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C-O isotope geochemistry of the Florida phosphate of four Corners and Hardee County mines, USA: Implication for genesis and diagenesis

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Abstract

The study area located in Florida, USA and emphasized on low-grade phosphorites in Hardee County (HC) and Four Corners (FC) mining areas. The main purpose of this study is to apply a standard geochemical technique to understand the diagenetic history and paleo-environmental aspects of phosphates within one of the major phosphate deposits in the USA. The effect of diagenesis on the phosphate minerals was studied by isotope analysis of the phosphate bone fragments and phosphatized mudclasts and rods. The environmental conditions that prevailed during the life of organisms was assessed by isotope analysis of the shark teeth. In this paper, variation in stable isotope (δ18O and δ13C) signatures of structural carbonate in rocks and shark teeth were studied in Florida phosphate. The studied samples show negative values for both δ 13C and δ 18O isotopes of structural carbonate. The light mudclast samples shows higher oxygen ratios (-1.6) than the dark mudclasts (-2.3) in Hardee County, whereas those values were lower, -2.3 and -3, respectively, in Four Corners samples. The shark teeth found in the deposits show narrow variations in values of δ 13C (-3.4 to -4.9 ‰) and δ 18O (-1.4 to 2.1‰) isotope. The bone fragments in the deposits are more similar to the light mudclasts regarding the isotope ratios and carbonate content. The alteration is evident in the Florida phosphorites where δ 18O values of bulk teeth are higher than those of bones and mudclast. This alteration could be because of increasing crystallinity and decreasing carbonate content with increasing depth of burial.