
[EE] Evening Poster | S (Solid Earth Sciences) | S-IT Science of the Earth's Interior & Tectonophysics

[S-IT22]Interaction and Coevolution of the Core and Mantle in the Earth and Planets

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Recent observational and experimental investigations have significantly advanced our understanding of the structure and constituent materials of the deep Earth. Yet, even fundamental properties intimately linked with formation and evolution of the planet, such as details of the chemical heterogeneity in the mantle and light elements dissolved in the core, remained unclear. Seismological evidence has suggested a vigorous convection in the lower mantle, whereas geochemistry has suggested the presence of stable regions there that hold ancient chemical signatures. The amounts of radioactive isotopes that act as heat sources and drive dynamic behaviors of the deep Earth are also still largely unknown. We provide an opportunity to exchange the achievements and ideas, and encourage persons who try to elucidate these unsolved issues of the core-mantle evolution using various methods, including high-pressure and high-temperature experiments, high-precision geochemical and paleomagnetic analyses, high-resolution geophysical observations, geo-neutrino observations, and large-scale numerical simulations. Since this session is co-sponsored by geomagnetism, paleomagnetism and rock magnetism division of the SGPSS, contributions in geomagnetism and geodynamo simulation are also encouraged.

[SIT22-P26]Heat flow determination in the central part of Japan

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As part of a research project to investigate chemical composition of the earth based on geoneutrino measurements, we have been working for better estimation of temperature structure and radioactive heat generation distribution in the crust of the Japanese islands. For this purpose, we need to obtain reliable heat flow values, the most basic data to constrain subsurface thermal structure, especially in the central part of Japan around Kamioka where geoneutrino flux has been measured.

Heat flow is determined as the product of temperature gradient and thermal conductivity. In boreholes on land, the temperature gradient should be measured in relatively deeper part, where the temperature distribution is little disturbed by ground water flow and/or temporal variation of ground surface temperature (GST). Influence of GST variation is generally not negligible down to a depth of about 200 m. It is therefore difficult to obtain reliable heat flow values in boreholes shallower than 200 m, though the critical depth may vary by region according as GST history varies.

In our target area, the central part of Japan, consisting of Chubu, Kinki and Kanto areas, there are a limited number of over 200 m-deep boreholes, while there exists lots of temperature profile data obtained in shallow boreholes. As it is important to use densely distributed heat flow data for estimation of

subsurface thermal structure, we take the following approach to obtain heat flow values in shallow boreholes. We first reconstruct the past GST history from temperature profiles measured in deep boreholes. Then we correct temperature profiles measured in shallow boreholes for influence of GST variation evaluated in deep borehole(s) in the vicinity. In this presentation, we show results of GST history reconstruction through inversion analysis of temperature data in deep boreholes at seven stations in the target area. In the case of Yokohama site, we could estimate GST variation in the last 300 years, which is characterized by significant surface warming in the last 100 years. The rate of GST increase, 3 K in 100 years, is higher than that of increase in surface air temperature recorded at Yokohama meteorological station, 2 K in 100 years. The difference in temperature increase may be attributed to differences of geographic location and land-use as well as contrast in warming mechanism of air and ground. The amount of GST increase in the last 100 years varies by site and ranges from 1.7 to 4.0 K at the seven stations. These values are similar to those obtained in Tokyo and Osaka metropolitan areas by previous studies.

We have also been working on updating compilation of published heat flow data in the northwestern Pacific area (from 0 to 60 °N and from 120 to 160 °E). The new dataset contains 3759 heat flow values, including 574 data added to the previous version released in 2004. We have compiled geothermal gradient data and thermal conductivity data in and around the Japanese islands as well. These datasets will be published in 2018. They can be used for estimation of crustal temperature structure in Japan and will also contribute to investigation of thermal structure of NW Pacific subduction zones.