Fracture domain of granite based on orientation analysis and its relation to water conducting fractures: an example from the “-500m access/research gallery-North” of the Mizunami Underground Research Laboratory

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Groundwater flow in the deep ground composed of crystalline rocks such as granite is largely controlled by the fracture system. Fracture intersections, steps and branches (spray structure) are potential and spatially linear main water conduits (Sugimura et al., 1997). So, it is important to confirm the applicability and sophistication of the geological technique to grasp the distribution of the fracture intersections. A homogenous region characterized by a predominant fracture direction is called a domain, and the domain boundary is a dense zone of the fracture intersections. To make clear spatial distribution of fracture domain, i.e. domain analysis is, therefore, a simple way to depict spatial distribution of fracture intersections. Sophistication of geological technique at the site-scale could be utilized to wide-scale advanced studies such as geological fracture mapping on the kilometer scale and groundwater discharge in relation to geological disposal of HLW.
Domain analysis of granite on the basis of fracture orientation in the 100 m scale by means of structural geologic techniques such as stereographic projection, Strike Versus Traverse Distance (SVTD) diagram (Marshak and Mitra, 1988) and Sequential Linked Median (SLIME) plot (Fisher, 1993) revealed relationship between distribution of water conducting fractures and fracture orientations. This attempt used fracture data taken from the “-500m access/research gallery-North” of the Mizunami Underground Research Laboratory (Kawamoto et al., 2014a, b). Improvement of the SLIME plot based on running median of span 3 shows domain boundary (large kink of fracture trend) and kink in domains of fracture trend (small kink), and their relation to positions of water conducting fractures (Ishibashi et al., 2016, Hayashida et al., 2018, JAEA, 2020), more clearly. Water conducting fractures are concentrated at these kinks of fracture trend. A location of one of the large kinks corresponds to a region of fractures with geochemically high connectivity from deeper parts. Methods to make SLIME plot would also be shown in our presentation.
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