



## **Element ratios between digestive gland and gill tissues of the Antarctic bivalve *Laternula elliptica* as a proxy for element uptake from different environmental sources**

H. Poigner (1), D. Monien (2), P. Monien (2), M. Kriews (1), H.-J. Brumsack (2), D. Wilhelms-Dick (3), and D. Abele (1)

(1) Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany (harald.poigner@awi.de), (2) Institute for Chemistry and Biology of the Marine Environment, University of Oldenburg, Oldenburg, Germany, (3) Department of Geosciences, University of Bremen, Bremen, Germany

Trace metals in bivalve carbonate shells are frequently used as environmental or paleoclimate proxies. Carbonate mineralogy and animals' physiology affect the incorporation of elements from different environmental sources into bivalve shells. Generally, metals from particulate matter are assimilated via the digestive tract; whereas dissolved metals are absorbed via gills. Therefore, measurements of element concentrations deposited in the shell matrix do not necessarily allow inference with respect to the assimilation pathways. In this study, we used element ratios between digestive gland (DG) and gills (cDG/cGill) of the Circum-Antarctic clam *Laternula elliptica* to identify predominating assimilation pathways and potential sources of bio-available metals. This normalization between tissues of each individual eliminates the effects of individual age and physiological condition (e.g. accumulation over lifetime, metabolic activity) on metal assimilation. These effects also minimize the reproducibility, when absolute element concentrations are compared between individuals from different locations. Therefore, an additional normalization is required. We favored "ellipsoid shell volume" over shell length or soft tissue weight as more conservative approximation for intra- and intersite comparisons. Metal concentrations in DG, gills, and hemolymph of the bivalve *L. elliptica*, collected at Potter Cove (King George Island, Antarctic Peninsula), were analyzed by means of inductively coupled plasma - optical emission spectroscopy and mass spectrometry after total acid digestion. The element ratios (cDG/cGill) indicate a predominant assimilation of Al, Ca, Fe, K, Mn, and Mg from the dissolved phase. These high Al and Fe concentrations in gill tissues and hemolymph are in contrast to the low solubility of Al and Fe in seawater. But high dissolved Fe concentrations in pore waters (up to  $1400 \mu\text{g L}^{-1}$  due to suboxic sediment conditions) and glacial melt waters enriched in dissolved Al (of approx.  $54 \mu\text{g L}^{-1}$  due to weathering processes) with respect to seawater concentrations ( $5.4\text{-}13.5 \mu\text{g L}^{-1}$ ) are likely bio-available sources at Potter Cove. In contrast, Cd, Cu, and Sr are mainly assimilated via the digestion of particulates. Since most studies on metal incorporation into bivalve shells have provided mathematical correlations to environmental data, this proxy-based approach provides a more causal relationship between sources and assimilation pathways. It improves the interpretation of element variations (if independent from shell mineralogy) in bivalve shells, especially, where a full characterization of the biogeochemical environment of the bivalves is lacking.