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Slope of isochronic skeletal d13C/d18O of zooxanthellate corals as potential proxy for water depth and sea level change

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Skeletal stable isotopic signatures of scleractinian reef corals are widely acknowledged as proxy indicators of environmental conditions and are used in high-resolution paleoclimate reconstructions. Investigations on skeletal δ^{13}C and δ^{18}O from isochronic samples of a branching Caribbean coral genus (*Madracis* spp) were carried out over a steep gradient in water depth. Carbonate samples were taken over the entire colony surface and thus originated from positions greatly varying in light conditions, algal photosynthesis and skeletal growth. Accordingly, the isochronic δ^{13}C and δ^{18}O signals produced an extreme signal range of several permil which can be explained by metabolic and kinetic isotope effects. Moreover, the regression slope of corresponding δ^{13}C and δ^{18}O values increased with increasing water depth. Correlation analysis between the slope of δ^{13}C/δ^{18}O and water depth revealed that the linear correlation is highly significant (R^2 = 0.916, $p < 0.001$). The slope of δ^{13}C/δ^{18}O of representative isochronic carbonate samples from zooxanthellate (fossil) corals may thus have great potential as proxy for (paleo-) reconstruction of the water depth at which a coral has been growing. This could provide an additional tool to reconstruct past sea levels and extreme events (hurricane, tsunami and abrupt sea level changes) specifically where an atypical composition of fossil coral species may not allow for sufficient resolution of water depth.