A study on the formation mechanism of Temagami Iron-Formations, Canada

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In order to elucidate systematically the formation mechanism of BIF (Banded Iron-Formations), a BIF sample collected at Temagami, Canada was characterized by optical microscope, EPMA, Xray microscope, SIMS, and chemical analysis. This BIF can be divided into three layers visually; black layer, white layer, red layer. Main minerals in the three layers were magnetite, dolomite and quartz with fine hematite particles respectively.

To estimate the formation temperature of each three mineral and the formation environment (especially oxidation-reduction conditions), the oxygen isotope ratios ($^{18}O/^{16}O$) and contents of rare earth elements were measured by SIMS and chemical analysis. The isotope equilibrium temperature of dolomite and magnetite located in the white layer were 250-350ºC. In the rare earth elements pattertns for all the layers, a positive Eu anomaly appeared suggesting contribution of the anoxic submarine hydrothermal fluid for the formation of the BIF. On the other hand, a negative Ce anomaly, which indicates a character of oxic sea water, was observed for a part of samples of the red layer. These dolomite and magnetite may be formed under reduction conditions at high temperature, that is, from mixed water of the large amount of anoxic hydrothermal water of 250-350ºC and the small amount of oxic sea water. While magnetite and dolomite located in the black layer shows lower formation temperature of 100 ºC than that of magnetite and dolomite in the white layer. The latter magnetite and dolomite may be formed from hydrothermal water with high mixing percentage of seawater.

As mentioned above, each mineral in the layers might be precipitate from the fluids formed by mixing of large amount of anoxic submarine hydrothermal fluid with high temperature and small amount of oxic seawater with low temperature. The mixing degree may be different among minerals in the BIF.

High-grade Ag-Cu-Sn-In mineralization in the Nishizawa-Ashio area, Tochigi Prefecture, central Japan

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Mineral Identification and Observation

Polymetallic (Au-Ag-Cu-Pb-Zn-Fe-As-Sb-Bi-Sn-In-W) vein-type mineralization in the Nishizawa-Ashio area occurs in strongly altered late Neogene felsic volcanic rocks. Recently Ishihara (2006) and Ishihara *et al.* (2006) reported that indium had been exploited in ore concentrates (e.g., 1200 tons In at Ashio). At Nishizawa, roquesite and "sakuraiite" ($CuZn_2InS_4$) were identified as discrete In minerals, associated with Pb,Se-bearing matildite, electrum (Au:Ag≒ 5:5–7:3), chalcopyrite, sphalerite (1-2% FeS), cassiterite and quartz. Canfieldite-argyrodite, Se-bearing acanthite, proustite-pyrargyrite, Ag-bearing tetrahedrite-freibergite (Cu:Ag=5.4:4.6-4.2:5.7), smithite and ferbeite (Fe:Mn≒ 9:1) are also observed. Roquesite frequently occurs as radiating prismatic crystals (up to 0.5 mm), and sometimes as intergrowths with "sakuraiite".

Conclusions

In-bearing sphalerite as solid solution between sphalerite and roquesite has been previously reported (e.g., Burke and Kieft, 1980). The roquesite-"sakuraiite" intergrowths at Nishizawa reveal no solid solution between roquesite and sakuraiite, and instead imply that In-bearing sphalerite represents solid solution between sphalerite and incompletely defined"sakuraiite" (with petrukite as an intermediate phase?).

References

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