

## **FERROUS IRON AND THE CRYSTALLOGRAPHIC CHARACTERISTICS OF HERRINGBONE CALCITE**

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Herringbone calcite, a distinctive calcite cement, is common in Archean carbonates and rare in younger rocks. Based on its stratigraphic distribution and characteristic crystal properties, Sumner and Grotzinger (1996) proposed that the herringbone calcite texture develops due to poisoning of specific crystal faces by an ion in seawater, possibly  $\text{Fe}^{2+}$ . Since then, extremely well preserved herringbone calcite has been identified in fissures in Middle Eocene carbonates, Egypt, and calcite precipitation experiments with  $\text{Fe}^{2+}$  have been performed. Egyptian herringbone calcite consists of 1.25-1.45 mm-thick serrate bands comprised of 800x120 micron crystals with their crystallographic c-axes perpendicular to elongation and parallel to banding. Crystal tips are feathery or have spearhead-like crystal faces projecting out from the main direction of elongation. Microprobe analyses yield  $5.5 \pm 0.4$  mol%  $\text{MgCO}_3$ , (Sr) of  $3200 \pm 600$  ppm, and (Fe) less than the 690 ppm detection limit. Samples do not luminesce demonstrating very low (Mn). Thus, preliminary analyses do not support  $\text{Fe}^{2+}$  as the textural cause of herringbone calcite. Results from precipitation experiments suggest that  $\text{Fe}^{2+}$  may promote precipitation of calcite crystals that are elongate nearly perpendicular to the c-crystallographic axis. Rhombic faces are commonly developed on sides of crystals, similar to the spearhead-like crystal faces in Egyptian herringbone calcite. Thus, preliminary experimental evidence suggests that  $\text{Fe}^{2+}$  may produce herringbone calcite-like crystals. The apparent contradictions between experimental and analytical results may be due to low incorporation of  $\text{Fe}^{2+}$  into calcite crystals during rapid precipitation as observed experimentally or to the existence of multiple inhibitors that can produce herringbone calcite-like crystals.