Crustal structure off West Enderby Land, Antarctica estimated using the surface ship gravity data onboard Icebreaker Shirase

Yasuo Konishi[1]; Yoichi Fukuda[1]; Yoshifumi Nogi[2]

[1] Geophysics, Kyoto Univ.; [2] NIPR

We have processed the surface ship gravity data obtained by JARE (Japanese Antarctic Research Expedition) and tried to make a homogeneous data set of the Antarctic Ocean. Using the data set, we estimated the crustal structure off West Enderby Land (35-55 E, 70-62 S), Antarctica, where the trace of an initial Gondwana breakup had been left.

Geophysical surveys (gravity, geomagnetism, topography and etc...) in the Antarctic Ocean is very important for the studies of the recovery of global plate motion, the process of continental division and plate evolution as well as the tectonics of Antarctic continent. However it is very difficult to obtain the data, because of the severe climate condition and the location far afield from civilized countries.

Since JARE27, the ship-borne gravity survey as well as other geophysical surveys such as three-component geomagnetic survey and bathymetric sounding have been continued onboard Icebreaker Shirase. Excluding the periods of no data due to equipment troubles and other reasons, the gravity data of about 17 years have been accumulated. Among those, the data obtained from JARE27 to JARE33 have already been processed, however the data after JARE 34 remain unprocessed. So we first processed those data to obtain free-air gravity anomalies by applying Eotvos correction and other corrections. Then we applied drift corrections for all the data sets so that the long wavelength signals fit to the satellite derived gravity anomalies by Sandwell and Smith (2004).

The drift corrected surface ship gravity data have homogeneous qualities over the survey periods, and we can merge them for the studies of detailed subsurface structures. The merged data set off West Enderby Land shows more detailed structure than the satellite derived gravity anomalies. For instance, the structure of negative gravity anomaly for NE-SW direction off Prince Olav Coast to Casey bay is clearly recognized, and the positive gravity anomaly off Casey bay cutting into the negative anomaly is also recognized. These structures are hardly recognized in the satellite derived gravity map.

Using the merged ship-born gravity anomalies, we estimated the 2-D crustal structures in the area by means of Talwani's method (1959). The result suggests that 1) the continental crust thickness in Amundsen Bay is about 2 km thicker than that from off Prince Olav Coast to Casey bay, 2) the transition area from the continental crust to the oceanic crust jumps discontinuously between off Prince Olav Coast and Casey bay. The second may suggest the direction changes of the ocean floor spreading in an initial continental division.