

A study on the electrical conductivity structure beneath the northeastern part of China -- A preliminary report

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Seismic tomography studies suggested an anomalous velocity structure corresponding to the past subducted oceanic plate, so-called the stagnant slab, beneath the area from Japan to China. In the northeastern part of China, there exists active Quaternary volcanism which may relate to the presence of the slab, though its cause is not well understood yet. This study aims to reveal the electrical conductivity structure in the mantle of this area by carrying out electromagnetic observations, as a part of the Ocean Hemisphere Network Project. Field experiment consists of a geomagnetic observation at Changchun and tentative recording of electric field variations using telephone lines in the area around the magnetic station. This paper presents preliminary results of observation and data analysis.

Seismic tomography gave us an image of a "stagnant slab" around the depth of 660 discontinuity in various zones of plate subduction in the world (e.g., Fukao et al, 1992). One of the clear examples can be found beneath the northeastern district of China. It is also well known that active Quaternary volcanism has taken place in the wide area including this district, producing a large amount of ejecta. However, the cause of this continental volcanism is still controversial, though there have been suggested several models. Miyashiro (1986) suggested that this volcanism is caused by a "hot region" in the upper mantle. Iwamori (1996), on the other hand, proposed a model of a "wet region" based on a petrological investigation. A study of large-scale electrical conductivity distribution in this region will give important information for investigating the cause of the volcanism and the lithospheric evolution, as well as their possible relation to the presence of a stagnant slab. For this purpose, a Network-MT experiment in Jilin province was planned as a part of the Ocean Hemisphere Network Project. As a first phase of the project, electric field measurements with a typical electrode spacing several tens of kilometers were made by using analogue telephone lines either in service or retired. A magnetometer system of Ocean Hemisphere Network type has been installed at the Changchun geomagnetic observatory recording three components of geomagnetic field variation every second. Electric field measurements will be extended to other parts of the province, and to other provinces in coming several years. This paper presents a preliminary result of this project. For example, the apparent resistivity obtained on a line near Changchun city takes around 500 W-m up to the period of 1,000 sec, where resistivity starts to decrease down to 50 W-m at around 100,000 sec. At the longest period, the apparent skin depth can be estimated as 1,000 km. This strongly indicates the feasibility of delineating the conductivity structure down to the depth of the transition zone.