Contrasted response of U-Th bearing minerals to albitization:

A case study from 3 albitite occurences in the Pyrenees

MARC POUJOL[1*], PHILIPPE BOULVAIS[1]

1Université de Rennes 1, UMR CNRS 6118 Géosciences Rennes, 35042 Rennes cedex, France. Marc.poujol@univ-rennes1.fr (* presenting author))

Albitization is a common metasomatic process active in various geodynamic environments. In the northern Pyrenees, several occurrences of albitites are described.

Like many other orogenic belts, the Pyrenees recorded numerous fluid-rock interaction events. Fluids led to talc mineralization in dolostones,ophicalcite development at the expense of peridotite massifs and albitization of granitoids and metamorphic rocks.. Because the Pyrenees have undergone the effects of both the Hercynian and Alpine orogenies, precise dating of the different fluid flow events is not straightforward.

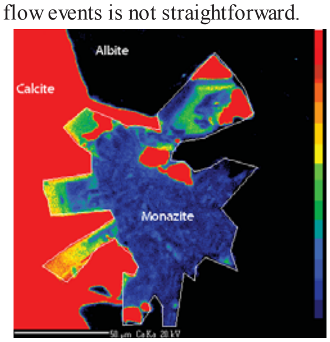

Fig 1: Ca chemical mapping of monazite

In this study, we focused on zircon, monazite and titanite, found either in metasedimenatry or meta-igneous protoliths that undergone pervasive albitization. Zircon grains were present in all the studied samples. Monazites were found only in an albitite occurrence developped from an igneous protolith while titanites were found in a albitized metasedimentary sample. These three types of mineral where selected in well characterized hydrothermal assemblages: zircons in metasomatically Zr-enriched rocks or in hydrothermal structures (millimetric veins cross-cutting granitoids); monazites when associated with calcite and/or albite in centimetric veins (Fig 1) and titanite with albite.

In-situ LA-ICP-MS ages obtained directly in thin sections from euhedral titanite and monazite grains from distinct albitites are 110 ± 8 and 98 ± 2 Ma, respectively [1]. The zircon U-Th-Pb isotopic system did not record this Cretaceous metasomatic event in any of the selected sample. This demonstrates that none of the zircons were affected (or grew anew) during fluid circulations. This confirms the robustness of zircon with respect to interaction with fluids.

We argue that the total time span of 20 Ma recorded by albitites corresponds to a long-lived hydrothermal system that was active during the rotation of Iberia around Europe. Because albitization and talc mineralization share a common spatial and temporal distribution in the Pyrenees, we argue that these two metasomatic phenomena are two independent records of this single, regional-scale, long-lived hydrothermal system.

The bulk composition of Rare Earth Elements (REE), Sc and Y in 36 chondrites: insight into elemental fractionation in the solar nebula

ALI POURMAND[1,2*], NICOLAS DAUPHAS[1], THOMAS J. IRELAND[1]

[1] Origins Lab, Department of Geophysical Sciences, University of Chicago, Chicago, IL 60637, USA

[2*] Neptune Isotope Lab, University of Miami - RSMAS, Miami, FL 33149, USA, apourmand@rsmas.miami.edu (presenting author)

Enrichment or depletion of the REE, Sc and Y in chondritic meteorites, relative to solar abundances preserved in the least equilibrated chondrites, has provided valuable insight into the condensation/evaporation history of refractory lithophile elements in the solar nebula during the early formation of the solar system [1-3]. A large portion of the existing data from bulk meteorite samples and their refractory inclusions, however, suffer from low precisions, or do not include mono-isotopic elements (Pr, Tb, Ho and Tm). Recently, we presented novel analytical techniques, utilizing low-blank fusion with $LiBO_2$ flux, TODGA extraction chromatography, and MC-ICP-MS for measuring the isotopic composition of actinides, REE, Sc and Y in extra-terrestrial materials [4], and revised the accretion age of Mars [5] and the mean of CI-chondrites for these elements [6]. Here, we present bulk concentrations of REE, Sc and Y in 36 (28 falls and 8 finds) carbonaceous (5), ordinary (15) and enstatite (16) chondrites using this new analytical methodology. All meteorite groups show varying degrees of enrichment or depletion in REE, Sc and Y relative to the mean of CI-chondrites. In general, three types of fractionation are dominant among other irregular patterns: 1) more refractory heavy REE (Gd, Tb, Dy, Ho, Er and Lu) are enriched relative to light REE (La, Ce, Pr, Nd, Sm and Tm), 2) more volatile elements (Eu and Yb) show positive or negative anomalies accompanied by minimal fractionation in other REE, 3) all elements show relatively similar enrichment or depletion without significant anomalies. More dispersion is also observed in the anomalies of more volatile elements (*e.g.,* Eu/Eu*) with increasing degrees of equilibration. While some fractionation patterns can be attributed to the presence of (ultra) refractory inclusions [3] or minerals (*e.g.,* phosphate) that concentrate REE in chondrites, other mechanisms may be needed for patterns that cannot be explained by dominance of a particular group of inclusions.

[1] Boynton (1975) *Geochim. Cosmochim. Acta* **39**, 569-584. [2] Evensen et al. (1978) *Geochim. Cosmochim. Acta* **42**, 1199-1212. [3] McPherson et al. (1988) in *Meteorites and the Early Solar System* pp. 746-807. [4] Pourmand & Dauphas (2010) *Talanta* **81**, 741-753. [5] Dauphas & Pourmand (2011) *Nature* **473**, 489–492. [6] Pourmand et al. (2012) *Chem. Geol.* **291**, 38-54.