Relationships between Ti-rich alkali silicate metasomatism and amphibole, glass and clinopyroxene genesis in mantle xenoliths from Antarctica, Australia and Austria

M.COLTORTI [1], L. BECCALUVA[1], C. BONADIMAN[1], B. FACCINI[1], T.NTAFLOS[2] AND F. SIENA[1]

[1]Earth Sciences Dept., Univ. of Ferrara, Italy (clt@unife.it)
[2]Petrology Dept., University of Wien, Austria

Textural and chemical features of clinopyroxene, amphibole and glass in mantle xenoliths from Australia, Antarctica and Austria were investigated with the aim of clarifying the role played by metasomatism in the genesis of these phases. Clinopyroxene occurs as a) primary crystals (cpx1), b) secondary crystals within reaction zones around orthopyroxene and clinopyroxene, and c) associated with growing amphibole (cpx-A). Chemically, these crystals can be easily distinguished on the basis of SiO_2, Al_2O_3, TiO_2 and Na_2O contents. Cpx-A shows the most variable (and lowest) SiO_2/Al_2O_3 ratios ranging from ca. 10 (analogous to cpx1) to 3.5 (approaching amphibole), with a parallel increase of TiO_2 from 0.7wt% to 5.0wt%, at constant *mgv*. Cpx1 is slightly enriched in trace element, with $(La/Yb)_N$ varying from 3.2 to 9.8, and pronounced Ti and Zr negative anomalies. $(La/Yb)_N$ of cpx-A varies between 2.5 and 6.4, mostly due to an increase in HREE content. Ti, Zr and Sr negative anomalies are observed. Amphibole occurs both disseminated and in veins. In the first case it is always associated with spinel and clinopyroxene, sometimes as a rim between the two minerals. No textural evidences of destabilization of this phase are observed. Disseminated amphiboles are always higher in SiO_2, Na_2O and *mgv* and lower in Al_2O_3 and TiO_2 with respect to vein amphiboles, both showing negative correlation between mgv and TiO_2. $(La/Yb)_N$ ratios range between 3.2 and 7.2 with remarkable Zr negative anomaly, irrespective of texture. Their trace element distribution is always intermediate between cpx-A and glass. Glass is often associated with clinopyroxenes and disseminated amphibole. Its composition is comparable with that of mantle glasses worldwide, but for an anomalously high TiO_2 content (up to 6 wt%). They are quite LREE-enriched ($(La/Yb)_N$, 10.0-21.2), trace element contents being always higher than cpx-A and amphibole. Compositional variations of cpx-A, amphibole and glass are strictly correlated. In several diagrams they tend toward a common point, thus excluding a simple fractionation process for which opposite trend would be envisaged. The above described textural and geochemical features strongly suggest a genetic link between glass, clinopyroxene and amphibole. Cpx-A starts growing at cpx1 expenses, being transformed in amphibole through reaction processes with a metasomatizing melt. Discrimination diagrams, as well as preliminary mass balance calculations, indicate that this melt was a TiO_2-rich highly-undersaturated alkali silicate magma.

Early Proterozoic alkaline magmatism in the Northeastern Brazil as an evidence of Archean and Early Proterozoic heterogeneous mantle

R.V.CONCEIÇÃO[1]*, M.L.S. ROSA[2], H. CONCEIÇÃO[2], L.V.S.NARDI[1]

1-Universidade Federal do Rio Grande do Sul - Laboratório de Geologia Isotópica* (rommulo.conceição@ufrgs.br, lauro.nardi@ufrgs.br)
2-Universidade Federal da Bahia (lourdes@cpgg.ufrbs.br)

Although rare, alkaline magmatism evidence is found since the Late Archean, generally related to felsic alkaline intrusive complexes (more specifically Si-saturated potassic syenites), nepheline syenites, or carbonatites, or extrusive trachytes, shoshonites and calc-alkaline lamprophyres. The last stabilization period of Early Proterozoic mobile belts in the Northeastern Brazil is characterized by the generation and emplacement (2,000 km^2) of various syenitic bodies, which are silica-saturated, alkaline, metaluminous, potassic to ultrapotassic, enriched in LILE, with high Cr, Ni and Mg# [100MgO/(MgO+FeO)] compared to common syenites. LREE is around 1000 times chondrites, and [La/Yb]N is around 142 to 886, without significant Eu anomalies. Initial isotopic characteristics demonstrate low and negative initial epsilon Nd at 2.1 Ga. (around -3.0), and Sri around 0.703. Initial isotopic and REE composition of separated clinopyroxenes (cpx), the early mineral to crystallize, matches well with the composition of the whole rock (Sri around 0.704 and epsilon Nd at 2.1 Ga. from -3.58 to -2.41, LREE and HREE around 100 and 10 times chondrites, respectively). Melts calculated from these minerals show close relation to the whole rocks REE composition and no significant correlation between the initial isotopic ratios and the Nd and Sr concentration (or even the SiO_2 content) are observed, discarding significant crustal contamination. These data are consistent with a model of producing partial melts in an enriched mantle, that already existed in the Late Archean / Early Proterozoic, to produce the liquid that will originate these syenites. From our data and interpretation, we conclude that the dynamic of the Late Archean and Early Proterozoic has to take into account an important heterogeneity of the Archean and/or Early Proterozoic mantle, which has to be considered in modeling the isotopic evolution of the Earth.