Heterogeneous lead isotopic composition of sulfide mineral in Janggun mine, South Korea

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Lead isotopic compositions (PbIC) of sulfide minerals are frozen since the phases formed because uranium and thorium are not incorporated in their crystal structure. This ensures that no radiogenic lead has been generated and thus, it retains a constant PbIC with time. To quantify the systematic variability of PbIC, ore samples were collected every 10 m in the Janngun mine, South Korea. .

Galena, pyrite, and sphalerite were micro-drilled in microstructurally well-characteized locations. Lead isotopic compositions were measured by multi-collector inductively coupled plasma mass spectrometer.

Analytically well-resolved heterogeneities of the PbIC of the sulfides were observed within each cm-sized polished section. The results fall into two groups: one with $^{206}Pb/^{204}Pb$ between 18.398 ± 0.002 and 18.409 ± 0.001, another between 18.429 ± 0.001 and 18.445 ± 0.001. The $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios co-variate with $^{206}Pb/^{204}Pb$ and range from 15.670 ± 0.002 to 15.687 ± 0.002 and from 38.877 ± 0.004 to 38.892 ± 0.005, respectively. PbIC correlates with texture, mineral assemblage, and sample paragenesis.

Overall, the measured sulfide minerals did not grow in equilibrium with the same fluid. This requires that more than one fluid circulation episode controlled the lead isotopic records. A time-variation of the interaction of the circulating fluid with wall rock can explain the observed heterogeneity.