tance spectra show the typical surface plasmon resonances of colloidal glass-metal nanocluster materials.

KEYWORDS: Pottery, lustre, nanoclusters.

HELLENISTIC «DIPPED» ENAMELS
(335)

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Enamelling in the round on a gold substrate (*émail en ronde bosse*) is a decorative technique most commonly associated with the period from the *early 15th century* onwards in Europe. Survivals are relatively rare, but are often highly ornate and are thus well-known (*e.g.* The Holy Thorn Reliquary and *Das Goldene Roessl*). Opaque white *enamel* is a dominant feature of these pieces.

Less well known are the Hellenistic (or «dipped») enamels. These are mainly items of *jewellery* such as earrings, and opaque white is again the main colour of glass used. Using non-destructive techniques (Optical Microscopy, Radiography and air-path X-ray Fluorescence) the technology of a number of these pieces has been investigated. They are made on gold wire with small pieces of gold sheet used as necessary to provide form. The white enamels appear to be high-lead soda-lime-silica glasses opacified by antimony. Tiny decorative spheres of gold were sometimes pressed into the glass before it had fully cooled. Unexpectedly one piece in an unusual green colour was found to contain significant levels of vanadium. To our knowledge, this is the first occasion on which *vanadium* has been found in an ancient glass; however, whether it was deliberately added to produce the strong green colour is not clear, as the glass also contains copper and iron which in combination also produce green.

KEYWORDS: Early 15 th century, enamel, jewellery, vanadium.

ART-TAX: A MOBILE SPECTROMETER FOR MICRO X-RAY FLUORESCENCE SPECTROMETRY AND FIRST APPLICATIONS ON GLASS AND ENAMEL *OBJECTS D'ART*

(184)

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During the past decade X-ray fluorescence spectrometry (XRF) for non-destructive and highly sensitive multielemental analysis of silicatic materials has been undergoing a considerable and not yet finished technical development. Both, the combination of miniaturized lo-power X-ray tubes with focusing glass-capillary optics and development of detectors working without liquid nitrogen meet the demands of archaeometry for portability and high lateral resolution.

Within a research project on dating problems of 16th century enamel paintings from Limoges (France) a spectrometer was designed which is especially suitable for the determination of glass matrix elements. This system consists of an air-cooled Mo-tube, a capillary optics to focus the primary beam to spot sizes of 50 to 100 μm and a Peltier-Coled Silicon Drift Chamber-Detector. Additional helium flow allows the analysis of light elements down to sodium. Sample positioning as well as documentation of the investigated area is done by an integrated video camera. The measurement head is fixed on a X, Y, Z-flexible support which can be assembled and dismantled within minutes.

The powerfulness of ART-TAX is currently under prove with investigations on Limoges painted enamels in German collections. These outstanding *objects d'art* were created by highly specialized workshops from the late 15th till the beginning of the 17th century. During the reviving interest in medieval and Renaissance art in history this lost art was «rediscovered» and 19th century replicas were often sold as original. Especially the nature of the polychrome or *grisaille* enamel fluxes with its coloring metals and opacifiers, but also the composition of copper carriers, underlying silver foils and gilding give detailed information on the dating of pieces in question. First results will be presented.

KEYWORDS: ART-TAX, *objects d'art*, X-ray Fluorescence Spectrometry.

ANALYSIS OF GLASS FROM SOUTH SULAWESI (203)

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Fifty-eight samples from glass beads, sheets and fragments, dating between the 1st and 17th centuries AD, were analyzed by INAA. The samples derive from Luwu, South Sulawesi, home of a major early kingdom of the Bugis.

The bead matrices were dominated by wound lead-rich glasses (9th-15th centuries), wound potash-rich glasses (9th-16th centuries), and drawn soda-rich glasses (1st-17th century). Independent of color, the wound lead-rich glasses and potash glasses were all low in Al, while the soda glasses were all high (>1-2%) in Al.

Glass chemistry was used to match beads and fragments. The separation of fragments 21, 23, 24 and 26 from fragments 25 and 27 is very useful since all had been assigned to the same original bead on the basis of lacking distinguishable visible features and having come from the same excavated location.

Red and yellow soda glass beads from a 9th to 10th century site seem to be made of the same glass, with the addition of 1%-3% Cu producing red glass, and the addition of Sn (4300 ppm-23,000 ppm) combined with the lack of copper producing yellow glass.