Poster

Enhanced Characterization of Ancient Glasses through Advanced Tomographic Techniques @ SESAME Synchrotron

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SESEAME is the first Synchrotron light source in the middle east and an intergovernmental organisation established under the auspices of the UNESCO. This contribution highlights the advantages and new experimental capabilities of Synchrotron X-ray tomography for cultural heritage science at the newly build ID10-BEATS (BEAmline for Tomography at SESAME) beamline. X-ray tomography offers a rapid, high-resolution, and non-invasive alternative to traditional microscopy. Through this approach, we unveil the hidden complexities of ancient glasses, providing invaluable data for their conservation and study.

Investigating the complex history and degradation processes of ancient glasses requires methodologies that are both sensitive to the fragile nature of these artifacts and capable of revealing their intricate internal details. Our study demonstrates advanced methods for tomographic contrast formation such as phase-contrast and quasi-monochrome X-ray CT. Combined with the non-destructive and non-invasive nature of the technique, these make Synchrotron CT an ideal tool for examining precious historical specimens. By tuning the detector magnification, field of view, X-ray beam energy, and intensity, we adapt our examination to samples of varying sizes and densities, enabling a comprehensive investigation beyond the capabilities of traditional methods.

Advanced 3D image processing techniques further our ability to visualize the microstructure of these ancient materials. Internal constituents as well as pores and cracks within the specimen can be identified and characterized quantitatively in 3D and with microscopic resolution. When combined with synchrotron analytical techniques, such as X-ray fluorescence, our approach provides comprehensive insights into both the structural and chemical composition of the glass that are complementary to crystallographic investigations, uncovering information critical to understanding its historical manufacture and subsequent alterations.

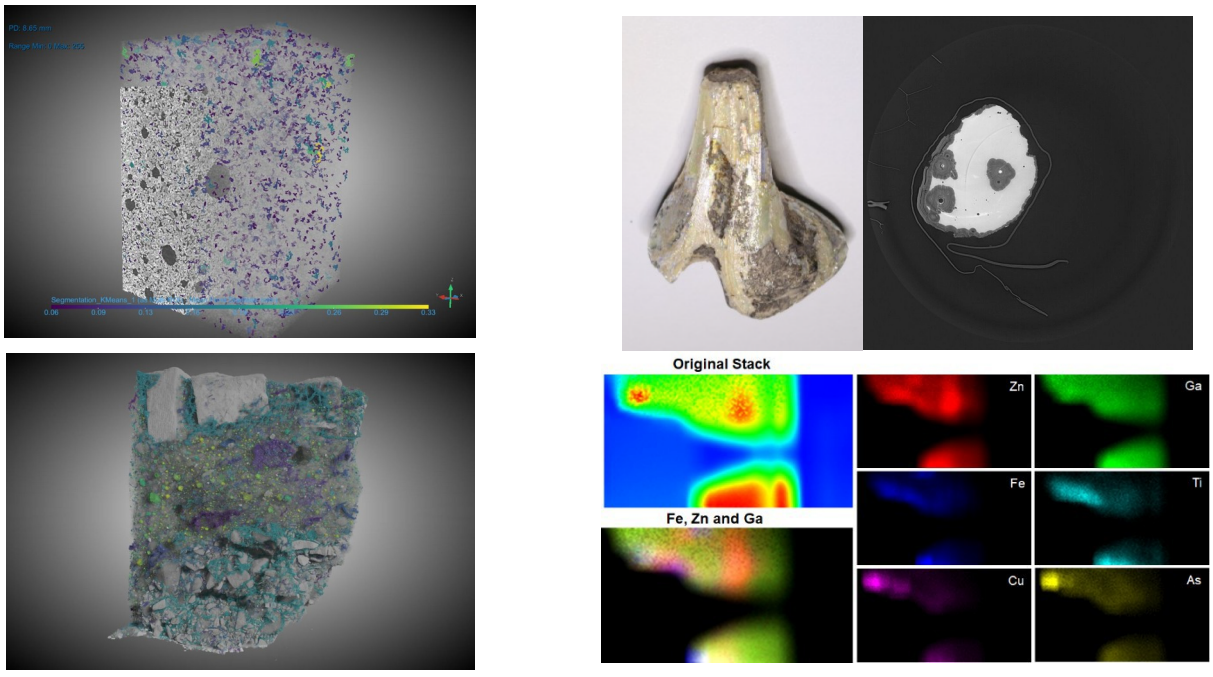

Figure 1. A compilation of various artifacts, ranging from Egyptian blue over replicas for understanding stability of mortars (left) up to an ancient byzantine roman glass found at Petra (including XRF maps of the bottom region, right)