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Composition and Origin of the Eighth Century B.C.E. Glass Inlays from Salamis, Tomb 79

Among the many spectacular finds from the Iron Age site of Salamis on the eastern coast of Cyprus are two royal pieces of furniture covered in ivory and inlaid with blue decoration. We have determined that this decoration is made of cobalt-blue glass, probably of Egyptian origin, similar to the inlays in the contemporaneous Nimrud ivories. The data link the glass from Salamis to the growing corpus of Iron Age Egyptian cobalt-blue mineral natron glass, found from Nimrud in Mesopotamia to Bologna in northern Italy, several sites in southeastern France, and now Cyprus.

The Excavation

Tomb 79 of the "royal necropolis" of Salamis, which was excavated by the Cyprus Department of Antiquities in 1966, had been looted earlier. It was used first in the Cypro-Archaic period (about 750–600 B.C.E.) and again in the Roman period, when the material in the chamber must have been removed. However, the spacious dromos of the original tomb and the propylaeum in front of the chamber had never been disturbed. The tomb yielded remains of sacrifices of horses and chariots, an impressively rich harvest of bronzes (including two large cauldrons), iron *obeloi* and firedogs, and several pieces of furniture decorated with ivory plaques. Salamis was no doubt the richest and most important kingdom of Cyprus during the Cypro-Archaic period. Its kings and nobles were buried in a separate part of the cemetery, in unusually monumental built tombs, with pomp and luxury.

Tomb 79 was used for burials twice. The first burial dates to the end of the eighth century B.C.E. or the initial stages of the Cypro-Archaic period. The second burial took place a short time later, before the wooden parts of the chariots of the first burial started to decay.[1] The ivory furniture

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[1]. For a discussion, see Vassos Karageorghis, *Excavations in the Necropolis of Salamis*, v. 3 (fascicle of text, plates, and folding plans and sections), Salamis, v. 5, Nicosia: Department of Antiquities, 1973, pp. 120–122.

belonged to the first burial and was found near the propylaeum. The two carved plaques, numbers 143 and 258, were found on the floor, near the throne to which they belonged. This throne was found in fairly good condition, with most of the ivory plaques preserved in situ; only the wood had disintegrated. The ivory bed, however, must have been disassembled and its pieces piled up on the floor, in the northwestern corner of the propylaeum.[2] It is not clear whether they were originally placed in the funerary chamber or were left in the dromos, having served during a funerary banquet. The size of the bed, as reassembled, is 188 centimeters in length and 111 centimeters in width; the size of the inner part of the chamber is 320 by 240 centimeters. We know that people were reclining on beds during feasting—as is seen, for example, on an engraved silver bowl from Cyprus, of about the same period, now in The Metropolitan Museum of Art, New York City.[3]

We re-examined the material that had been identified simply as “blue glass” or “frit” when first described. The style of the Salamis ivory furniture has been discussed and compared with that of the famous Nimrud ivories, dated to the third quarter of the eighth century B.C.E.[4] They can be assigned to a “Phoenician” *koine* that flourished along the Syro-Palestinian coast. The Salamis ivories may have been made there and exported to Cyprus, like those also known and admired by Homer.[5]

The Glass Inlays

Several of the opaque blue glass inlays are mounted on the headboard of the reconstructed bed and exhibited in the Cyprus Museum (Fig. 1). Close visual inspection showed that they were indeed glass rather than frit, probably drawn into plates, as indicated by the shape of the air bubbles (Fig. 2).

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[2]. *Ibid*., plan V and pl. XXXV.

[3]. Vassos Karageorghis, Joan R. Martens, and Marice E. Rose, *Ancient Art from Cyprus: The Cesnola Collection in The Metropolitan Museum of Art*, New York: the museum, 2000, pp. 180–189.

[4]. Karageorghis [note 1].

[5]. Cf. *ibid*., pp. 94–97. Georgina Herrmann and Stuart Laidlaw (*Ivories from Rooms SW11/12 and T10 Fort Shalmaneser*, fasc. 7.1, *Commentary and Catalogue*, London: British Institute for the Study of Iraq, 2013, p. 117) link ivories richly inlaid with glass and highlighted with gold to the Classic Phoenician group, for which they consider Tyre and Sidon as possible production centers.

FIG. 1.

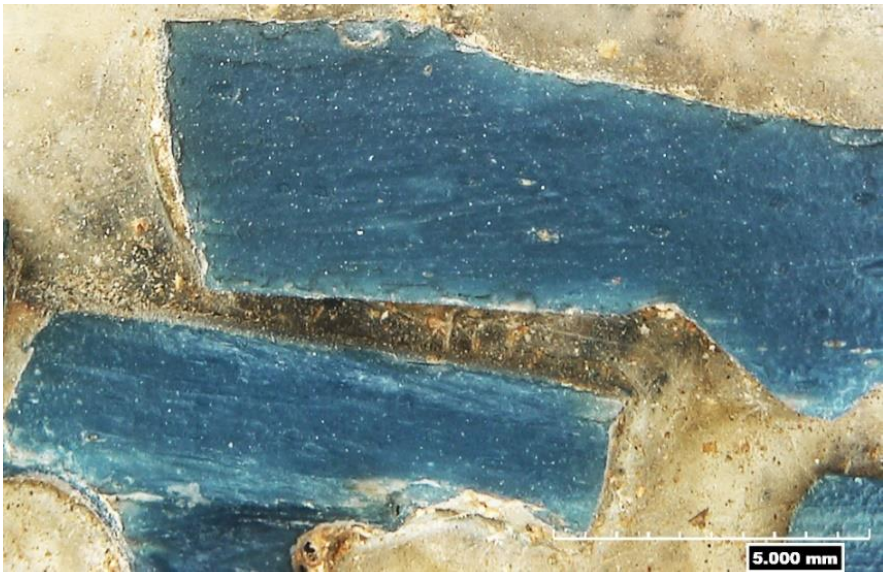


FIG. 2.

Three pieces were analyzed using a hand-held X-ray fluorescence (hhXRF) instrument; two of them were analyzed twice, resulting in five separate measurements. The instrument's "Soil" calibration was tested against three reference materials, and the results were corrected accordingly (Table 1 and Fig. 3).

TABLE 1

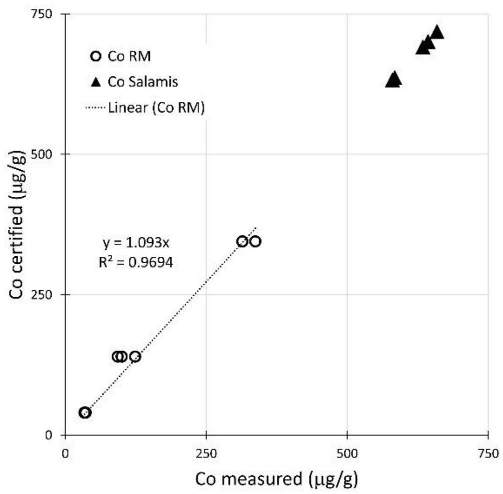
Results of hhXRF Analyses of Three Glass Inlays (Analyses 7 and 8, 9, and 10 and 11)*

[JACI – PLEASE CHECK THAT THIS TABLE LOOKS ON AND IS FORMATTED CORRECTLY WHEN YOU BRING IT INTO INDESIGN.]

Sample	K	Ca	Ti	Mn	Fe	Co	Ni	Cu	Zn	As	Sn	Sb	Pb
#7	1816	33063	391	3630	4902	634	538	35	3358	19	ND	7952	15
#8	1854	29556	316	3199	4421	584	470	45	2598	18	ND	7540	12
#9	1568	23167	210	2537	4352	580	503	207	743	17	ND	8373	23
#11	1455	27640	286	2974	4994	659	559	76	1089	17	ND	8282	31
#13	1700	29898	332	3286	4761	643	512	116	1321	22	ND	7699	26
Ave. µg/g	***1679***	***28665***	***307***	***3125***	***4686***	***620***	***516***	***96***	***1822***	***19***	ND	***7969***	***21***
	K_2O	CaO	TiO_2	MnO	FeO	CoO	NiO	CuO	ZnO	As_2O_3	SnO_2	Sb_2O_3	PbO
Ave. ox.	***2022***	***40108***	***512***	***4035***	***6030***	***788***	***657***	***120***	***2268***	***25***	***ND***	***9540***	***24***
Corr. Factor	0.76	0.98	1.24	1.26	1.14	1.09	0.95	1.02	1.03	1.34	1.02	1.05	1.22
Ass. Wt %	**0.15**	**3.9**	**0.06**	**0.5**	**0.7**	**0.09**	**0.06**	**0.01**	**0.23**	**<0.01**	**<0.01**	**1.0**	**<0.01**

* All data are in micrograms per gram (µg/g). The lower part of the table reports average oxide concentrations and the correction factor determined by analysis of Corning B and D and BAM-S005 reference glasses. The bottom line presents the assumed composition in weight-percent oxide, correcting the measured concentrations based on the comparison with the reference glasses.[6]

[6]. For instance, the average value of 3125 µg/g Mn equals 4035 µg/g MnO; this was then assumed to represent about 0.5 wt % (5000 µ/g) MnO, because the results from the reference glasses indicate a significant underreporting of Mn (correction factor 1.26).



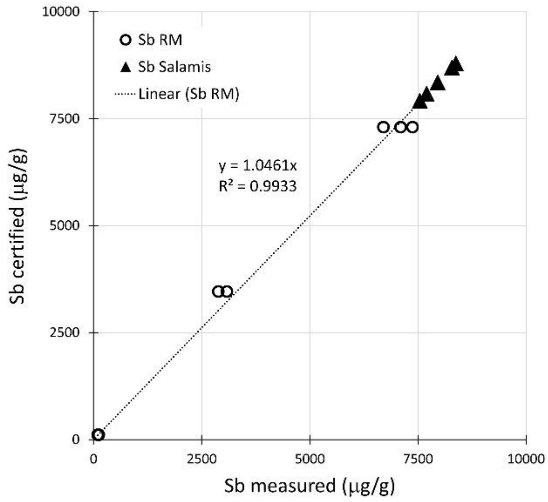


FIG. 3.

Among the base-metal oxide concentrations, antimony stands out with about 1 wt %, while zinc, cobalt, and nickel are present at between 0.5 and 0.1 wt %. The copper content is remarkably low, at about 0.01 wt %, and arsenic, lead, and tin are present at well below 0.01 wt %. The relative consistency of the repeat analyses (nos. 7 and 8 and nos. 11 and 13 respectively) for copper and zinc, compared with the extent of difference among the samples, demonstrates that these reflect real differences in composition, indicating that these pieces were made from different glass batches. The very low contents of potash and lime are consistent with mineral natron glass, as already expressed for Iron Age cobalt-blue glass from Nimrud in Iraq[7] and from Kaman-Kalehöyük in Turkey.[8] In contrast, cobalt-blue glass from Late Bronze Age (LBA) Egypt, although known for its relatively low potash content compared to other LBA plant-ash glass, has significantly higher potash and lime levels.

The glasses are colored by cobalt oxide, associated with the oxides of manganese, iron, and zinc. The antimony content is due to the presence of calcium antimonate as the opacifier; clusters of this are visible at high magnification. This combination of cobalt and other transition metals is well

[7]. Wendy Reade, Ian C. Freestone, and St John Simpson, “Innovation or Continuity? Early First Millennium BCE Glass in the Near East: The Cobalt Blue Glasses from Assyrian Nimrud,” *Annales de l’Association Internationale pour l’Histoire du Verre*, v. 16, London, 2003 (Nottingham, U.K., 2005), pp. 23–27.

[8]. Julian Henderson and others, “Hittite and Early Iron Age Glass from Kaman-Kalehöyük and Büklükale, Turkey: Evidence for Local Production and Continuity?,” *Anatolian Archaeological Studies*, v. 21, 2018, pp. 70–84, esp. p. 78.

known from LBA cobalt-blue glass from Egypt and Early Iron Age northern Italy[9] and France,[10] but lacks the high copper content of the copper-cobalt-blue glass found predominantly in Mycenaean contexts and the Uluburun glass ingots. The cobalt originated in the Egyptian alum deposits,[11] corroborating the suspected Egyptian origin of the mineral natron–based glass. The Egyptianizing motif of the corner decorations (Fig. 4a) is typical for the Classical Phoenician style,[12] including the combination of cobalt-blue glass with gold foil (Fig. 4b).

FIG. 4a.

FIG. 4b.

Conclusion

The cobalt-blue glass from the late eighth- or early seventh-century B.C.E. wooden bed from Salamis, Cyprus, is compositionally similar to inlays from contemporaneous ivories from Nimrud and numerous early first-millennium beads from northern Italy and southeastern France.

[9]. Rossella Arletti and others, “Glass Beads from Villanovian Excavations in Bologna (Italy): An Archaeometrical Investigation,” *European Journal of Mineralogy*, v. 23, 2011, pp. 959–968.

[10]. Bernard Gratuze, “Les Premiers Verres au natron retrouvés en Europe occidentale: Composition chimique et chrono-typologie,” *Annales de l’Association Internationale pour l’Histoire du Verre*, v. 17, Antwerp, 2006 (2009), pp. 8–14.

[11]. A. Kaczmarczyk, “The Source of Cobalt in Ancient Egyptian Pigments,” *Proceedings of the 24th International Archaeometry Symposium*, Washington, D.C.: Smithsonian Institution Press, 1986, pp. 369–376.

[12]. Herrmann and Laidlaw (note 5, chap. 2) repeatedly stress the strong cultural link between the Phoenician cities and Egypt.

Compared with the cobalt-colored plant-ash-based glass from LBA Egypt and the Aegean, they all have low potash and lime contents (less than 0.5 wt % and about 4 wt % respectively), consistent with Egyptian mineral natron glass from the early first millennium BC.E.[13] The compositional similarity with these well-provenanced objects and the characteristic suite of transition metals associated with cobalt ore from the western oases are strong evidence for the ongoing primary production in Egypt of cobalt-blue glass throughout much of the Third Intermediate Period, previously not well recognized.

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FIGURE CAPTIONS

FIG. 1. Partial view of the glass inlays mounted on the headboard of the reconstructed wooden bed from Salamis, Tomb 79.

FIG. 2. Closeup of the glass inlays, with elongated gas bubbles indicating the hot drawing of the glass plates before cold working.

FIG. 3. Comparison of measured concentrations (x-axis) for cobalt (*left*) and antimony (*right*) in µg/g, with the certified values for three reference glasses: Corning B and D and BAM-S005 (y-axis). The analyses of glass inlays (black triangles) are plotted along the linear trendline for the reference glasses, which was used to correct for systematic analytical error.

FIG. 4a. Corner plaque of the bed, with cornflower motif. Glass inlays in carved ivory.

FIG. 4b. Closeup of central rosette in the second tier, showing remnants of gold foil together with the blue glass inlays.

[13]. Birgit Schlick-Nolte and Rainer Werthmann, “The Glass Beakers of Nesikhons: A Preliminary Report,” *Annales de l’Association Internationale pour l’Histoire du Verre*, v. 15, New York and Corning, 2001 (Nottingham, U.K., 2003), pp. 1–3.