

Signal tracking diagenesis model

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Carbonates deposited and buried in marine sediments make an archive of Earth history as they reflect seawater chemistry at the time of deposition and record a variety of proxies, e.g., carbon and oxygen isotopes. Complication is imposed by biogenic reworking of the upper portions of the sediments and the preservation of sedimentary carbonates is influenced by ocean chemistry, both of which distort the proxy signals. On the other hand, diagenetic models in the literature generally lack the ability to record shifts in proxy signals and realization of different kinds of bioturbation. In our new model, shifts in proxy signals of deposited carbonates are simulated by including multiple solid carbonate species with different proxy signals and variations in other properties such as particle size. The model can also simulate both local and non-local mixing of solid materials to represent different styles of bioturbation by using corresponding transition matrices. Several example transitions recorded in seawater proxies and accompanied by changes in ocean physics, chemistry and biology are considered to illustrate the utility of the model for deciphering past environmental changes despite obscuration by bio-mixing and chemical erosion.