

Increased carbonate associated with phosphate demand in bioapatite crystallites

HELEN E. KING¹ AND STEVEN TOMMASINI²

¹Department of Earth Sciences, Utrecht University, Utrecht, The Netherlands

²Department of Orthopaedics and Rehabilitation, Yale University, New Haven, U.S.A.

The mineralogy of bone tissues has important implications for bone physical and chemical properties. We employed Raman and FTIR spectroscopy to study bone bioapatite in the femurs and tibia of healthy mice and those with hypophosphatemia - a genetic disorder that creates a phosphate deficiency and results in lower bone mineralization [1]. Specifically we focused on the changes in the carbonate content of bone from healthy, wild-type mice (WT) and hypophosphatemic mice (HYP) when increased remodelling has occurred due to pregnancy and lactation. The contributions of the carbonate and phosphate symmetrical stretching bands were used to determine changes in carbonate content. FTIR spectroscopy indicates an increased carbonate content of the bone bioapatite in HYP compared to WT mice in response to increased remodelling during lactation and phosphate demand. This is particularly evident in the lactating HYP mice where bone is expected to experience the most intense remodelling. Raman spectroscopy confirms this trend in lactating, pregnant and virgin mice. Changes in carbonate content will alter the crystallinity and thus solubility of the bone crystallites with concomitant effects on the role of bone crystallites during homeostasis and remodelling properties of bone. Despite the impaired mineral metabolism in the HYP mice, these mice employ similar adaptations to mineral demand as WT mice.

[1] Tommasini et al. (2014), ASBMR 2014 Annual Meeting, September 2014, Houston, Texas.