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Analytical study of the first royal Egyptian heart-scarab, attributed to a seventeenth dynasty king, Sobekemsaf

Gianluca Miniaci, Susan La Niece, Maria Filomena Guerra and Marei Hacke

Summary: Analytical examination of the heart-scarab EA7876 belonging to a king Sobekemsaf has produced new evidence on its production. The heart-scarab, with its unusual inscription containing incomplete hieroglyphs, was acquired from Henry Salt's collection and entered the collections of the British Museum in 1835. It was allegedly found inside the coffin of king Nubkheperre Intef and has been linked to king Sekhemre Shedtawy Sobekemsaf whose tomb at Thebes was sacked, as evidence by the robbers' confession recorded in the Abbott and Amherst papyri (c.1110 BC). The heart-scarab was examined and analysed by optical microscopy, radiography, XRF, SEM-EDX, Raman, FTIR and GC-MS to determine the materials and techniques used in its production. The results are compared with other objects in the British Museum belonging to king Nubkheperre Intef, in order to understand any possible chronological and material link with him: finger ring EA57698, bearing the prenomen of the king Nubkheperre, and spacer-bars from a bracelet EA57699, belonging to his wife, queen Sobekemsaf, both dated with more certainty to the seventeenth dynasty. All these items were found to be made of unrefined alluvial gold with copper added to lower the melting temperature for hard soldering of the components. The craftsmen of these three items used a similar repertoire of manufacturing techniques; sheet and wire components, sharp chisel cuts to mark details and chasing for inscriptions. There is no evidence for casting. The finding of a mixture of *Pistacia* resin and a coniferous resin from the Pinaceae family being used as a fill for a hollow gold item has not previously been reported. A close link between king Sobekemsaf (with no prenomen) and king Nubkheperre Intef could have been confirmed if it was evident from the toolmarks that the same goldsmith chased the personalised inscriptions on the different pieces. That this was not the case does not prove there is no link, only that it has not yet been proven. What the results of this study do, however, is attest that in the Second Intermediate Period, a period known for lack of resources, the Theban region still retained goldsmithing knowledge and expertise.

<a> INTRODUCTION

** Second Intermediate Period gold objects from the collections of the British Museum**

A green jasper scarab (Figure 1) set in a gold plinth (EA7876) entered the collections of the British Museum from Sotheby's sale of Henry Salt's third collection in June-July 1835 [1; p. 396, n. 5]¹. Although scarabs are amongst the most characteristic and well known items from ancient Egypt, the British Museum scarab belongs to a distinctive type, the "heart-scarab" [2], its base inscribed with a verse of Spell 30B of the Book of the Dead [3; pp. 209, 212, 226].

The name of the person for whom the scarab was intended is inscribed at the end of the formula along the sides of its plinth, "*Made for the Osiris king Sobekemsaf, justified*" [4; pp. 22-23, no. 211]. Although heart-scarabs are rare before the New Kingdom (c.1550 BC), they are attested from a few late Middle Kingdom (c.1700 BC) burials [5], and the British Museum

exemplar represents the first recorded for a royal person [2; p. 73]. Unfortunately, the name of the king is written without prenomen and at present it is uncertain to which king Sobekemsaf it could have belonged [for a recent summary 6; pp. 117-118]. However, there are only two kings securely attested of that name: Sekhemre Shedtawy Sobekemsaf [7; pp. 173-175] and Sekhemre Wadjkhau Sobekemsaf [7; pp. 175-178], both from the Second Intermediate Period (c.1800-1550 BC) [8; p. 5 and table 2], and attributed to the (late) thirteenth [9], sixteenth [10; p. 276], or seventeenth dynasty [11; pp. 237-242, 268-269]. Although there is some mystery surrounding the circumstance of discovery, the repeated indication of the Theban necropolis as find-place in the sale description can be considered reliable [12].²

The scarab bears one of the earliest versions of the spell 30B of the Book of the Dead, whose “archetype” was inscribed on a fragment of wood, presumably a coffin [13; p. 71, fig. 116], found by de Morgan in one of the tombs of royal princesses at Dahshur and datable to the late Middle Kingdom (c.1850 BC). The hieroglyphic signs in the scarab inscription are distinctive in chronological and topographical terms: birds and snakes are reproduced in a truncated form, missing part of their body; other animated or human figures are represented complete. The custom of composing inscriptions with incomplete hieroglyphs begins approximately at the end of the reign of Amenemhat III (c.1820 BC) in the Fayyum area of northern Egypt, extending to other regions of Egypt by the end of the Second Intermediate Period and declining into incoherent reproduction around the later seventeenth dynasty (c.1550 BC), mainly in southern Egypt [14].

The incomplete hieroglyphs and the spell for protection of the heart confirm dating of the royal name inscribed on it to the Second Intermediate Period. Nevertheless, the time span covered by the modern definition “Second Intermediate Period” is more than 300 years, and represents a transitional phase [15; pp. 14-21]. The archaeological and textual evidence for this period is scant and does not produce a coherent historical picture. Many questions about the scarab remain to be answered: the find- place, the identity of its owner, its link with other kings of the period (notably with Nubkheperre Intef), and the quality of its manufacture, which is unexpected for this period when there was an apparent loss of expertise in fine metalwork [16, 17].

From the Dyson Perrins Collection comes an unprovenanced lapis scarab set in a gold funda as a ring bezel (1924,1215.1; EA57698) inscribed with the name Intef (Figures 2 and 3). Two reasons suggest the owner of the ring may be identified as the king Nubkheperre Intef of the seventeenth dynasty [1; pp. 394-395]: firstly, also from the Dyson Perrins collection, there were two gold bracelet spacers decorated with cats (Figure 4) (1924,1215.2 and 3;

EA57699 and EA57700) inscribed to king Nubkheperre Intef and his queen Sobekemsaf (Figure 5) which may belong with the ring [18; pp. 342-343; 11; p. 233, n. 5]; and secondly, the spelling of the name on the ring, Ini-it-f, to be rendered more precisely as Inyotef, , might identify its owner with the king Nubkheperre, who usually spelled his name with an infix “i” [18; p. 25]. A stela from Edfu recounting the restoration of the tomb of queen Sobekemsaf [19; p. 203] and other attestations of the queen at Edfu have led scholars to suppose that the two objects exhibited by Perrins in the Burlington Fine Arts Club at the beginning of twentieth century came from the tomb of the queen at Edfu [7; p. 283, no. 19]. However, at the moment there is no evidence supporting this.

<A> HISTORY OF THE HEART SCARAB

In 1836, a report made by Giovanni D’Athanasì, who had sold Henry Salt’s collection to the British Museum in summer 1835, provided further information on the scarab. D’Athanasì, referring to the discovery of the burial of king Nubkheperre Intef (seventeenth dynasty) at Dra Abu el-Naga [20], in the northernmost part of the Theban necropolis, mentions the heart-scarab as coming from his mummy [12; pp. xi-xiii] and many scholars accept this, but there are difficulties with this assumption.

A heart-scarab was conceived with the purpose of being placed over the heart of the deceased in order to protect him, implying a strong link between object and owner, not transferable from one person to another. Such a function is known from archaeological evidence, for instance the burial of Neferkeut in the early eighteenth dynasty (*c.* 1500 BC) [21], and from textual evidence [22]. Although circulation of goods and inclusion of heirlooms in burials of the Second Intermediate Period is widely attested [15; p. 58], the presence of this heart-scarab in a burial other than that of king Sobekemsaf would be curious and suspicious. Moreover, it is worth remembering the common practice of nineteenth century dealers of combining items from different burials in an unrealistic ensemble in order to excite the interest of purchasers.

At approximately the same time as the discovery of the Nubkheperre Intef coffin, a canopic box belonging to a king called Sobekemsaf with no prenomen appeared at Thebes and a few years later was sold to the National Museum of Antiquities in Leiden [23; 18; pp. 319-320] by an Italian dealer called Piccinini operating mainly at Thebes. The features that the canopic box shares with the scarab are manifold: same owner’s name, same lack of prenomen, same incomplete hieroglyph system, and probably the same provenance, i.e. the Theban necropolis.

The simplest conclusion could be that both objects belonged to the same king called Sobekemsaf. In the early nineteenth century the tombs of king Nubkheperre Intef and of an unspecified king called Sobekemsaf, it is suggested, could have been discovered almost contemporarily. The echo of such a possibility is heard in a note of Auguste Mariette, “*J’ai reconnu à Drah-abou-neggah l’emplacement de sept tombes royales qui sont: – celles du rois Ra-noub-Kheper-Entef et Sevek-em-saf, creusées à l’ouest de la plaine, dans les flancs d’une colline; le tombe du premier de ces rois est un héli-spéos, et la façade était ornée de deux obélisques; [...]*”, suggesting the discovery of a tomb belonging to a king Sobekemsaf after that of king Nubkheperre [24; p. 28]. Puzzlingly, Mariette does not give any details about the tomb of Sobekemsaf and many scholars have doubted he really found it [25].³ However, more intriguingly, a door-jamb has been recently found from “gebel Antef” at Thebes; the inscription on it clearly makes king Nubkheperre Intef son of a king called Sobekemsaf [26; pp. 50-51] raising the possibility of a shared tomb. Furthermore two other kings of the late Second Intermediate Period (seventeenth dynasty), Sekhemre Wepmaat Intef [1; pp. 393-394] and Sekhemre Heruhirmaat Intef [1; p. 395], also buried at Dra Abu el-Naga, shared the same tomb, as indicated in a sketch by Gardner Wilkinson [15; pp. 70-72].

Hence, the scarab and the canopic box have usually been considered to belong together, variously attributed by scholars over the years to either Sekhemre Shedtawy Sobekemsaf [27; 28; pp. 139-140] or Sekhemre Wadjkhau Sobekemsaf [11; pp. 268-269; 7; p. 175; 1; pp. 169-171]. Table 1 shows the distribution of attestations from western Thebes of different kings named Sobekemsaf. However, neither the written nor the archaeological sources can confirm the identity of the scarab owner.

The Amherst-Leopold II papyrus and Abbott papyrus, reporting inspections carried out in the Theban necropolis following robberies in the late Ramesside period, refers to extensive and destructive looting of the tomb of king Shedtawy Sobekemsaf Sekhemre: “*we [the robbers] opened their outer coffins and their inner coffins in which they lay. [...]. The noble mummy of the king was all covered with gold and silver inside and outside with inlays of all kinds of precious stones. We appropriated the gold which we found [...] We set fire to their inner coffins. We stole their outfit which we found with them*” [29; pp. 37, 48-49]. The gold scarab and wooden canopic box, would have hardly survived this looting and fire.

The attribution of the scarab to Sobekemsaf Wadjkhau proposed by Kim Ryholt could be true [1; p. 396], but there is no firm evidence that king was buried at Thebes since the material belonging to him from the western part of Thebes is confined to a fragmentary block from Deir el-Bahri [1; p. 396; 26; pp. 136-137].

It would be safer to consider the scarab (and the canopic box) as belonging to a yet unidentified king Sobekemsaf of the Second Intermediate Period.

<a> TECHNICAL DESCRIPTIONS

Heart-scarab (EA7876). Length: 3.8 cm, Width: 2.5 cm Weight 17.1 grams (**Figure 1**)

The human-headed green scarab is set into a cloison on top of a sheet gold box or plinth which was confirmed to be hollow by X-radiography. The stone of the scarab was confirmed by Raman spectroscopy as green jasper (an opaque microcrystalline quartz). 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 which prevents the stone from falling into the hollow box. This adhesive filler, extracted from down the sides of the setting, was identified by FTIR and GC-MS as a mixture of *Pistacia* resin and a coniferous resin from the Pinaceae family [32]. Both tree resins have previously been substantiated in many ancient Egyptian contexts ranging from uses for mummification to incense and varnish but analytical evidence for their use as a filler in goldwork is hitherto scarce [33; pp.7-8][34].

The cloison surrounding the scarab has a double wall, enclosing a corrugated strip of gold, imitating a beaded wire border (Figure 6). The beetle's legs were individually cut from sheet gold and sharply incised to represent hairs. They were soldered to the top sheet of the plinth before its sides were added.

Hieroglyphs around the plinth, and in five horizontal rows across its underside, show marks with the characteristic soft profile of chasing executed with a blunt chasing tool, causing indentation of the sheet gold around each symbol (Figure 1). Some marks may have been punched by a tool with a wedge shaped tip (Figure 7a). Straight lines dividing the inscription appear to have been scraped with several sweeps of a sharp pointed tool. A comparison of details of the toolmarks of the hieroglyphs on this and the other items shows the distinctive differences between the pieces (Figure 7).

Gold finger-ring (EA57698). Diameter: 2.6 cm, Thickness: 1.2 cm, Weight 7.2 grams

The finger ring is set with a blue scarab with details of the insect's head outlined. The mineral identification was confirmed by Raman spectroscopy as lazurite $[\text{NaCa}]_4[\text{AlSiO}_4]_3[\text{SO}_4\text{SCl}]$,

indicating the stone is lapis lazuli. The scarab is set in a gold fundu or tray which acts as a ring bezel. The back of the gold fundu is inscribed with the name Intef, with no surrounding cartouche Figures 2 and 3. Three holes are drilled at each side of the scarab, 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 fundu. Two legs show traces of inscribed markings, indicating hairs, but these have been largely overlaid by hard solder. The top of the legs slot into the holes in the side of the scarab, holding it like a claw setting. At either end of the fundu is soldered an undecorated gold collar through which the ring shank, a gold rod of hammered wire, is threaded. The wire of the shank at the head end of the scarab runs through the perforation of the body and is coiled around the other side of the shank to form a decorative mechanical join. The wire of the shank at the tail end of the scarab is threaded across the fundu, under the scarab body and is coiled to matching effect, around the shank at the head end. The hieroglyphs are chased into the gold fundu with tool marks indicating the use of a blunt tool, producing feathered lines around the curves (Figures 3 and 7b). These toolmarks are overlaid by sharp scratching which is likely to relate to later cleaning out of the inscription.

Pair of bracelet spacer-bars decorated with cats (EA57699 and EA57700). Length: 3 cm, Width: 1.8 cm, Height: 1.2 cm. Weight 19.2 and 19.1 grams respectively

These gold spacer-bars each consist of an open-sided shallow box formed around twelve 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, and two separate sheets along the shortest sides. On top of each box three cats are soldered, each made up of seven solid rod/wire components, worked to shape and hard soldered together. The body and head are one piece with details of eye, nose and mouth worked into the gold. Ears were made separately and soldered. The four legs and tail were formed of wire and details of front paws and striped tail were cut into the metal (Figure 4).

<a> GOLD ANALYSIS

Surface depletion of copper and, to a lesser extent, silver from gold alloys causes surface-enrichment in gold. This depletion may result either from 'pickling' by the goldsmith during

manufacture or from corrosion of less noble metals, particularly copper, during burial. This well-known phenomenon affects surface XRF and, to an even greater extent, SEM-EDX analyses [35, 36] thus analyses of the surface alloy reported in Table 2 may not accurately reflect the core metal composition and therefore these results should be considered semi-quantitative.

Concentrations of silver (10-18% Ag) in the alloys of these objects are typical of naturally occurring, unrefined alluvial gold, as might be expected at this period [37]. The silver results (c. 17%) for the components of both boxes of the bracelet spacers are consistent, suggesting that these sheets were cut from the same piece, whereas the components of the cats show wider variation in composition which may reflect the use of different pieces of rod/wire.

The copper content of naturally occurring alluvial gold is typically below 2% [38, 39] but copper concentrations detected for some components of these artefacts in Table 2 are higher, suggesting intentional addition of copper. The addition of copper to gold in Egypt was cited by Schorch [40] for the early eighteenth dynasty. Copper, presumably added to lower the melting temperature of gold for a hard solder was identified by analysis in jewellery from the so-called Qurneh queen's burial, at Thebes [41]. In the case of the ring in Table 2, the solder on the scarab's legs is visible under magnification and the compositional difference is clear. The box construction of the heart-scarab and the bracelet spacers also show visible soldered joins and this may account for some elevation of copper near the joins.

The presence of several platinum group element (PGE) inclusions confirms that the metal used in the manufacture of both the heart-scarab and the finger ring contained alluvial gold [42, 43, 44]. Normalised SEM-EDX analysis detected 37% ruthenium, 32% osmium, 31% iridium for the inclusion on the cast fundus of the finger ring, and 12% ruthenium 48% osmium and 40% iridium for an inclusion in the sheet gold of the heart-scarab. White metal inclusions seen on the bracelet spacers were not accessible to analysis but it seems likely they are of a similar type and indicate that this gold too is likely to be from alluvial sources.⁴

<a> CONCLUSIONS

Analysis has established that all these items are made of unrefined alluvial gold with copper added to lower the melting temperature for hard soldering of the components. The craftsmen of these items used a similar repertoire of manufacturing techniques; sheet and wire components, sharp chisel cuts to mark details on the cats and scarabs and chasing, with perhaps some punching, for inscriptions. There is no evidence for the casting of any of the components of these pieces. The finding of a mixture of *Pistacia* resin and Pinaceae (*Cedrus* genus or *Pinus* genus) resin being used as a filler and adhesive for a hollow gold item has not

previously been reported, which may be because it has not been looked for analytically outside the context of mummification, but it is not surprising that it could have served both purposes. The carved stones used for the scarabs, green jasper and lapis lazuli were relatively common at this period in Egypt. Jasper could have been sourced locally but the lapis lazuli was a precious trade item from Afghanistan.

For the ring and spacers the absence of incomplete hieroglyphs could be explained by their different functions - daily life, not funerary like the heart-scarab - however, the style and execution of the hieroglyphic inscriptions show important differences which indicate that they were not executed by the same hand (Figure 7). A close link between king Sobekemsaf (with no prenomen) and king Nubkheperre Intef could have been confirmed if it was evident from the toolmarks that the same goldsmith chased the personalised inscriptions on the different pieces. In spite of the tradition surrounding the discovery of the heart-scarab, this has not been proven. Furthermore, the name Intef, as recorded on the ring, was quite widespread in society of the time and does not prove that the ring belonged to king Nubkheperre Intef. The link between the ring and spacers was suggested by their presence in the same collection: it does not prove they were found together. In conclusion, a link between king Sobekemsaf (with no prenomen) and king Nubkheperre Intef, or their burial equipment, although evocative, is not supported on the basis of the technical study of these items. What the results of this study do, however, attest that in the Second Intermediate Period, a period known for lack of resources, the Theban region still retained and shared goldsmithing knowledge and expertise.

<a> EXPERIMENTAL APPENDIX

 Gold analysis

Elemental analysis of the surface of the gold was carried out using X-ray fluorescence analysis (XRF) with a Bruker Artax spectrometer with a molybdenum X-ray tube operated at 50 kV and 800 μ A, with a 0.65mm collimator. Small components were analysed using energy dispersive X-ray analysis in a Hitachi S-3700N Variable Pressure Scanning Electron Microscope (SEM-EDX), set to an accelerating voltage of 20 kV and a chamber pressure of 30 Pa. These semi-quantitative results of the surface analyses were calculated using three from the British Museum's in-house set of gold alloy standards : SB12 90% Au, 5% Ag, 5% Cu; SB39 50% Au, 30% Ag, 20% Cu; SB8A 70.98%, 24.07% Ag, 4.95% Cu.

 X-radiography

Images were produced with a Siefert DS1 X-ray tube at 100 kV and an exposure of 5 mA for 4 minutes.

 Raman spectroscopy

Identification of the stones of the two scarabs was carried out *in situ* using a Jobin Yvon LabRam Infinity spectroscope with a green (532 nm) laser with maximum power of 1.8 mW at the sample, a liquid nitrogen cooled CCD detector and an Olympus microscope system. Spectra were collected for between 5 and 20 seconds, with at least five scans used to produce each spectrum.

 Identification of material inside the heart-scarab

A powdered sample was analysed by Fourier transform infrared (FTIR) spectroscopy in transmission mode on a Nicolet 6700 with a Continuum IR microscope. Further analysis was carried out by gas chromatography mass spectrometry (GC-MS): the sample was extracted in dichloromethane, derivatised in bis(trimethyl-silyl)trifluoroacetamide with 1% trimethylchlorosilane and analysed on a HP5-MS column in an Agilent Technologies 890N Network GC system with Agilent 5973 Network Mass Selective Detector [32].

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<a> AUTHORS

Gianluca Miniaci (g.miniaci@gmail.com) is researcher in Egyptology at the Institute of Archaeology - University College London.

Susan La Niece (slaniece@thebritishmuseum.ac.uk) and

Marei Hacke (mhacke@thebritishmuseum.ac.uk) are scientists in the department of Conservation and Scientific Research, British Museum, London WC1B 3DG, UK

Maria Filomena Guerra (maria.guerra@culture.gouv.fr) is director of research at CNRS (Institute of Chemistry), at the Centre of Research and Restoration of the French Museums and UMR8220.

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NOTES

1 See [1] for complete bibliography. Ryholt assumes the scarab belongs to king Sekhemre Wadjkhau Sobekemsaf.

2 "A *Scarabeus of jasper, in the form of a 'cartouche,' set in gold and mounted on a gold base, round which are hieroglyphics, and on the bottom are five lines of hieroglyphics, 1 ¼ in. long Thebes, £ 16. 10s. This unique and very curious relic was taken from the breast of a male mummy found at Thebes*"

3 It is probable that when Mariette discovered Antef Nubkheperre's tomb that he remembered the story about a golden scarab bearing the name of a king Sobekemsaf associated with the discovery of king Antef coffin from an account of Athanasi in 1827, but it is also possible that Mariette had found a tomb belonging to a king named Sobekemsaf.

4 A larger set of gold analyses will be presented in a forthcoming publication: PICS 5995 CNRS "Analytical study of Bronze Age Egyptian gold jewellery".

FIGURES



AN408855001

Figure 1. Gold and green jasper heart-scarab EA7876 and inscription on reverse. Length: 3.8 cm



Figure 2. Gold finger-ring with lapis lazuli scarab. EA57698 . Diameter: 2.6 cm



Figure 3. Inscription on the underside of the scarab ring EA57698 [AN217496001]



Figure 4. A pair of bracelet spacer-bars decorated with cats . EA57699 and EA57700.

Longest axis 3 cm



Figure 5. Inscription on underside of EA57699 (top) and EA57700

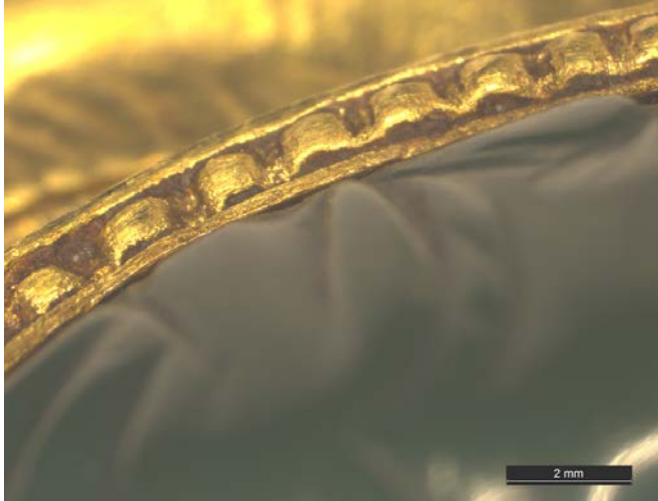


Figure 6. Detail of imitation of beaded wire or granulation around the stone of the heart-scarab

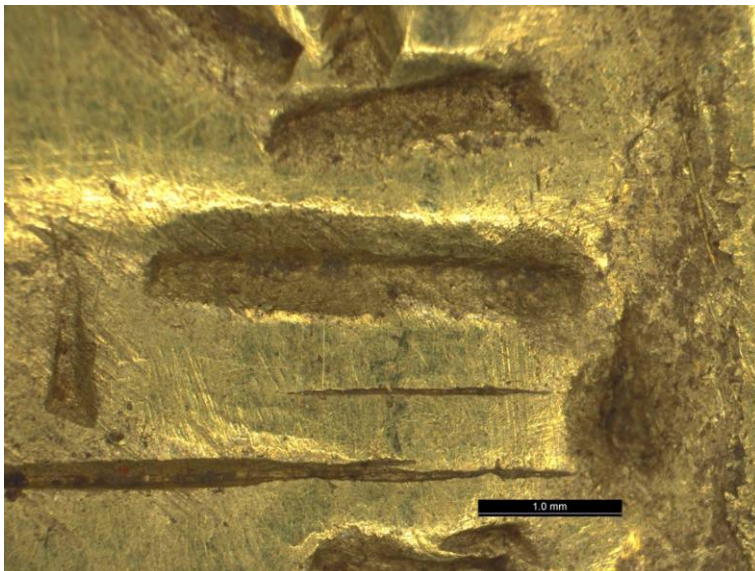
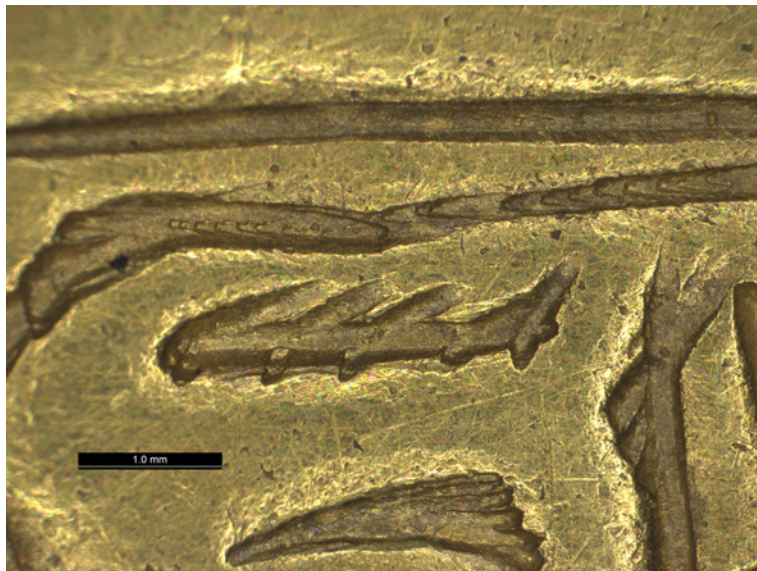


Figure 7. Details of the differences in inscribing the same hieroglyph between the three objects (a) Heart-scarab 'n' sign, centre of image



(b) Ring 'n' sign



(c) Bracelet spacer 'n' sign

Table 1: Distribution of attestations from western Thebes of different kings named Sobekemsaf

Sekhemre Shedtawy Sobekemsaf	Sekhemre Wadjkhau Sobekemsaf	Sobekemsaf with no prenomen
Base of a statuette - Dra Abu el-Naga (Thebes west) [1; p. 393, no. 3]	Block- Deir el-Bahri (Thebes west) [1; p. 396, no. 10]	Heart-scarab - Thebes west
Stela of a private individual - Dra Abu el-Naga (Thebes west) [1; p. 393, no. 4]		Canopic box - Thebes [30; pp. 60-65; 31; pp. 37-47, 118, 152-153, pls. 14-16]
Stela of a private individual - Thebes west [1; p. 393, no. 5]		Door jamb - Farshut Road (Thebes west) [26; pp. 50-51]
Tomb as recorded by "inspection papyri" (non contemporary sources) - Thebes west [1; p. 393, no. 9-11]		
Lintel - Thebes west (?) [1; p. 393, no. 7]		

Table 2 Semi-quantitative analysis of the gold alloys

Region of analysis	Au	Ag	Cu	Method
<i>Heart-scarab 7876</i>				
top plate of plinth	86.2	12.6	1.2	XRF
corrugated strip around scarab	86.1	12.6	1.3	XRF
side wall of plinth	86.5	11.5	2.0	SEM-EDX
base plate of plinth	86.8	12.3	0.9	XRF
leg - front left	86.1	12.6	1.3	XRF
leg - back right	85.4	13.1	1.5	SEM-EDX
leg - back left	87.5	11.3	1.2	SEM-EDX
<i>Ring 57698</i>				
hoop	85	14.0	1.0	XRF
bezel plate	83	16.0	1.0	XRF
coiled wire	84	15.0	1.0	XRF
leg left	91.3	7.6	1.1	SEM-EDX
leg right (including hard solder)	85.2	10.0	4.8	SEM-EDX
collar	87	11.3	1.7	SEM-EDX
<i>Bracelet spacer 57699</i>				
base plate	81.7	17.0	1.3	XRF
end plate	81.1	16.8	2.1	XRF
top plate	80.5	17.0	2.5	XRF
cat body 1	88	11.0	1.0	XRF
cat body 2	88.7	10.3	1.0	XRF
cat body 3	88.9	10.1	1.0	XRF
cat tail	82.4	16.3	1.3	XRF
cat front leg	85.6	13.3	1.1	XRF
<i>Bracelet spacer 57700</i>				
base plate	81.1	17.4	1.5	XRF
end plate	81.3	17.0	1.7	XRF
top plate	79.1	17.5	3.4	XRF
cat body 1	87.8	11.0	1.2	XRF
cat body 2	87.5	11.2	1.3	XRF
cat body 3	86.6	11.8	1.6	XRF
cat tail	84.4	13.4	2.2	XRF
cat front leg	85.6	12.7	1.7	XRF

