K/Ar dating of a fossil Lagerstätte locality: The Tlayúa quarry, Puebla, Mexico

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Localities of exceptional fossil preservation are scarce. Many of them are found in limestones, a particularly difficult rock for absolute dating with the usual geochronological tools. The exceptional faunal assemblages of this type of locality are often useless for biostratigraphy due to the great amount of new species generally found.

Among the geochronological tools for obtaining absolute ages in limestone we want to mention U-Pb in calcite, which is now in an early stage of development, and $^{87}Sr/^{86}Sr$ ratios in carbonate, which can date the limestone accurately only in some particular ranges of the stratigraphic scale and after some requirements are fulfilled.

We present an attempt to date with the K/Ar technique the famous Cretaceous Tlayúa quarry, Puebla, Mexico which shows a diverse and very well preserved biota [1]. Our study has been centered on the thin white-orange-red strata interbedded in the limestones. These beds have been attibuted to the presence of hematite [2, 3] or argillaceous material [4]. Our X-ray diffraction study shows the presence of calcite, kaolinite, smectite, hematite, quartz and alkali feldspar in diverse proportions.

We centered our attention on the sanidine+quartz+calcite (plus minor kaolinite and/or smectite) beds that we interpret as altered volcanic ash. Sanidine shows well defined X-ray diffraction peaks so these samples are suitable for K/Ar dating after calcite dissolution. The measured ages present a bimodal distribution, 116-117 Ma (Aptian) and 86-88 Ma (Coniacian). The first age is within the range deduced by the previous authors [e.g. 2, 3, 4] and we are examining the geological meaning of the younger ages.

The finding of volcanic ash in these thin beds (< 1 mm), which are in general not studied at all, gives a renewed interest about the direct dating of carbonate formations. Not all regions in the world will show near volcanic activity, but "cryptic" ash layers are probably widespread in many sedimentary successions.

[1] Applegate (1987) *Rev. Soc. Mex. Paleontol.* **1**, 45-54. [2] Kashiyama *et al.* (2004) *Cretaceous Res.* **25**, 153-177. [3] Benammi *et al.* (2006) *Earth Planets Space* **58**, 1295-1302. [4] Pantoja (1992) *UNAM, Inst. Geol. Rev.* **9**, 156-169.

Localisation and extent of Zn isotopic fractionation in higher plants

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Zn is a vital micronutrient for organisms notably because it is essential for the activity of proteins involved in energy metabolism and protein/nucleic acid synthesis. In cells, Zn concentrations can reach over 2 mg per g of dry material, though none in the form of free Zn^{2+}. Plants therefore could play an important role in the biogeochemical cycle of Zn. Weiss *et al.* [1] proposed that Zn isotopic fractionation resulted from a membrane-transport-controlled uptake of Zn in the shoot after measuring an enrichment in light Zn isotopes in shoots compared to roots of 3 plants.

In plants, there are several physical barriers to the transport of minerals from the soil to the leaves. This study aimed at (1) determining where in the plant Zn isotopic fractionations could occur, in order to (2) identify the processes responsible for these fractionations. We measured Zn isotopic fractionation between the various organs (root, stem, secondary stem, petiole, leaf veins and photosynthetic tissues) of 4 plants from diverse taxonomic status (*Rosa sinensis*, *Brassica oleracea*, *Phyllostachys aurea* and *Pseudotsuga menziesii*) and their growth media.

Our results show that the total Zn in the soil and the fraction readily available to the roots are not fractionated. In all plants, we observed an enrichment in heavy Zn isotopes in roots (R) compared to the soil, and an enrichment in light isotopes in photosynthetic tissues (PT) compared to the stem (S). *B. oleracea* and *P. menziesii* show an enrichment in heavy Zn isotopes in the stem compared to roots, whereas *Rosa* shows the opposite behaviour. We measured a strong fractionation gradient in the aerial parts of all plants from the base of the stem to the photosynthetic tissues of the upper leaves. Within each plant, the extent of fractionation is $\Delta^{66}Zn_{S-PT}$ = 0.94‰ and 0.47‰ for *B. oleracea* and *P. menziesii*, respectively and $\Delta^{66}Zn_{R-PT}$ = 0.53‰ for *Rosa*.

Our results are consistent with a transport-induced fractionation in the root. The strong enrichment in light Zn isotopes in the photosynthetic tissues compared to the other compartments of the plant suggests a specific Zn carrier for the uptake of Zn in the photosynthetic tissues.

[1] Weiss *et al.* (2005) *New Phytologist* **165**, 703-710.