Reaction between MORB magma and lower oceanic crust: An experimental study

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Mid-ocean ridge basalt (MORB) has long been recognized as a probe to the composition of the inaccessible mantle. Crustal level modifications to MORB compositions are largely attributed to fractional crystallization which can be correted through thermodynamic calculations [1]. However, such corrections do not consider melt-rock reaction. Reactions between migrating MORB melts and lower oceanic crust are inevitable during the emplacement of primitive melt into variably evolved cumulates, and the flow of (evolved) interstitial melt through the lower crustal crystal mush. Such reaction is known to modify mineral compositions in the lower crust, and is also inferred to cause chemical variations of MORB [2]. Nonetheless, reactions between MORB and lower oceanic crust cumulates have not been experimentally studied. It remains unknown how and to what extent such processes would change MORB compositions and hence, how such interaction will affect our knowledge of mantle source compositions and melting processes.

We conducted melt-rock reaction experiments to investigate the mechanism and chemical consequences of such process by reacting primitive and evolved MORB glasses with either a primitive or an evolved lower oceanic crust cumulate (troctolite or olivine gabbro). All of the experiments were conducted at 5 kbar and the respective liquidus temperatures of the starting melts (1200°C and 1180°C for the primitive and evolved MORB, respectively) with duration ranging from 6 to 27 hours. Different cooling rates (quenching and slow cooling) were used to study the chemical and lithological variations, texture, and the liquid line of descent of the reacted MORB melts. The results have enabled a reconstruction of the crystal-melt reaction mechanisms, and have placed constraints on the chemical consequences of melt-rock reaction on both the plutonic rocks and the melt.

[1] Grove et al. (1992), *Geoph. Monog. Series*, **71.** 281-310; [2] Lissenberg & Dick (2008), *Earth Planet. Sci. Lett.*, **271**. 311-325.