Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

STT056-P05 Room:Convention Hall Time:May 26 16:15-18:45

Imaging of fault structure and fresh/salt water boundary in a coastal zone by electric survey

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Fault structures in coastal zones are important for disaster prevention and mitigation against large earthquakes that originate in latent fault movement in the sea areas, identification of flesh/salt water boundary, and evaluation of nutrient loads on sea environments associated with groundwater discharge. However, geological investigations in the coastal zones have not been much accumulated because of the difficulty in approaches. Then, we applied an electric survey method and using borehole data to clarify hydrogeologic structure in a coastal zone.

The Kumamoto Plain facing the Ariake Sea is well-known groundwater resource because of high mountains behind the plain such as Mt. Aso. Resistivity value is an important physical property of geologic media, which is related to porosity of rocks and soils. Chargeability is also an important electric property which is calculated from the temporal change of electric potential after stopping the current supply.

In addition to the traditional electric survey, we measured temporal resistivity change which were aimed at detecting inflow and outflow of groundwater (or seawater) in the sediments using the large difference in resistivity between seawater and groundwater. The measurements were carried out five times during 2007 to 2010 with 2D measurement lines of 150 m and 260 m lengths, using an equipments, Syscal-R2 (IRIS instrument) and multi electronode system. The measurement lines were set to be parallel and perpendicular directions to the coastal line.

By the inversion analysis of apparent resistivity and chargeability data, two fault lines along the extension of an active fault in the mountain and fresh/salt water boundary near the 20 m depth were detected from the temporal change of the resistivity. This boundary may originate from the groundwater flow along the fault line. Study area is divides into permeability zone of sand and non-permeability zone of clay. It is thought that groundwater and sea water moves along the pervious layer.

Keywords: Ariake Sea, Uto peninsula, chargeability, Resistivity