R003-06
D 会場 ：11/5　 PM1 （13:45-15:30）
15:00〜15:25

#赤松　祐哉 [1), 片山　郁夫 [1)]
[(1] 広大　先進理工

Interpretation of electrical resistivity structure of oceanic crust based on analysis of seismic velocity structure

#Yuya Akamatsu[1)], Ikuo Katayama[1)]
[(1]Hiroshima Univ.

Water transported through cracks in oceanic crust play key roles in various subsurface processes, including seismic activity, heat and chemical exchanges, and microbial activity. Fluid-filled cracks strongly affect geophysical properties, such as seismic velocity and electrical resistivity; therefore, a number of seismological and electrical surveys have been conducted at various locations in the oceanic lithosphere. In order to quantitatively interpret such geophysical data and understand the subsurface fluid behavior, laboratory measurements on rock's physical properties are essential. In this study, we conducted laboratory measurements on the electrical resistivity and elastic wave velocity of oceanic crustal rocks collected from drilled cores of the Oman ophiolite, in which tectonic fragments of ancient oceanic plate are preserved on land. The measurements were performed under dry and brine-water-saturated (wet) conditions using discrete cubic samples that were taken from the drilled cores.

The experimental results show that electrical resistivity and elastic wave velocity under wet conditions are clearly correlated with porosity, suggesting that these properties are closely related to pore structure. Application of effective medium theory, which predicts effective elastic properties containing penny-shaped cavities, shows that the variations in elastic wave velocity can be interpreted mainly by two parameters characterizing pore structure: crack density and crack aspect ratio. Electrical resistivity changes markedly at low crack densities, possibly reflecting percolation of fluids through the crack network. Applying a crack fluid flow model based on statistics and percolation theory proposed by Gueguen and Dienes (1989), variation in the measured resistivity is related to crack porosity and connectivity, which can be estimated from the crack density and aspect ratio. To understand effects of in situ conditions in oceanic crust, we applied the cross-property relationship established by our laboratory measurements to geophysical properties obtained by logging measurements at IODP Hole 1256D. As a result, resistivity structure predicted from sonic velocities is generally consistent with the observation, suggesting that the physical properties of oceanic crust can be interpreted using the same model at both laboratory and in situ scales.