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Strontium Anomaly in Modern vs. Ancient Dolomites: Are Geochemical Studies of Modern Carbonate Sediments and Associated Fluids Applicable Analogues for Ancient Systems?

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The typical Sr content of ancient dolomites is on the order of a few hundred ppm, whereas Holocene dolomites precipitating under hypersaline conditions are often more enriched in Sr with values exceeding 2000 ppm. If modern hypersaline analogues are to be useful for interpreting ancient carbonate sequences, this quantitative difference in the Sr composition of ancient vs. modern dolomite needs to be studied using a process-based approach in specific modern environments to characterize the factors leading to Sr incorporation in the dolomite precipitate and, where relevant, the subsequent removal of Sr ions during early diagenesis. With this objective, we have conducted a geochemical survey of sediment cores containing calcium magnesium carbonates precipitated in two hypersaline coastal lagoons (Lagoa Vermelha and Brejo do Espinho) located in the Região dos Lagos east of Rio de Janeiro, Brazil, together with the associated pore fluids and regional waters. We observed that sediments containing a mixture of high Mg-calcite and poorly ordered Ca-dolomite record some of the highest concentrations of Sr with an average value of ∼1600 ppm, whereas the Sr content of samples comprising 100% ordered dolomite averages ∼650 ppm. In contrast, our geochemical analyses of pore fluids and regional waters indicate that they are not enriched in Sr with maximum values reaching only 20 ppm.

Because these lagoons are rare examples of modern dolomite precipitation in a hypersaline environment, they have been studied intensively during the past 30 years, revealing the importance of microbial processes in the precipitation of the carbonate sediments. Thus, we propose to attribute the elevated Sr concentrations in the carbonate sediments to be associated with the biotic influence on carbonate precipitation in the lagoons. In contrast, the Sr decrease in the 100% dolomite samples is attributed to changes occurring with very early diagenesis. However, as stated by Lynton S. Land (1980) in his classic paper on the isotopic and trace element geochemistry of dolomite, “If we are to invoke ‘the present is the key to the past’, the key must be used honestly. Problems of time and scale cannot be ignored.” With this caution in mind, we evaluate the significance of geochemical results stemming from a modern analogue and their potential application to studies of ancient dolomites.

Land, Lynton S. (1980). SEPM Spec. Pulb. No. 28, 87-110.