A NEW METHOD FOR THE DETERMINATION OF THE $\delta^{18}O$ COMPOSITION OF BONE PHOSPHATE: APPLICATIONS TO THE THERMAL PHYSIOLOGY OF VERTEBRATES

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A new method for the preparation of bone samples for $\delta^{18}O$-PO_4 analysis has been developed. The phosphate from bone samples is separated and purified using ion exchange chromatography, and then precipitated as silver phosphate using the Firsching method. O_2 is then extracted by reaction with bromine pentafluoride and converted to CO_2 for isotopic analysis. Advantages of the silver phosphate technique over the bismuth phosphate technique are (1) the simplicity of the method, (2) silver phosphate is not hygroscopic so atmospheric water is not an oxygen contaminate, and (3) very small samples (2 mg to 10 mg) can be analyzed with an increase of precision compared to previous techniques. Iron and silica oxides added to Ag_3PO_4 standards produce no offset, which suggests that this new technique is not sensitive to interferences from cements commonly found in fossil bone material. Analyses have been performed on standards ranging in size from 30 mg to 2 mg with a σ_1 of $\pm$ 0.05 per mil.

The $\delta^{18}O$-PO_4 compositional pattern of the bones of modern vertebrates have been analyzed to provide a base for the interpretation of the $\delta^{18}O$-PO_4 pattern of fossil vertebrates. The average $\%PO_4$ in modern mammals and reptiles is approximately 15% with a σ_1 of 2-3 %. The average $\%PO_4$ of fossil reptiles range from 10 to 25% with σ_1 variations of up to 10%. The $\%PO_4$ variation can be related to cementation of void spaces in the bone material. XRD analysis reveals that calcite, dolomite, ankerite, and silica cements are commonly present. FTIR (Fourier Transform Infrared Spectroscopy) yields low indices calculated according to the formula of Shemesh , 1990 [GCA 54(9):2433]. Thin sections of the fossil bone material show detailed structures. All this evidence suggests that the fossil bone $\delta^{18}O$-PO_4 composition is pristine and not altered by diagenesis. The total $\delta^{18}O$-PO_4 σ_1 variation of 10 or more skeletal elements analyzed for each individual specimen varies from 0.1 per mil for a domestic cow (*Bos)* to 0.8 per mil for a Komodo dragon (*Varanus*). Variations in between appear to be related to thermal physiology and variations in drinking water $\delta^{18}O$ due to seasonality or migration.

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