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Seasonal records and temperature relationships from bivalve shell carbonates using Ca isotope and stable isotope ratio profiles

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Ca isotopes of bivalve carbonate, used in combination with light stable isotopes and metal/Ca ratios may provide a useful archive of annual and seasonal parameters such as temperature, salinity or nutrient level, and therefore for high-resolution palaeoclimate reconstructions. Thus, the reliability of these proxies remains questionable given potential vital and microenvironmental effects. Conducting field experiments in the Dutch Wadden Sea near the Netherlands Institute for Sea Research (NIOZ), we investigated these potential effects in the blue mussel *Mytilus edulis* and in juveniles of the ocean quahog *Arctica islandica* by directly comparing time series of instrumental environmental data, changing growth rate and shell chemistry. Our study is completed using samples from growth experiments on young *Arcitca*'s which were performed at the NIOZ laboratory. These individuals were cultured in five temperature controlled basins, ranging from 1 to 12 deg Celcius. Here, temperature should be resolvable as the dominating effect on the growth and on the Ca isotopic composition of similar sized specimens.

Ca isotope signatures of the bivalve shells are depleted in the heavy isotope relative to the external seawater Ca source and are positively correlated with temperature. However, preliminary Ca isotope data on *A. islandica* and *Mytilus edulis* suggest only a slight effect of temperature, which seems superimposed by a second trend potentially related to growth rate. The slope of the temperature-fractionation relation is similar

to inorganic aragonite precipitates. Investigating the aragonitic and calcitic outer bivalve shell layer of *A. islandica* and *Mytilus edulis*, respectively, we were further able to show that the mineralogy has no influence on the Ca isotopic composition of the bivalve shell. The weak temperature sensitivity and possible interferences from biological fractionation effects limit the use of Ca isotopes in bivalves as temperature proxy, but appears to offer new insights in the complexity of bivalve biomineralization. This is a contribution to EuroCLIMATE project 04 ECLIM FP08 CASIOPEIA.