Petrology and Geochemistry of Devonian Adakite, Boninite and Related Volcanic rocks of Altay area, Xinjiang, NW China.

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We carried out bulk rock major and trace element X-ray fluorescence analyses on 26 samples and mineral analyses on representative samples of the Devonian adakite, boninite and related volcanic/plutonic rocks in the Altis-Altay area, Xinjiang, NW China. These volcanic/plutonic rocks constitute the arc member of the Paleozoic crustal growth in central Eurasia (Sengor et al., 1993, Nature, 364, 299). The adakite occurs in only minor area (ca. 100*100m) to the south of Fuyun (46.31.55'N, 89.34.64'E) , and actually occurs as a fine-grained monolithologic volcanoclastic deposit. The adakite consists of mineral grains of plagioclase, augite, hornblende, quartz, magnetite, and lithic grains of predominant hornblende andesite and pyroxene andesite. The bulk rock composition has SiO2=55.1 wt%, with very high Sr/Y ratio of 121-135 and low Y (14-16ppm). Although the rock represents clastic deposit, the plagioclase contains up to 1.3wt% of SrO, which confirms the rock be classified as adakite of Defant and Drummond (1990). The very high Sr/Y ratio with Y content of ca.15 ppm is only produced in the absence of plagioclase in the residual at pressures of more than 15kb, and the Altay adakite represents the partial melt of the subduced slab in the Paleozoic time.

The boninite occurs ca.20km west of Fuyun(46.55.22'N, 89.16.03'E), as pillow lava or pillow breccia and also as a ophiolitic mélange component along with alkali basalt and gabbro. The rocks are metamorphosed, but retains the original porphyritic textures, consisting ca. 15 vol.% phenocrysts of clinopyroxene and olivine. Only Clinopyroxene is present as a relict mineral, partly replaced by hornblende- actinolite, epidote, calcite, and chlorite. Most of the relict clinopyroxene has Mg# (=100*Mg/(Mg+Fe)) of 90-92, with Cr2O3 contents of 0.8-1.2 wt%. The groundmass consists of actinolite, chlorite, albite, and interstitial phase, which is too fine grained to analyze. The bulk rock composition of the boninite is, SiO2=56-58(anhydrous basis), TiO2=0.27-0.28, Al2O3=10.7-11.4, FeO*=7.4-7.5, MgO=8.6-9.6, CaO=9.0-10.3, Na2O=1.6-2.1, K2O=2.5- 2.7, and P2O5=0.2-0.36wt%. Ni and Cr contents are 95-142 and 322-563 ppm, respectively. The boninite is characterized by low REE, and HFS elements and also by high Ba (1100-1300ppm) content. It can be classified as Ca-rich boninite of Crawford et al.(1989). Althgouh Falloon & Danyushevsky (2000, JP) suggested that high-Ca boninite may generate at water- undersaturated (2-3wt% H2O) high temperature (-1480) conditions, these experimental melt composition are much higher in MgO (16-27 wt%) than the Altay boninite. The chromian cpx phenocryst in the Altay boninite is almost in Mg-Fe partition equilibrium with the bulk rock composition, suggesting that the primary magma of the Altay boninite has MgO content of ca. 10 wt.%. We suggest that the Altay high-Ca boninite is formed by melting of mildly refractory mantle peridotite fluxed by slab-derived fluid component.

Basaltic rocks occurring in association with boninite, and in another locality ca.50 km northwest of Buerjin (48.19.4'N, 86.20.6'E) occurs as massive lavas, tuff breccia, lapilli tuff and blocks in tectonic mélanges. They show aphyric to sparsely-phyric texture, and mostly metamorphosed into minerals of actinolite, chlorite, epidote, albite, carbonate, quartz, iron oxides. Relict clinopyroxene is present. The bulk rock composition show variation in MgO contents (4.0-10.7wt%), and TiO2 content (0.3-2.8wt%). High total alkali contents and presence of titan-augite in the groundmass suggest most of them can be classified as alkalic basalt. High Ba/Rb ratio and Th/Ta ratio of these basalt suggest that they formed under island-arc tectonic setting.

The present study showed that the Devonian volcanic rocks of the Altay area were formed by magmatism associated with young plate subduction in island-arc tectonic settings.