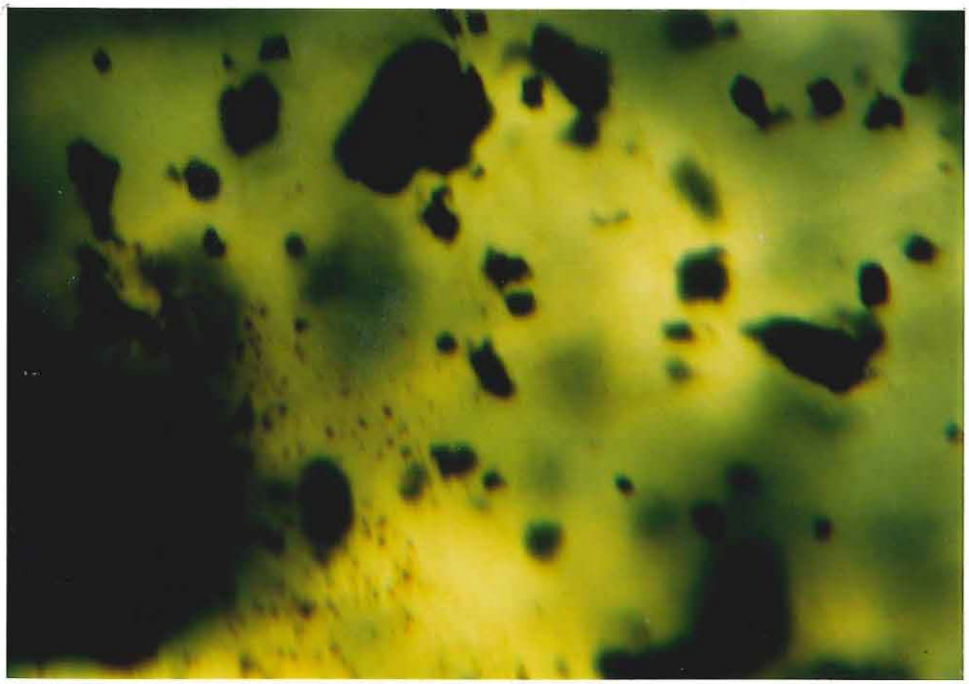

PLATE 3. The inclusions by transmitted light.
Field of view: c 8.3 x 5.6mm. (Wild film 36, 27)