

## **Barnacles – recorders of environmental conditions with unique geochemical signatures**

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Barnacles are calcite-forming arthropods that occur in a wide range of habitats in modern times and are found in sedimentary successions reaching back to the Paleozoic. Despite potential use of their mostly low-Mg calcite hard parts for palaeoenvironmental reconstructions, their geochemical composition has been little studied.

Here, we present the first comprehensive overview of barnacle geochemistry, with C and O isotope, as well as Mg/Ca, Sr/Ca, Mn/Ca and Fe/Ca data for multiple samples of 42 species covering the orders Sessilia, Scalpelliformes, and Lepadiformes.

XRD analyses confirm calcite as the only significant carbonate mineral of the studied barnacle shell material. Apart from one species, median Mg/Ca ratios fall below 50 mmol/mol, the approximate limit for low-Mg-calcite. In the order Sessilia, the scuta and terga are on average enriched in Mg by 36 % over the unmoveable plates. Amongst the calcite-forming marine animals, barnacles have very high Sr/Ca ratios of 2.6 to 5.9 mmol/mol, amongst the highest known for calcite secreting animals. Mn/Ca and Fe/Ca ratios are commonly low and compatible with other modern shell calcite, but can be strongly enriched to > 1 mmol/mol in proximal habitats, particularly close to areas strongly affected by human activity. Carbon and oxygen isotope data indicate formation of the calcite in or near isotopic equilibrium with ambient water conditions. Apart from species showing  $\delta^{18}\text{O}$  values below 0 ‰ V-PDB, a negative correlation of oxygen isotope ratios with Sr/Ca ratios is observed, which may be related to metabolic activity.

Compositional patterns in barnacle shell material, particularly high Sr concentrations and Mg distribution in shell plates of the Sessilia, point to a great potential of barnacles for high fidelity reconstruction of past seawater chemistry and environmental conditions complementary to other archives.