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**Carbonate Substitution in the Apatite Structure.** N. Papanearchou<sup>1</sup>, Th. Leventouri<sup>1</sup>, B. C. Chakoumakos<sup>2</sup>, V. Perdikatsis<sup>3</sup>, <sup>1</sup>Physics Dept., Florida Atlantic Univ., Boca Raton, FL 33431, USA, <sup>2</sup>Condensed Matter Sciences Division, Oak Ridge National Laboratory, Oak Ridge TN 37830 USA, <sup>3</sup>Technical Univ. of Crete, Dept. of Mineral Resources Engineering, 73100 Chania Crete, Greece.

The inherent biocompatibility of apatite makes it a prominent biomaterial and the physical and physiological properties of apatite ceramics for prosthetic implants and thin-film coatings are of continuous research interest. It is well established that bone mineral crystals are structurally similar to the synthetic carbon hydroxyapatite (CAp). However, the exact arrangement of the  $\text{CO}_3^{2-}$  planar ion in the  $\text{PO}_4^{3-}$  tetrahedral site of the apatite structure remains a controversial research subject for several decades. We will present results from our x-ray and neutron powder diffraction studies of natural and synthetic carbonate apatites. A model for the carbonate substitution will be discussed.

