Initial break-up process of Gondwana around the Natal Valley and the Mozambique Ridge, off South Africa.

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The Natal Valley and the Mozambique Ridge are considered to be formed during the initial break-up stage of Gondwana, however the detailed opening process is not well defined because of the poor geophysical survey data set in this region. To understand the crustal nature and history of the Natal Valley and the Mozambique Ridge, vector magnetic data are obtained during R/V Pelagia cruise 2009. Vector magnetic anomalies and magnetic boundary strikes are calculated from vector magnetic data. The total magnetic anomalies around this region are compiled by using those calculated by vector magnetic anomalies and marine magnetic anomalies from National Geophysical Data Center (NGDC) as well as the EMAG2 digital magnetic anomaly data set. Intensity of the crustal magnetization is deduced from the total magnetic anomalies incorporated with ETOPO1 topography data and offshore global sedimentation model. 2D magnetic block models are also estimated along some of the magnetic anomaly profiles. Moreover, crustal thickness is estimated from satellite derived gravity anomalies using with ETOPO1 topography and offshore global sedimentation model.

It is unlikely that the total magnetic anomalies in the northern Natal Valley (NNV) indicate the magnetic lineations proposed by previous studies. Low intensity of crustal magnetization similar to that of adjacent African continental area is observed on the area of the thick crust (about 14km) that is predominant in the NNV. The thick crust (about 14km) with the low intensity of magnetization most likely shows stretched continental crust. Areas of high intensity of crustal magnetization (more than +3A/m) with thin crust (about 12km) would represent the basaltic crust, and account for about 30% in the NNV. Magnetic boundary strikes obtained in the NNV most likely indicate the boundaries between basaltic intrusion and the stretched continental crust. The basaltic intrusion might be related to Karoo volcanism. In the southern part of the southern Natal Valley (S-SNV), NW-SE magnetic boundary strikes along the total magnetic anomaly profiles show the magnetic isochrones M10-M0 proposed by previous studies. Several fracture zones are suggested from the magnetic boundary strikes and intensity of crustal magnetization along observation lines. In the northern part of the southern Natal Valley (N-SNV), low intensity of crustal magnetization with the 9~11km crustal thickness are observed and these imply the stretched continental crust similar to the stretched continental crust area of the NNV. The N-SNV most likely shows the edge of the stretched continental crust, and seafloor spreading in the S-SNV started at the time of M10. In the northern part of the Mozambique Ridge (N-MOZR), features of intensity of crustal magnetization and crustal thickness are also similar to those in the NNV, suggesting the same formation process of the NNV. In contrast, high intensity of crustal magnetization is dominated in the southern part of the Mozambique Ridge (S-MOZR). The magnetic boundary strikes show the clear NW-SE trend however the magnetic anomaly pattern is not clear and crustal thickness is thicker more than 11km. High intensity of crustal magnetization and thick crust probably indicates that the S-MOZR was formed with excessive volcanism such as hotspot. NW-SE trend of magnetic boundary strikes may represent the trend of the spreading ridge. These results suggest that there is continental ocean boundary between the N-MOZR and the S-MOZR.

We will present the crustal features deduced from magnetic anomalies and gravity anomalies in the Natal Valley and the Mozambique Ridge, and discuss about the initial break-up process of Gondwana in this region.

Keywords: vector magnetic anomalies, break-up of Gondwana, Natal Valley, Mozambique Ridge

