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Genesis of the Huangshandong Cu-Ni deposit in Eastern Tianshan, Central Asia orogenic belt: Constraints from U-Pb and Re-Os geochronolgy and Sr-Nd isotopes

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The Eastern Tianshan metallogenic belt is one of the most important iron-copper-nickel-gold metallogenic belts in China. Many Cu-Ni sulfide deposits (Huangshan, Huangshandong, Xiangshan) were discovered in the 1970s. Geochronological studies for ore and host rock of the Huangshandong Cu-Ni sulfide deposit have utilized the Sm-Nd, Rb-Sr, and K-Ar isotopic systems, which have yielded ages ranging from 270 Ma to 317 Ma during various studies. This range of ages introduces a degree of uncertainly in timing and interpretation of the geodynamic evolution and tectonic setting of these magmatic systems and associated ore deposits. We report new and accurate measurements of the mineralization age using the Re-Os isotope system and of the formation age of the host rock using the zircon U-Pb isotope system. We also report the Sr and Nd isotopic characters of host rocks to indicate the geodynamic and tectonic environment. The Re-Os isochron age of 289.6±7.7 Ma for pyrite from the Huangshandong deposit obtained in this study is consistent with the Re-Os isochron age of 284±14 Ma reported by previous workers, and is also consistent the the zircon U-Pb age of 296.8±7.5 Ma for the ore-bearing wallrock of the Huangshan intrusion obtained in this study and by SHRIMP zircon age at 287±5 Ma by prior workers. The above age data indicate that the Huangshan intrusion and the associated Cu-Ni sulfide Huangshandong deposit were formed during the Permian. Eight ore-bearing wallrock samples were collected for Nd and Sr isotope analysis. The initial $^{87}Sr/^{86}Sr$ and $\varepsilon Sr(t)$ range from 0.7033~0.7045 and -12~4, respectively. The initial $^{143}Nd/^{144}Nd$ and $\varepsilon Nd(t)$ range from 0.51265~0.51267 and 1~8, respectively. These isotopic characteristics indicate that the intrusion was mainly derived from a depleted mantle. But the γOs mean value of ~99 for pyrite indicates more crustal components contributed to the Huangshandong Cu-Ni deposit during the ore-forming process.