

Structural analysis of fault zone in the underground by active fault drilling

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'Fault-zone drilling' is very important to research about mechanisms of earthquake occurrence. It is especially important in understanding the structure, composition and physical properties of active faults. Therefore 'Active Fault Zone Drilling Project' has been conducted in the central part of Japan by the National Research Institute for Earth Science and Disaster Prevention (NIED). We investigated various active faults in central Japan and have performed the case study. We will show about how the knowledge acquired until now is put to a future research project.

In the near future, the deep sea drilling vessel 'CHIKYU' will penetrate a seismogenic zone in the plate subduction area. Probably at this time, it becomes a problem most 'Where is a fault plane?'. As a matter of fact, it is difficult unexpectedly to recognize where is a fault plane in the drill cores. Of course, it is easy when the lithologic boundary itself is a fault plane. However, it is not so often. Usually, the fault plane passes in the same lithologic face. Therefore, it is useless only by observing partially, and the necessity of grasping the whole structure correctly comes out.

From our experience, we can use geophysical logging data (such as velocity and density etc.) to hold an outline at the beginning. And that mineral assemblage and chemical composition analysis are effective in order to grasp details further. Especially, the amount of water (water of crystallization) is very important. In the case of the Nojima fault, we detected plenty of water (about ten times as much as the average) in a fracture zone. This is due to the greater degree of wall-rock fracturing in the fracture zone. However, it does not become evidence too sufficient in just the quantity of water. For other things (such as mineral assemblage, distribution of major and minor elements, microscope observation etc.) are needed. They will suggest the characteristics that are associated with fault activity and the nature of fluid-rock interactions in the fracture zone.

Especially an important thing, even in the underground, a fault plane is not simple 'plane'. In many cases, it constitutes 'Fault zone' with a certain width. So, we must know the three-dimensional structure of it. Only by doing so, the position of a fault plane in the underground can grasp correctly.