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A Large Turquoise Glass Writing Palette from Tutankhamen's Tomb

Scribes' palettes are an essential part of ancient Egyptian culture, representing the art of writing and administration. The combination of a long, rectangular body with two ink pans on one end and a small slot to hold the reeds used for writing evolved from the Fifth Dynasty onward, and was well established by the 18th Dynasty.[1] Fifteen such writing palettes were found in the tomb of Tutankhamen (r. 1333–1323 B.C.E.), in a variety of materials—from the more common wood, often gilded, to rare examples made of ivory or stone. Only three of them are functional; the others are referred to as ritualistic.[2] Here, we present a brief description and compositional data pertaining to a unique large writing palette made of opaque turquoise glass from the king's tomb.

The Palette

Howard Carter, the excavator of the tomb, concisely describes the object as "a large turquoise-glass ritualistic palette; of one piece of glass . . . the reeds of light blue, dark blue and yellow glass rods; has two pans for colours, one of which is covered with a calcite boss, the other missing; cover of slot for reeds of thin wood gilt. The glass is of a very fine turquoise colour with very few flaws."[3]

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[1]. Adelheid Schlott-Schwab, *Schrift und Schreiber im alten Ägypten*, Munich: C. H. Beck 1989, pp. 58–59.

[2]. Nonfunctional specimens are also labeled votive or model, reflecting the lack of precise definitions and differentiated use of the terms in the literature. Thus the term "ritualistic palette," chosen by Howard Carter (see note 3), is used tentatively for the nonfunctional palette discussed here, because a careful analysis of its actual function, meaning, or use is still pending.

[3]. Object card 367n. The object cards, with full excavation records and further illustrations, are in the open database of the Griffith Institute, University of Oxford (www.griffith.ox.ac.uk/griffith.html).

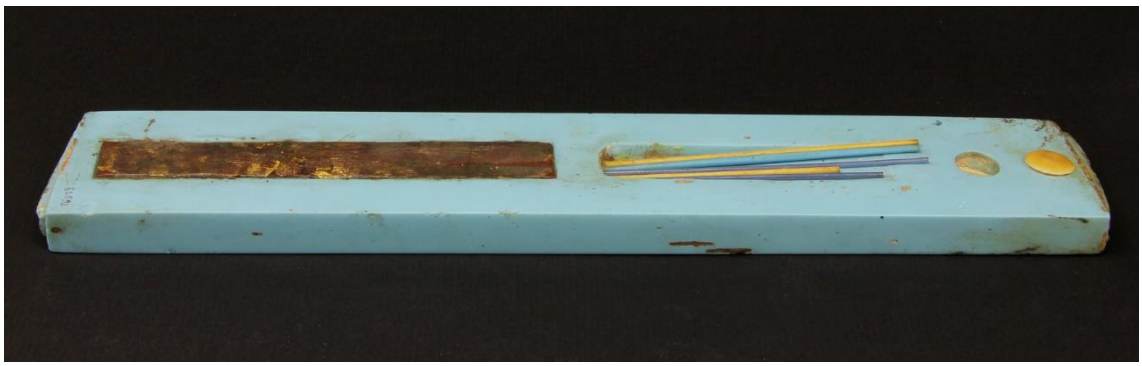

FIG. 1.

The glass is indeed of high quality, with very few imperfections: predominantly a few elongated bubbles now filled with dark sediment (Fig. 1, front side) and a few areas of light brown discoloration. Its color is similar to that of the turquoise glass headrest from the same tomb,[4] but with hardly any of its patches of strong brown discoloration. The palette is one of the largest (L. 42.1 cm) glass objects surviving from New Kingdom Egypt, even though its mass of about 1.7 kilograms is well within the range of weights recorded for contemporaneous glass ingots.[5] The reeds (Fig. 2) are represented by six thin glass rods (two opaque yellow, three dark blue, and one light blue); a seventh seems to be missing. Three other ritualistic palettes[6] were decorated with glass rods as well, and a total of 30 similar glass rods[7] were found in the annex of the tomb.

[4]. Carter no. 403a. Katja Broschat, Thilo Rehren, and Christian Eckmann, "Makelloses Flickwerk – Die gläsernen Kopfstützen des Tutanchamun und Anderes," *Restaurierung und Archäologie*, v. 9, 2016, pp. 1–24; Katja Broschat and Thilo Rehren, "The Glass Headrests of Tutankhamen," *Journal of Glass Studies*, v. 59, 2017, pp. 377–380.

[5]. The weights of 18 complete glass ingots from the Uluburun shipwreck, of the roughly 175 ingots recovered overall, fall between 1.1 and 2.4 kilograms: Edgar B. Pusch and Thilo Rehren, *Hochtemperatur-Technologie in der Ramses-Stadt: Rubinglas für den Pharao*, Forschungen in der Ramses-Stadt, Grabungen des Pelizaeus-Museums Hildesheim in Qantir-Piramesse, v. 6, pt. 1 (text), Hildesheim: Gerstenberg, 2007, p. 271.

[6]. Carter no. 367l and m, and Carter no. 620(89).

[7]. Carter no. 620(65).

FIG. 2.

Glass Compositions and Origin

The visual similarity between the glass of the palette and the glass of the headrest mentioned above raised the question of whether they were made from the same glass. The analyses were performed with the same hand-held X-ray fluorescence instrument that had been used to analyze the headrest two years earlier.[8]

TABLE 1

Composition of Scribe's Palette and Headrest from the Tomb of Tutankhamen*

	K_2O	CaO	TiO_2	MnO	FeO	CuO	Co	Ni	Zn	Sr	Zr	Sn	Sb	Pb
Headrest	2.1	5.3	0.04	0.04	0.28	0.45	*	10	40	360	20	*	10500	10
Palette	2.9	8.5	0.03	0.02	0.18	0.55	*	10	40	500	10	*	13000	10
Trq.-blue rod	2.0	7.3	*	0.01	0.31	0.88	*	*	*	1100	30	170	**	X00
Co-blue rods	0.8	6.1	*	0.09	0.41	0.17	300	160	440	1100	60	*	**	X00

[8]. See note 4.

Yellow rods	1.2	6.0	*	0.01	0.31	0.09	*	*	850	1100	*	*	**	6000
Quartz rod	*	0.5	*	*	0.03	0.06	*	*	*	*	*	*	4000	*

* Data are the averages of multiple individual analyses.[9] Oxides in wt %, elements in micrograms/gram.
*: not detected; detection limits are about 50 ppm for TiO_2, and 10–20 ppm for Co, Ni, Zn, and Sn.
**: Because of the high background signal for antimony from the underlying glass slab, identified in the pure quartz rod analysis, no reliable readings were available for antimony.

The two large turquoise objects, namely the headrest and the palette, are similar in composition: they are colored with copper rather than bronze, and opacified with antimony, presumably as calcium antimonate. They are also similar in their other trace-element concentrations, suggesting that they were made following a similar recipe, and indicating a common workshop or source area. However, they are clearly distinct in their calcium oxide and potash contents, ruling out that they are from the same batch of glass. Noteworthy is the very low concentration of tin in both objects, as well as their relatively low strontium contents.

Earlier work had highlighted the tendency of Egyptian copper-blue glass to be colored by bronze rather than copper, while almost all Mesopotamian glass was colored by copper.[10] There also appears to be a tendency for Mesopotamian glass to have lower strontium concentrations than glass from Egypt,[11] possibly indicating that the glass for these two objects was imported into Egypt rather than made locally. However, more recent work has shown that both characteristics, low tin

[9]. The palette was analyzed on five different spots, using Soil and Mining+ modes collimated to three millimeters. (The sixth rod was too short to be reached by the hhXRF instrument.) Each of the five thin glass rods was analyzed once using only Mining+, because collimation was not available for the Soil mode. The data were corrected, based on the results of analyses of reference glasses (Corning B, Corning D, NIST 610, and NIST 612), analyzed on the same day under the same conditions. A pure quartz rod similar in diameter to the glass "reeds" was analyzed next to the "reeds" to determine the see-through of X-ray radiation from the underlying palette; this was particularly noticeable for calcium and antimony. Accordingly, antimony values for the glass "reeds," measured on the order of 6,000 to 7,000 micrograms/gram, are not given. Full analyses and correction details will be provided in a forthcoming publication; see also Broschat and Rehren [note 4], n. 6.

[10]. A. J. Shortland ("The Raw Materials of Early Glasses: The Implications of New LA-ICPMS Analyses," *Annales de l'Association Internationale pour l'Histoire du Verre*, v. 16, London, 2003 [Nottingham, U.K., 2005], pp. 1–5) found tin in 19 of 26 Egyptian copper-blue glasses, and in none of the roughly 40 samples from Mesopotamia.

[11]. Andrew J. Shortland, Nick Rogers, and Katherine Eremin ("Trace Element Discriminants between Egyptian and Mesopotamian Late Bronze Age Glasses," *Journal of Archaeological Science*, v. 34, no. 5, May 2007, pp. 781–789) report average strontium concentrations of just over 400 ppm for 25 Mesopotamian glasses, but 640 ppm for 30 Egyptian glasses, including several with more than 1,000 ppm Sr.

and low strontium concentrations, are also found in copper-colored glass from the workshop at Lisht in Lower Egypt.[12] Thus, a firm statement regarding the geographical origin of the turquoise glass is impossible to make with the current data,[13] while the quintessentially Egyptian nature of both objects clearly points to local manufacture.

In contrast, the turquoise glass rod conforms closely to turquoise glass known from elsewhere in Egypt, with high strontium concentrations and nearly 200 micrograms/gram tin. The two transparent blue glass rods are colored by cobalt, making an Egyptian origin all but certain,[14] while the two opaque yellow rods have the same very high strontium contents as the other analyzed glass rods, and are therefore probably also of Egyptian origin.

As was noted above, the turquoise glass palette from the tomb of Tutankhamen is one of the largest glass objects from New Kingdom Egypt. The glass is of very high quality and homogeneity, showing hardly any of the brown discoloration that so badly affects the turquoise glass headrest from the same tomb. Its very low tin and low strontium contents are in stark contrast to the composition of the thin turquoise glass rod—which, like the other glass rods, is compositionally more similar to Egyptian glass that is well known from other New Kingdom contexts. Whether the compositional similarity of the two large objects to glass found at Lisht indicates an earlier production of glass there than had previously been assumed, or whether it is the result of an importation of turquoise glass from Mesopotamia (as is indicated by pictorial evidence[15]), must remain an open question until more detailed trace-element data become available.

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[12]. Melina Smirniou, Thilo Rehren, and Bernard Gratuze, "Lisht as a New Kingdom Glass-Making Site with Its Own Chemical Signature," *Archaeometry*, v. 60, pt. 3, June 2018, pp. 502–516) report data on seven copper-blue glasses, of which only three have tin concentrations consistent with the use of bronze; these seven have, on average, 360 ppm strontium.

[13]. Shortland, Rogers, and Eremin [note 11] demonstrate that the best discriminators for Egyptian vs. Mesopotamian glass are lanthanum, chromium, zirconium, and titanium. These, however, could not be determined with sufficient accuracy using the equipment available to us.

[14]. During the Late Bronze Age, cobalt-colored glass is almost exclusively known from Egypt. The cobalt source is thought to be the alum beds in the western oases (A. Kaczmarczyk, "The Source of Cobalt in Early Egyptian Pigments," *Proceedings of the 24th International Archaeometry Symposium*, Washington, D.C.: Smithsonian Institution Press, 1986, pp. 369–376). It is characterized by the co-occurrence of manganese, iron, cobalt, nickel, and zinc, with varying amounts of copper.

[15]. E.g., the 18th-century tomb scene showing the offering of turquoise glass ingots, reproduced in Andrew J. Shortland, *Lapis Lazuli from the Kiln: Glass and Glassmaking in the Late Bronze Age*, Leuven: Leuven University Press, 2012, fig. 7.5.

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FIGURE CAPTIONS

FIG. 1. Scribe's palette with dark blue, turquoise, and yellow glass "reeds." H. 2 cm, L. 42.1 cm, D. 7.6 cm. Now in the Grand Egyptian Museum, Giza, formerly in the Egyptian Museum, Cairo (JdE 62093). (Photo: Chr. Eckmann, Römisch-Germanisches Zentralmuseum, Mainz [RGZM])

FIG. 2. The glass "reeds" from the scribe's palette. L. 14 cm (some are broken off), Diam. 2–4 mm. (Photo: Chr. Eckmann, RGZM)