

## Study on long-term stability of geochemical environments using fracture-filling calcite at deep underground

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Observation and fluid inclusion analysis of fracture filling calcites in granite at the Tono area were conducted to assess long-term stability of geochemical environment at deep underground. The result of observation using SEM and luminoscope shows that precipitation processes of calcite can be divided into four generations (I to IV) based on their occurrence. (1) Generation I: indistinct morphology and includes the wall rock fragments. (2) Generation II: rhombohedral and hexagonal form. (3) Generation III: elongate rhombohedral form, growth over the layer of generation II calcite. (4) Generation IV: small rhombohedral form crystals growth from surface of generation III calcite. On Generation I calcite, it seems to be hydrothermal origin related to fracture activation. According to previous studies, the groundwater from which generation III calcite precipitated would be the highest salinity such as seawater. Generation II and IV calcite may be precipitated from groundwater with low salinity. On the other hand, fluid inclusions were recognized in generation II and III. All inclusions indicated mono-generation (liquid generation). These suggest that generation II and III calcites were precipitated in low-temperature condition. Result of salinity analysis indicates that two groundwaters having different chemical properties had existed during generation II and III calcite precipitation. Based on these results, geochemical environment had changed by input of high salinity groundwater during Generation II and III calcite precipitation.