

Geodetic estimation of back-arc spreading at the Mariana Trough inferred from repeated GPS surveys

Tsuyoshi Watanabe[1]; Takao Tabei[2]; Teruyuki Kato[3]; Takeshi Matsushima[4]; John Takai Camacho[5]; Ramon Chong[5]

[1] Phys., Kochi Univ.; [2] Natural Environmental Sci., Kochi Univ.; [3] Earthq. Res. Inst., Univ. Tokyo; [4] SEVO, Kyushu Univ.; [5] EMO, CNMI

Mariana Islands Arc (MA) is a N-S trending islands arc located at the easternmost margin of the Philippine Sea plate (PH). In the east, the Mariana Trench runs parallel to the islands, where the Pacific plate subducts beneath them at a rapid rate of about 10cm/yr. In the west, back-arc spreading (or rifting) has occurred at the Mariana Trough (MT), which is the most significant tectonic feature in this region. To clarify the spreading process of the MT geodetically, campaign-mode GPS surveys had been started in 1992 (Beavan et al.,1994). Since then, Kato et al.(2003) have repeated GPS surveys from 1992 to 1999 at six islands located at the central and southern parts of the MA (from 13degN to 19degN), and estimated spreading rate of the MT using horizontal GPS velocities. For better understanding the variation of spreading rate of the MT, we need horizontal GPS velocity at the northern part of the MA (north of 19degN), where three GPS sites had been constructed by Beavan et al.(1994).

We conducted GPS surveys at six sites used by Kato et al.(2003) in January 2003 and at three sites constructed by Beavan et al.(1994) in January 2003 and June 2004. Including these data, we estimate spreading rate of the MT. At first, we estimate site coordinates using GIPSY-OASIS II software and calculate site velocities from coordinates time series at each site. Since these site velocities contain the rigid motion of the PH and displacement produced by back-arc spreading, we calculate the rigid motion of the PH of each site using REVEL-2000 (Sella et al.,2002), a new global model for recent plate velocities, and subtract them from the observed site velocities. We regard these velocities as indirect spreading rate of the MT. At the central and southern parts of the MA, spreading rate varies from 46mm/yr in a direction of N96degE near 14degN to 22mm/yr in N75degE near 19degN. Our spreading rate is generally less than that of Kato et al.(2003) by 6-10mm/yr. Moreover these discrepancies increase toward the north. This is probably caused by the difference of observation period and software used for estimating site coordinates and velocities. At the northern part of the MA, though one site near 20degN shows displacement of 15mm/yr in a direction of N26degE, we can't detect any significant displacement suggesting back-arc spreading at the other sites. We believe that the result is related to the short observation period (about 2yr). Successive GPS surveys will bring us better understanding the spreading process at the MT.