Multicomponent measurements of seismic velocity and electrical resistivity using foliated serpentinite and peridotite

*Tomohiro Ito[1], Ikuo Katayama[1], Katsuyoshi Michibayashi[2], Kazuki Matsuyama[2]

1. Hiroshima University, 2. Nagoya University

Water is involved in various phenomena at subduction zones. When a subducting plate releases water into the mantle wedge, the water reacts with the mantle to form serpentinite. Seismic low velocity and high electrical resistivity in the mantle have been interpreted as mantle hydration; however, these geophysical data can be highly anisotropic. In this study, we performed multicomponent measurments of seismic velocity and electrical resistivity of the foliated serpentinite and peridotite to discuss the fluid movement and mantle hydration at subduction zones.The rocks used in this study are serpentinite and peridotite with the x-axis is parallel to the lineation and the z-axis is normal to the foliation. An intravessel deformation and fluid flow apparatus was used to measure seismic velocity and electrical resistivity at the confining pressures ranging from 5 MPa to 200 MPa. The fluid used was a 0.5 mol/L NaCl solution, and the fluid pressure was controlled at 1 MPa. These measurements represent the physical properties of the rocks, including microcracks. We also measured the crystal orientation using EBSD to evaluate the anisotropy of the minerals. Serpentinite and peridotite show higher P-wave velocity in the x- and y-axes than in the z-axis, although the P-wave velocity of serpentinite is nearly the same in the x- and y-axes. These results are most likely due to crack alignments subparallel to the foliation and crystal preferred orientation. The electrical resistivity of serpentinite tends to be about an order of magnitude lower in the x-axis than in the z-axis, while the electrical resistivity of peridotite is almost the same in the z- and x-axes. From the multicomponent seismic velocities, we calculated the elastic constant tensor and produced pole figures of seismic velocity (Mainprice, 2014). We will discuss these data in more detail with application to seismic tomography and electrical resistivity data at subduction zones.

Keywords: Ultramafic rocks, Seismic velocity, Electrical resistivity, Anisotropy