ANALYTICAL ELECTRON MICROSCOPY OF BIOGENIC AND INORGANIC CARBONATES

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In the terrestrial sedimentary environment, the mineralogically predominant carbonates are calcite-type minerals (rhombohedral carbonates) and aragonite-type minerals (orthorhombic carbonates). Most common minerals precipitating either inorganically or biogenically are high magnesium calcite and aragonite. High magnesium calcite (with magnesium carbonate substituting for more than 7 mole % of the calcium carbonate) is stable only at temperatures greater than 700 °C or thereabouts, and aragonite is stable only at pressures exceeding several kilobars of confining pressure. Therefore, these carbonates are expected to undergo chemical stabilization in the diagenetic environment to ultimately form stable calcite and dolomite.

Because of the strong organic control of carbonate deposition in organisms during biomineralization, the microchemistry and microstructure of invertebrate skeletal material is much different than that present in inorganic carbonate cements. The style of preservation of microstructural features in skeletal material is therefore often quite distinctive when compared to that of inorganic carbonate even though wholesale recrystallization of the sediment has taken place.

In this brief presentation, microstructural and microchemical comparisons will be made between high magnesium calcite echinoderm skeletal material and modern inorganic high magnesium calcite inorganic cements, using Analytical Electron Microscopy and related techniques. Similar comparisons will be made between analogous materials which have undergone stabilization in the diagenetic environment.

Similar analysis schemes may prove useful in distinguishing between biogenic and inorganic carbonates in returned Martian carbonate samples.