Collision and westward motion of the Izu Peninsula

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The Izu Peninsula, the northern cusp of the Izu volcanic arc, is located on the northernmost tip of the Philippine Sea plate, and is considered to be colliding with Honshu, Japan. The velocity vectors in the Izu Peninsula obtained from continuous GPS observations are clearly different from those expected from the plate motion model such as Seno et al. (1993); the Izu Peninsula, especially its southern part, has been moving more westward compared with the motion predicted from the model.

In order to explain this difference, Sagiya (1999) proposed an 'Izu microplate' hypothesis and Mazzotti et al. (1999), an idea of 'Zenisu-West Izu block', both being alike each other. Heki and Miyazaki (2001) and Tabei et al. (2001) obtained plate motion models for the Izu microplate. However, as Ishibashi and Itani (2001) pointed out, there are several serious difficulties in the Izu microplate model from the viewpoint of plate tectonics. Therefore, in this paper we try to explain the discrepancy between observed and predicted velocity vectors in the Izu Peninsula through an approach different from the Izu microplate model. We consider that the collision of the Izu Peninsula with Honshu essentially brings about the westward shift of its motion, and that additional westward motion may be produced by presumable intra-arc rifting east-to southeast-off the Izu Peninsula

We analyzed data from the Japanese nationwide continuous GPS array (GPS Earth Observation Network, GEONET) by Geographical Survey Institute. GPS velocity vectors in the Izu Peninsula relative to Gotenba, which is located a little northward of the collision boundary, during the period from November 1998 to June 2001, when crustal activities around the Peninsula is expected to have made almost no influence, show very small westward movement in the northern part of the Peninsula and larger west-northwestward movement in its southern part. This suggests that the northward motion is reduced in the northern part of the Peninsula due to collision.

Westward components of velocity vectors in the southern part of the Izu Peninsula are almost equal to that of Hachijyo-jima Island, which is considered to almost represent the true motion of the Philippine Sea plate. Therefore, we interpret that basically only the northward motion of the Izu Peninsula is blocked due to the collision.

However, if the westward component is also blocked to some extent, the source is needed east- to southeast-off the Peninsula to produce some westward additional motion of the Peninsula. It may possible that the intra-arc rifting in the southern part of the Izu volcanic arc as pointed out by Morita (1998) has propagated as north as around the Izu Peninsula.