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FIRST ARCHAEOMETRICAL DATA OF GLASS FROM SARNO NECROPOLIS (9th - 6th CENTURY BC)

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The archaeometrical data on a set of 35 glass beads coming from two ancient necropolis, situated near the modern city of Sarno (Napoli), are reported in this work. The glass samples are dated from the 9th to 6th century BC, when the Sarno valley was a contact area between the new Greek colonizing culture and the indigenous Etrurian one. The chemical analyses were obtained by Electron Microprobe (EMPA), for major and minor elements, and by LA-ICPMS (laser ablation-inductively coupled plasma-mass spectrometry) for trace elements.
The chemical data indicate that both natron and plant ash glass are present in the sample set. The natron glass beads are mainly copper blue and turquoise, cobalt blue and iron black. The cobalt blue samples show very high Al_2O_3 and MgO levels (5.5-7.3% and 3.6-4.6%, respectively) associated to trace elements such as Ni and Zn, that indicate the use of cobaltiferous alums as source of colorant [1]. Furthermore they exhibit a very low amount of CaO (1.3-3%), K_2O and P_2O_5 (0.2-0.6% and 0.03% respectively). The question about what kind of fluxing agent was used to produce these glass has been object of great debate. In particular Shortland and Tite [1,2] and Rehren [3] after studying the New Kingdom cobalt blue glasses, concluded that probably plant ash [3] or both natron and plant ash [2] were used. Gratuze and Picon [4] and Reade et al. [5] underlined the differences between the 2nd millennium BC cobalt blue glass and the 1st millennium BC ones. The latest contain low amount of K_2O (<0.5%) and P_2O_5 (<0.1%) as the earlier, but show also low levels of CaO (3-4%). These chemical characteristic strongly suggested the use of natron (as lime is a major constituent of plant ash, their employ would typically yield a glass with 5% CaO or more [5]). The Sarno cobalt blue glasses were hence probably produced with natron and the high amount of MgO can be related to the use of cobaltiferous alums. The iron black samples exhibit similar chemical characteristics as regards CaO (≤3%), K_2O (≤1%) and P_2O_5 (≤0.2%), but show low levels of MgO (≤1.2%). This composition is consistent with the use of natron, as also observed for coeval black glass from France [4] and Italy [6]. Moreover, these beads are rich in FeO (10-14%), which is responsible for the black coloration. The majority of the plant ash samples are colorless and an high antimony levels are found (Sb_2O_3 ~ 0.40%). From the analysis of the graphs of Fig. 1 we can observe that the plant ash and the natron samples (excluding the cobalt blue and the iron black) are characterized by a high Sr concentration, suggesting the use of a coastal sand as vitrifying raw material [7]. The natron glass show also the highest Zr level, related to the employ of an impure sand rich in heavy minerals. The natron cobalt blue and iron black samples exhibit the lowest amounts of Sr (~75 ppm), that could indicate the use of a limestone-bearing sand as vitrifying, rather than coastal sand [7]. In addition, they show high levels of Y: according to Shortland et al. [8] high amounts of Y are characteristic of the Egyptian cobalt blue glass made with alum, where Y was associated to the colorant. Gratuze [4] suggests the use of cobaltiferous iron-rich alums also for the production of the 1st millennium French black glass. So it can be supposed that both Sarno

cobalt blue and iron black glass were produced with cobalt-iron rich alums. The comparison of the Sarno black samples with 1st millennium BC (8th-6th cent BC) black glass from Bologna [6] enhances the similar chemical composition and the use of natron as flux.

There is no chronological distinction among the samples: the presence of natron glass and plant ash glass overlap each other in a span of time from the 8th to the 6th century BC; but it can be notice that the iron black glass is the only kind of glass attested in the earlier moment (9th-8th century BC), and that it disappears after this time.

References

[1] Shortland, A. J., Tite, M. S., 2000. Raw materials of glass from Amarna and implications for the origins of Egyptian glass. Achaeometry 42, 1, 141-151.

[2] Tite, M. S., Shortland, A. J., 2003. Production technology for copper-and cobalt blue vitreous materials from the New Kingdom site of Amarna-a reappraisal. Achaeometry 45, 2, 285-312.

[3] Rehren, T., 2001. Aspect of the production of cobalt-blue glass in Egypt. Achaeometry 43, 4, 483-489.

[4] Gratuze, B., Picon, M., 2006. Utilisation par l'industrie verriers des sels d'aluns des oasis égyptiennes au début du premier millénaire avant notre ère. In: *Colloque International- L'alun de Méditerranée- 4-8 Juin 2003 (ed. Brun, J. P.), Institut Français de Naples, Naples*.

[5] Reade, W., Freestone, I., Simpson, J., 2005. Innovation or continuity? Early first millennium BCE glass in the Near East: cobalt blue glasses from Assyrian Nimrud. In: *Annales du 16e Congrès de l'Association International pour l'Histoire du Verre—London 2003 (ed. H. Cool), 23–7*.

[6] Henderson, J., Arletti, R. (Personal communication).

[7] Freestone, I. C., 2006. Glass production in Late Antiquity and Early Islamic period: a geochemical perspective. In: *Geomaterials in Cultural Heritage, edited by Maggetti, M. and Messiga, B., London.*

[8] Shortland, A., Rogers, N., Eremin, K., 2007. Trace element discriminants between Egyptian and Mesopotamian Late Bronze Age glasses. Journal of Archaeological Sciences 34, 781-789.

[9] Wedepohl, K. H., 1995. The composition of the continental crust, Geochimica et Cosmochimica Acta, 59, 1217-1232.

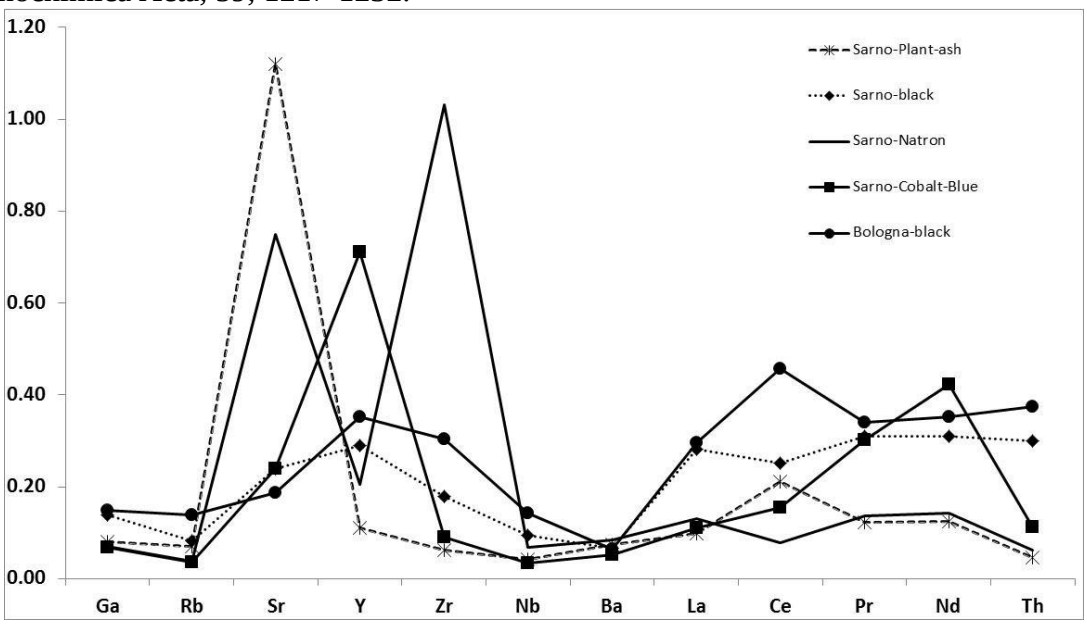

Fig. 1. Average trace element composition for Sarno compositional glass groups normalised to the composition of the upper continental crust [9]