

## Archaeometrical analyses of Early Egyptian glass from the Thebe area

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In this work a series of fragments of Egyptian unguentaria are characterized from the chemical and physical point of view. The analyzed samples were produced in the first step of the Egyptian glass production, during the new Kingdom of Egypt. The glass production in Egypt started under Thumosis III kingdom and developed until it reached its maximum during the kingdom of Amenhotep III (XVIII dynasty, 1390-1352 BC.) e Amenhotep IV/Akhenaton (XVIII dynasty, 1352-1338 BC). In this period, different glass shapes and typologies appears, and also the variety of decorations and colors increased. The analyzed samples pertain to six vessels (amphoriskoi and krateriskoi) coming from Thebes area and now stored at the Egyptian Museum of Turin (Italy) after the excavation carried out at the Valley of the Queens. All these vessels, are blue with yellow, white and turquoise decorations and were produced with the core forming technique.

The chemical analyses of major and minor elements were performed by Electron Microprobe (EMPA), while the trace element analyses were obtained by LA-ICP-MS. The nature of the opacifying and coloring agents was determined by X-ray powder diffraction. Since only micro volumes were sampled from the artifacts (less than 1 mm<sup>3</sup>), the diffraction experiments were successfully carried out using a single crystal diffractometer equipped with a CCD camera.

The chemical data obtained show that all the samples contain high levels of Na<sub>2</sub>O along with rather high level of both MgO and K<sub>2</sub>O - thus indicating they were produced with plant ash. All the blue samples show high Al, Zn, Mn and Ni, strongly correlated with Co.. This is consistent with the data available in literature for blue glass of the XVIII dynasty recovered in Malkata and Amarna, while, it is attested the use of copper for coeval Mesopotamian glass. The trace elements data for almost all the samples show they are very similar with the coeval Egyptian glass, only two exception show a trace elements pattern more similar to Mesopotamian glass. I

Yellow opaque decorations are rich in Pb and Sb, while only Sb is present in the white and light blue ones. This is consistent with the results of the X-ray powder diffraction analyses, that confirmed the presence of lead antimonates in the yellow decorations and of calcium antimonates in white and light blue ones. The shape of the crystals and the chemistry of the opaque yellow and white samples suggest the opacifiers were synthesized ex situ and then added to the glass.