Paleomagnetic direction of the Paleogene Kobe Group ; the constraints on the paleoposition of Southwest Japan

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Paleomagnetic studies of the Miocene and Cretaceous rocks in Southwest Japan since 1980s suggested that Southwest Japan suffered clockwise rotation of about 40° relative to the Asian continent in a short period in the Miocene (e.g., Hoshi et al., 2015). Before that, no significant motion is assumed since the late Cretaceous (Uno et al., 2017). However, the apparent polar wander path, that is important to understand drift history of continents or crustal blocks, has not been established for Southwest Japan, particularly due to scarce paleomagnetic data from the Paleogene.

The Kobe Group, distributed in southern part of Hyogo prefecture, was dated at 30-39 Ma (Late Eocene to Early Oligocene) by K-Ar, Ar/Ar and fission-track dating, but its paleomagnetic direction has not been examined yet. In attempt to obtain Paleogene paleomagnetic poles representing Southwest Japan, we collected samples of tuffacious sediments of the Kobe Group in western part of the Sanda basin, where the strata are relatively well exposed. After measuring magnetic susceptibility and its anisotropy with a Kappabridge, we made measurement of remanent magnetizations using a cryogenic magnetometer (2G SRM) and stepwise thermal or alternating field (AF) demagnetizations. In addition, we made stepwise acquisition experiments of anhysteretic remanent magnetization (ARM) and isothermal remanent magnetization (IRM) in order to assess the coercivity spectra.

Results of the thermal and AF demagnetization are classified into three groups characterized by (1) only low temperature or low coecivity components, (2) additional high temperature or high coecivity components and (3) no meaningful components identified. The low temperature/coecivity components were recognized all the sites with the directions close to the present axial dipole field, suggesting overprints of viscous remanent magnetization (VRM). The high temperature/coecivity components, which were identified only at several sites, consistently showed eastward deflections of about 40-60° from the true north.

We interpret that the high temperature/coecivity components likely represent primary paleomagnetic direction of the Kobe Group, although the current data may be insufficient to average out the effect of paleosecular variation. The mean direction, however, is consistent with the late-Paleogene paleomagnetic directions reported from the Tonosho Group in Kagawa Prefecture and the KawamotoGranodiolite in Shimane Prefecture, providing the paleomagnetic pole plotted between the early Miocene (20Ma) and the Late Cretaceous poles. This result suggests that Southwest Japan had been a part of the continental block of east Eurasia during 70-20 Ma. Further investigation of the Paleogene paleomagnetic directions in Southwest Japan is expected to give clear constraints for paleogeography of East Asia before the opening of the Japan Sea.

Keywords: Paleogene, Southwest Japan, paleomagnetic direction