ORIGIN OF TROCTOLITES THROUGH OLIVINE DISSOLUTION AND CRYSTALLIZZATION: AN EXPERIMENTAL STUDY AT 0.5 GPa.

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Keywords: melt-olivine reaction, oceanic lithosphere, high-pressure experiments.

Olivine-rich troctolites are the most primitive magmatic rocks documented at mid-ocean ridges. Based on microstructural and chemical observations, their origin has been ascribed to the interactions between precursor mantle dunite and infiltrating basalt (e.g. Drouin et al., 2010). Experiments on MORB-dunite interactions suggest that the melt/olivine ratio plays an important role in controlling the origin of reactive troctolite (Borghini et al., 2018). However, the effect of this parameter is far to be fully experimentally investigated and quantified. We are performing piston cylinder experiments at 0.5 GPa on mixtures of San Carlos olivine (Fo_{90}) and a MORB-type melt at variable proportions (10, 25 and 50 wt% of melt). For each mixture, we perform isothermal runs at 1300°C for 24 hours and step cooled by lowering the temperature down to 1100°C after the isothermal stage. Specific aims are to investigate and quantify the effect of the initial melt/olivine ratio on the amount of olivine dissolution, the lithology produced by reaction, and the textural and mineral chemistry evolution of products. After the high-T stage, olivine occurs as large subhedral crystals with straight and lobate curvilinear rims or as smaller rounded grains. At increasing initial melt amount (from 25 to 50 wt%), olivine grain size and tortuosity increase. Relatively high initial melt/olivine ratio enhanced the reaction promoting olivine crystal growth and dissolution resulting in higher olivine tortuosity. Olivine X_{Mg} increases from 0.91 to 0.92 at initial melt amount increasing (from 25 to 50 wt%). NiO content drastically decreases after reaction with initial melt and is further lowered at increasing melt/olivine ratio (up to 0.04 wt%). After reaction, glass composition records higher X_{Mg}, SiO_2 and NiO contents and lower FeO, Cr_2O_3 and Al_2O_3 abundances. Step cooled experiment at 25 wt% of initial melt results in olivine plus interstitial clinopyroxene and glass. The premature appearance of clinopyroxene as compared with plagioclase could reflect melt compositional variations, in particular an MgO increase due to the significant olivine dissolution. After cooling, olivine X_{Mg} is similar (X_{Mg} = 0.91) to its analogue isothermal experiment. Clinopyroxene Al_2O_3 content is higher than in natural olivine-rich troctolites likely reflecting the absence of plagioclase precipitation. The Na_2O content in clinopyroxene is not influenced by the melt/olivine ratio in our experiments.

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