Differentiation of peraluminous granite 'en route' to the surface

R. TARTÈSE* AND P. BOULVAIS

Géosciences Rennes – UMR CNRS 6118 - Rennes1 University - 35042 Rennes Cedex – France (*correspondence: romain.tartese@univ-rennes1.fr)

Leucogranites display petrological and geochemical heterogeneities that can be related to either primary processes acting at the source, or to secondary processes of differentiation. In the Armorican Massif, a Hercynian domain in western France, syn-tectonic leucogranites were emplaced along major shear zones. The Lizio and Questembert massifs are derived from a similar metasedimentary source and emplaced at distinct depths, *ca*. 3-4 kbar and 1-2 kbar, respectively. Questembert rocks are more differentiated than Lizio rocks, as demonstrated by a lower amount of modal biotite, a higher SiO_2 content and a more pronounced peraluminous character. The high-SiO_2 Questembert rocks can derive from low-SiO_2 Lizio samples by a 15 wt.% fractionation of the assemblage *kfs* + *pl* + *bt*. The magmatic evolution is well recorded by the oxygen isotope evolution of whole rocks and mineral separates, demonstrating that these granites crystallized from almost crystal-free liquids (Fig. 1).

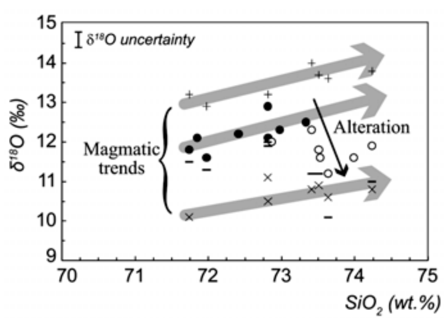

Figure 2: $\delta^{18}O$ vs. SiO_2 for Lizio (●) and Questembert (○) whole rocks and for quartz (+), muscovite (×) and feldspar (-).

We propose that the differences between the Questembert and the Lizio granites are related to processes acting during magmas rising. Questembert is more differentiated than Lizio because it covered a longer distance during its vertical migration, allowing more crystal-liquid segregation. Regional deformation likely enhanced this process through a filter-press type mechanism. The shallower emplacement of Questembert liquids led to the exsolution of a fluid phase, which further interacted with surrounding rocks, developing a pervasive deuteric alteration. A further influx of fluids from the surface was possible because of the very shallow depth of emplacement.

Multi-stage igneous evolution of anorthite in three type B CAIs

Y. TASAI[1], T.J. FAGAN[1]*, S. ITOH[2] AND H. YURIMOTO[2]

[1]Waseda University, Tokyo, Japan (*correspondence: fagan@waseda.jp)
[2]Hokkaido University, Sapporo, Japan

Different multi-stage crystallization histories of primary anorthite in three type B Ca-Al-rich inclusions (CAIs) are revealed by cathodoluminescence combined with in situ O and Al-Mg isotopic analyses. Primary anorthites in CAIs 3655A (Type B1 from CV3 chondrite Allende), 4022 (B2, Allende) and CGI-10 (B1, Efremovka) exhibit blue cathodoluminescence (CL) with variable brightness. In each CAI, some CL-dark domains are slightly enriched in MgO (>0.10 wt%) and Na_2O (>0.10 wt%).

In 3655A, CL-dark Mg-rich domains of anorthite form mantles with angular boundaries on CL-bright cores. Analyses of both domains show near-canonical Al-Mg isotopic systematics (initial $^{26}Al/^{27}Al \sim 5x10^{-5}$; see Fagan *et al.* 2007, MaPS v. 42, 1221-1240) and are ^{16}O-poor (new isotopic analyses by secondary ion mass spectroscopy using the Hokkaido University Cameca 1270 ion microprobe). In 4022, CL-dark Mg-rich domains occur as embayed relict cores mantled by CL-bright anorthite. The cores have near-canonical Al-Mg isotope systematics, whereas the CL-bright mantles have smaller ^{26}Mg excesses. Both domains are ^{16}O-poor, but the ^{16}O-depletion is less extreme in one CL-dark core. In CGI-10, separate crystals of CL-dark Mg-rich and CL-bright Mg-poor anorthites were identified. Both types are ^{16}O-rich. All analyses exhibit sub-canonical Al-Mg isotope systematics, but ^{26}Mg excesses are smaller or absent in the CL-bright domains.

Relatively pure anorthite in 3655A was overgrown by Na-Mg-bearing anorthite. Both feldspar domains formed prior to closure of the Al-Mg isotopic system. Oxygen isotopic alteration either occured early or did not disturb Al-Mg isotopes. The CL-dark cores in 4022 are relics of an early stage of igneous crystallization. CL-bright mantles formed in a later igneous event that was rapid enough so that canonical Al-Mg systematics and ^{16}O-rich oxygen in some of the early anorthite were preserved. Early Na-Mg-bearing anorthite was also followed by a later stage of igneous Na-Mg-poor anorthite in CGI-10. Low excesses of ^{26}Mg in the Na-Mg-poor anorthite combined with the ^{16}O-rich compositions of all analyzed anorthite in this CAI suggest that a ^{16}O-rich reservoir was present in the solar nebula after the decay of most ^{26}Al.