Geophysical Research Abstracts
Vol. 20, EGU2018-4069, 2018
EGU General Assembly 2018

Rutile geochemistry of Sangdong W-Mo-Bi deposit, Republic of Korea

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Sangdong W-Mo-Bi deposit is the richest W deposit in Republic of Korea. The main scheelite-molybdenite mineralization in the deposit occurs in skarnized intercalated carbonate-rich layers in the Cambrian shale formation (Myobong formation), while some Mo mineralization also occurs in the underneath Cambrian quartzite formation (Jangsan formation) as quartz veins. The skarn in the Myobong shale is subsequently crosscut by series of quartz veins forming alterations of amphibole → mica (biotite + muscovite) → muscovite. Major W-Mo ore deposition in the Sangdong deposit is associated with the mica alteration. Muscovite ^{39}Ar-^{40}Ar age of the ore-bearing veins are 86-87 Ma. The Mo-bearing quartz veins in the Jangsan quartzite formation contain minerals of quartz, K-feldspar, zircon, monazite, rutile, molybdenite, wolframite, arsenopyrite, pyrite, and bismuthnite. Redox–sensitive trace element such as Mo and REE patterns in the scheelite from the Sangdong deposit indicate that a host-controlled redox change in the hydrothermal fluids might control the major molybdenite precipitation.

Rutile in the Sangdong deposit occurs in quartz vein (with molybdenite, wolframite, pyrite, zircon, monazite, sericite, K-feldspar) and in alteration zone (with sericite, pyrite, zircon, monazite, K-feldspar and apatite). We identified two types of the rutile grains by its geochemistry. First type is nearly "pure rutile" that contains very low contents of trace elements, and second type is "enriched rutile" that contains high contents of trace elements (such as W, V, Nb, Cr and Fe). By the LA-ICP-MS microanalysis of the pure and the enriched rutiles, we detected Mg, P, Sc, Mn, Cu, Zn, Ga, Zr, Mo, In, Hf, Ta, and U. Trace elements in the enriched rutile have higher concentration of Al (6 times), Sc (22 times), V (23 times), Mn (5 times), Fe (7 times), Cu, Zn, Ga, Zr (17 times), Nb (19 times), Mo (94 times), Hf (19 times), Ta (30 times), and U (16 times) compared to the pure rutile. However, some trace elements such as Sn (8 times) and In (8 times) in pure rutile are higher compared to the enriched rutile. The two rutile types are suggested to be due to the "exogenic" rutile grains transported by hydrothermal fluids or the rutile precipitated from the hydrothermal fluids.