

# **Molybdenum solubility and partitioning in CO<sub>2</sub>-rich fluids: Implication for the formation of Collisional-type porphyry Mo deposits**

NUO LI

Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences

Presenting Author: [linuo@ms.xjb.ac.cn](mailto:linuo@ms.xjb.ac.cn)

The Mo deposits from the Qinling-Dabie area, central China, which are characteristic for a new type of porphyry Mo deposits named the Collision-type, were formed in CO<sub>2</sub>-rich magmatic-hydrothermal environments. Yet the effects of CO<sub>2</sub> on molybdenum transport and precipitation are still poorly known. To fill this gap and provide insight into the formation of Collision-type porphyry Mo deposit, we performed high pressure experiments to systematically quantify the role of CO<sub>2</sub> on the solubility of molybdenum-bearing phases. Molybdenite was placed together with a single-phase H<sub>2</sub>O-CO<sub>2</sub>-NaCl fluid (8 wt.% NaCl.eqv) at 600 °C and 200 MPa. The experiments were buffered by the pyrite-pyrrhotite-magnetite assemblage. At such conditions, combined microthermometric and LA-ICPMS analysis of synthetic fluid inclusions reveals that the molybdenite solubility in the fluids coexisting with molybdenite decreases slightly (from 87 ± 17 ppm to 38 ± 13 ppm) with increasing CO<sub>2</sub> (from X<sub>CO<sub>2</sub></sub>=0.10 to 0.25 molar fraction). Such a Mo solubility is comparable to that determined in CO<sub>2</sub>-free fluids (61 ± 14 ppm) with the same salinity. At X<sub>CO<sub>2</sub></sub>=0.33, fluid immiscibility is observed and Mo would partition preferentially into the brine phase, with a  $D$  value of 2.9 ± 1.0 (1s). The evolution of molybdenite solubility with increasing CO<sub>2</sub> in the fluid may be explained by changes of the dielectric constant of the solvent. Our results demonstrate that at the studied experimental temperature and pressure, CO<sub>2</sub>-rich fluids can transport comparable amounts of molybdenum as in H<sub>2</sub>O-dominated solutions. Combined with existing literature data over a broad range of pressure, temperature, and oxygen fugacity conditions, our data indicate that decreasing temperature and oxygen fugacity facilitate molybdenite precipitation. Albeit the nil-to-negative effect of CO<sub>2</sub> on molybdenum solubility, the presence of CO<sub>2</sub> would affect significantly fluid saturation of silicate melts. Notably, boiling is expected to occur at higher pressure in the presence of CO<sub>2</sub>, which may explain the deeper mineralization depth observed for the Collision-type porphyry molybdenum deposit.