Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS26-02 Room:303 Time:May 19 09:15-09:30

Development of the cosmic-ray muons detecting system in boreholes to image the fault zone structure

Daisuke Nakadachi[1*], Akimichi Taketa[1], OMURA, Kentaro[2], Hiroyuki Tanaka[1]

[1]ERI, [2]NIED

It is important to assess active fault's dips and dip directions in order to predict the seismic intensity. However, we cannot always get these data by geological surveys because the crush zone is easy to be eroded. In addition, digging has been necessary to know the width and density structure of the crush zone. However, we can easily investigate the structure if we use indirect way by the geophysical exploration. Therefore the technique using cosmic-ray muons, one of the method of the geophysical exploration, was applied to the new way exploring the fault zone structure.

In recent years, it has been shown the usefulness of this method using cosmic-ray muons by successful examples imaging active volcanoes and fault structure(e.g. Tanaka et al., 2007, 2008, 2009, 2011). Using this way, we can obtain the average density along the detecting direction and its result almost only depends on the density of the components. This unique property, which any other methods of the geophysical exploration do not have, may provide useful data unless its heterogeneity at the shallow part of the continental crust. However, traditional muon-detecting devices were set on the ground and caught muons coming only from the sky, so we have not been able to survey the underground structure. It is difficult to miniaturize the traditional muon detecting devise and put it into boreholes because traditional one has a function which detects paths of the muon.

In order to solve this problem, we developed a new technique. We gave up its function detecting their paths and introduced new one which statistically knows coming directions instead. Using this technique, we could miniaturize the muon-detecting devise. Putting it into a borehole, we are able to survey ground structure several hundred meters from the borehole inside. If we give a demonstration and can get a good estimation of the structure near a borehole, we can show it has the ability to assess fault zone structure from one borehole.

We gave a demonstration putting the detector into a well located in Hongo campus, the University of Tokyo, and investigated ground structure. The detector was installed from ground level to 60m depth and inferred the rock density near the well. The result showed good agreement with a past digging investigation data. Its spatial resolution is lower than the traditional one because of the miniaturization, but this result showed it is possible to image underground structure by using cosmic-ray muons.

It is expected as a new method to supply the knowledge of fault zone structure at the shallow part of the crust.

Keywords: muon, borehole, fault