GPS observation of crustal defomation in the Macolod Corridor, Philippine

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The Philippine archipelago is currently wedged between two opposing subduction zones. The Eurasian plate is being subducted eastward along the Manila Trench on the western side of the Philippines while the Philippine Sea plate (PHS) is undergoing a westward subduction along the Philippine Trench on the eastern side. The west-facing arc is composed of two segments, the Bataan arc and Mindoro arc. The Macolod Corridor (MC), dividing these two arcs, is a major zone of Quaternary volcanism trending NE-SW direction through the central part of the Luzon island. This zone of volcanism is almost perpendicular to the island arc.

The origin of the MC is an unsolved problem, and various hypothesis had been suggested to explain its formation. Defant et al. (1988) supposed that the MC is a pull-apart rift zone between the West Luzon shear zone and the Philippine fault zone. Foster et al. (1990) cited inactivation of the West Luzon shear zone since early Miocene and proposed a pull-apart between the southern part of Manila Trench and the Philippine fault zone. Besana (1995), on the other hand, proposed a model that this region was formed from crustal thinning caused by collision of Palawan and Mindoro blocks, which was initiated in the Upper Miocene (e.g. Stephan et al., 1986).

Thus, in order to understand formation process of the MC, it is very important to determine and understand its present crustal deformation, not to mention the presence of both Taal and Banahaw volcanoes which are still active. Therefore, monitoring of the crustal movements in the MC using GPS measurement was initiated as one of an integrated research which includes a paleomagnetic study and K-Ar dating of volcanic rocks by Kyoto University and Philippine Institute of Volcanology and Seismology (PHIVOLCS).

Thirteen stations were established in 1996 and two stations wer added in 1999 in and around the MC. From April 1996 through September 2001, ten GPS campaigns were made. In each campaign, 5 to 8 dual-frequency geodetic GPS receivers (Ashtech Z-XII and Topcon GP-R1DY) were used to acquire the data simultaneously at different stations. Each observation was done for continuous 3 - 5 days and the data was collected at a 30 second interval for 24 hours.

After analyzing data using Bernese GPS software Ver. 4.2, a left lateral motion at 2-3 cm/yr with a large amount of counterclockwise motion was detected in the southern part of the study area. Furthermore, a large amount of extension, directing NNW-SSE or N-S was found in the MC. These observations are consistent with the block motion after 2Ma determined through a recent paleomagnetic research and a K-Ar dating study of volcanic rocks in and around the MC. It is possible that these crustal movements detected by GPS observations are closely related to the formation process of the MC.