Geophysical Research Abstracts
Vol. 21, EGU2019-12191, 2019
EGU General Assembly 2019

Controls of subduction zone on Paleozoic magmatism, crustal thickness and ribbon continental geometry in Central Asian accretionary orogeny

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The late Paleozoic magmatic activity is characterized by episodic magmatism, which can be regarded as the important tectono-magmatic events in southwestern Central Asian Orogenic Belt (CAOB). Three representative granitic batholiths (Husite, Dongdujing and Jibuke) with two groups of different ages from Northern Yili Block were selected for this study. These granitic batholiths mainly consist of monzogranite, K-feldspar granite and granodiorite. On the basis of the geochronological and geochemical data, these samples can be divided into two groups: Group 1 is the samples from the Husite batholith with the ages of the Late Devonian (374-369 Ma) and Group 2 is the samples from the Dongdujing-Jibuke batholith with the Late Carboniferous ages (ca.304 Ma). They have similar major and trace elements contents, but distinct Sr-Nd-Hf isotopic compositions. Most of these granitoids show high-K calc-alkaline and metalumious affinities. They are enriched in large ion lithophile elements (LILE) and depleted in high field strength elements (HFSE), and contain low Sr/Y (3.4-20.7) and Sr (96-431 ppm) values, indicating typical arc geochemical affinities. They have variable SiO_2 (62.6-72.9 wt.%) and $Fe2O_3T$ (2.54-5.21 wt.%) contents, and Mg# (33-51) values. Group 1 granitoids have slightly higher initial 87Sr/86Sr ratios (0.7075-0.7089) but lower εNd(t) (+0.3 to +0.9) values than those of Group 2 granitoids (87Sr/86Sr(i)= 0.7060-0.7066 and εNd(t)= +1.7 to +2.0). Group 1 granitoids show the lower εHf(t) (-3.62 to +6.79) values and older TCDM (0.90-1.61 Ga) than those of Group 2 granitoids (εHf(t) of +1.21 to +11.3 and TCDM of 0.56 to 1.25 Ga). These geochemical features indicate that the two groups of granitoids were derived from a hybridized source of the Proterozoic basement rocks with various degrees of Paleozoic juvenile materials input, i.e. Group 2 granitoids have greater contribution of Paleozoic juvenile materials than Group 1. Therefore, the Devonian to Carboniferous igneous rocks along the Northern Yili Block were probably formed in the southward subduction of Junggar oceanic plate, which made contribution to massive crustal growth of Northern Yili Block. Integrating with the previous geochemical data, the granitoids of this study a define striking secular εHf(t) - εNd(t) trend: these values decrease from 400 to 350 Ma and increase from 350 to 300 Ma. Besides, the temporal variations in (La/Yb)N of intermediate rocks imply that the continental crust thickened in 400-350 Ma, but thinned in 350-300Ma. In addition, the Devonian-Carboniferous magmatism temporal-spatial feature in the study area shows that the ages of igneous rocks perpendicular to the trench direction gradually become young after ca. 350 Ma. These characteristics probably reflect a tectonic switch of Northern Yili Block from an Andean-type (advancing subduction regime) to a Western Pacific-type (retreating subduction regime) active continental margin at ca. 350 Ma. With the retreat of the trench after ca. 350 Ma, the North Tianshan Accretionary Complex was intruded by voluminous granitic rocks, and the Awulale Mountain was developed into an immature back-arc basin due to extension.

Acknowledgement
This study was financially supported by National Science Foundation of China (41622205) and Hong Kong RGC grants 17302317 and 17303415.