

Separation of Gagua Rise from Great Benham Rise in the West Philippine Basin during the Middle Eocene

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The West Philippine Basin (WPB) has started opening at ~ 58 Ma and ceased spreading at ~ 33 Ma, developing a fast spreading (~44 mm/yr half-spreading rate) magmatic episode between 58 and 41 Ma and the second amagmatic episode between 41 and 33 Ma. The occurrence of the first stage of spreading is closely related to the Oki-Daito mantle plume and related Benham Rise (BR) and Urdaneta Plateau (UP) activity. To the east of the Luzon–Okinawa Fracture Zone (LOFZ), BR was the most active volcanism from 48 to 41 Ma. The geomagnetic ages on both sides of the LOFZ have been determined; however, their causal relationship and evolution in the WPB remain unclear. In this study, we performed integrated analyses of multichannel seismic data and swath bathymetry data for the area to the west of the LOFZ. To the west of the LOFZ, the Gagua Rise (GR), is identified by a high residual free-air gravity anomaly, volcanic seamount chains and an overlapping spreading center. The GR is located at magnetic isochrons C20/C22 (50 to 44 Ma) and shows a thick oceanic crust of at least 12.7 km. We first propose an oceanic plateau named Great Benham Rise (GBR) which includes GR, UP and BR. We infer that the GR was a portion of the GBR since ~ 49 Ma and was separated from the GBR at ~ 41 Ma by the right-lateral LOFZ motion. Later, the relict GBR magmatism only continued in the area to the east of the LOFZ. Overall, the GBR dominates the spreading history of the WPB.

Keywords: West Philippine Basin, seafloor spreading and plume interaction, crustal structures