Paper Number: 1806

New precise timing constraints for Keketuohai pegmatite No.3 vein, Altaid Orogen, Northwest China

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Hundreds of thousands of pegmatite veins were formed during the Altay orogen in northwest China. It is worldwide known that the Keketuohai pegmatite No.3 vein is the most typical pegmatite characterized by a superlarge scale composite rare metal-bearing deposit. Presently, the age of mineralization is still a matter of debate. Our work constrains more precisely the age of formation of this vein, by Re-Os dating of molybdenite.

Keketuohai No.3 rare metal-bearing pegmatite vein is situated in Paleozoic Kanas-Keketuohai magmatic-arc, the middle North Altay, an active belt at the continental edge of the Sinerian block. The vein occurs in the southern outer-contact zone of the Aral granite. it consists of an upper vertical pipe and a slightly tilted vein at the bottom. Based on mineralogical assemblages, the vertical pipe can be divided into nine internal zones, forming a perfect homocentric ring from outside to the center of the kupola [1].

Six molybdenites were sampled at the contact between the vertical pipe and its wallrock, which represents the outer zone of No.3 vein. Their model ages vary from 207.8 ± 3.8 Ma to 212.2 ± 3.5 Ma, yielding an average weighted age of 209.9 ± 1.3 Ma (MSWD = 0.69). This model age is consistent with the isochron age of 208.8 ± 2.4 Ma (MSWD = 0.89), implying that isotopic decoupling of Re-Os within molybdenites can be neglected[2]. The age of 209 Ma or 210 Ma can represent the time of molybdenite depositing from the hydrothermal fluid. Previously published ages related to No.3 vein by K-Ar, Rb-Sr and Ar-Ar dating indicates a range of crystallization ages. According to previous studies, multiple periods of strong tectonic activities took place in the Altay orogenic belt. During the formation of the pegmatite, hydrothermal activity is also very intense. So timing contraints using K-Ar or Ar-Ar dating technique may cause obvious ages differences. Rb-Sr isotope, in complicated granitic pegmatite, can generate a wide range of ages[3]. Based on a detailed study, using Rb-Sr isotopic data which Zhu et al. [4] obtained from No.3 vein, Zhong et al. [5] have discovered that the Rb-Sr isotopic system is really disturbed or open. We found that there are complications concerning the zircon ages from the No. 3 vein obtained by SHRIMP and LA-MC-ICP-MS techniques. The complication is that the U content in zircon is generally high, most zircons were altered in varying degrees and the metamictization developed in many zircons, caused by the radioactive decay of U and Th [5]. However, after the formation of the molybdenite, it is very difficult to destroy and reset the Re-Os isotopic system[6]. Re-Os age of molybdenite is often used to constrain metallogenic age. Geologically, the crystallization of molybdenites we have collected is nearly simultaneous with the formation of the marginal zone of the vein. So we can infer that the formation of No.3 vein began around 209 Ma or 210 Ma, which correspond to the late middle-Triassic, middle Indosinian.

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