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Fault development processes from fracture filling and chemical change in fault zone: -along the Atera fault Gifu, central Japan-

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In a geological disposal system for high-level radioactive waste (HLW), maintenance of a geological environment is considered to be important for long-term safety. And it is a important factor for long-term safety that the changes of features of fluid flows with fault activities. Fluids profoundly affect the evolution of fault zones in the Earth's crust. Fluids penetrate and influence the development of normal fault (Glazner & Bartley 1991), reverse faults (Sibson 1988). Fault zones may be fluid-flow conduit-barrier systems that vary over time and space during the life of the fault (Evans et al. 1997). Thus, numerous field and laboratory studies have been carried out on the chemical changes of fault rocks, whereas the process of these changes throughout fault activities is less well investigated.

We carried out out-crop scale observation of fault zone and geochemical, mineralogical analysis on intrafault materials collected at fault zone of the Atera fault in order to reveal the fault development from chemical changes of fault zone. Atera fault is one of the active faults in central Japan and runs northwestwards mainly through the Nohi Rhyolite and Naegi-Agematsu Granite which intruded the rhyolite. And Atera fault is approximately 70 km in length and has a left lateral slip sense.

The outcrop scale observation and sampling is carried out in the outcrop which is located in the nearly center of Atera fault. On out-crop scale observation, we observed six faults. A fault is consist of cataclasite, and the other five faults are consist of fault gouge and fault breccia. On microscopic analysis, we observed cataclastic structure of fault rocks, and altered minerals. In the fault which is consist of cataclasite, jigsaw puzzle structure is observed, and any altered mineral is not observed. In some faults which are consist of fault gouge and fault breccia, some quartz or plagioclase grains are surrounded by matrix in fault gouge, and some plagioclase grains are altered to sericite. And the other faults which are consist of fault gouge and fault breccia, some plagioclase grains which are altered to sericite have fractures filled calcite.

In addition to, we carried out geochemical and mineralogical analysis on intrafault materials collected at faults. In geochemical analysis, some chemical compositions tend to loss or gain, comparing with those of host rock. The chemical composition of the fault which is consist of cataclasite is not show loss or gain. The chemical composition of some fault gouges is rich in Fe, Ca, K, Mn, Mg, Al and poor in Na. And the other fault gouges are rich in Fe, K, Mn and poor in Ca. The chemical components of fault breccias are rich in Fe, K, Mn and poor in Ca, Na. In mineralogical analysis, some minerals show including or less, comparing with those of host rock. Some fault gouges is including more amounts of pyrophyllite, sericite or chlorite, and on contrary less amount of plagioclase. And the other fault gouges is including more amount of smectite, and on contrary less amount of plagioclase. Fault breccias are less amount of plagioclase.

Structural observation of fault zone and geochemical analysis of fault rocks reveal the processes of the fault development with chemical changes. From those results, we can be divided processes of fault development to three stages. Stage 1: The fault which is consist of cataclasite was formed at a depth of several km (Sibson, 1986). This fault was not suffered influence of fluid flow. Stage 2: The faults which are consist of fault gouge and fault breccia with hydrothermal circulation. This stage faults were suffered hydrothermal influences, for example, Alteration of feldspars and forming sericite or pyrophyllite. Stage 3: The faults which are consist of fault gouge and fault breccia on around the ground surface. This stage faults were suffered the influences of rain water penetration, for example, hydrolysis of feldspar and forming smectite.