An Introduction to Ryoke Cataclastic Rocks in Tsukide, Mie Prefecture, Japan: An Approach Using 3D Reconstructions From Thin Sections

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The Japan Median Tectonic Line (MTL) is the longest fault system in Japan where it spans from Kyushu Island and extends towards the north east direction up until Ibaraki Prefecture. It has been an active strike slip fault since the Mid-Cretaceous period, which was originally formed as the southern marginal shear zone in the Ryoke belt (e.g. Hara et al., 1980) leading to the formation of mylonite and superposed by cataclasite at the core region.

This study aims to identify the kinematic history of the fault plane and its effect on the cataclastic rocks from a 3D viewpoint. The fieldwork was conducted in the hanging wall section of the MTL in Mie Prefecture, Japan. The hanging wall of the MTL in the study area is characterized by Createaceous Ryoke granitic rocks which was deformed into mylonitic rocks and was later overprinted by cataclasite at the proximal region. The main objective of this project is to identify and relate the kinematics of the MTL and physical conditions during the formation of the cataclasite.

From the thin sections observations, the grain size reduction of the mylonitic clasts was observed and was related with cataclasis. The cataclasite formed at the brittle fault zone enables chemically rich fluids to penetrate. This promotes the growth of foliated phyllosilicate minerals mainly muscovite from the alteration of presumably feldspars. Microstructural features such as riedel shears with C'-type shear band fabric assist in indicating the sense of motion. Fracture densities and distributions are also quantified in all of the three sides of the sample in order to obtain a clearer view on the brittle properties.

Also, based on the crossed cutting relationship seen in the microstructures of the sample, a schematic deformation history of the sample was constructed. The MTL begins with a sinistral shear sense which causes the mylonitisation of the Ryoke granitoids. Upon the cooling of temperature, cataclasite was formed and transpression of the shear zone causing pressure solution seams to be precipitated which resulted in the formation of phyllonite. Lastly, a late stage reactivation of the pressure solution seams caused faulting to occur.

Furthermore, using the rake angle of the C' and S fabrics of the Riedel shears, measured from the thin sections representing the different sides of the sample, the orientations of both the C' and S planes could be reconstructed and plotted as a stereographic projection with values of [278/ 48N] and [124/ 82SW] respectively. The XZ plane which is 90° away from the intersection point of C' and S planes has an orientation of [031/ 67SE]. By assuming plane strain and with the assistant of the software StrainSim v3, the simple shear strain, γ=0.73, the angular shear, Ψ=36° and material internal friction angle, Φ= 56°. Similarly, the principle stress orientations are found to be at [62°→158], [23°→301] and [15°→037] for σ_1, σ_2 and σ_3 respectively. By combining all the relationships mention above, the motion sense of the fault was identified as the NE block moving NW and downwards with a more dominant dip slip component. This dominant dip slip movement of the fault could be potentially related to the normal faulting movement of the MTL during the Ichinokawa Phase at 63-58Ma.

Moreover, the electron backscatter diffraction (EBSD) analysis of the sample is currently being conducted to analyse the distribution of the quartz’ s and calcite’ s C-axis fabric.

References

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