The hinged mirrors from Kirkham Priory, Yorks.

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This assembly (A.M. No.749175) was examined and analysed for comparison with two similar objects from Perth which were investigated for the Museum of London. All analytical results were obtained by x-ray fluorescence unless otherwise stated.

The metal casing was a gunmetal, the major alloying element added to the copper being zinc, but with a reasonable amount of tin too. The alloy also contained a few % of lead. This was a very similar composition to that of the mirror case of the same design from Perth. The second (more highly decorated) of the Perth mirror cases was of pewter (tin and lead with a few % of copper).

The glass in the mirror cases appeared to contain some lead. This may have been redeposited from either the lead backing on the glass or the blacking on top of the surrounding 'putty' (see below). Alternatively it may have been a deliberate addition to the glass but this is not very likely as translucent lead glass is virtually unknown in the mediaeval period and anyway tends to be better preserved than this glass appears to be. The colour of the glass is rather variable, that in the plainer Perth case appearing brown, that in the Kirkham case translucent, clear in some parts and brown in others, and that in the pewter case paler than the other Perth glass. In this last case the glass may originally have been completely clear but its fairly advanced state of decay makes a definitive comment impossible.

The glass in all the mirror cases has a thin layer of lead on its underside (between the glass and the metal case). This presumably acted as a reflective (mirror) surface which suggests that all the glass must originally have been translucent and of a pale colour, if not colourless. If the glass were dark brown its upper surface would act as a mirror, making the lead coating superfluous. The brown colour now visible in the glass must therefore be a result of the decay processes it has undergone during the hundreds of years it has been buried. The colour may be due to the deposition of material from water in the soil in cracks in the glass.

In all cases the glass was held into the metal case by a white 'putty'. A sample from the pewter case was analysed by

x-ray diffraction (XRD) and found to be calcite (calcium carbonate). This could originally have been applied in either of two forms; firstly as putty - whiting (calcium carbonate) ground up in a drying oil-or secondly as a lime plaster that set, producing calcite. The lime might also have been applied with a drying oil as a lime putty. Which it was cannot be said from the existing evidence.

The 'putty' in both the mirror cases from Perth had been covered by a black layer, presumably to enhance the appearance of the finished objects. This was shown (by XRD) to be galena (lead sulphide). This is a lead ore which has a lustrous grey-black appearance. The putty in the Kirkham mirror case may also have had a black covering but none had survived on the exposed areas of 'putty'.

All the analyses performed only record what is now present; it is quite possible that the burial conditions have produced chemical changes and what we now see is not what was originally there. Above I have suggested that the lead detected in the glass is not part of its original composition but merely deposited in cracks in it, together with the colouring agents which are also post-burial additions.

The 'putty' is now calcite but what it was when it was applied to the objects is not sure; all three suggestions above are possible on the analytical evidence. Knowledge of methods and materials used by mediaeval craftsmen could suggest which possibility is most likely.

The blacking could have been applied as a lead oxide which has then been reduced to the sulphide by burial e.g. in a cesspit or other waterlogged organic deposit. I do not consider this likely (although I do not know anything about the nature of the find spots for these objects) as I think the blacking was applied as a decorative finish - and for this purpose galena would be the most suitable lead compound.

X-ray fluorescence analyses

	Kirkham Priory	Perth (plainer)	Perth (more decorated)
Metal case	932	901	906
Glass	933	902	
Backing to glass	934	903	912
Putty		904	914
Blacking over putty			913

The figures are A.M.L. XRF (milliprobe) run reference numbers.