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Sulfide and silicate melt inclusions in the D. João de Castro Volcanic Seamount, a hydrothermally active area on the Terceira Rift, Azores

A.F.A. Marques (1), S.D. Scott (2), P. Madureira (3,4), C.J.P. Rosa (5), N. Lourenço (3), P. Conceição (3), and TerRiftic Team ()

(1) CREMINER (LARSyS) - Universidade de Lisboa, Fac. Ciências, Dept. Geologia, Portugal (afamarques@fc.ul.pt), (2) Scotiabank Marine Geology Research Laboratory, Dept. Geology, University of Toronto, Canada, (3) EMAM - Estrutura de Missão para os Assuntos do Mar, (4) Centro de Geofísica de Évora / Dept. Geociências da Universidade de Évora, Portugal, (5) LNEG - Laboratório Nacional de Energia e Geologia

The Azores plateau is a bathymetric high located in the North Atlantic encompassing a triple junction where the American, Eurasia and African plates meet. The Terceira Rift (TR), within the plateau, defines the Eurasia/African plate boundary and corresponds to a 550 Km long, ESE trending line of volcanic islands and seamounts (e.g. D. João de Castro - DJC) alternating with deep basins (e.g. Hirondelle - HIR) [1, 2]. Fresh basalts from the TR, in particular the DJC and HIR areas, were sampled from 2007 to 2009 [EMEPC 2007/2008/2009 cruises]. The team is now studying their melt inclusions [MI] in order to understand processes of magma evolution and mixing as well as the behavior of trace metals and volatiles in the pre-erupted magmas. Petrographic observations indicate that in DJC and HIR, basalts are porphyritic, vesicular, with a microcrystalline groundmass composed mostly of plagioclase laths $\pm$ olivine $\pm$ clinopyroxene $\pm$ skeletal Fe-Ti oxides $\pm$ glass. Phenocrysts are subhedral to euhedral with corroded rims. Clinopyroxene (aluminian diopside) is the main phenocryst phase, followed by olivine (Fo83 – DJC; Fo80 – HIR) and minor plagioclase (often as microphenocrysts). Incompatible trace elements in groundmass, glass, and exposed MI in clinopyroxene depict enriched patterns above the OIB field. REE patterns are similar in the groundmass and glass from DJC and HIR. Exposed MI from HIR depicts less enriched REE patterns than the groundmass, whilst DJC MI show similar REE patterns to the groundmass. MI were found in most mineral phases studied. They are distributed randomly (azonal) and appear glassy, partially devitrified or completely opaque with one or more vapor bubbles. Glassy to devitrified MI may show interpenetrating arrays of mineral phases, skeletal Fe-Ti oxides, and included euhedral Cr-spinel. Sulfide globules are common in clinopyroxene-hosted MI and are dispersed within the groundmass. Globules are small, less than 10 μm, and contain distinct mineral phases that suggest exsolution from a higher temperature solid solution phase (Fe-Ni-Cu-S). Oxides rim some of the globules. Samples with no visible sulfide globules in the groundmass contain, apart from Fe-Ti oxides, coarse-grained Fe-oxides. Preliminary observations indicate that immiscible sulfide phases were present at different stages of magma evolution. This may have implications for metal mobility during pre- syn and post eruptive degassing (e.g., DJC and HIR), or even active hydrothermalism (DJC). Moreover, geochemical and textural similarities found between samples from the DJC volcanic high and HIR deep basin have implications for the understanding of the TR melting processes.

[1] Lourenço, N et al, (1998) Mar.Geophys.Res. 20:141-56
[2] Vogt PR and Jung WY (2004) EPSL 218:77-90

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