Lead isotopic variations on sulfides in Janggun deposit, South Korea

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Several Pb isotopic evolution models over Earth's history has been suggested [1, 2, 3]. However, a common feature of all terrestrial Pb models is that the hundreds of supposedly "conformable lead" points scatter unsystematically around any of the models' best-fit curves. This should not happen based only on magmatic differentiation since Pb in sulfides (devoid of U and Th) should freeze in the Pb isotopic composition (PbIC) of the crustal segment from which the ore deposits are formed, to which no radiogenic Pb was added.

We chose the Janggun Pb-Zn-(Ag) deposit in South Korea for our exploration of Pb isotopic homogeneity by closely-spaced sampling and by comparing Pb and S isotopic compositions as well as studies of microscopy, EPMA, trace elements. We collected various sulfides by micro-drilling which allows the in-situ extraction with a resolution of 200μm to 1mm. For country rocks, we prepared at least one leachate and residue for analyses of PbIC and trace elements.

PbIC diagrams require at the very least seven isotopically distinct fluid circulation episodes: at different times, temperature, and above all with different fluid circulation pathways. At the 10m and cm scales, Pb isotopic variations exceed analytical uncertainties by up to two orders of magnitude. S isotopic composition confirms the heterogeneity at the cm scale and at the 10m scale, and the vague proximity of our data to literature data from different areas of the Janggun mine. Leaching of country rocks by circulating fluids is able to produce the observed PbIC in the sulfide minerals, whereby different end-members identified by the Pb isotope correlation diagrams can be linked to different country rocks.

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