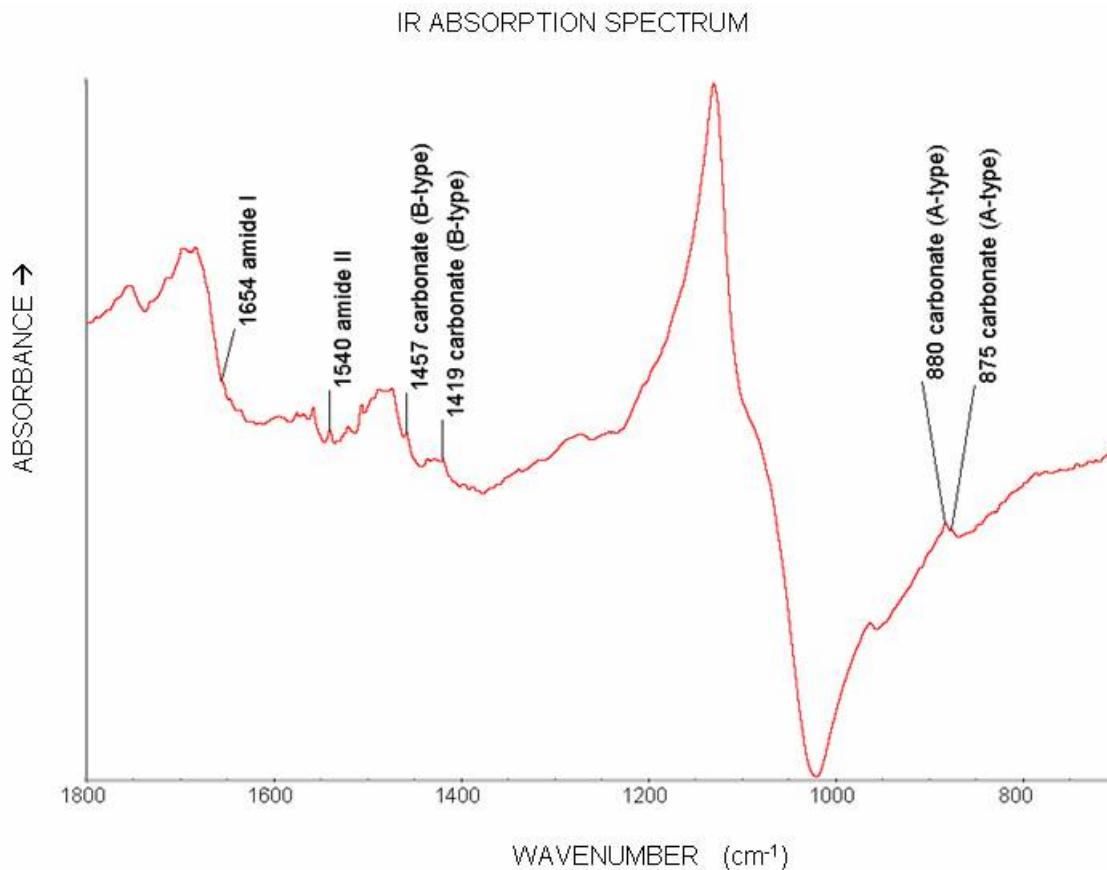


The Raman peaks detected at  $960\text{ cm}^{-1}$  (phosphate  $\text{PO}_4^{3-}$ ,  $\nu_1$ ),  $1070\text{ cm}^{-1}$  (carbonate  $\text{CO}_3^{2-}$ ,  $\nu_3$ ),  $1245\text{ cm}^{-1}$  (amide III),  $1450\text{ cm}^{-1}$  ( $\text{CH}_2$  bending) and  $1656\text{ cm}^{-1}$  (amide I) matched with a bovine bone (i.e. cow or buffalo or bison) (see J. W. Ager III et al., Deep-ultraviolet Raman spectroscopy study of the effect of aging on human cortical bone, *Journal of Biomedical Optics*, Vol. 10, No. 3, 2005, pp. 1–8). The bone had an extremely heterogeneous composition made up predominantly from collagen fibers with other proteins, and also an inorganic fraction of a calcium phosphate mineral called hydroxyapatite (see M. D. Morris and A. Carden, Raman analysis of damaged bone, *Raman Review Issue*, Vol. 1, 2003). The hydroxide ( $\text{OH}^-$ ) and phosphate ( $\text{PO}_4^{3-}$ ) in the hydroxyapatite mineral is mainly substituted by carbonate ( $\text{CO}_3^{2-}$ ) creating A-type and B-type carbonate substitutions respectively. In this bone pendant, we found both types of carbonate substitution ( $875$  and  $880\text{ cm}^{-1}$  for A-type, and  $1419$  and  $1457\text{ cm}^{-1}$  for B-type) by using FTIR spectroscopy. The age of the bone contributes the amount of carbonate substitutions that may increase structural disorder. The amide I and II proteins are also detected at  $1654$  and  $1540\text{ cm}^{-1}$  respectively. The shape of the phosphate spectral region (from  $1200$  to  $950\text{ cm}^{-1}$ ,  $\nu_1$  and  $\nu_3$ ) is contributed by the degree of mineral crystallinity (see H. Ou-Yang et al., Infrared microscopic imaging of bone: Spatial distribution of  $\text{CO}_3^{2-}$ , *Journal of Bone and Mineral Research*, Vol. 16, No. 5, 2001, pp. 893–900).



UV-VIS-NIR REFLECTANCE SPECTRUM

