

Preservation of residue-melt equilibria in contact-metamorphic anatexites: The effect of deformation on rapid equilibration

ALFONS BERGER¹ AND CLAUDIO ROSENBERG²

- 1 Institute for Geological Sciences, University of Bern
Baltzerstr. 1, CH-3012 Bern, Switzerland; Email:
berger@geo.unibe.ch; Tel: ++41-31-6318493
- 2 Fachbereich Geowissenschaften, Freie Universität Berlin,
Malteser Str. 74-100, D-12249 Berlin; Germany

A combined petrological-textural-chemical approach is used to interpret the relationship between chemical exchange and deformation during partial melting of a granodioritic gneiss in the contact aureole of the Bergell Pluton (Central Alps). In contrast to most regional metamorphic anatexites, chemical equilibrium between residue and segregated melt is preserved in the rocks of the present study. This equilibrium is inferred to affect both the main and the trace elements hosted in the rock-forming minerals and the light rare earth elements (LREE), mainly hosted in the allanites. The reactive behaviour of allanite during anatexis, in contrast to the refractive behaviour of zircon and xenotime (containers of HREE), controls the change in REE pattern during water present melting of continental rocks. The uncommon preservation of chemical equilibrium between leucosome and residue requires special boundary conditions. We propose that the achievement of equilibrium between melt and residue was favoured by deformation, operating via a mechanism of dissolution-accommodated grain-boundary sliding. During this process, large parts of the grains may be dissolved, thus enhancing chemical equilibration and inhibiting disequilibrium melting. Microstructural observations indicate that melt-present granular flow was the dominating deformation mechanism in these anatexites. Two factors permitted the preservation of the compositional equilibrium: rapid cooling at contact metamorphic conditions and the lack of deformation after attainment of the solidus.

Metasomatic origin of pyroxenites in the Solomon Islands.

T. BERLY¹, J. HERMANN², R.J. ARCULUS¹ AND H. LAPIERRE³

- ¹Geology Department, ANU, Canberra, ACT 0200, Australia
(thomas@geology.anu.edu.au)
- ²RSES, ANU, Canberra, ACT 0200, Australia
- ³LGCA, UJF, Grenoble, France

Due to the collision between Ontong Java Plateau (OJP) and Solomon arc, pyroxenites associated with harzburgites and dunites are now exposed in SE Santa Isabel and San Jorge.

The pyroxenites range from clinopyroxenite, websterite to orthopyroxenite depending on modal proportion of clinopyroxene (cpx) relative to orthopyroxene (opx). Cpx is poor in Al₂O₃ (0.5-2%), in K₂O (<0.2%) and Na₂O (<0.5%). The 100*Mg/(Mg+Fe) (Mg#) of both cpx and opx range respectively from 88-95 and 84-95. The cpx-Mg# and opx-Mg# of opx-rich pyroxenites are the highest values similar to that of the mantle. Olivine (88<Mg#<92) occurs rarely (<10%) mainly in orthopyroxenites as well as euhedral Cr-spinel (60<Cr#<73). Secondary phases present are amphibole (hornblende and tremolite), pyrite and serpentine. The hornblende is related intimately to fluid inclusions (trails) and form blebs within cpx. Two-pyroxene thermometry gives a large range of equilibration temperatures between 800 and 1050°C. The assemblage cpx-opx-sp-ol requires 0.7<equilibration pressures<1.7 GPa.

Trace element abundances (determined by LA-ICP-MS) in cpx show variable depletion in light relative to medium REE (0.1<(La/Nd)_N<0.5) and flat to convex medium to heavy REE (0.5<(Sm/Yb)_N<1.5). Overall REE abundances range from 0.4 to 1.3 times chondritic, but cpx from clinopyroxenites has the highest trace element concentrations compared to those of orthopyroxenites. Primitive mantle-normalized multi-element diagrams of cpx are marked by positive anomalies in Cs, Ba, Pb and Sr. These selective enrichments could be attributed to chromatographic effects of melt percolation through peridotite or metasomatism by hydrous fluids from subducting slabs

In an arc setting, aqueous fluids released from the slab, interact with the mantle wedge. At the P-T conditions mentioned above, fluid or hydrous melt can generate pyroxene-rich rocks with features found in the Solomon Islands. During exhumation, secondary fluids coming up from the slab, affect the pyroxenites and result in formation of amphibole and appearance of fluid inclusions. We propose that opx-rich rocks result from fluid metasomatism of peridotites whereas clinopyroxenites are derived from interaction between peridotites and hydrous melt.