International Workshop on High Energy Earth Science:
Muon and Neutrino Radiography
(June 26-27, 2008, Tokyo, JAPAN)

Future collaboration of magnetotelluric and cosmic-ray muon measurements in volcanic research

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The electrical conductivity is an important physical property to reveal the underground structure, as well as density, seismic velocity and so on. It is enhanced by several orders of magnitude according to its environment such as high temperature and presence of fluid. Thus magnetotelluric (MT) measurement is a useful tool to estimate the volcanic structure because it has high sensitivity to high electrical conductance body. Aizawa et al. [1], for example, conducted the MT measurement at the Mt. Asama, central Japan, and detected highly conductive structure at shallow regions and beneath crater. Although it may correspond to magma ascent zone and conduit for the last eruption in 2004, MT method has less spatial resolution because the electromagnetic signals diffuse beneath ground, and it requires another information for highly resolved spatial structure to conclude it.

Tanaka et al. [2] developed an astonishing method to detect highly-resolved density structure by using cosmic-ray muon radiography. They succeeded to reveal density structure beneath summit area with tens meter spatial resolution and detect a dense cap at the bottom of crater floor and a porous conduit beneath it. In the near future, a collaborated measurement of three-dimensional muon radiography and MT is expected to detect a highly-resolved spatial density structure and electrical conductivity structure, and will give us information on present state in conduit, such as temperature, fluid volume, and so on.

References

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