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Shell growth and environmental control of methanophyllic Thyasirid bivalves from Svalbard cold seeps

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The analysis of molluscan shell material (sclerochronology) can provide information about an organism's age, growth history, and environmental conditions during its lifetime. Bivalve molluscs are common members of hydrothermal vents and methane cold seeps communities where, supported by chemosynthetic symbionts, they can reach high density and biomass. But little is known about methane-associated bivalve populations inhabiting high-Arctic cold seeps, and sclerochronological analysis of methane-influenced bivalves is rare. We measured growth rates and elemental and isotopic shell signatures in a newly discovered species of bivalve (Thyasiridae) from cold seeps at 350-390m depth southwest of Svalbard. First discovered in 2014, recently described shells of Thyasira capitanea sp.nov. were found at 2 independent seep systems in Storfjordrenna. Mean shell carbon isotopic ratios from inorganic δ13C (mean = -4.8‰ and organic δ13C (mean = -26.9‰ fractions clearly indicate a methane influenced habitat and food source for these organisms. Shell mineral ratios (Li/Ca, Mg/Ca, Mn/Ca, Fe/Ca, Sr/Ca, Ba/Ca, Pb/Ca) sampled along the axis of growth with laser-ablated ICP-MS exhibit variability through time and between sites, suggesting that concentrations of these elements that may be affected by methane emissions. The mineralogical data also elucidates the internal pattern of shell deposition and growth checks, and combined with the isotopic and growth rate data, enables us to interpret the temporal history of methane release from these locations.