Bioturbation influences dolomitization patterns in carbonate rocks

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The 'dolomite problem' is normally addressed with models that reflect larger-scale processes that describe the relationship between the supply and transport of Mg, and geochemical conditions that are amenable to the precipitation of dolomite. However, heterogeneities in the substrate, made by bioturbating infauna, may play a more important role in dolomitization than has been previously considered. The concentration of organic material in burrows locally increases permeability and porosity, supports microbial populations whose byproducts mediate dolomitization, and provides a source of organic acids that compound with metal ions and act as chelating agents.

Burrow-facilitated dolomitization is evident in the Ordovician Tyndall Limestone (Red River Group, Selkirk Formation). The diagenetic fabrics present are attributed to dolomitizing fluids that both developed in, and flowed through burrow networks. Petrographic analysis suggests that two phases of dolomite precipitation are present: the first consists of a fine-grained, fabric-destructive cement that probably accompanied early burial; the second is a fine- to medium-grained, locally sucrosic dolomite that is interpreted to have precipitated during later burial. Isotopic analysis supports the proposed paragenetic history. An apparent linking of the stable isotopes ^{13}C and ^{18}O strongly suggests that the matrix (micritic cement) precipitated during very early diagenesis and was derived from sea-water. The initial phase of

dolomitization is potentially microbially mediated, as evidenced by the enrichment of $\delta^{13}C$. This was probably due to fermentation occurring within the burrow microenvironment. Isotopic values for ensuing dolomite reflect the mixing of ground water and resorbed early dolomite.