Internal structure of a mid-crustal magmatic conduit: The Punta Falcone mafic pluton (Sardinia, Italy)

ANNE-CÉCILE HAUSER[1] AND FRANÇOIS BUSSY[2]

[1,2]Institute of Earth Sciences, University of Lausanne, Géopolis, CH-1015 Lausanne. ([1]anne-cecile.hauser@unil.ch, [2]francois.bussy@unil.ch)

The granite-hosted mid-crustal gabbroic pluton of Punta Falcone is built by many magmatic pulses with contrasting textures and composition. Gabbros can be divided into a supposedly older external zone (EZ) and a central zone (CZ) based on mineralogical, textural and geochemical arguments. CZ gabbros are more primitive in composition as indicated e.g. by higher mg-# in amphiboles. They contain relics of orthopyroxene, which are absent in the EZ gabbros. Whether the change in chemistry is due to more thorough interaction of the earlier pulses (EZ) with the host rocks during ascent/in the source region or whether it represents a change in the magma source should be resolved by radiogenic isotope compositions.

High An-contents of plagioclase as well as important amounts of amphibole in all gabbros express the high water content of the system. Phase diagrams based on water-saturated experiments allow linking the early stabilization of amphibole in the EZ gabbros (sub-euhedral grains) with cooling of the magma during ascent. The later appearance of amphibole in the CZ gabbros (poikilitic interstitial phase around euhedral plagioclase) on the other hand indicates higher temperatures for the same pressure and thus thermal maturation of the system over time. Furthermore the first pulses (EZ) crystallize as a whole with isotropic granular textures, whereas later pulses (CZ) show signs of crystal segregation and cumulate processes. They display remarkable rhythmic black and white layering at the cm-scale, which is roughly vertical and parallel to the limits of the cooling units. A second set of layers is crosscutting the main one at an angle of ca. 35°. Dark bands are defined by interstitial amphibole, which is absent in the white layers. The amount of lost liquid might reach several tens of wt%. The concentration of late crystallizing amphiboles in the dark layers indicates that liquid extraction is possibly linked to the development of the layering.

We interpret these magmatic structures as resulting from shearing of a crystallizing mush during its ascent or at its final emplacement level, with concomitant extraction of residual liquid, which escaped to higher crustal levels.

The effect of hydrothermal iron on marine dissolved organic carbon

J. A. HAWKES*[1], D. P. CONNELLY[1], A. DJURHUUS[2] AND E. P. ACHTERBERG[1]

[1]National Oceanography Centre Southampton, European Way, Southampton, UK

[2]University of Oxford, Department of Zoology, South Parks Road, Oxford, UK

High temperature hydrothermal vents produce particle rich plumes in particle deprived deep ocean regions. Dissolved organic carbon (DOC) may be adsorbed onto this iron rich particulate matter and as a result hydrothermal plumes may act as a sink for DOC [1]. It is estimated that the ocean's water is cycled through hydrothermal plumes on a 4000-8000 year timescale [2], making even very small DOC concentration changes in plume waters significant to the ocean budget of DOC. With an increasing variety of venting types being discovered [3,4], including environments which produce new DOC from magmatic CH_4 and CO_2 [5,6,7], a deeper understanding is required to assess the impact of hydrothermal vents on marine DOC.

We present new carbon and iron concentration data from plumes in three different hydrothermal settings: a back-arc vent site, a deep mid ocean ridge vent site and a ocean core complex hosted vent site. The plume characteristics (physical and chemical) are very different at these three sites, and samples were taken from vent fluids, diffuse areas of venting, the buoyant plumes and the dispersing (neutrally buoyant) plumes, allowing a comprehensive description of the interactions between dissolved and particulate iron and carbon in these three high-temperature vent environments. We will use the results to consider the overall impact that hydrothermal venting has on the concentration and nature of marine organic carbon globally.

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DOI:10.1180/minmag.2013.077.5.8