The High-Grade Mo-Re(-Cu) Mount Dore and Merlin Deposit, Cloncurry District, Australia: Ore Genesis

Joao Babo,[1] Carl Spandler,[1] Mike Rubenach,[1] Nick Oliver,[1] Mat Brown,[2] and Damian Jungmann[3]

[1]School of Earth and Environmental Sciences, James Cook University, Townsville, QLD 4811, Australia
[2]Principal Geoscience Consultant, MBC (Mat Brown Consulting)
[3]Senior Exploration Geologist, Chinova Resources

*E-mail, joao.a.babo@gmail.com

In 2008, the the world's highest grade Mo-Re orebody (Merlin) was discovered by Chinova Resources (previously Ivanhoe Australia) during the drill out of the Cu-polymetallic Mount Dore orebody in the Cloncurry District, Mt Isa Inlier, Australia. The Mount Dore orebody consists of primary and supergene Cu mineralization, and is locally cut by the Merlin orebody, which is composed of Mo-Re mineralization. The Mount Dore and Merlin deposit have a complex hydrothermal history with several mineralization stages that vary in mineral assemblages depending on host rock and fracture density. The main rock types are, from top to bottom and east to west: Mount Dore granite (thrust above the metasedimentary rocks), interbedded phyllites and carbonaceous slates, calc-silicate rocks, and silicified siltstone.

An event similar to the regional Na-(Ca) hydrothermal alteration that is ubiquitous in the IOCGs in the area was the first hydrothermal event; this alteration was most intense in the calc-silicate rocks. This event was followed by the formation of Cu-polymetallic mineralization that is mostly concentrated in the carbonaceous slates and largely appears as infill of angular clast-supported breccias. The Mo-Re mineralization was dated by Re-Os and consists of a main mineralization event and two smaller remobilizations. The Mo-Re is mostly concentrated in matrix-supported breccias with rounded clasts, which were formed at ~1535 Ma, located in the contact zones between the carbonaceous slates and calc-silicate rocks. A secondary Mo-Re mineralizing event occurred at ~1521 Ma, concomitant with the emplacement of the Mount Dore granite (~1517 Ma, U-Pb in zircons), and consisted in a remobilization of the main Mo-Re mineralization into veins, commonly stylolitic, and disseminations that are mostly located in the calc-silicate rocks below the Mo-Re mineralized breccias. A very minor remobilization event occurred at ~1502 Ma, probably synchronous with the thrusting of the Mount Dore granite above the metasedimentary package.

Sulfur isotope and LA-ICP-MS trace element analysis of chalcopyrite, pyrite, and molybdenite were conducted in the Mount Dore and Merlin deposit. In the Cu-dominated mineralization (cpy, py), sulfur isotope values cluster between 0 and 6‰, while sulfides of the Mo-rich mineralization cluster between -1 and -4‰. S/Se, S/Te, and W/Mo ratios were used to interpret f_{O2} and pH variations during the mineralization events. The combination of petrography, geochronology, sulfur isotopes, and LA-ICP-MS trace elements suggests the following: (1) The Cu-rich mineralization was sourced from bittern brine fluid; (2) The Mo-rich mineralization was sourced from a felsic igneous fluid. Both the Cu-rich and the Mo-rich mineralization were precipitated due to a drop in f_{O2} when the fluids came in contact with the carbonaceous slates.