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Magmatic to hydrothermal transition in the Menez Gwen and Lucky Strike seafloor hydrothermal systems, Azores hotspot, Mid-Atlantic ridge

A. F. A. Marques (1,2), S. D. Scott (1), F. J. A. S. Barriga (2), Y. Fouquet (3)

(1) Scotiabank Marine Geology Research Laboratory, Department of Geology, University of Toronto, Canada, (2) CREMINER (LA/ISR), Department of Geology, University of Lisbon, Portugal, (3) IFREMER, Brest, France (marques@geology.utoronto.ca)

The Menez Gwen (37º50'N) and Lucky Strike (37º17'N) are active seafloor hydrothermal systems hosted by basalt on the Mid-Atlantic Ridge (MAR), south of the Azores hotspot (40ºN). The recent discovery of a shallow magma chamber 3 km below the Lucky Strike area is in agreement with the published literature on fluid chemistry of Menez Gwen and Lucky Strike that points to the presence a reaction zone and phase separation at shallow depth (low pressure), and the venting of hydrothermal fluids that have low metal contents but are rich in volatiles (CO_2, CH_4) with a magmatic signature. Our work on melt inclusions and vesiculation in relation to degassing of magma contributes new information to the understanding of this magmatic-hydrothermal interface.

Porphyritic basalts collected near the active area of Menez Gwen depict small-scale heterogeneity, as in the Lucky Strike. Group I porphyritic basalts can be highly vesicular (14.3 - 54.6 %, on a phenocryst-free basis) and are extremely enriched in incompatible trace elements with high Nb/Zr, Ba/Nb, Zr/Y and Nb/Y ratios. Group II porphyritic basalts are less vesicular (16.5 - 27.4 %, on a phenocryst-free basis), less enriched in incompatible trace elements and have lower, Nb/Zr, Ba/Nb, Zr/Y and Nb/Y ratios. Porphyritic basalts in the Lucky Strike have varied vesicularity (13.1-66 %) that can be as high as 73.3 % vesicles in one plagioclase cumulate sample. Statistics and vesicle size distributions (VSD) identified three main peaks of vesicle

population: small (3.3 to 5.3 μm), medium (10.5 to 16.6 μm) and large diameter (41.8 to 66.2 μm). Larger size vesicles (diameters $>$ 83.3 μm) are commonly coalesced. Group I porphyritic basalts have distinct VSD relative to group II porphyritic basalts since the later lack the population of large size and coalesced vesicles. The three different populations of vesicles are interpreted to represent different vesiculation events during pre-eruptive, syn-eruptive and post-eruptive degassing stages. Group II porphyritic basalts may have been initially depleted in volatiles or degassed extensively in upper crustal levels. Silicate melt inclusions (MI), hosted in plagioclase, contain metallic (Fe-Ni-Cu-Zn) precipitates inside the vapor bubbles, indicating degassing of a metal-rich magmatic fluid at the time of plagioclase growth.

Merging the data, the magmatic to hydrothermal transfer of ore-metals becomes a likely process in the Menez Gwen and Lucky Strike systems as evidenced by the extensive pre-eruptive degassing of volatiles (at some stages carrying ore metals) and their input to the hydrothermal fluids.