Strike-slip displacement accompanied by non-brittle lateral deformation around an active fault revealed by paleomagnetic analysis

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We made magnetic measurements on samples from the Kamitakara pyroclastic flow deposit at thirty sites around the Enako fault in central Japan, in order to evaluate vartical-axis surface deformation around the fault. The Kamitakara pyroclastic flow deposit is Quaternary welded tuff whose K-Ar age is 0.63+-0.04 Ma (Watanabe et al.,1999), and the deposit consists mostly of biotite rhyolite welded tuff with eutaxitic structure. The Enako fault is an active right-lateral strike-slip fault, in a part of the Takayama-Ohara fault zone, and lies along the southern margin of the Takayama basin in central Japan.

By means of the aerial photograph analysis and the geomorphological and geological mapping, we determined the detailed location of the Enako fault trace and observed that the maximum dextral offset in the distribution area of the Kamitakara pyroclastic flow deposit is 150-170m (offset channels).

We found that all sites preserved stable primary magnetization through progressive demagnetization tests using thermal and alternating field methods, and then we calculated site-mean directions. In addition, we applied tilt-corrections for the directions with tilting data obtained from measurements of anisotropy of magnetic susceptibility of the pyroclastic flow deposit and observations of the eutaxitic structure in the outcrops, the core samples and the thin-sections. As a result, we obtained fifteen tilt-corrected site-mean paleomagnetic directions in the lower unit of the Kamitakara pyroclastic flow deposit and five directions in the upper unit of the deposit.

Consequently, the current knowledge of the proposed vertical-axis deformation in a strike-slip shear zone can be summarized as follows. Firstly, within a range of several hundred meters across an active strike-slip fault, there is large enough tectonic rotation to be detected as rotation of a paleomagnetic direction for the past 0.6 million years. Secondly, differential clockwise rotations are found around a right-lateral strike-slip fault. Thirdly, we discovered a strong negative correlation between relative rotations and distances from a atrike-slip fault trace. Therefore, seeing the deformation in broad perspective, non-brittle simple shear deformation model is suitable for this strike-slip shear zone. Finally, the minimum amount of strike-slip displacement involved the non-brittle vertical-axis deformation around the Enako fault is about 100m for assumption that width of the shear zone is 500m. Then, the sum of this value and displacement revealed by offset of geomorphological features is about 250-270m for the Kamitakara pyroclastic flow deposit.