

A Geochemists Guide to Stratigraphic Variability in Shallow- water Carbonate Sediments

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Shallow-water carbonate sediments constitute the bulk of sedimentary carbonates in the geologic record and are widely used archives of Earth's chemical and climatic history. Exactly what kinds of environmental information they record, however, is still a matter of debate. One approach is built on the assumption that the $^{13}\text{C}/^{12}\text{C}$ of bulk carbonate sediments record the $^{13}\text{C}/^{12}\text{C}$ of the ocean-atmosphere inorganic carbon reservoir and can be used as a correlative tool. In this framework, stratigraphic variability reflects secular change in the global ocean.

An alternative framework, built on measurements of the $^{44}\text{Ca}/^{40}\text{Ca}$ and Sr/Ca ratios of bulk carbonate sediments, indicates that early marine diagenesis and dolomitization play a fundamental and underappreciated role in shaping the chemical composition of shallow-water carbonate sediments. This framework suggests that much of the observed variability in the $^{13}\text{C}/^{12}\text{C}$ of shallow-water carbonate sediments can be attributed to local processes. The observation that the $^{13}\text{C}/^{12}\text{C}$ of carbonate sediments can be correlated globally indicates that these local processes must also occur globally but do not require that they reflect changes in the ocean-atmosphere inorganic carbon reservoir. In this framework, stratigraphic variability may reflect secular change in the global ocean, but in many cases it appears to reflect secular change in either 1) the local processes that determine the chemical composition primary shallow-water carbonate sediments or 2) secular changes in the 'style' of diagenetic alteration (i.e. fluid-buffered or sediment buffered).

This talk will argue that the 2nd approach, framed around measurements of $^{44}\text{Ca}/^{40}\text{Ca}$ and Sr/Ca ratios in bulk carbonate sediments, is likely to provide more robust paleoenvironmental reconstructions.