

# **Unveiling the origins: a geochemical study on Final Bronze Age Glass from Central Italy**

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The study of ancient glass provides insights into historical trade networks, local production sites, and the social practices of past civilizations. During the last decades, geochemical analysis, including major and trace element content as well as radiogenic isotope systematics, has proven effective in provenance studies, enabling the differentiation of raw material sources based on their distinct geological signatures.

The present study focused on the chemical (major, minor and trace elements) and isotopic (Sr, Nd and Pb) characterization of five vitreous materials dated to the Final Bronze Age – Early Iron Age (1126 BC – 897 BC) and selected as representative among 16 artefacts found in the archaeological site of Paduli, lago di Piediluco (Rieti, Italy).

One sample is a natron (i.e., NaO rich) vessel fragment, bichrome blue and white, showing a chemical (i.e., Al<sub>2</sub>O<sub>3</sub> and REE) and isotopic (Sr and Nd) compositions suggesting a Levantine production. <sup>87</sup>Sr/<sup>86</sup>Sr, paired with CaO, Sr, Ba and U contents, indicates the use of aragonitic marine organisms' shells as a source of stabilizer. Lead, probably added to enhance glass fluidity, has an isotopic fingerprint comparable to that of the Taurus ores (Turkey).

The other four samples are mixed alkali glasses (i.e., high K<sub>2</sub>O), a composition typical of European vitreous materials. Chemical and isotopic fingerprints of these beads link them to Frattesina, a known glass production centre active in Northern Italy during the Bronze Age. The differences among these samples can be ascribed to: i) the possible use of various types of stabilizers (CaO), recognizable by their concentrations of Sr, Ba and U, as well as their Sr isotope ratios; ii) the use of sands (as a vitrifying agent source) with variable Nd isotopic composition possibly linked to Po and Adige Rivers; iii) the use of colourants with slightly different composition and origin, but generally compatible with metals coming from Trentino-Alto Adige and Austrian ores.

Our results suggest that the Paduli archaeological site was an important trade centre between North Italy and the Eastern Mediterranean, where known glass-making centres were active during the Late Bronze Age (i.e., Frattesina and the traditional production centres in the Levant).