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Mineralization of breccia pipes at the Ulaan ore field, northeast Mongolia.

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The Ulaan ore field locates 120 km north of the town of Choibalsa, northeast Mongolia. The geology of the area is composed of Proterozoic and Paleozoic basement rocks and overlying successions of sedimentary rocks and basic to acidic pyroclastics of Mesozoic age. Major geological structure of the area is predominated by the NNW-trending Mukhar fault zone and the EW-trending tectonic fractures crossing to the fault zone. Bodies of breccia pipe appear at the intersection of the Mukhar fault zone and tectonic fracture, and they accompany polymetallic mineralization. Mineralized breccia pipes are explored at the Ulaan and Mukhar mines for Pb-Zn resources. Ores from both mines show similar occurrence; brecciated fragments of silicified pyroclastic rocks of <1 cm to about 10 cm in size are filled with massive aggregate of hydrothermal minerals.
Two ore types are distinguished at the Ulaan deposit. They are epithermal ore composed of quartz -sulfide or quartz-fluorite-sulfide assemblages (U-1) and skarn ore composed of epidote-actinolite that accompanies veinlet of sulfide minerals (U-2). Ores from the Mukhar deposit (M-1) resemble that of epithermal ore of the Ulaan deposit.
Homogenization temperature and salinity of fluid inclusions in quartz and fluorite are measured. They are 233-354 deg. C in quartz and 201-301 deg. C in fluorite. Average salinity of these inclusions in quartz and fluorite are 2.1 and 2.7 wt% NaCl equivalent, respectively. Sulfur isotopic values of sulfide minerals are between 1.0 and 4.5 per mil in delta ^{34}S, which suggest typical hydrothermal ore fluid for the origin of sulfur. Sulfur isotopic temperature calculated from coexisting galena-sphalerite pairs in U-1, and M-1 ores are 180-198 deg. C. The average homogenization temperature of fluid inclusions hosted in quartz of U-2 ore does not agree with the isotopic temperature. The discrepancy of both temperatures suggests two-stages mineralization of early skarn-style (about 300 deg. C) and overprinted epithermal-style sulfide mineralization (<200 deg. C).

Keywords: Ulaan deposit, breccia pipe, Mongolia, Zn-Pb mineralization