



Coexistence of three calcium carbonate polymorphs in the shell of the Antarctic clam *Laternula elliptica*: Consequences for trace metal incorporation

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We analyzed shell cuts of the Antarctic bivalve *Laternula elliptica* collected at King George Island by means of Confocal Raman Microscopy (CRM) as well as Electron Microprobe (EMP). Large area CRM scans (5 mm x 2 mm) reveal that three polymorphs of calcium carbonate – aragonite, calcite, vaterite – are present in the umbo region, the connection of both shell valves. Until now the shell of *L. elliptica* was believed to be exclusively composed of aragonite. Annual shell growth layers continued through aragonite and vaterite, suggesting simultaneous mineralization of both polymorphs. Spatially congruent EMP scans showed that the calcium carbonate polymorph affects the distribution of magnesium and strontium within the umbo. Mg was distinctly enriched in the vaterite layers deposited during winter. To the contrary Sr was enriched in the aragonite layers, also deposited during winter. This is, to our knowledge, the first report of the coexistence of three calcium carbonate polymorphs within the mineralized structures of a marine calcifying organism, including foraminifera, bivalves, and corals. Particularly the significant amounts of vaterite are quite unusual. The strong effect of the calcium carbonate polymorph on trace element fractionation restricts the suitability of Mg and Sr based proxies in shells of *Laternula elliptica*. Further analyses will show whether this is a unique finding typical for *L. elliptica*, or if this also applies to other bivalve species.