

How the Shikoku Basin cease to open? - Precise geomagnetic analysis using deep-tow magnetometer system

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The formation of the Shikoku Basin began at 30Ma, and the ridge axis direction was N-S and the full spreading rate was maximum 7-8cm/year as for the early stage. The ridge axis direction turned to NW-SE at about 20Ma and the spreading rate decreased to 3-4cm/year. It is considered that the spreading stopped at 15Ma.(Okino et.al. 1994) A seamount chain, called Kinan Seamount Chain is located at the remnant spreading axis, and the size of seamount becomes smaller as it goes to the south, Though the spreading stopped at about 15Ma based on the magnetic lineation analysis, age data from the basalt samples dredged at the Kinan Seamount Chain indicates two peaks of volcanism at around 15Ma just after the spreading and at 7-10Ma.(Ishii et.al. 2000)

A deep-tow proton magnetometer survey was done in the R/V Tansei-maru (Ocean Research Institute of the University of Tokyo) cruise in 1998, and precise geomagnetic profiles were collected across the remnant ridge axis. The purposes of the survey are to identify the magnetic anomaly lineation in the axial area and to decide the accurate date of the end of the spreading. Two profiles were collected, one across the Koshu Seamount, the northernmost Kinan Seamount Chain, and the another crossing between the 1st Kinan Seamount and the 2nd Kinan Seamount 120km southeast of the first line. The lengths of the profiles are 90km and 100km, respectively. The water depth was 3600-4400m, and the towing altitude was about 700-1500m.

The main results are as follows;

(1) Magnetic anomalies from 5C to 5B2 were identified and it was confirmed that the spreading stopped between chron 5B1 (14.800-14.888Ma) and 5B2 (15.034-15.155Ma). But, the timing when the spreading finally stopped is not simultaneously for two profiles (=segments), but the southern segment ceased to open at maximum circa 70,000 years after the end of the spreading at the northern segment.

(2) The small positive anomaly peaks between 5C and 5B2 are recognized on both profiles, which may be a new event which has not been reported.

(3) It is presumed with the north profile that the seamount was made at the center of the ridge axis after the spreading. The large amplitude of the magnetic anomaly near the seamount may be due to the influence of the seamount magnetization. On the other hand, the location of the seamount deviates 20km west from the axis along the southern profile. The northeastern side of the southern profile is close to the faults, so the pattern of the magnetic anomaly isn't clear.

The results of our precise magnetic data analysis indicate that the Shikoku Basin stopped spreading north to south. It may seem curious that a ridge system does not stop simultaneously, but the timing differs with respect to each segment. And, the mantle upwelling continued for a certain time after the spreading, causing the volcanic activity near the remnant axis. Assuming that the spreading continues longer in the southern segment, the remaining melt beneath the axis could not be enough to form a larger seamount after the spreading.