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Preliminary crust-basalt interaction experiments at 0.8 – 1.0 GPa: new hybrid melts formation

S. Mollo (1), V. Misiti (2), D. Dolfi (1)

(1) Università Roma Tre, Largo San Leonardo Murialdo 1, Rome, Italy, (2) Istituto Nazionale di Geofisica e Vulcanologia Sezione di Sismologia e Tettonofisica, Via di Vigna Murata 605, Rome, Italy

(silviomollo@libero.it/Phone: +39-06-54888093)

One of the main problems in studying volcanic rocks, especially in active continental margins, is discerning crustal contribution to the magma composition. Actually assimilation of crustal rocks can produce geochemical modifications of mantle-derived melts, where interaction between crust and mantle can occur both during magma ascent to the surface and during subduction processes involving crustal materials in the mantle wedge.

In order to understand the mechanisms of crust-basalt interaction, a series of experiments in which a calcalkaline and shoshonitic basalts (from Panarea Island and Campanian Province, respectively) react with a continental crust, have been performed. NNO+2 auto-buffered end-loaded piston cylinder experiments have been conducted in the range of 0.8 -1.0 GPa and 1200 ˚C. The experiments consist in a close contact of two different samples: the powder at the top of the sealed $Au_{75}Pd_{25}$ capsule is a granulite, representative of the lower crust, while the sample powder at the bottom of the capsule consists in the shoshonitic basalt, for the first set of experiments and in the calcalkaline, for the second ones. The granulite is a meta-anorthosite rock with 80 % modal plagioclase (An_{40-50}) leucocratic layers and 20 % modal phlogopite, garnet (Alm_{36} - Grs_{29}- Prp_{25}), and hornblende melanocratic layers.

Experiments performed at 0.8 GPa and 1200 ˚C show the interaction between basaltic melts, in superliquidus conditions, with about 50 % modal of partially molten granulite. The chemical composition of both basalts is constant from the bottom of the capsule up to the contact with the granulite. Plagioclase, rare apatite and glass constitute

the paragenesis of the crustal material (i.e. granulite). The anhedral apatite crystals are typically 50 μm long, while the plagioclase ranges in size from 10 to 100 μm and the composition becomes more anorthitic compared to that of the starting rock (granulite).

At 1.0 GPa and 1200 ˚C the shoshonitic basalt shows clinopyroxene and plagioclase (about 5 % modal in total) on liquidus close to the contact with granulite. The calcalkaline basalt, on the contrary, is partially crystallised (around 40 % modal) with clinopyroxene, plagioclase and glass paragenesis again at the contact with crustal material. The granulite modal melt fraction decreases considerably up to 30 %: its mineralogical assemblage is composed by only aluminous phases as plagioclase and spinel. Plagioclase is the major constituent (80 % modal) and the spinel, typically 5 μm in size, crystallized around rare partially molten plagioclase crystals.

Independently by the pressure and the shoshonitic and calcalkaline compositions, at the interface between granulite and basalts, new Na-alkali rich liquids are present and neo formation plagioclases crystallized from them.

In conclusion, increasing pressure, the granulite partial melting decreases and the crystallisation degree of basalts increases, but new hybrid melts are always produced. The silica saturation and albitic composition of hybrid melts increase with pressure, compared to the basaltic starting materials.