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The Role of Ca and Mg in Controlling the Skeletal Composition of Scleractinian Corals

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The concentrations of many trace and minor elements in aragonitic coral skeletons are widely used within the annual banding structure to provide information on a wide range of environmental factors. Such ratios are measured not only in recent corals, but also in well preserved corals collected from rocks as old as the Triassic where they have been interpreted as reflecting changes in the minor element and calcium concentrations of the oceans. In particular the changing Mg/Ca ratio of seawater throughout geological time. Most of these trace elements are believed to substitute for Ca within the skeleton and therefore a principal tenant of this approach is that the ratio of an element being measured relative to Ca responds directly the same ratio in seawater. In order to test the fundamental assumption in corals we have grown specimens of the coral *Pocillopora damicornis* in seawater spiked with combinations of elevated Ca and Mg for periods of $\sim$ 10 weeks and measured the concentrations of a number of elements in the new skeletal growth. These elements include Ca, Sr, Mg, Ba, Mn, S, P, B, Li, and Fe. These experiments provide evidence that the minor and trace element incorporation is much more complicated than previously believed. For example, while the Sr/Ca ratio of coral skeletons is directly related to the same ratio in seawater over a wide range, is also influenced by the Mg content of the seawater. Hence raising the Mg content lowers the distribution coefficient for Sr in corals. The incorporation of other elements such as Ba, B, S, and P in the skeleton are influenced in other unexpected ways.