McDONALD INSTITUTE MONOGRAPHS

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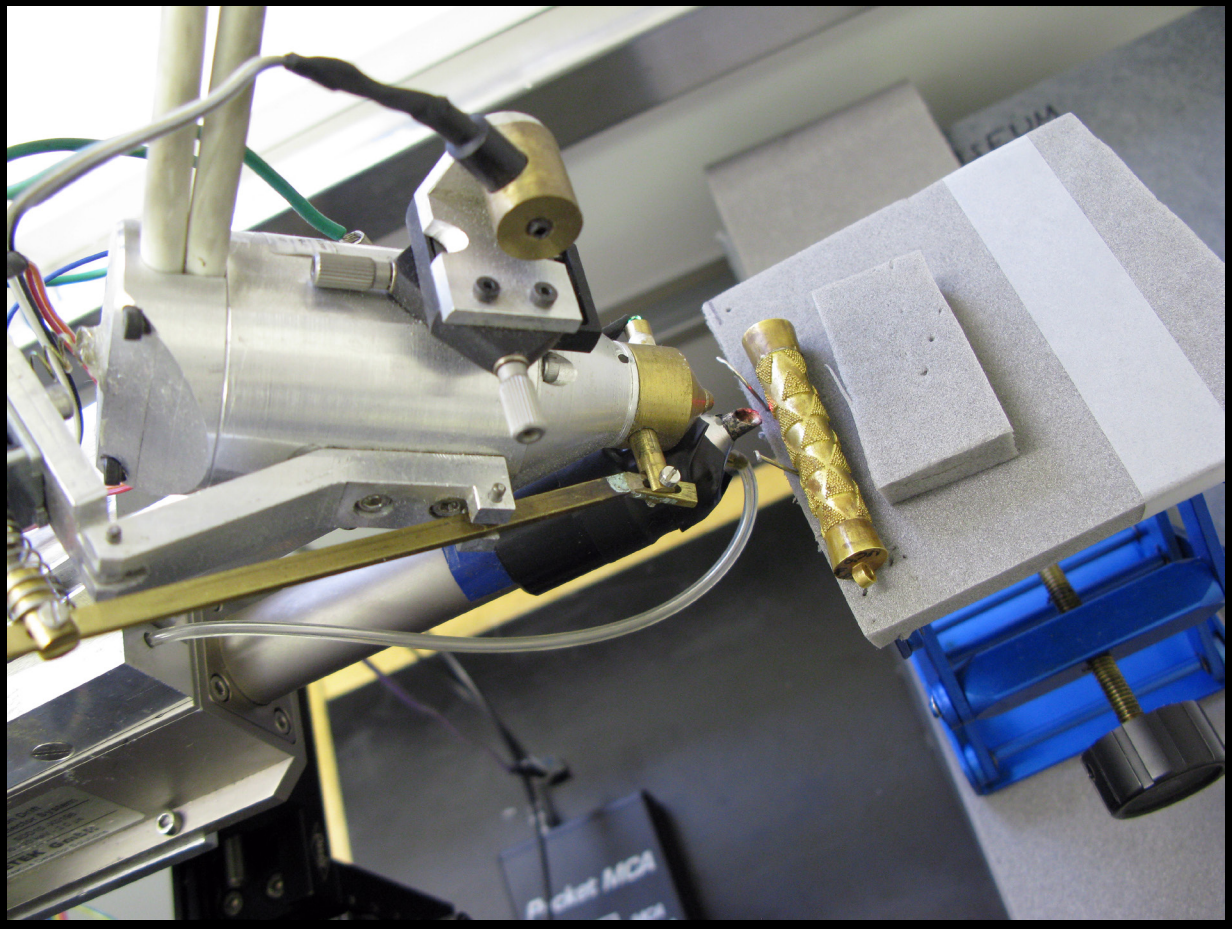
Edited by Maria F. Guerra, Marcos Martinón-Torres & Stephen Quirke



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with contributions from
Wolfram Grajetzki, Maria F. Guerra, Marei Hacke, Mona Hess, Susan La Niece, Quentin Lemasson, Lindsay MacDonald, Margaret Maitland, Marcos Martinón-Torres, Nigel Meeks, Gianluca Miniaci, Brice Moignard, Jack Ogden, Claire Pacheco, Sandrine Pagès-Camagna, Laurent Pichon, Matthew Ponting, Campbell Price, Stephen Quirke, Martin Radtke, Uwe Reinholz, Ian Shaw, Jim Tate, Isabel Tissot & Lore Troalen

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On the front cover: *Analysis of the gold cylindrical amulet from Haraga at The Petrie Museum of Egyptian Archaeology (UC6482) using a portable XRF spectrometer*.
On the back cover: *Details under the SEM of the triangular designs of granulation on the tube of the cylindrical amulet from Haraga*.

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Contents

Chapter 9.3

Second Intermediate Period jewellery in the collection of the British Museum

Susan La Niece, Gianluca Miniaci, Marei Hacke & Maria F. Guerra

Among the few gold objects dated to the Second Intermediate Period in the collection of the British Museum, the most renowned is a green jasper scarab set in a gold plinth (EA7876) bought in 1835 from Henry Salt's third collection. This scarab belongs to the type 'heart-scarab' – intended to restrain the heart of the owner from witnessing against them during judgement in the afterlife – and represents the first recorded for a royal figure (Malaise 1978; Miniaci et al. 2018).

There is some mystery surrounding the circumstances of the scarab's discovery, allegedly found inside the coffin of king Nubkheperra Intef at Dra Abu al-Naga (d'Athanasi 1836, xi–xiii), in the northernmost part of the Theban necropolis (Miniaci 2009), but in the base of the scarab is inscribed the name of another sovereign: 'Made for the Osiris king Sobekemsaf, justified' (Hall 1913). Knowing that heart-scarabs were not transferable from one person to another, there is no reason to attribute this one to king Nubkheperra Intef. Unfortunately, the name of the king is written along the sides of the heart-scarab plinth without prenomen so that it is currently uncertain to which king Sobekemsaf it might have belonged, Sekhemra Shedtawy Sobekemsaf or Sekhemra Wadjkhau Sobekemsaf, both from the Second Intermediate Period. It seems however unlikely that the owner was king Sekhemra Shedtawy Sobekemsaf, whose tomb at Thebes was sacked, according to the accounts stated in the Abbott papyrus, if its findspot in the description can be considered reliable (for a summary of the scarab historical and archaeological context, see Miniaci 2011, 70–2; Miniaci et al. 2013).

In the collection of the British Museum are other objects dated to the Second Intermediate Period, all donated by Dyson Perrins (1864–1958). One is a lapis lazuli scarab inscribed with the name Intef, set in a shallow gold tray, which acts as a ring bezel (EA57698); the others are two gold bracelet spacers decorated with cats (EA57699 and EA57700). The spelling of the name Intef on the ring could point to king Nubkheperra Intef of the 17th Dynasty (the same king linked with the heart scarab above); the spacers were inscribed with the name of a queen called Sobekemsaf and king Nubkheperra Intef. The objects are unprovenanced, but some evidence led scholars to suppose that these spacers and the ring could actually come from Edfu, where the tomb of a queen Sobekemsaf could be (Miniaci et al. 2013).

The objects were examined and analysed in the Department of Scientific Research at the British Museum for their construction and the gold alloys employed in their fabrication. Optical microscopy, X-radiography, X-ray fluorescence spectrometry (XRF) and scanning electron microscopy with energy dispersive X-ray spectrometry (SEM-EDS) were used. The stones were identified *in situ* by Raman spectroscopy and the nature of the fill of the hollow heart-scarab was identified by Fourier transform infrared spectroscopy (FT-IR) and gas chromatography-mass spectrometry (GC-MS).

Technical description

The heart-scarab EA7876 (Fig. 9.10) consists of a human-headed green scarab set into a cloison on top of a sheet gold box or plinth that was confirmed to be hollow by X-radiography (Fig. 9.11). The stone of the scarab was identified as green jasper by Raman spectroscopy.

The base, sides and top of the box forming the hollow plinth are made of three sheets of gold, soldered together and apparently filled with a translucent brown material. The cloison surrounding the scarab has a double wall enclosing a corrugated strip of gold that imitates a beaded wire border, Figure 9.12a. The beetle's legs were individually cut from sheet gold, and

Figure 9.10. *Heart-scarab EA7876 (weight 17.1 g, length 3.8 cm and width 2.5 cm), in the collection of the British Museum. On the left the green jasper set in a gold mount and on the right the inscription on the base of the mount.*

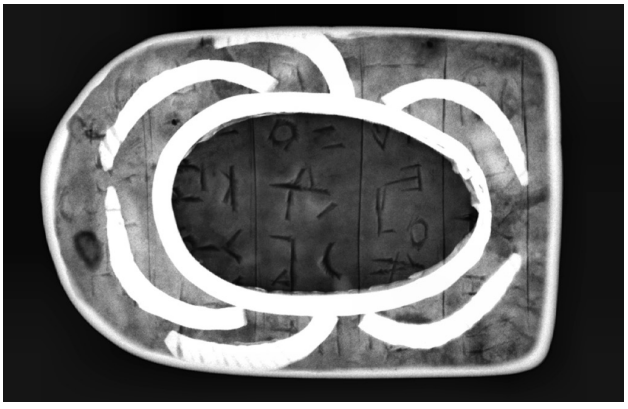

Figure 9.11. *X-radiographic image of heart-scarab EA7876 produced using a Siefert DS1 X-ray tube operating at 100 kV with an exposure of 5 mA for four minutes.*

sharply incised to represent hairs, Figure 9.12b. They were soldered to the top sheet of the plinth before its sides were added. Hieroglyphs around the plinth (Fig. 9.13a) and in five horizontal rows across its underside, were chased with a blunt tool, causing indentation of the sheet gold around each symbol (Fig. 9.13b). Some marks may have been punched using a tool with a wedge shaped tip. Straight lines dividing the inscription appear to have been scraped with several sweeps of a sharp pointed tool, as shown in Figure 9.13c.

Finger-ring EA57698, shown in Figure 9.14, is set with a blue scarab with details of the insect's head outlined. Raman spectroscopy identified lazurite, the marker mineral for lapis lazuli, in the blue stone. The back of the gold setting is inscribed with the name Intef, with no surrounding cartouche. The hieroglyphs are chased into the gold with marks that indicate the use of a blunt tool, producing feathered lines around

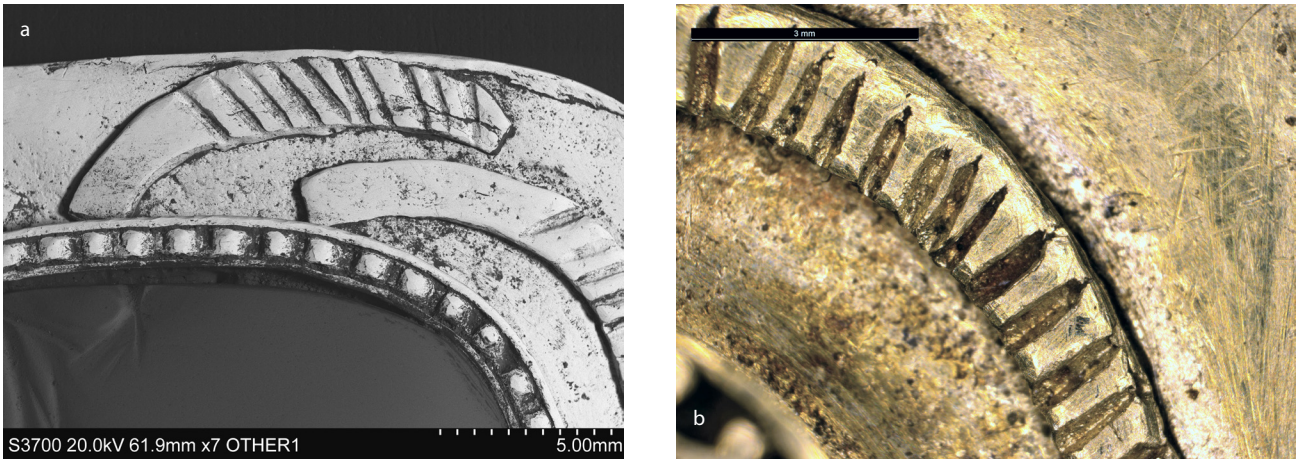

Figure 9.12. *Details of heart-scarab EA7876: (a) SEM detail of the corrugated gold strip in imitation of beaded wire around the stone and (b) detail of the incised hairs on the beetle's legs.*

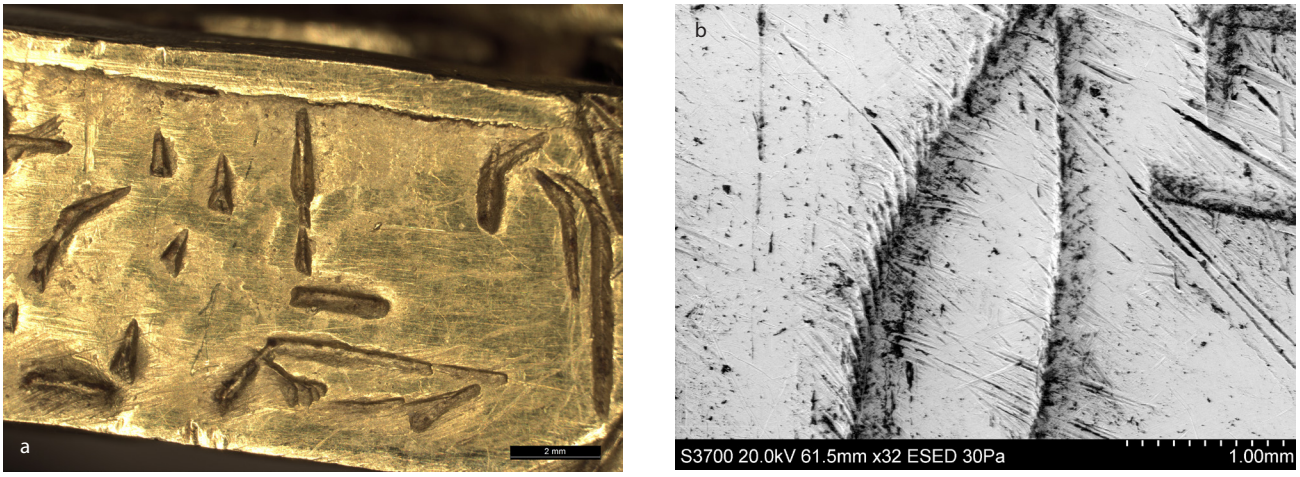

Figure 9.13. *Details of hieroglyphs on heart-scarab EA7876: (a) around the plinth, and (b,c) on the underside.*

the curves (Fig. 9.15). Sharp scratching overlies these toolmarks, which is likely to relate to later cleaning out of the inscription.

Three holes are drilled at each side of the scarab (Fig. 9.15) and another runs through its body from end to end. The legs of the scarab are made of six gold strips joined by hard soldering to the inside rim of the gold setting. Two legs show traces of inscribed markings, indicating hairs, but these have largely been overlaid by hard solder. The tops of the legs slotted into the holes

Figure 9.14. *Finger-ring EA57698 with lapis lazuli scarab (diameter 2.6 cm, thickness 1.2 cm and weight 7.2 g). On the right the inscription on the underside.*

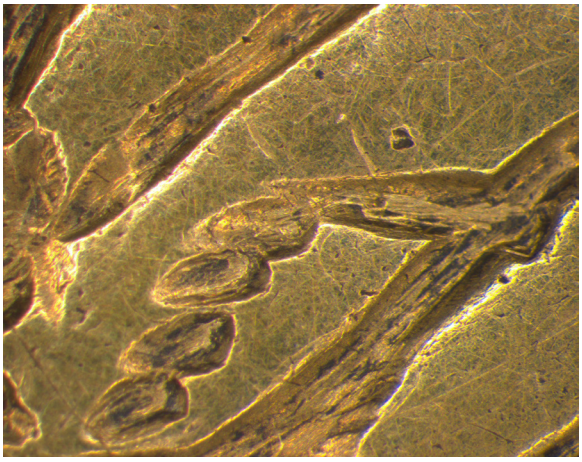

Figure 9.15. *Details of finger-ring EA57698: (left) inscribed hieroglyphs in the gold and (right) holes drilled in the stone for the gold legs.*

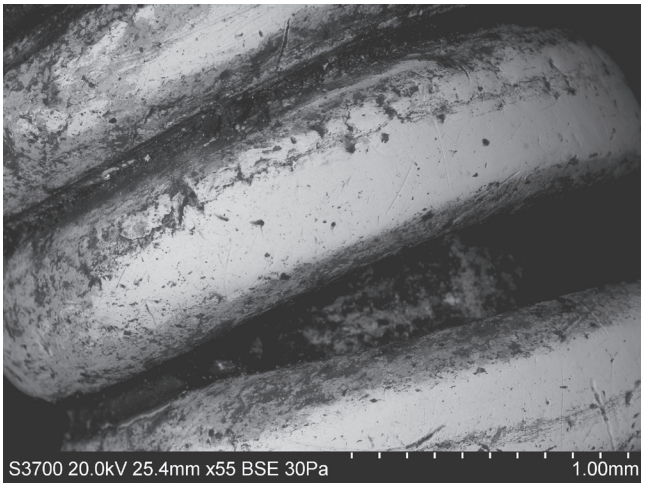

Figure 9.16. *Details of the wire of the shank of finger-ring EA57698 showing features indicative of rolling. Left, under the stereomicroscope. Right, under SEM.*

Figure 9.17. *Spacer-bars EA57699 and EA57700 (3 cm long, 1.8 cm wide, 1.2 cm high, and weight 19.2 g and 19.1 g, respectively).*

Figure 9.18. *Detail under the stereomicroscope of the hieroglyphs incised on underside of spacer-bar EA57699.*

in the side of the scarab holding it in the manner of a claw setting. At either end of the setting is soldered an undecorated gold collar through which the ring shank – a gold rod of hammered wire – is threaded.

The wire of the shank runs through the perforation of the body and is coiled around the other side of the shank to form a decorative mechanical join shown in Figure 9.16. The wire of the shank at the tail end of the scarab is threaded across the setting, under the scarab body, and is coiled to matching effect around the shank at the head end. The marks on the wire could be indicative of a form of strip-drawing.

The pair of gold spacer-bars EA57699 and EA57700 in Figure 9.17, consists each of an open-sided shallow box formed around 12 gold tubes through which strings for the bracelet were threaded. The tubes are each formed of a single sheet of gold crudely rolled into a cylinder with a longitudinal seam. The box is formed of a top plate on which three cats lie, an inscribed base plate, deeply chased (Fig. 9.18), and two separate sheets along the shortest sides. The three cats that are soldered onto the top of each box are each made up of seven solid rod/wire components, worked to shape and hard soldered together. The body and head are one piece, but the ears were made separately and soldered onto the heads. The four legs and tail were formed of wire and details of the front paws and striped tail were cut into the metal.

Gold alloys and joining technique

The elemental analysis of the objects was carried out on the surface of the metal by a Bruker Artax XRF with a 0.65 mm collimator operated at 50kV and 800 μA and small components were analysed using EDS in a Hitachi S-3700N SEM set to an accelerating voltage of 20kV and a chamber pressure of 30Pa. It should be remembered that the surface composition of the gold alloy quoted here is likely to be depleted in the baser metals silver and copper compared to the original alloy due to a combination of losses during manufacture and burial. These semi-quantitative results of the surface analyses were calculated using British Museum in-house gold alloy standards.

The different parts of the heart-scarab showed the use of gold alloys that contain 11 to 13 wt% Ag with a copper content that ranges from about 1 to 2 wt% (Table 9.4). The visible soldered joins in the box construction may account for some elevation of the copper levels near the joins.

A sample of the adhesive filler, extracted from the side of the setting after removing the surface layers to minimize the risk of contamination from the mummy, was identified by FTIR spectroscopy and GC-MS as a mixture of Pistacia resin and a coniferous resin from the Pinaceae family (Hacke 2013). Although these tree resins have previously been identified in many ancient Egyptian contexts, ranging from uses in mummification to incense and varnish, analytical evidence for their use as a filler in goldwork has hitherto been scarce (Lucas & Harris 1962, 7–8, 35–6).

The elemental analysis by XRF of the different parts of the finger-ring showed the use of different

Table 9.4. *Results obtained by XRF and SEM-EDS for heart-scarab EA7876.*

Region of analysis	Method	Au wt%	Ag wt%	Cu wt%
top plate of plinth	XRF	86.2	12.6	1.2
corrugated strip around scarab	XRF	86.1	12.6	1.3
side wall of plinth	EDS	86.5	11.5	2
base plate of plinth	XRF	86.8	12.3	0.9
leg – front left	XRF	86.1	12.6	1.3
leg – back right	EDS	85.4	13.1	1.5
leg – back left	EDS	87.5	11.3	1.2

Table 9.5. *Results obtained by XRF and SEM-EDS for finger-ring EA57698.*

Region of analysis	Method	Au wt%	Ag wt%	Cu wt%
hoop	XRF	85	14	1
bezel plate	XRF	83	16	1
coiled wire	XRF	84	15	1
leg left	EDS	91.3	7.6	1.1
leg right (including hard solder)	EDS	85.2	10	4.8
collar	EDS	87	11.3	1.7

Table 9.6. *Results obtained by XRF for spacer-bars EA57699 and EA57700.*

Region of analysis	Au wt%	Ag wt%	Cu wt%
EA57699			
base plate	81.7	17	1.3
end plate	81.1	16.8	2.1
top plate	80.5	17	2.5
cat body 1	88	11	1
cat body 2	88.7	10.3	1
cat body 3	88.9	10.1	1
cat tail	82.4	16.3	1.3
cat front leg	85.6	13.3	1.1
EA57700			
base plate	81.1	17.4	1.5
end plate	81.3	17	1.7
top plate	79.1	17.5	3.4
cat body 1	87.8	11	1.2
cat body 2	87.5	11.2	1.3
cat body 3	86.6	11.8	1.6
cat tail	84.4	13.4	2.2
cat front leg	85.6	12.7	1.7

alloys (Table 9.5). The hoop and the bezel plate are made from a gold alloy that contains an average 15 wt% Ag and 1 wt% Cu, while the alloy employed to fabricate the collar contains about 11 wt% Ag and almost 2 wt% Cu. The scarab legs are also made from a different alloy, containing about 1wt% Cu and lower silver contents, and hard soldered to the base plate. The spatial resolution of the XRF equipment used to carry out the analysis is not appropriate to separate the different regions of the join, but it is clear that the hard solder, visible under magnification, contains a higher copper content.

The elemental analysis by XRF of the different parts of the two spacer-bars showed the use of different alloys (Table 9.6). Both the boxes are made from alloys containing about 17 wt% Ag and copper contents ranging from 1.3 to 3.4 wt%, and it is suggested that the sheets were cut from the same piece with some elevation of the copper levels near the joins where the soldered joins are clearly visible. The different parts of the cats are made from alloys containing lower silver contents with a wider variation suggesting they were cut from different pieces of wire or rod.

The alloys employed contain amounts of silver expected for unrefined alluvial gold. Its use is confirmed by the presence of several platinum-group element inclusions in all the pieces, one is shown in Figure 9.19. Although white metal inclusions were seen on the bracelet spacers, these were not accessible for analysis due to the geometry of the instrument, but normalized EDS analysis could be carried out on inclusions present at the surface of the heart-scarab and the finger-ring, summarized in Table 9.7.

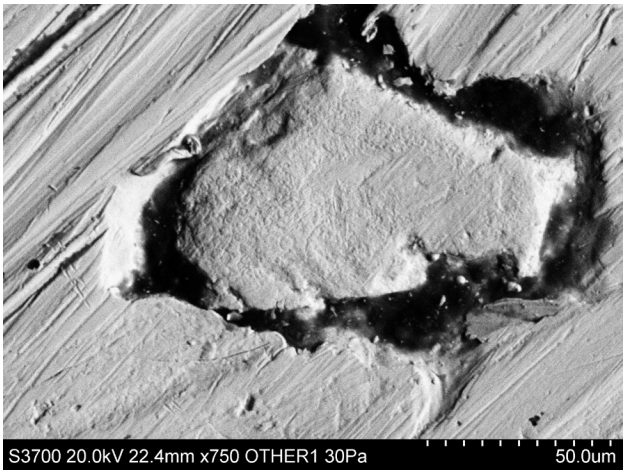

Figure 9.19. *SEM image of platinum group element inclusion at the surface of the gold component of heart-scarab EA7876.*

Conclusions

A similar repertoire of manufacturing techniques was employed in the fabrication of all these items: sheet and wire components, sharp chisel cuts to mark details on the cats and scarabs, and chasing, with perhaps some punching, for inscriptions. A comparison of details of the toolmarks on all the pieces demonstrates however that they were made by different hands and there is no evidence of a workshop link. The use-wear marks found on the jewellery surface do not indicate intensive use.

Some variation was observed for the alloys employed in the fabrication of the jewellery, with a gold content that ranges between 80 and 87 wt%. These alloys are very similar to those employed in the fabrication of part of the jewellery group from Qurna (see Chapter 9.2). With the exception of the girdle, the adult's jewellery is made from alloys similar to those employed in the manufacture of the jewellery in the British Museum.

Table 9.7. *Results obtained by SEM-EDS for platinum-group element inclusions.*

Acc. No.	Ru wt%	Os wt%	Ir wt%
Ring 57698	37	32	31
Heart-scarab 7876	12	48	40

The amounts of silver in the alloys are those expected for unrefined alluvial gold, which is confirmed by the presence of platinum-group element inclusions in all the pieces. The copper contents in the alloys are sometimes higher than those expected for unrefined alluvial gold, and would have been added to lower the melting temperature in particular when the construction includes hard soldering of components.

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For references see pp.356–7 at the end of this chapter.

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