3.4.P08

Pt/Pt* anomaly and PGE elemental pairs as new tools to trace the origin of sulfide mineralization: Taking the Cambrian Ni-Mo sulfide bed as an example

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Similar to the definition of the Eu anomaly in Chondrite-normalized REE patterns, we define a new parameter of Pt anomaly using the following equation:

$$Pt/Pt^* = \frac{Pt_N}{\sqrt{Rh_N * Pd_N}}$$

Where Pt_N, Rh_N, and Pd_N are the chondrite-nomalized values for the samples. Our study show that most of the crust-derived sources show positive Pt anomaly with large Pt/Pt* values (>1), whereas the mantle-derived sources display negative Pt anomaly with Pt/Pt* close to or less than 1 (Jiang et al., 2003). For example, the Ni-Mo sulfide ore from the Lower Cambrian strata in South China shows low but similar Pt/Pt* values (0.9-2.1) as those of Kuroko-type VMS sulfide ore (0.2-1.2), implying that they both have similar submarine hydrothermal origin.

In a plot of Pt/Pd vs Ir/Pd, we define a crust-derived and a mantle-derived source line (Jiang et al., 2003). Data for the oceanic Fe-Mn nodules and phosphorites fall along the crust line, whereas data for the mantle peridotites and Kuroko-type VMS sulfide ore fall along the mantle line. The Ni-Mo sulfide ore from the Lower Cambrian strata in South China show similar Pt/Pd and Ir/Pd ratios as those for the Kuroko-type VMS sulfide ore, again indicating that they both may have a similar submarine hydrothermal origin. The identification of discharge of hydrothermal fluids into the Cambrian ocean will have great effect on life during Cambrian Explosion period.

Reference

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3.4.P09

Compositional variation of epidote in the Campi Flegrei geothermal field, Naples, Italy

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Epidote is abundant in the calcium-aluminum silicate alteration zone of the Campi Flegrei geothermal field located west of Naples, Italy. This geothermal field has developed in a complex caldera where the last eruption was Monte Nuovo (AD 1538). The Campi Flegrei volcanic system has evolved undersaturated products, mostly trachyte, and defines a large (~12 km) composite caldera. Exploration in search of a high enthalpy fluid, produced drill core and cuttings to ~3km in the Mofete and San Vito areas.

Complex compositional variation such as oscillatory zoning, sector zoning, and patchy zoning is one of the important features observed in epidote. Epidote occurs as veins, in vugs, replacing primary igneous phases, and as isolated single crystals. Commonly associated with epidote are sulfides, such as pyrrhotite, pyrite, galena, arsenopyrite, sphalerite, and molybdenite. Also found are scheelite, and rare Bi-Te, Ni-Fe-S, and Ag-S phases.

Detailed electron microprobe analyses have shown that the compositional zoning is caused by variable Fe^{3+}-Al substitution. Ps [$100Fe^{3+}/(Fe^{3+}+Al)$] ranges from ~Ps7 to ~Ps33. MnO varies from below detection limit (100 ppm) to 2 wt. %. Light rare earths (La, Ce, Nd) are enriched in epidote in zones near allanite cores. Titanite, allanite, and apatite are commonly observed in the cores of zoned epidote crystals. Fluid inclusion and measured downhole temperatures [1] of epidote-bearing samples range from 270 ° - 350 ºC and from 300 ° - 390 ºC for the Mofete and San Vito areas, respectively. The Ps systematically decreases as a function of increasing temperature with a relatively constant host rock composition. However, the Ps variability at any particular temperature reflects compositional zoning. The Ps decrease with depth observed in the Mofete field is more uniform than that in the San Vito field which records recent fault displacement. The variety and complexity of the epidote zoning suggests disequilibrium crystallization and chemical fluctuations in the local hydrothermal system.

References

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