

## Glass analysis – relation to historical questions

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Glass is material of complex composition that varies with time and is characteristic for particular historic periods. An interesting period starts with late antiquity, with the introduction of HIMT glasses, and later in the beginning of the 9<sup>th</sup> century, when the flux made of natron, a dry sediment of Egyptian lakes, was replaced with the ash of halophytic plants.

Ion beam methods are a suitable tool for glass analysis, as they do not require demanding sample preparation and are little destructive. The method established in the lab now includes PIXE for the analysis of silicon and heavier elements, and PIGE for analysis of sodium, magnesium and aluminum. Gradual improvements of the method include development of a handy fitting program for the evaluation of gamma spectra, and different methods for normalization of the X-ray yields.

Recent studies include further analysis of glass from the Late Roman settlements, which showed glass of Levantine origins, but only a few examples of the HIMT glass that was quite common in western Europe. We further complemented the study of medieval glass beads, circulating in the territory of the present Slovenia from Late Antiquity until about the 11<sup>th</sup> century AD. The beads were made of glass using either natron or plant ash as flux, the latter beads not being older than about 800 AD. The occurrence of such beads in particular graves can then be used as a terminus *ante quem*, and is applied for dating of the Köttlach culture in central Slovenia, particularly of its earlier phase that some archaeologist dated to 7<sup>th</sup> and 8<sup>th</sup> c. AD. The appearance of plant-ash beads in such graves then speaks for a later dating to the 9<sup>th</sup> c. AD.