延岡衝上断層ボーリングコア中の断層帯の化学組成分布

Chemical composition distribution of the drilled core across the fault zone of the Nobeoka thrust

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Megasplay fault branching from a plate boundary at subduction zone is thought to be the source of earthquakes and tsunamis. Nobeoka thrust is the low-angle thrust which subdivides the Shimanto belt in Kyushu into the northern (Cretaceous and Tertiary) and the southern (Tertiary) subbelts, and is an exhumed analogue of an ancient megasplay fault. The hanging wall and the footwall of Nobeoka thrust show difference in lithology and metamorphic grade and their maximum burial temperature is estimated from vitrinite reflectance analysis to be 320~330°C and 250~270°C, respectively. Assuming these temperature gap is made by fault displacement, the total displacement is approximately 10 km (Kondo et al., 2005). As a unique analogue of modern megasplay fault, the Nobeoka thrust is the key for understanding current plate boundary process.
Fluid-rock interaction is one of a very important processes for faulting. We focus on the element composition distribution across the Nobeoka thrust, and thus analyzed chemical composition of the drilled core obtained by Nobeoka thrust drilling project (NOBELL). Major elements and trace elements are analyzed by XRF and ICP-MS, respectively
Results of XRF analysis showed no significant difference between the hanging wall and the footwall despite the difference in lithology and metamorphic grade. Na_2O, Al_2O_3, SiO_2, K_2O and CaO increase just above the fault core (Depth 41.3~41.8 m). This increase would be caused by the decrease in SiO_2, because SiO_2 is the dominant component in the analyzed rocks (60~80 wt.%).
Results of ICP-MS analysis also did not show significant difference between the hanging wall and the footwall, except for Li and Cs which are relatively abundant in the footwall. High concentration of Li just above the fault core may suggest Li-rich fluid from external source. The provenance of Li can be attributed to the basalts where significant quantity of the oceanic crust is subducting. Some elements showed increase just above the fault core as observed in the major elements.
Summarizing the results, the divergence in chemical composition is limitedly observed in the vicinity of the upper interface of the fault core. The depletion in Si just above the fault core might be caused by the development of pressure solution resulting Si dissolution and flowing-out in this horizon. Chemical anomalies observed within and just above the fault core suggest high-temperature fluid-rock interaction associated with the faulting. Further characterization of stable isotope analysis (such as Sr, Nb) will provide insights into the provenance of the fluids.

References

Kondo et al. (2005) Deformation and fluid flow of a major out-of-sequence thrust located at seismogenic depth in an accretionary complex: Nobeoka Thrust in the Shimanto Belt, Kyushu, Japan.

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