NATURAL ANALOGUE
Working Group

Barrier function of crystalline rock -An evaluation based on in-situ characterization and experiments at the Mizunami Underground Laboratory (MIU), Japan-

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In the Japanese islands, orogenic crystalline rocks typically include many faults and crush zones that have to be taken into account when considering their suitability as isolating repositories. However, the hydrology of these fault zones and their ability to retard or prevent migration is little understood.

The Mizunami Underground Research Laboratory (MIU) in central Japan is constructed within crystalline rock and has been used as a study site to investigate the barrier properties of fault zones. In particular, detailed in-situ experiments and characterization have been carried out by drilling, hydraulic tests and geochemical monitoring. The long-term behavior of faults and the interaction between water and rock after fault formation were examined by dating the illite in faults using the Rb-Sr method and by C-14 dating for carbonate fillings formed in fractures associated with fault zone. Structural, geochemical and mineralogical data show that the fault zone readily illustrates how certain contaminants might react and be retarded by the fracture fillings and also by open pore geometry, due to chemical sorption and/or physical retardation. Current mineralogical studies and dating analyses of fault fillings suggest that physically, faults are relatively stable. The knowledge requires rethinking the safety case used in evaluating the function of the near-field (NF) to far-field (FF) barrier and it has also been used as a structural model for safety assessment. In particular, these results enable us to provide a realistic model of fault zones within crystalline rocks and thereby to increase confidence in a technical approach that is applicable for the modeling of nuclide migration within orogenic rocks.