Seafloor spreading process in the Mozambique basin off east Africa during the initial breakup of Gondwana

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The break-up of Gondwana is the single most important geological event to have affected the southern hemisphere in the past 200 Myr. The Mozambique Basin between the African continent and Madagascar are features central to this break-up. The present geodynamic models for the Mozambique Basin and on the conjugate side the Riiser-Larsen Sea have only few constraints on the detail of the opening history. Especially, there are no magnetic data reported to constrain any geodynamic model in the area east of 40E for the Mozambique Basin. Newly conducted shipboard three-component magnetic survey in the Mozambique Basin during the R/V SONNE cruise SO-183 from May to July in 2005, reveal more detailed seafloor spreading history in the Mozambique basin during the initial breakup of Gondwana.

Along the total 16 lines with each ˜700 km long and a spacing of ˜30 km, three-component magnetic data were collected for the entire basin. The magnetic polarities and the locations of polarity boundaries were determined for each survey line from variation of both the vertical and horizontal components. The seafloor ages were estimated by comparing the observed magnetic profiles with the model profiles. In addition, the spreading rate and the magnetic strikes change with age are determined.

We have identified three spreading segments (Segment-1 in the west to Segment-3 in the east) and two distinct fracture zones in the Mozambique Basin. To the East of the Segment-3, it was difficult to correlate magnetic reversal between the lines. The amplitudes decrease from west (˜500 nT) to east (˜150 nT). The magnetic isochrones are identified from Chron M3 to M24 in the Segment-1, Chron M3 to M22 in the Segment-2 and Chron M0 to M22 in the Segment-3. For all segments, the spreading half rate increased up to ˜25-30 km/Myr at ˜130 Ma and ˜15-20 km/Myr before this age. The spreading direction also changed from ˜N10E to ˜N10W at the same age. This faster spreading rate continued until ˜126 Ma and then gradually decreased to ˜15 km/Myr at ˜120 Ma. These changes can be related to the initial opening of the Southern Atlantic Ocean. Although the previous model for the opening of the Mozanbique Basin (Segoufin, 1978; Segoufine and Patriat, 1980) is mostly consistent with our results, our new findings from Mozanbique Basin especially the detailed changes of spreading rate and its direction, and the precise location of the fracture zones will constrain the existing geodynamic model for the break-up of Gondwana. Moreover, we suggest a new breakup model is necessary to explain the magnetic features in the eastern part of the Mozanbique Basin.