Selenium isotope variations in weathering zones of Se-rich carbonaceous rocks at Yutangba, China

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Extremely selenium-rich carbonaceous chert and carbonaceous shale occur in the Permian Maokou Fm. of Yutangba, 81km SE of Enshi city, China. Rock and soil can exceed 1000 mg/kg Se, and human and livestock Se poisoning has been reported. Selenium isotope variations in weathering zones of Se-rich carbonaceous rocks were investigated to determine the mechanism of Se enrichment. Mass-dependent fractionation of Se isotopes is caused mainly by reduction of Se oxyanions and thus serves as an indicator these reactions. $^{82}Se/^{76}Se$ ratios were measured by double spike MC-ICP-MS, with 0.20 per mil precision. $\delta^{82}/^{76}Se$ in fresh carbonaceous shale and chert, with 185 ±76 mg/kg Se(n=12), fell within a narrow range, from -0.03 to 1.38‰, (vs. SRM3149) with an average of 0.71±0.49 ‰. Drill core samples from >50m depth, averaging 108 ±54 mg/kg Se (n=25), also have a narrow range of $\delta^{82}/^{76}Se$, from -2.54 to +1.74 per mil with a mean of 0.08±0.98 ‰. In contrast, outcrop samples from a horizontal transect across the nearly vertical, partially weathered beds exposed in a shallow quarry are extremely Se- rich (106-26054mg/kg Se with a mean of 2774 mg/kg; n=45), show very wide Se isotope variation, from -13.19 to +11.37 per mil. This indicates most of the Se has undergone at least one cycle of oxidation, transport, re-reduction, and precipitation in these organic-rich rocks. The pattern of isotopic variation predicted by a simplified model of the system is heavy isotope depletion in zones that Se-rich infiltrating waters encounter early in their downward migration, and heavy isotope enrichment in less accessible zones that receive Se after it has been partially reduced. The observed pattern fits this model, though the fracture-dominated system is complex and other factors may be involved. The mechanism of Se enrichment appears to be repeated oxidative mobilization and reductive re-precipitation, with Se trapped within a redox front that migrated downward along near-vertical bedding planes as the land surface lowered.

This project was supported by NSF of China (Grant No. 40573050)

LA-ICP-MS single particle zircon U-Pb dating and metallogenetic tectonic setting of Jingduicheng large-scale porphyritic molybdenum deposit in East Qinling, P.R. China

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Introduction

A precise U-Pb dating based on single particle zircon laser probe dating technology (LA-ICP-MS) and petrologic and ore geochemical study have been applied to ore-bearing porphyry of Jinduicheng large-scale porphyritic molybdenum deposit in East Qinling.

Discussion and Result

The weighted average age by Single Particle zircon U-Pb dating of the porphyry is 140.95±0.45Ma, which is consist with the lower limit molybdenite Re-Os model age dated by the former researchers [1]. This indicates that the period of mineralization was almost simultaneous with the diagenesis or slightly later. These two events were involved in the same system of J-K, which was tally with the geodynamical event of extend happened in the period of tectonic system conversion in about 140Ma at east China [2, 3]. The pluton-forming and the molybdenum mineralization took place in the extrusion-extension transforming stage in J-K, and the corresponding tectonic setting was the intracontinental orogenic and extention process after collision and orogenesis of Yangz plate and Northern China plate [2].

Jinduicheng ore-bearing porphyry and deposit geochemical data indicate that the metallogenetic substance origin from deep earth, and was generated by mixing of lower crust and upper mantle. When the molybdenum enriched magma intruding to the upper crust along structure weakness zones, ore-forming fluid generated by magma condensation fraction filling in the cracks and replacing the surround rock, then the deposit was formed.

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