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Trace element distribution in marine shells of ostracods

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Magnesium and strontium calcium ratios (Mg/Ca and Sr/Ca) of tiny crustaceans such as ostracods have been used to reconstruct past water temperature and salinity respectively. However, shell preservation, inter-species variability and specimen instar have been shown to affect the trace element concentration and therefore influencing paleo environmental reconstructions. Here, the distribution of trace elements such as magnesium (Mg), strontium (Sr), manganese (Mn), aluminum (Al), iron (Fe), zinc (Zn), copper (Cu) and sodium (Na) is compared between ostracod shells of different instars, species and with different level of preservation. Chemical analyses were performed on shallow marine ostracods including Sinocytheridea impressa and Neomonoceratina delicate, species that are common benthic ostracod from Hong Kong and Asian coastal marine waters. Mapping of different profiles of the shell were obtained through Electron Probe Micro-Analyzer (EPMA), single shells were measured by inductively couple plasma mass spectrometer (ICP-MS) and a slow dissolution analysis of the shell was performed using Flow Trough Time Resolve Analysis (FT-TRA). The mapping of adults and A-1 juvenile shells of Sinocytheridea impressa shows that bands and heterogeneous distribution occurs in a group of valves for Mg and Na respectively. Other trace elements show a rather homogenous distribution but with some variability depending on several factors, including shell preservation and ostracod section. These results are complemented by chemical analysis through FT-TRA, which often shows a variable evolution of trace element calcium ratios (E/Ca) during the dissolution of the calcium carbonate in both species, confirming the chemical variability of ostracods valves. In particular, FT-TRA shows that the Mg/Ca and Sr/Ca ratio could vary as much as 3 mmol/mol to less than 1 mmol/mol respectively during the first half of the dissolution in comparison with the second half. This suggests that the inner variability of Mg and Sr has the potential to produce a significant uncertainty in paleoenvironmental reconstructions, especially if broken shells are used. Our analysis also highlights the importance of Fe and Al as indicators of non-biogenic sources of contamination in ostracod valves, as they are mainly found in the outer shell or in the pore canals of valves. These investigations enhance the importance of the study of the shell internal composition and the need of a better understanding of proxies to develop more precise paleoenvironmental reconstructions.