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Characterization of cosmetic pigments found in shells from Iron Age graves (SE Arabia)

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Marine and terrestrial shell remains found in archaeological excavations is considered a cultural heritage to be preserved and studied. Such findings can be analyzed applying methods of different fields, such as Earth Sciences and chemistry. In these cases, the fruitful collaboration of different areas of research also provides useful information for historians and archaeologists. Archaeology employs malacology to understand for example the evolution of the climate or to interpret functional aspect of a site.

The present study focuses on marine shells found in burial contexts from Arabia as part of the grave goods and containing greenish or blackish pigments, interpreted as eye make-up containers. Such archaeological contexts date to the Iron Age, (ca. 300-400 BC). Such artefacts are commonly found in pre-Islamic archaeological contexts from south-eastern Arabia, but in the current literature [1,2] there are indeed some, though not many, studies of their excavation and characterization.

The set of samples consists of 37 shells, both bivalves (Figure) and gastropods, the latter being much less abundant; some of them contains abundant pigments, others show only a residual patina of pigment on the surface. The pigments observed have a predominantly green color, other shells, although fewer in number, show a black-brown color.

The aim of the investigation is to study pigments found inside shells to characterize their mineralogical composition and to identify the occurrence of organic binders. The samples are investigated using non-invasive and micro-invasive techniques to establish the origin of pigments. All samples have been observed using a digital microscope (DinoLite); then SEM-EDX analyses were carried out on samples (18 specimen) as is to observe the morphology of the shell fills and to obtain information on their elemental composition. ATR/FTIR analysis was performed on micro-samples taken from each specimen, providing information on the molecular composition of pigments. Finally, Raman spectroscopy was applied, especially for those samples that did not respond satisfactorily to other diagnostic techniques.

The project will also include the application of other techniques, such as the use of GC-MS to detect the possible presence of organic material and XRD to obtain information on the crystalline phases contained in the samples. It will also be interesting to apply LIBS analysis to obtain not only elementary pigment information but also stratigraphic information to make an in-depth study. In particular, the LIBS technique, which does not require sampling, will be applied on those samples (which are the most numerous, i.e. 28) that only have pellicular remains of pigments.

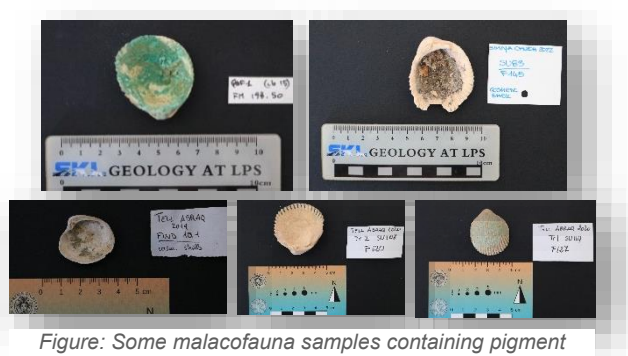


Figure: Some malacofauna samples containing pigment

References

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