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High-resolution Li/Mg in cold-water coral skeletons: metabolic processes involved

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Skeletal Li/Mg has recently been presented as a vital-effect-devoid proxy for seawater temperature in both coastal and deep-sea corals. Bulk analyses on multiple scleractinian species appear to follow an exponential law when plotted against measured seawater temperature. *In situ* coral wall micro-analyses of cold-water species, however display a variability that cannot be solely inferred to relate to seawater temperature and must be influenced by some other processes. High-resolution (i.e. seasonal and infra-annual) reconstruction of palaeotemperatures using Li/Mg from cold-water carbonates is therefore questionable from our current understanding of these processes.

In order to address this uncertainty we present LA-ICP-MS elemental maps of Li, Mg, Sr and Li/Mg from the skeleton of the cold-water coral *Lophelia pertusa*. Fluctuations in concentration of these elements are present in both radial and longitudinal axes of growth, implying a potential bias in absolute values measured, depending on the position of an analytical transect.

Microstructures of *L. pertusa* skeletons can provide some insight into the potential use of elemental ratios as proxies for fluctuations in environmental conditions. Observation of growth patterns permits a micro-textural definition for calibration of geochemical fluctuations occurring over the course of a year or more. Two cycles of geochemical fluctuations are observed per year, meaning that seasonal fluctuations cannot be solely responsible for these variations. Moreover, high elemental concentrations in the coral wall correspond to large growth increments, suggesting that certain elemental incorporation is dominantly ruled by growth rates and thus kinetic processes. Growth rate fluctuations, which appear to occur twice per year, are likely caused by interaction of physiological mechanisms and local physicochemical conditions. Specifically for *L. pertusa* skeletons, further characterization and discreet separation of these interactions need to be addressed prior to interpretation of elemental fluctuations as reliable environmental proxies.