



Mineral chemistry and thermobarometry of peridotite xenoliths from Central Tien Shan basalts

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Meso-Cenozoic basaltoids were revealed in the Tien Shan on a vast area (>285.000 km²), from the mountainous framing of the Fergana basin in the west to the Dzhungar Alatau spurs in the east. They occur as dikes and stocks among the Paleozoic Tien Shan complexes. Basaltic flows and sills were found among the deposits of the Suluterek Formation localized in the basement of the section of continental sediments filling the Tien Shan neotectonic depressions. In the Toyun basin in China and in the Fergana valley, basaltic flows and sills occur among Cretaceous-Paleogene marine deposits. Meso-Cenozoic effusive bodies are mainly olivine and plagioclase basalts. The trace- and rare-earth-element compositions of rocks show that most of the studied basaltic series in the Tien Shan formed in within-plate magmatic systems related to mantle plume sources.

Spinel lherzolite xenoliths were found in basalts from Ortosu sites located in Kyrgyzstan. New basalt sites with ultramafic xenoliths have high significance for reconstruction of the composition, structure and evolution of the upper mantle of Tien Shan and geodynamic processes in Central Asia.

Spinel lherzolite xenoliths are characterized by an anhydrous four-phase mineral assemblage: olivine, clinopyroxene, orthopyroxene, and brown Cr-spinel. Peridotite textures are largely protogranular. Rock forming minerals have high Mg# = 0.87-0.91 in Ol, 0.87-0.91 in Opx, 0.88-0.91 in Cpx, and 0.75-0.77 in Sp. NiO content in olivine reaches 0.4 wt.%. Clinopyroxenes are Cr-diopside and characterized by high Al₂O₃ (4.6-7.5 wt%), Cr₂O₃ (0.7 – 1.11 wt%), Na₂O (1.4-1.7 wt%) contents and 0.44-0.5 Ca/(Ca+Mg) ratio. Cr/(Cr+Al) ratio in spinel is equal to 0.09-0.18.

Temperatures of equilibration for spinel lherzolites range from 920 to 1150C for Opx-Cpx thermometer and from 920 to 1070C for Ca-in-opx thermometer of Brey, Kohler (1990) and 912-1080C for Opx-Cpx thermometer of Wells (1977). Pressures calculated from Cpx barometer of Nimis (1999) are in the range 14 to 17 kbar. The spinel lherzolite xenoliths represent the uppermost mantle beneath Central Tien Shan.

Based on these calculated P-T conditions, spinel lherzolite types closely match a local geotherm substantially hotter (~70-80 mW/m²) than that the lithospheric mantle beneath the Siberian platform (45mW/m²) and close to estimates of thermal flow for the Baikal rift zone and South-eastern Australia (70 mW/m²). The relatively high equilibration temperatures of the mantle xenoliths in Ortosu basalts are largely attributable to the plume occurring beneath Central Tian Shan in Meso-Cenozoic.