# 岩盤中の透水性亀裂とその長期的挙動

## —現状と今後の課題—

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## Fluid Conducting Fractures and Their Long-term Behavior in Crystalline Rocks: Present Understanding and Future Perspectives

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**Abstract**

Fractures distributed in crystalline rock inevitably influence fluid transport and solute migration. Most evaluations of fluid-conducting features and contaminant migration processes have been conducted with the present hydrological characteristics of fractures for deep underground usages (*e.g.*, for high level radioactive waste (HLW) disposal, and LPG and $CO_2$ storage). Relatively little attention has been given to the possible long-term behavior and evolution of these features, and their influence on fluid flow and geochemical interaction after installation of engineered materials underground. In the orogenic field of Japan, there are large areas of crystalline rock. The rocks in each area have a distinctive history, which is partly reflected in the characteristics of the fracture systems and associated mineral fillings that occur. These characteristics generally imply that fluids can flow through fracture networks, except in the cases of fault zones or crushed zones. Structural and mineralogical features readily illustrate how certain contaminants might react and be retarded by fracture fillings and open pore geometry, due to chemical sorption and/or physical retardation. The study reported here seeks to provide geological evidence that natural long-term physical and chemical processes are unlikely to significantly change the overall transport and retardation properties of rock. Hence, the study improves confidence in the currently adopted evaluation methodology and its long-term applicability.

This paper, with the present understanding, describes fracture systems that are developed in intrusive crystalline rocks of different ages within the Japanese orogenic belt, and the fluid transport properties of these fracture systems. The aim is to build a synthetic model for the long-term fracturing process and hence evaluate fracture stability. Mineralogical studies and dating analyses of fracture fillings also suggest that structurally the fractures are relatively stable. Studies on fluid-conducting fractures show the unique characteristics of the fracture-forming process and the relatively stable geometries of fracture network systems in crystalline rocks distributed within the orogenic belt. This geological evidence also enables us to provide a model to build confidence in a technical approach that is applicable to hydrogeological and geological modeling over long time scales under the orogenic stress field present in Japan. The model might also be useful for other host rocks, as well as for characterizing a site in crystalline rocks at a continental margin, in order to allow the underground environment to be exploited.

**Key words**： fluid conducting fractures, long-term behavior, crystalline rocks, fracture fillings, water-rock interaction, orogenic geosphere environment
**キーワード**： 透水性亀裂, 長期挙動, 結晶質岩, 亀裂充填鉱物, 水–岩石反応, 変動帯地殻環境

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