Geophysical Research Abstracts
Vol. 17, EGU2015-454, 2015
EGU General Assembly 2015

Multi-stage supra-subduction metasomatism in the Cabo Ortegal Complex, Spain

Romain Tilhac (1,2), Suzanne O'Reilly (1), William Griffin (1), Norman Pearson (1), Georges Ceuleneer (2), Michel Grégoire (1,2)

(1) ARC Centre of Excellence for Core to Crust Fluid Systems (CCFS) and GEMOC, Department of Earth and Planetary Sciences, Macquarie University, Australia (romain.tilhac@gmail.com), (2) Géosciences Environnement Toulouse (GET), Université Paul Sabatier, Toulouse III, France

Three harzburgitic massifs are exposed in the Cabo Ortegal Complex as part of the Variscan suture in Spain. Among these, the Herbeira massif has an unusually high volume of massive and layered pyroxenites whose formation has never comprehensively understood due to a particularly complex tectonothermal history (Ábalos et al., 2003). We use a detailed structural and geochemical approach to reveal a multi-stage metasomatic scenario unraveling the intricacy of magmatic and metamorphic features.

Our new mapping of the Herbeira massif suggests that it consists of a single exposure of heterogeneous mantle cross-cut by different generations of mafic veins, outlining a potential metasomatic conduit developed in a subduction zone. The recognition of an overprinting sheath-fold deformation confirms that the whole massif has been deformed in a deep-subduction setting. However, thickness variations in pyroxenites may not only result from various degrees of shear deformation as previously suggested (Girardeau and Gil Ibarguchi, 1991), thus more than a single magmatic event potentially occurred. Structural and textural observations are consistent with the massive pyroxenites intruding the package of harzburgite and layered pyroxenites prior to its intrusion into the subduction zone. The massive pyroxenites display homogeneous enrichments of light rare earth elements (LREE) whereas layered pyroxenites are variously enriched, resulting in spoon-shaped to strongly LREE-fractionated patterns, characteristic of varying degrees of chromatographic re-equilibration. We suggest that an initial metasomatic episode occurred when the parental melt of the massive pyroxenites percolated through the massif, forming dunitic aureoles via additional melt extraction from harzburgites. After intrusion into the subduction zone, shear deformation was accompanied by fluid percolation controlled by inherited lithological heterogeneities and specifically the existence of dunitic channels, as evidenced by sharp compositional gradients of large-ion lithophile elements (LILE) and lithium. This episode was sealed by the injection of mafic magma forming garnet-bearing veins during/after peak metamorphism. Subsequently, fluid-mobile elements enrichment and abundant hornblende formation occurred during exhumation. High contents of platinum-group elements (PGE) observed in chromitites and pyroxenites in the vicinity of mafic veins suggest a metasomatic remobilization of PGE at amphibolite- to greenschist-facies conditions.

The combination of in situ geochemical data with a detailed structural study reveals that the Cabo Ortegal Complex may be a natural laboratory contributing to better understand the metasomatic processes in subduction zones. It has a great potential for achieving the integration of those processes into a well defined metamorphic and deformational background constrained by regional geodynamics.

REFERENCES

Ábalos, B., Puelles, P., Gil Ibarguchi, J.I., 2003. Structural assemblage of high-pressure mantle and crustal rocks in a subduction channel (Cabo Ortegal, NW Spain). Tectonics, 22: 1006-1027.
Girardeau, J., Gil Ibarguchi, J.I., 1991. Pyroxenite-rich peridotites of the Cabo Ortegal complex (Northwestern Spain): evidence for large-scale upper-mantle heterogeneity. Journal of Petrology, Special Lherzolites Issue: 135-154.