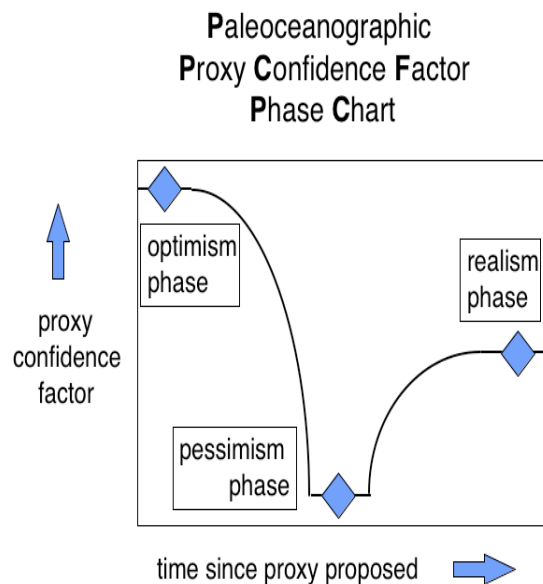


Trace element incorporation into marine biogenic carbonate: paleotemperature in oceanic records

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The history of development in this field started out with scepticism but has led to the establishment of a number of proxies based on trace element incorporation into marine biogenic carbonate. Perhaps the most widely used is the foraminiferal Mg/Ca paleothermometer, which despite the complexities associated with biogenic calcification has in part through calibration and in part through its application proven to be a valuable tool to probe past oceans. Other proxies include Cd/Ca, Sr/Ca, B/Ca, Li/Ca and of marine biogenic carbonate corals, ostracods and coccolithophores as well as planktonic and benthic foraminifera. One philosophy has been to develop proxies that can be applied to generate the detailed paleoceanographic records required to address ocean climate on orbital and millennial timescales. However, more complex “boutique proxies” (a term coined by David Lea) have shown their value.

This talk will provide a broad overview of factors involved in trace element incorporation into marine biogenic carbonate. It will consider their use for paleotemperature and other applications, with consideration of the role of secondary factors that have been revealed through the community assiduously testing new proxy methods (see the figure I introduced a decade or more ago) based on calibrations for example using core tops, sediment traps and plankton tow material.



One important issue that has arisen recently is the role of carbonate ion saturation perhaps as a secondary factor and perhaps as the dominant factor and this is exemplified from use of B/Ca and $\delta^{11}\text{B}$ and Mg/Ca in benthic foraminifera in ocean records: glacial-interglacial changes in carbonate saturation and events at the mid Pleistocene Transition.