

## High pressure fluid evolution derived from veins in UHP eclogites (Dabieshan, China)

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Fluids linked to deep burial form and evolve under (ultra-) high pressure (UHP) conditions and are characterized by enhanced element solubilities [1], resulting in transport and fractionation of both fluid-mobile and nominally immobile elements [2]. Reconstructing UHP fluid evolution is thus essential for a better understanding of element mobility and redistribution among Earth's reservoirs.

Representing fossil pathways of fluid flow, we sampled mineral veins in UHP eclogites from the Triassic Dabieshan continental collision zone. Three vein generations are distinguished based on mineralogy and field evidence: (1<sup>st</sup>) early UHP near-peak qtz + rt veins, (2<sup>nd</sup>) HP post-peak phg + ep/czo + brs + ap + qtz + rt ± ky ± omp ± pg ± zo veins and (3<sup>rd</sup>) late HP retrograde ab + phg + ep/czo + qtz veins.

Petrography, microthermometry and Raman analyses reveal pure high density N<sub>2</sub> inclusions (0.56 g/cm<sup>3</sup>) in eclogitic quartz and three assemblages of aqueous inclusions in vein and eclogitic qtz: (i) primarily trapped CaCl<sub>2</sub> + NaCl ± MgCl<sub>2</sub> brines (30–35 wt% NaCl<sub>eq</sub>), (ii) primary to pseudosecondary CaCl<sub>2</sub> + NaCl solutions (17–27 wt% NaCl<sub>eq</sub>), (iii) secondary NaCl-bearing fluids (0–12 wt% NaCl<sub>eq</sub>). Homogenization temperatures among the aqueous groups are bimodally distributed, clustering at 200 and 400°C. High salinities clearly correlate with high T<sub>H</sub> and low salinities with low T<sub>H</sub>. Zoning in vein epidote minerals from LREE- and LILE-rich allanitic cores to slightly resorbed, depleted clinozoisite and overgrowths of trace element-poor epidote mirrors the solute depletion trend indicated by fluid inclusions.

The results reflect an evolution from highly saline, trace element-rich brines near the metamorphic peak towards low salinity, trace element-poor solutions along the retrograde path. The earliest fluids are interpreted to originate from prograde dehydration and their initially high solute content is 'consumed' by precipitation of vein minerals and likely by late dilution with meteoric waters. The nitrogen is suspected to be progradly inherited from metasedimentary lithologies in which the sampled eclogite bodies are embedded.

[1] Kessel *et al* (2005) *Nature* **437**, 724–727. [2] Xiao *et al* (2006) *GCA* **70**, 4770–4782.

## Primary magmas, fractionation modelling and mantle sources of Etnean lavas

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A backward mass balance fractionation was used to reconstruct the primary composition of Etnean magmas and get some inferences on the petrological composition of their mantle sources. The entire evolution of Etna magmatism, from Tholeiitic period to Recent Mongibello, were taken into consideration. fO<sub>2</sub> activity was estimated using [1] and Fe<sup>3+</sup>/Fe<sup>2+</sup> ratio were calculated according to [2] equation. The least differentiated products for each alkaline period were identified and about 15 to 20% of a solid assemblage made up of olivine (87 to 100%) was added to re-equilibrate the basalts with mantle olivine (Fo<sub>87</sub>). If clinopyroxene is added to equilibrate the lavas with mantle olivine a much higher percentage (>40%) of solid fractionation is needed. A further subtraction of 20–25% of a solid assemblage constituted by ol (6–18%), cpx (26–55%) and plag (25–48%) is needed to get to the most differentiated erupted lavas. Taking into account the volume of the erupted magmas this modeling can be used to evaluate the quantity of material intruded below the volcano edifice. Calculated major element compositions of the primary magma is well comparable with those obtained by melt inclusions study [3] and references therein, while trace element patterns fit well with those reported in the literature. These compositions are also similar to those found in the Iblean Plateau [4] apart from a slight enrichment in Rb, Th and U and a depletion in Ti, Hf, Y and Yb, indicating the presence of discrete percentages of volatile-bearing phases, that is amphibole and phlogopite, in the Etnean mantle sources.

[1] France *et al* (2010) *J. Volcanol. Geotherm. Res.* **189**, 340–346. [2] Kress and Carmichael (1988) *Am. Mineral.* **73**, 1267–1274. [3] Collins *et al* (2009) *Geology* **37**, 571–574. [4] Beccaluva *et al* (1998) *J. Petrology* **39**, 1547–1576.