

# The tectonic features in Mariana Trough, inferred from gravity anomalies

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We have conducted a surface geophysical survey in the Mariana Trough between 13.6N and 16.5N during KR03-13 and YK03-09 cruises in 2003. This area has an important key for understanding spreading process of the Mariana Trough, because the north and south of this area have different spreading features. We compiled gravity data which collected during these cruises and previous several Japanese cruises. We will show regional features of gravity anomalies in the Mariana Trough.

Free-air gravity anomaly was calculated with subtracting the normal gravity field and with corrections of the drift and of the Eotvos effect using DGPS data. Then, we adjusted the trend of this free-air gravity anomaly to that of the free-air gravity anomaly from satellite altimetry (Sandwell and Smith, 1997) and we merged them to get better free-air gravity anomaly. Finally, Mantle Bouguer gravity Anomaly (MBA) was calculated by the method of Parker (1972), using the free air gravity anomaly and multi-narrow-beam bathymetry. Assumptions for this calculations are; 1) the crust is the crust is constant thickness of 6 km. 2) the seawater, crust, and mantle densities are 1030, 2700, and 3300 kg/m<sup>3</sup>, respectively. 3) the mean water depth in the Mariana Trough is 3800m. Furthermore, we estimated variations of crustal thickness that reflects the amount of the melt supply at the spreading axes.

The MBA revealed five distinct different regions: 1) The north of 22N (Region A) shows extremely low MBA (between -20 mgal and 0 mgal) and crustal thickness is about 8 to 13 km. 2) The spreading axis between 21N and 22N (Region B) has relatively low MBA and variation of 30mgal along axis with low amplitude (the minimum is 0 mgal), suggesting abundant magma supply. We can consider this feature as "Bull's eye" features along the axis, which is known to occur commonly along slow spreading ridges. The crustal thickness of about 7km is estimated at the center of this segment and about 4km is also estimated at the end points of this segment. 3) The central region between 15.6N and 21N (Region C) shows "Bull's eye" features along the axes. They have variations of 10 to 20 mgal with low amplitude (the minimum is 20 to 25 mgal). But some segments show a constant value of MBA. The mean crustal thickness in this region is about 5.5 km. 4) A region between 14.3N and 15.6N (Region D) shows higher a constant value of MBA (about 60 mgal) and has a crustal thickness of 4.5km. 5) The south of 14.3N (Region E) shows lower a constant value of MBA (approximately 20mgal) than that in the central region and has a crustal thickness of about 7 km.

We interpreted these features as follows.

The value of MBA in the Region A is between an oceanic and island crust regions, indicating this region is the stage of rifting.

Upwelling flow beneath the spreading center has three-dimensional structure in the Region B and C. But the Region B has higher amplitude of MBA. It suggests existence of other magma source like an island arc magma source.

The ascending magma flow has two-dimensional structure perpendicular to the spreading axes in the Region D and E. But the crustal thickness is different in both regions.

The features of MBA in the Region E suggest the difference of spreading rate and existence of other magma source.