

Tectonic history of the Conrad Rise and initial breakup process of the Gondwana

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The Conrad Rise are situated in the middle of the Southern Indian Ocean between Africa and Antarctic, and regarded as one of the LIPs (large igneous provinces) related to upwelling plume activities. However, hot spot tracks associated with the Conrad Rise are not clearly established and the origin of the Conrad Rise are not well demonstrated. Moreover, the Gondwana breakup process and the relation between plume activity and breakup in the Southern Indian Ocean still remains poor-defined because of the sparse observations in this area. Total intensity and vector geomagnetic field measurements as well as swath bathymetry mapping were conducted during the R/V Hakuho-maru cruise KH-10-7 to understand the tectonic history of the Conrad Rise related to the Gondwana breakup in the Southern Indian Ocean. The dredge rock sampling were also performed at the Ob and Lena Seamounts in the Conrad Rise during the cruise. Magnetic anomaly data as well as swath bathymetry data obtained during the R/V Hakuho-maru cruise KH-07-4 Leg3 and KH-09-5 are also used in this study.

Magnetic anomaly profiles with amplitude of about 300-500 nT are observed almost parallel to the west of WNW-ESE trending structures just to the south of Conrad Rise inferred from satellite gravity anomalies. These magnetic anomalies most likely indicate Mesozoic magnetic anomaly sequence. Mesozoic sequence magnetic anomalies with amplitude of about 300 nT are also obtained along the NNE-SSW trending lineaments between the south of the Conrad Rise and Gunnerus Ridge. Oceanic crusts formed during Cretaceous normal polarity superchron are found in those profiles, although magnetic anomaly C34 has been identified just to the north of the Conrad Rise. However symmetric Mesozoic sequence magnetic anomaly patterns are not observed along the WNW-ESE trending lineaments just to the south of Conrad Rise. These suggest counter part of Mesozoic sequence magnetic anomalies in the south of Conrad Rise would be found in the East Enderby Basin, off East Antarctica. Moreover, approximately one-third of the dredged rock samples at the Ob Seamount are of metamorphic origin, whereas half of recovered samples are volcanic rocks. Gravity anomaly patters in vicinity of the Ob seamount show broad positive anomalies, and are different from that around the Lena Seamount which show negative gravity anomalies around the seamount. These imply that the Ob Seamount are continental origin and have left behind in the middle of the Southern Indian Ocean by initial breakup process of the Gondwana. These results provide new constraints for the tectonic history of the Conrad Rise and the initial breakup process of the Gondwana in the Southern Indian Ocean.

Keywords: Indian Ocean, Conrad Rise, Gondwana, magnetic anomaly, gravity anomaly, continental crust