Origin of mafic melts in the Pamir mountains – Evidence from trace-element and isotopic data of volcanic and plutonic rocks

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The Pamirs at the northwestern corner of the India-Asia collision zone experienced significant Cenozoic crustal thickening, extension, and wrench tectonics; related magmatism was interpreted to result from continental subduction, slab break-off, and lithospheric mantle delamination. Here we present geochemical data from volcanic and plutonic rocks of the Pamir-Tibet plateau to assess their origin and the composition of their source as well as post-melting processes affecting their composition prior to eruption.

REE patterns of volcanic rocks from the Central Pamir (CP) are enriched ($(La/Yb)_n$=7.0-13.5) and steep for the LREE ($(La/Sm)_n$=2.8-4.4), but relatively flat and depleted for the HREE ($(Tb/Lu)_n$=1.5-1.1) at unradiogenic $^{143}Nd/^{144}Nd$ ratios (ε_{Nd}~-8), indicative for a refertilized, moderately depleted mantle source and assimilation of a crustal component. In contrast, volcanic samples from the Northern Pamirs (NP) are less enriched with variable $(La/Yb)_n$ and $(La/Sm)_n$ ratios (0.7-9.1 and 0.6-4.2, respectively), and have strongly depleted, flat HREE patterns ($(Tb/Lu)_n$=0.9-1.1) and radiogenic $^{143}Nd/^{144}Nd$ ratios (ε_{Nd}~+3), indicative for a variably refertilized but multiply-depleted, refractory mantle source. All samples share negative Nb-anomalies, consistent with a subduction and/or crustal related origin.

Calculated melt compositions fit the observed trace-element patterns in the volcanic rocks if a primitive to depleted mantle composition and 3 - 8% melting in the spinel stability field is assumed for the NP samples, but an enriched source for the CP samples. To fit the Nb and Zr compositions in both groups, the sources are required having negative Nb, but positive Zr anomalies. This decoupling of the HFSE elements (Nb-Ta vs. Zr-Hf) suggests the influence of a crustal source component, possibly crustal melting during continental subduction.

Sound velocity measurements of polycrystalline clinohumite and phase A at high pressure

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Acoustic velocity of polycrystalline aggregates of dense hydrous magnesium silicate phases (DHMS) clinohumite ($Mg_9Si_4O_{16}(OH)_2$) and phase A ($Mg_7Si_2O_8(OH)_6$) have been measured at high pressure and room tempearature condition. The starting materials have been prepared by gel-technique and synthesis experiments were conducted in rocking piston cylinder and multianvil apparatus (Schmidt & Ulmer, *GCA*, 2004) to produce homogenous polycrystalline aggregates. The obtained specimens are homogeneous with small grain sizes of less than 20 micrometers, free of microscopic cracks, devoid of preferred orientation, and with bulk densities greater than 95% of the theoretical value. They are appropriate for the study of sound wave propagation velocites.

Measurements were conducted in a 6/8 multi-anvil device utilizing ultrasonic wave propagation technique. Pulses were created by Li-Niobate dual transducers with a resonant frequency in the range 10-40 MHz that generate both compression (P) and shear (S) waves simultaneously. A sin(x)/x signal was propagated through the rock sample and reflections were collected to measure travel times that, in turn, were used to determine elastic wave velocities. To date, experiments have been performed in the pressure range 1 to 10 GPa at room temperature for different samples to confirm the reproducibility of the experiments. Future experiments will be designed to measure the propagation velocities of the DHMS phases clinohumite and phase A under high pressure and simultaneous high temperature to evaluate the effects of hydrous phases in deeply subducted oceanic lithosphere on the resultant seismic velocity profiles.