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Qualitative analysis of some glass beads from Halstock Villa

Justine Bayley
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Five glass beads were submitted for examination and analysis which was carried out by energy-dispersive X-ray fluorescence. The results were not fully quantitative but as a basis for rough comparison each peak height was expressed as a ratio relative to silicon which is a major component of all glass and thus relatively constant. These figures are presented in Table 2.

Table 1: The beads

Bead No	Munsell hue	Colour	Comments
76	7.5 PB	blue	
136	5 PB	blue	opaque white inclusions
392	5 BG	blue/green	"natural-coloured"
491	2.5 B	turquoise	section of drawn glass tube
680	2.5 G	green	? section of drawn glass tube

The beads had previously been seen by Mrs Guido who identified all except No 491 as 3rd or 4th century in date. She described most of them as 'peacock blue' but on close examination they do in fact show a range of colours. In an attempt to describe the colours more exactly the beads were compared with a Munsell colour chart. This is designed for use with opaque samples so the figures quoted here are only approximate; they do however give a less subjective assessment of the colours than words alone (see Table 1).

Table 2: XRF peak heights normalised to silicon

Bead No	Elements detected									
	Ti	Mn	Fe	Co	Ni	Cu	Zn	Pb	Sn	Sb
76	.03	.17	1.01	+	?	.26	.03	.17		
136	.03	.36	.62	+		.17	?	1.08		.14
392	.04	.14	.60			1.03	.05	.61	.03	.04
491	.03	.20	.34			1.49		.53	.04	.04
680	.04	.12	.78			1.46	.06	.09	.04	.05

Not all the results in Table 2 are typical of the colours of glass represented but the dominant colourants can still be identified. That in Nos 76 and 136 is cobalt (Co) though it is only present at low levels while the other three beads are coloured by iron (Fe) and/or copper (Cu). Copper gives a turquoise colour in ordinary alkali glass but a green colour in glasses containing significant amounts of lead while iron can give a whole range of colours ranging from turquoise through

green to yellow, depending on the redox conditions under which it is melted.

Pale blue/greens like No 392 are normally iron coloured but here copper would appear to be more important. No 491 is both compositionally and visually a typical copper turquoise. The lead level in No 680 is not high enough to make the copper produce the green colour seen and equally the iron is not any higher than in any of the other beads so the colour here must be a complex effect due to the combination of copper and iron.

The traces of tin (Sn) and zinc (Zn) detected in these beads probably entered the glass with the copper, suggesting that an alloy rather than pure metal was used. Antimony (Sb) was widely used as a glass opacifier in Roman and earlier times and the higher level detected in No 136 suggests the opaque white particles are almost certainly calcium antimonate.