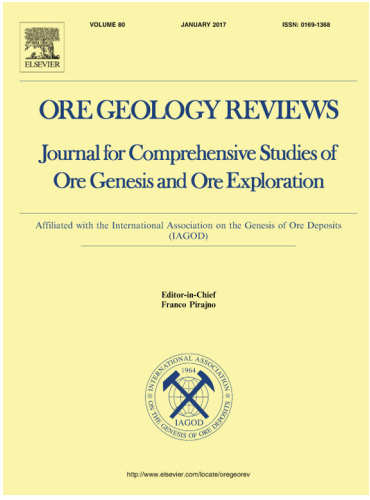

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Ore genesis and hydrothermal evolution of the Wulandele Mo deposit, Inner Mongolia, Northeast China: Evidence from geology, fluid inclusions and H–O–S–Pb isotopes

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Abstract: The newly identified Wulandele Mo deposit is located in the western part of the Great Xing'an Range, Northeast China. Molybdenum mineralization generally occurs as veins or disseminations hosted in Permian to Cretaceous granitic intrusions, associated with potassic alteration, silicification, greisenization and propylitic alteration. The ore-forming process can be divided into four stages: quartz ± K-feldspar ± biotite ± pyrite (stage I), quartz + molybdenite ± K-feldspar ± pyrite (stage II), quartz + chalcopyrite ± bornite (stage III), and quartz + carbonate (stage IV). Combined fluid inclusion microthermometry and stable and Pb isotopic compositions are used to constrain the hydrothermal processes and ore genesis of the Wulandele Mo deposit. Fluid inclusion data show four types of fluid inclusion assemblages (FIAs), i.e., L_0 (liquid-rich two-phase FIAs), V_0 (vapour-rich two-phase FIAs), C (CO_2-rich FIAs), and rare L_1 (liquid-rich three-phase FIAs with one transparent mineral), but only the former three types of FIAs were analysed. Aqueous and carbonic fluid inclusions occur in quartz veins of stages I and II, and only aqueous inclusions are observed in stages III and IV. Hydrogen and oxygen isotopic compositions of quartz indicate a primarily magmatic origin, and the proportion of meteoric water increased during the ore-forming process. Sulfur ($\delta^{34}S_{VCDT}$ = 1.90–4.19‰) and lead isotopes suggest that the ore-forming materials came predominantly from magmatic fluids. The Wulandele Mo deposit was formed by an initially high-temperature, high-oxygen fugacity and CO_2-rich fluid system at an estimated depth of ~0.4 to 3.3 km. Decreases in temperature and fO_2 as well as the input of meteoric water were critical factors for sulfide precipitation. Combining

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