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Geochronological, petrological and geochemical constraints on the origin of the Daxueshan magmatic Ni-Cu deposit in the northern part of the Sibumasu Block, SW China

Jun Deng*, Gongjian Li, Chusi Li, Jinyu Liu, Edward M Ripley

*State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Beijing, Beijing, China, Email: djun@cugb.edu.cn

The Daxueshan magmatic Cu-Ni sulfide deposit is located in the northern part of Sibumasu Block, SW China. It contains ~0.52 million tons of sulfide ores at 0.67 wt.% Ni and 0.46 wt.% Cu. The age, petrology and geochemistry of the deposit are reported here for the very first time. The host rocks of the deposit are mainly harzburgite and lherzolite. Mineralization occurs in the base of the intrusion, mainly associated with harzburgite, as gently dipping (10° to 30°) disseminated sulfide zones with thickness ranging from 4 to 13 m, generally parallel to the layering structure of the intrusion. Rare small massive sulfide veins cross-cutting the layering structure are also present in the vicinity of the concordant disseminated sulfide zones. The principle sulfide minerals in both occurrences are pyrrhotite, pentlandite and chalcopyrite. The δ34S values of the sulfide minerals vary from -2.6 to 1.2‰, slightly larger than the range for MORB (-1.57 to +0.60 ‰, Labidi et al., 2013). SHRIMP U-Pb dating of zircon crystals from lherzolite yields a crystallization age of 300.5±1.6 Ma for the intrusion. The forsterite contents of olivine in the intrusion vary from 76 to 80 mol%. Coexisting clinopyroxene has augite composition. The whole rocks are characterized by moderate light REE enrichments relative to heavy REE (LaN/YbN >2) and pronounced negative Nb-Ta anomalies, similar to the characteristics of coeval arc basalts in the region. The (87Sr/86Sr)i ratios and εNd(t) of the Daxueshan ultramafic intrusive rocks are from 0.7116 to 0.7139 and from -6.10 to -7.09, respectively. These values are slightly higher and lower than those of the coeval basalts, which can be explained by up to 20 wt.% more crustal contamination for the ultramafic intrusive rocks than the associated basalts. Such difference supports the premise that sulfide saturation in the Daxueshan magma was induced by extensive crustal contamination. Like other arc-type magmatic sulfide deposits worldwide, the PGE tenors of the Daxueshan deposit are very low and the inferred initial concentrations of PGE in the parental magma are more than one order of magnitude lower than those in the undepleted picritic basalts worldwide. It is suggested that Ni exploration in the region focus on the ultramafic intrusions with ages and lithochemical compositions similar to those of the Daxueshan ultramafic intrusion.