[JJ] Evening Poster | S (Solid Earth Sciences) | S-SS Seismology

[S-SS11]Crustal Structure

convener:Yasuhira Aoyagi(Central Research Institute of Electric Power Industry)
Thu. May 24, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
The aim of this session is to cover seismological and geophysical studies on the Earth's crust. Contribution on seismological and geophysical structure of the crust, processes that develop in the crust which include earthquakes, volcanoes and geological descriptions of the crust are welcomed. We also welcome theoretical and methodological studies that will serve as basics in such explorations.

[SSS11-P01]Electrical resistivity structure of the Hidaka crust based on resistivity measurements of the Hidaka metamorphic rocks

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We measured electrical resistivity of representative rock samples collected from the Hidaka metamorphic belt, where a part of the tilted cross section across the ancient Kuril-arc crust, i.e., Hidaka crust, is known to be exposed, in order to investigate the electrical resistivity structure of the Hidaka crust. Resistivity measurements on as-is samples and samples saturated with 35g/L KCl solution have been conducted at frequencies ranging from 10 Hz to 1 MHz by the four-electrode method.

As-is samples show unstable resistivity values at frequencies lower than 100 Hz, while their resistivity values significantly decrease to nearly the same values at frequencies higher than 100 kHz. Therefore, resistivity values of as-is samples are reliable only at frequencies ranging from 1 kHz to 10 kHz. As-is samples other than hornfels show similar resistivity values of ≈100 kΩ·m at 1 kHz. In contrast, the hornfels sample shows an unusually low resistivity value of ≈1.5 kΩ·m at 1 kHz. This sample contains carbonaceous matter aligned parallel to bedding, which is likely metamorphosed to graphite and responsible for the low resistivity values of this sample.

KCl solution-saturated samples show resistivity values lower than 10 kΩ·m at all frequencies. Their resistivity values do not change significantly at frequencies lower than 10 kHz, but decrease at frequencies higher than 100 kHz. Therefore, resistivity values of saturated samples are reliable at frequencies lower than 10 kHz. They show a negative correlation with porosity.

As-is Hidaka metamorphic rocks other than hornfels have similar resistivity values of ≈100 kΩ·m at 1 kHz, while as-is hornfels has a much lower resistivity value of ≈1.5 kΩ·m at 1 kHz. Because hornfels is widely distributed in the upper part of the Hidaka metamorphic belt parallel to its N–S extension with the width of ≈5 km, and also because the Hidaka metamorphic belt is a part of the tilted cross section across the Hidaka crust, it is supposed to form a ≈3−4 km thick horizontal layer in the Hidaka crust. Such a low resistivity value of hornfels therefore suggests the presence of a low resistivity layer in the upper part of the as-is Hidaka crust. In contrast, saturated Hidaka metamorphic rocks have resistivity values lower than 10 kΩ·m at 1 kHz, suggesting low resistivity throughout the saturated Hidaka crust. However, the Hidaka crust is supposed to have been somewhere between as-is and saturated. Therefore, the resistivity structures based on resistivity values of as-is and saturated samples provide the upper and lower bound cases, respectively.