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Isotope analyses of fossil small mammals in karstic sites

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Fossil skeletal accumulations in kartstic complexes, such as caves, are quite common, especially during the Pliocene and Quaternary. These fossil assemblages are sometimes difficult to study, as specimens from different ages can be found together (time averaging). The traditional approach to study this kind of paleontological sites was taphonomic (understanding the origin and other factors affecting the bone accumulation) and/or taxonomic (systematic description of the remains). However, other kinds of analyses, such as biogeochemical techniques to reconstruct past diets and environments, are being more frequently used.

Small-mammals have a wide geographical distribution, and their remains (bones and teeth) are extensively represented in the fossil record; therefore, isotopic analyses in fossil small-mammals are a powerful tool to reconstruct paleoenvironments. Field samples for small-mammal studies yield large amounts of sediment-residues that need to be reduced in the laboratory (usually by means of diluted hydrochloric or acetic acid). Therefore, samples of fossil small-mammal for isotopic analyses usually receive two different acid treatments: one to reduce the carbonate residue of the sediment, and afterwards another one to remove digenetic carbonates from the ground sample. Those treatments, along with the small size of the remains, may increase the probability of chemical fractionation during those pre-treatment stages. Those acid treatments are even more aggressive in kasrtic fossil localities, as limestone has to be dissolved to extract the small mammal remains.

In this abstract, we present the results of two different treatments carried out in limestone from the Pliocene karstic locality of Moreda (Guadix Basin, Spain) and a control sample. One batch of samples were treated with a solution of 1M acetic acid-acetate calcium buffer (ph 4,5), and the rest with diluted acetic acid (at 15% concentration, Ph 2,2), which is the most used to reduce the sediments residue in karstic levels. The control sample was not treated with acids in this stage, as it was physically extracted from the limestone. The results confirm that the Ph must be monitored in order to minimize the isotopic fractionation of carbonates from bones and teeth. The less aggressive acid treatment was carried out with the solution of 1M acetic acid- acetate calcium buffer (Ph 4,5). So, apparently, soft acid treatments did not affect too much the oxygen isotopic composition of hydroxyapatites. However, as the acid digestion is slower with this treatment, samples usually require repeating this step several times to remove the carbonate sediment residue.

Museums and research centres should take those results into account since appropriate pre-treatments would enable them to obtain all the information that small mammal remains potentially have.