Brecciation event elucidate the high energy processes involved in porphyry copper deposit

*Geri Agroli[1], Atsushi Okamoto[1], Masaoki Uno[1], Noriyoshi Tsuchiya[1]

1. Tohoku University

Breccia is a common texture found in the subvolcanic environment, and vast amounts of mechanisms govern the formation of each individual texture. Scholars relate the breccia texture with high energy input in the magmatic-hydrothermal environment, and somehow, it marks the transient pressure shift from lithostatic to hydrostatic fluid regime. We conducted an investigation on breccia texture from Erdenet deposit, Mongolia, to deduce the formation mechanism and how energy release after magma emplacement. The previous study also mentions the initial intrusive body followed by the explosive brecciation on this deposit.

We retrieved ±700 m drilling samples from Erdenet Porphyry Cu-Mo. This porphyry was a product of the Permian-Early Triassic volcanic product situated in Orkhon-Selenge trough and its collision product of Siberian Craton and the Northern Mongolian block and generated vast amounts of intrusive activity. The breccia is a distinct texture observed at some depth along with the core samples at a depth of 8 m, 315 m, 679 m, where respective breccia exhibits different characteristics of matrices and clasts. The samples from 8 m depth consist of clast supported breccia where matrices comprise of Gp+Qz±Cal, and the clast consist of monolithic component of quartz porphyry+Qz. The 315 m samples depth shows the monolithic component composed of Qz+Pl+Chl+Py of aphanitic texture enclosed by the matrix of Cal+Qz. This breccia is matrix-supported, and the last breccia occurrences at a depth of 679 m consist of heterolithic clast of granodiorite porphyry+Qz+Ab+Cal+Chl+Kfs+Py. The matrices comprise of Py+Ccp+Qz+Bt. Ti-in-Qz geothermometer was performed on the matrix-quartz show that the deep breccia (679m) has Ti-content of 4-87 ppm correspond to the temperature at 471-731˚C while the sample from 315 m no Ti was detected from the matrix-quartz correspond to the temperature <400˚C.

This preliminary investigation gives us the general idea that the brecciation in the Erdenet system occurs in several stages; it could be related to the overpressurized-fluid release that traps under the impermeable layer since the impermeable sealing can present at several depths perhaps breccia form at variable circumstances within the upper crust. We suggest that 679 m breccia mark the first brecciation processes where the quartz that precipitates upon initial magma cooling (pre-mineralization), which underwent the fragmentation together with the host granodiorite porphyry. The subsequent brecciation (315 m) took place at lower P-T conditions (syn/post mineralization), and 8 m breccia mark the late stages of brecciation since the gypsum is the latest product of hydrothermal activity on Erdenet system (post mineralization).

Keywords: Erdenet Porphyry Cu-Mo, Breccia, Cathodoluminescence, High-Energy Processes

