Development of a shallow-seafloor magnetotelluric survey system and its application at the Horonobe coastal area

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【Outline】

We have developed a new seafloor magnetotelluric (MT) survey system that can reduce interference caused by wave motion and can be applied to measurements under a shallow sea. High-quality data were successfully obtained for the first time in a field survey at the Horonobe coastal area, Hokkaido, Japan.

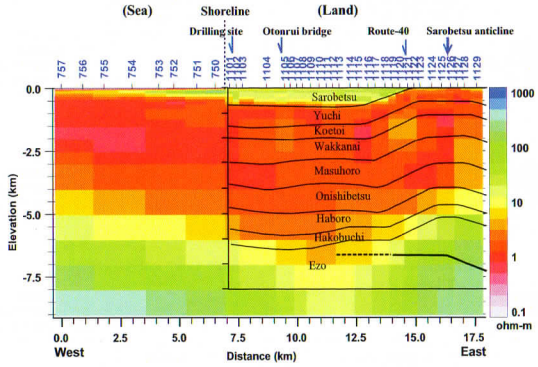
【Details】

We have been conducting research on geophysical technology (the MT method) for seamlessly evaluating geological structures that extend from land to sea, under a nuclear waste depository research project funded by the Ministry of Economy, Trade and Industry. Application of the MT method in shallow seas is extremely difficult because sea waves sway magnetic sensors and generate strong electromagnetic noise. We have developed a new seafloor MT instrument that is short in height to reduce the motion caused by sea waves. The first MT survey using this instrument was conducted in Horonobe in 2010, and high-quality MT data were successfully obtained. Our institute also drilled to 1,000 m on land near the coastline and obtained detailed geological information for the area. A 2-D resistivity model calculated by the inversion of both land and seafloor MT data clearly indicates that a Quaternary high-resistivity sedimentary layer of a few hundred meters in thickness, which was determined to be a freshwater layer by the drilling, extends a distance of several kilometers under the sea.

【Application of research results】

The results of this research will be applied to geological characterization for future nuclear waste depository projects. Other possible uses include geological evaluation for CO_2 geological sequestration and active fault surveys over coastal zones.

A new seafloor MT instrument



2-D electrical resistivity model for the Horonobe coastal area obtained by inversion of land and seafloor MT data (color section). Layer boundaries estimated from an existing seismic reflection survey on land are overlaid (black lines).

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