SEG 2017 Conference

The genesis of magmatic Ni sulfide deposits from recycling of continental crust: Geochemical and geochronological evidence from the post-collisional Kaipinggou mafic-ultramafic complex, North Qaidam orogen, China

Pengjie Cai*, Rongke Xu, Youye Zheng, Jia Liu, Xin Chen, and Xiaozeng Chen

Institute of Geological Survey, China University of Geosciences, Wuhan, China, *e-mail, caipengjie@cug.edu.cn

The Kaipinggou mafic-ultramafic complex in Qinghai Province, China, is located in the north region of the Qaidam region, which is bordered by the Qaidam block to the south and the Qilian block to the north. The Kaipinggou area contains two mafic-ultramafic complexes that have been emplaced into metamorphic rocks of the Dakendaban and Yuka Groups. A belt of nickel mineralization belt is found at the base of the complex. The Kaipinggou mafic-ultramafic intrusions comprise multiple crystallization cycles. A sample of serpentinized dunite from the Kaipinggou complex yields an age of 416 ± 3.2 Ma, which is interpreted as the time of magmatic crystallization. Considering the tectonic evolution of the region, the complex probably formed in a post-collisional, extensional regime. Samples from the Kaipinggou complex show arc-like trace element distribution patterns with low Nb/U and TiO_2/Al_2O_3, indicating the intrusions were derived from continental crust-derived melts that had previously been modified by abundant subduction-related aqueous fluid, and that experienced assimilation–contamination during ascent. The nickel-rich sulfide mineral assemblage is pentlandite-heazlewoodite, indicating origination from a sulfur-poor magma source. The Kaipinggou mafic-ultramafic rocks are characterized by LILE and LREE enrichments, Nb and Ta negative anomalies and a depletion in HFSE. Considering the regional geology, above age data, and the above petrochemistry, we propose a process whereby post-collisional and extensional mafic magmatism in the Qaidam orogen was important for the mineralization. Early Paleozoic oceanic crust subduction occurred in the southern Qilian Ocean between the Qaidam and Qilian blocks. The subducting dense oceanic lithosphere would serve as a pulling force for subsequent subduction of light continental lithosphere. The felsic melts, which were derived from partial melting of continental crust during deep subduction, metasomatized the peridotite of the overlying juvenile subcontinental lithospheric mantle wedge to generate mafic-ultramafic metasomatites. Partial melting of the metasomatites gave rise to mafic-ultramafic magma, which experienced assimilation–contamination during ascent. Upon arrival in the Kaipinggou dynamic conduit system, multistage magmatism was characterized by formation of alternating sulfide-poor and sulfide-rich zones. Similarly, the variations in lithology and Ni content in the Kaipinggou mafic-ultramafic complex reflect different sulfide liquid compositions during the development of the ore system.