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ANALYSIS OF GLASS VESSEL FRAGMENTS FROM VENDEUIL, FRANCE

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Small samples for quantitative analysis were taken to investigate the composition of the vessel and the decorative trail. The samples were taken from the translucent light green glass of the vessel wall and from the opaque red trail applied to its surface.

The samples were mounted in resin and polished before being analysed using a Link Systems energy dispersive X-ray analyser attached to a Scanning Electron Microscope (SEM) operating at 15 KV. Quantitative analytical results were calculated for both the vessel glass and the decorative trail using ZAF 4 software (see Table 1).

The vessel glass is a typical potash-lime-silica glass which is first produced in north-west Europe in the ninth century AD and which gradually becomes the dominant glass type after the tenth century AD. Potash glass often referred to as "forest glass", is made using sand and wood ash. The wood ash, which is rich in potassium, acts as the source of alkali in the glass manufacture. According to **Theophilus**, writing in the twelfth century, two parts of beechwood ashes and one part sand were mixed thoroughly and placed in a furnace to be fritted (*Hawthorne & Smith* 1963). After fritting the mixture was melted in ceramic crucibles to produce the glass.

The levels of impurities in wood ash vary tremendously (*Sanderson & Hunter* 1981), but the high levels of magnesium, phosphorus, calcium and manganese oxides are entirely consistent with early medieval glasses that have been analysed from continental Europe (Geilmann 1955). In particular the high lime levels are characteristic of the use of wood ash such as oak or beech and do not necessarily suggest the separate addition of lime to the glass. None of the ancient glass recipes mention the use of lime and it is likely to have entered the glass as an impurity in either, or both, the sand and ash components.

The opaque red trail is made of a similar potash-lime-silica bulk glass, but the addition of copper has led to the production of the "sealing wax" opaque red colour. The colour and opacity is due to the presence of crystals of metallic copper and/or cuprous oxide in an otherwise clear glass matrix. At high magnification, it was possible to identify small streaks of "colourless" glass on the surface of the trail. These inhomogeneities, which appear black due to total internal reflection, are a common feature of opaque red glass (*Guido et al.*, 1984). To produce this colour the glass must have been heated in a reducing atmosphere causing the copper to precipitate out of solution. The low lead levels in the glass leads to the development of fine grained cuprite which is duller and more brownish in colour than the more brilliant red colours of the high lead opaque red glasses. The technology of producing the opaque red colour would have been simpler with the low lead levels as the fine cuprite would have formed during cooling without the need for heat treatment and less careful control of the oxidation state of the glass would have been necessary (*Freestone* 1987).

TABLE 1

Quantitative compositional analyses of Vendeuil glass.

	Vessel	Trail
Na_2O	0.8	0.7
MgO	5.8	5.1
Al_2O_3	2.0	2.3
SiO_2	50.5	51.0
P_2O_5	3.7	3.4
S	0.1	0.2
Cl	0.1	0.1
K_2O	15.4	14.3
CaO	17.4	15.8
TiO_2	0.3	0.3
Cr_2O_3	0.0	0.1
MnO	1.3	1.1
Fe_2O_3	1.2	1.8
CuO	0.4	2.7
SnO_2	0.3	0.2
PbO	0.1	0.1
Total	99.4	99.2

NB. Figures are quoted *as oxide weight* percentages. The quoted figures in each case are mean percentages taken from two analyses of different areas of the vessel and trail.

RÉFÉRENCES :

Freestone I.C. "Composition and microstructure of early opaque red glass", (1987) *M. Bimson & I.C. Freestone* (eds) Early Vitreous Materials, **British Museum Occasional Paper N° 56**, pp. 173-191.

Geilmann W. (1955) "Die chemische Zusammensetzung einiger alter Glaser insbesondere deutscher Glaser des 10. bis 18. Jahrhunderts", **Glastechnische Berichte**, Vol. 28, 146-156.

Guido M., Henderson J., Cable M., Bayley J. & Biek L. (1984) "A Bronze Age glass bead from Wilsford, Wiltshire : Barrow G. 42 in the Lake group", **Proceedings of the Prehistoric Society, Vol. 50**, pp. 245-54.

Hawthorne J.G. & Smith C.S. (1963) **On Divers Arts : the treatise of Theophilus.** The University of Chicago Press, Chicago.

Sanderson D.C.W. & Hunter J.R. (1981) "Composition variability in vegetable ash", **Science and Archaeology, N° 23**, pp. 27-30.