Correlation between crystallization patterns and diurnal growth bands in Scleractinian corals

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Diurnal growth bands are characteristic features of many scleractinian corals [1, 2] and are thought to be linked to the microstructure of the usually aragonite based mineral forming the coral skeleton. To shed light on this correlation we employed focused ion beam to create large (10 x 30 μm) thin lamellae for transmission electron microscopy enabling the detailed study of crystal morphology and orientation in spherulites of *Porites lobata*.

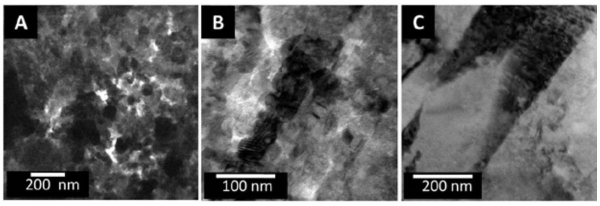

Figure 1: A) Randomly oriented nanocrystals with high porosity. B) Partly oriented nanocrystals with high porosity. C) Large acicular crystals orientated along the [0 0 1] direction (using the Pmcn spacegroup notation).

The investigations show a remarkable sequence of crystal morphology of randomly oriented, partly aligned nanocrystals and acicular crystals (fig 1). Selected area diffraction data shows that the morphology of the partly aligned nanocrystals is polycrystalline at the micrometer scale and no evidence for a non-classical growth mechanism (e.g. self assembly of small units; mesocrystal growth [3]) was found. The overall microstructural sequence is correlated with the observed optical contrast bands associated with a diurnal growth cycle. This is supported by TEM analysis of nanocrystal growth within aragonite needle-like bundels precipitated, using $CaCO_3$ solutions with organics additives.

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Experimental Investigation into the Density, Compressibility, and Phase Equilibria of the Northern Volcanic Plains on Mercury

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Knowledge of the density, compressibility, and other physical properties of magmas at high pressure is required in order to understand the differentiation of planetary interiors and secondary crust formation. With the recent estimates of Mercury's surface composition from the X-ray spectrometer and Gamma ray spectrometer onboard the Mercury Surface, Space Environment, GEochemistry and Ranging (MESSENGER) spacecraft, we now have our first opportunity to investigate the physical properties of magmas from the planet Mercury **[1-3].**

The Northern Volcanic Plains on Mercury (NVP) represent, to our knowledge, the most likely example of magmatic liquids that can be compositionally assessed from orbit with relatively high spatial resolution **[1-2].** Although these NVP lavas may not represent primary, unfractionated partial melts of the mercurian mantle, they represent our best candidate to experimentally study magmas from the mercurian interior. Our goal is to determine the density and compressibility for a NVP composition using sink/float experiments in order to assess its eruptability onto the surface of Mercury.

We report the sinking of Fo_{100} spheres at 2.5 GPa, 3.5 GPa, and 5 GPa and temperatures of 1973 K, 2048 K, and 2223 K, respectively. We also report the floating of Fo_{100} spheres at 6 Gpa and 2323 K. With these results we can place tight constraints on the compressibility of this melt at 0.08 $g/cm^3/GPa$. This is slightly more compressible than a komatiite (0.075 $g/cm^3/Gpa$) or peridotite (0.065 $g/cm^3/Gpa$) melt. Phase equilibria experiments are currently underway to determine a possible depth of origin for this melt. However, given its current density curve, the NVP composition is able to erupt at all pressures relevant to Mercury's mantle as a result of buoyancy alone.

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DOI:10.1180/minmag.2013.077.5.22