



Figure S2. (a) Phosphorus K-edge XANES spectra of dried (blue curves) and calcined (700°C; red curves) bone apatites (untreated data of Rajendran, 2011; Rajendran et al., 2013). (b) Relative secondary peak height of dried (blue curves) and calcined (red curves) bone apatites. Secondary peaks of averaged and individual spectra of synthetic HAPs (Sigma Aldrich,  $n = 3$ ; Fisher Scientific,  $n = 2$ ; Clarkson Chromatography Products Inc.,  $n = 1$ ), natural HAP (HAP-1), OCPs ( $n = 7$ ) and poorly crystalline HAP are shown for comparison. Comparable relative secondary peak heights and similar oxygen oscillations (relatively broad; see Figure 2) of dried bone apatites and poorly crystalline HAP indicate abundance of poorly crystalline apatite in untreated bones. See Table 1 for detailed properties of reference compounds.