A review of thermal state of the shallow part of the Earth’s lithosphere: What we know and do not yet know

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*田中 明子[1]、Yamano Makoto[2]
*Akiko Tanaka[1], Makoto Yamano[2]

1. Geological Survey of Japan, AIST、2. Earthquake Research Institute, Univ. Tokyo
1. Geological Survey of Japan, AIST, 2. Earthquake Research Institute, Univ. Tokyo

To improve our understanding of the thermal evolution and structure of the deep Earth, it is necessary to know the shallow part of them. Surface heat flow provides important constraint on in. However, the number of heat flow data is limited and spatially very inhomogeneous and even in regions with measurements the data quality varies. To provide an attempt at a higher resolution map of heat flow, thermal conductivities are measured using sampled cores and used from existing and newly collected data. Also, to estimate the heat flow using geothermal gradient data, the closest thermal conductivity data is used for each gradient data. This approach does not take into account geological and hydrodynamical models to use the thermal conductivity, but this assumption works well enough to provide rough estimates of heat flow from geothermal gradient.

Meanwhile, there exist many indicators that are proxies for quantifying the thermal structure. One of the promising indicators is the cut-off depth of shallow seismicity. Several studies have been conducted to assess the inverse correlation between the cut-off depth and heat flow, since it has attributed primarily to the temperature. Another indicator is the depth of magnetic sources based on spectrum analysis of magnetic anomaly data. This analysis is still controversial, however, good correlation between estimated depths of crustal magnetic sources and heat flow suggests that this depth may reflect the broad average temperature. We address the advantages and limitations of each data and method.

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