Occurrence of primitive melt inclusions in the olivine crystallites in Carlsberg Ridge basaltic glasses

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Melt inclusions entrapped in minerals are significant in terms of understanding the frozen-in composition and evolutionary condition of a magmatic system [1]. Such inclusion compositions could be partially obliterated from the host rock or glass compositions by dynamic processes such as magma mixing, crystal fractionation, degassing, diffusion and also by contamination [2]. The melt inclusion chemistry inherently provides information on the character and efficiency of the isolation of the entrapment with reference to the external system. Here we report, highly primitive (MgO > 17%) melt inclusions trapped by olivine crystallites in the MORB glasses of the Carlsberg Ridge. The glasses were collected from the Lat-3° 40'-3° 39' N and Long-63° 50'-63° 49'E at a water column depth of approximately 2900 m. The glasses, minerals and their melt inclusions were analysed on Cameca SX100 EPMA. The glass compositions show variation in terms of their major element compositions (all in wt. % - TiO_2: 1.19-2.04, Al_2O_3: 14.01-18.09, MgO: 4.69-9.17, CaO: 9.87-12.84, Na_2O: 2.04-3.41, K_2O: 0.05-1.42 and CaO/Al_2O_3: 0.61-0.83). Olivine crystallites show a very narrow compositional variation typical of MORB olivine from Fo 0.85 to Fo 0.88 with CaO wt. % ranging from 0.27-0.40. Melt inclusions trapped within the olivines show compositional scatter overlapping the most primitive melts (with MgO wt. %: 13.07-17.35, Cao/Al_2O_3: 0.69-0.71) and the melt compositions described in the foregoing. Variations across the melt inclusions trapped in olivine suggest post entrapment modifications through equilibration as reported in the literature [3]. The entrapment of most primitive melt inclusions in the most primitive olivine suggests inhomogeneities in the mantle source peridotites. Chemical variations in melt chemistry suggests possible cryptic crutal contamination.

[1] Shaw *et al.* (2010) *Earth & Planet. Sci. Letters* **289**, 311–332. [2] Sobolev (1996) *Petrology* **4**(3), 209–220 [3] Kamenetsky & Gurenko (2007) *Contrib. Mineral. Petrol.* **153**, 465–481.

Advanced argillic alteration at the Desmos caldera, Manus Basin

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Advanced argillic alteration of basaltic andesites at the Onsen site on the NE slope of the Desmos caldera in the Manus Basin, Papua New Guinea, has been associated with venting of acid-sulfate fluids in the area (Gena *et al.* 2001). We have collected rock and fluid samples from the Onsen site during an RV *Melville* cruise with ROV *Jason II* in 2006 from water depths around 1930 meters below sea level. Fluids and rocks were comprehensively analyzed, and geochemical reaction path modeling was used to determine phase relations during progressive interaction between fresh basaltic andesite and acid-sulfate vent fluid.

Rocks from the vicinity of acid-sulfate fluid vents show distinct outward zoning patterns from fresh to propyllitic (talc–biotite–feldspar) to argillic (pyrophyllite–cristobalite–pyrite) to advanced argillic (Na-alunite–sulfur–cristobalite) alteration. The efficiency of the element leaching is K>Ca>Mg>Fe>Na>Al. Removal of these elements is virtually complete except for Na and Al (50%). Sulfur and silica become enriched in the course of progressive alteration. Ti and Zr are immobile.

Fresh rocks are porphyritic (plag, cpx, and trace olivine) and vesicular, and this texture is largely preserved during alteration. However, in the outermost bleached rims, vesicles are entirely filled with alunite and sulfur and secondary porosity has developed, resembling the texture of vuggy quartz alteration known from epithermal systems on land.

Geochemical modelling shows that the zoning patterns observed in the rocks can be reproduced in a simple reaction path model, in which the venting fluid is titrated with fresh rock at the temperature slightly above that of the venting fluid (120°C). The phase relations suggest metastability. The vent fluid is saturated with cristobalite – not quartz. Suppressing quartz in the calculations predicts pyrophyllite to form instead of kaolinite, which is expected to form at T<300°C in equilibrium with quartz.

Acid-sulfate fluid venting at Desmos represents a natural experiment that provides insights into the development of alteration types and patterns known from epithermal high-sulfidation systems.

[1] Gena *et al.* (2001) *Resource Geology* **51**, 31–44.