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# Recent Discoveries of Elevated Mg within Coral Skeletons and Other Applications of Laser Ablation and the Scanning Electron Microscope

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High-resolution laser-ablation inductively coupled plasma mass spectrometry (LA ICP-MS) was used to analyze a small portion of the large framework coral *Montastraea faveolata* to determine the geochemical signatures within and among specific skeletal structures. Data reveal potential problems in geochemical analysis and interpretation. Depending upon sample size and location of sampling within the skeleton, results may differ. Vertical transects (spot/raster sampling) were conducted along three parallel skeletal structures: endothecal (septal flank), corallite wall, and exothecal (costal flank) areas. The results reveal that trace-element levels vary among the three structures. The amount of magnesium (Mg) varied prominently among the adjacent structures and is most abundant within the exothecal portion of the skeleton.

Using a scanning electron microscope (SEM), we found hexagonal crystals forming discs, pairs, and rosettes in several samples. High levels of Mg within these crystals have been confirmed with energy dispersive spectrometry (EDS) and LA ICP-MS. The chemical composition is consistent with the mineral brucite [$Mg(OH_2)$]. The crystals, located exclusively in the exothecal area of the skeleton, are associated with green endolithic algae and are commonly associated with increased Mg levels found in the adjacent corallite walls. The excess Mg precipitated within the microenvironment of the exothecal area may be a result of photosynthetic processes. The presence and locations of high-Mg crystals found within microenvironments of the coral may explain anomalous Mg data researchers have been questioning for years.

In addition, the laser-ablation technique along with the SEM/EDS allows us the opportunity to collect historical chemical information from the coral skeleton. Trace elements that are either incorporated into the skeleton or found as inclusions within the skeleton may record environmental variables influencing the growth of a particular coral. In addition to using particular elements as proxies for paleothermometry and freshwater/groundwater influence, other elements may show “contamination” of the coral. For example, African dust particles may get incorporated into the skeleton and show a record of dust flux. Also, the Flower Garden Reef corals, located in the Gulf of Mexico southwest of the Mississippi River delta, may record sediment fluxes of the Mississippi and Atchafalaya Rivers.