SEG 2017 Conference

Geochemical and petrological studies on the early Carboniferous Sidingheishan mafic-ultramafic intrusion in the southern margin of the Central Asian orogenic belt, NW China

Tao Sun*, Zhuang-Zhi Qian, Joyashish Thakurta, Shu-Cheng Tan, Wan-Ting Li, and Ai-Ping Zhang

School of Resource Environment and Earth Sciences, Kunming, China, *e-mail, suntao06@126.com

The Sidingheishan mafic–ultramafic intrusion is located in the eastern part of the northern Tianshan Mountains, along the southern margin of the Central Asian Orogenic Belt in northern Xinjiang Province of China. The intrusion is mainly composed of wehrlite, olivine websterite, olivine gabbro, gabbro, and hornblende gabbro. At least two pulses of magma were involved in the formation of the intrusion. The first pulse of magma produced an olivine-free unit and the second pulse produced an olivine–bearing unit. The magmas intruded the Devonian volcanic–sedimentary rocks of the Que'ershan Group along with the associated granites and granodiorites. An age of 351.4 ± 5.8 Ma for the Sidingheishan intrusion has been determined by U-Pb SHRIMP analysis of zircon grains separated from the olivine gabbro unit. A U-Pb age of 359.2 ± 6.4 Ma from the gabbro unit has been obtained by LA-ICP-MS. Olivine of the Sidingheishan intrusion reaches 82.52 mole % Fo and 1414 ppm Ni. On the basis of olivine-liquid equilibria, it has been calculated that the MgO and FeO included in the parental magma of a wehrlite sample were approximately 10.43 wt.% and 13.14 wt.%, respectively. The Sidingheishan intrusive rocks are characterized by moderate enrichments in Th and Sm, slight enrichments in light REE, and depletions in Nb, Ta, Zr, and Hf. The εNd(t) values in the rock units vary from +6.70 to +9.64, and initial $^{87}Sr/^{86}Sr$ ratios range between 0.7035 and 0.7042. These characteristics are collectively similar to the Heishan intrusion and the Early Carboniferous subduction-related volcanic rocks in the Santanghu Basin, northern Tianshan and Beishan areas. Crystallization modeling methods suggest that the parental magma of the Sidingheishan intrusion was generated by flush melting of the asthenosphere and subsequently there was about 10% contamination from a granitic melt. This was followed by about 5% assimilation of upper crustal rocks. Thus, the high-Mg basaltic parental magma for the Sidingheishan intrusion is interpreted to have formed from partial melting of the asthenosphere during the break-off of a subducted slab.