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Marine magnetic anomalies in the NE Indian Ocean: the Wharton and Central Indian basins revisited

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The North-eastern Indian Ocean has recently received a renewed interest. The disastrous earthquakes and tsunamis of Dec. 2004 off Sumatra have triggered a large international effort including several oceanographic cruises. The Ninetyeast Ridge, a long submarine ridge which extends NS on more than 4000 km, has been the focus of a recent cruise aiming to study the interaction of a hotspot with the oceanic lithosphere and spreading centres. Both the study of the seismogenic zone under Sumatra and the Ninetyeast Ridge formation require accurate determination of the age and structure of the oceanic lithosphere in the Wharton and Central Indian Basins. First we delineate tectonic elements such as the Sunda Trench, the Ninetyeast Ridge, and the fracture zones of the Wharton and Central Indian basins from a recent version of the free-air gravity anomaly deduced from satellite altimetry and available multibeam bathymetric data. We use all available magnetic data to identify magnetic anomalies and depict seafloor spreading isochrons in order to build a tectonic map of the Wharton Basin. To do so, we apply the analytic signal method to unambiguously determine the location of the magnetic picks.

The new tectonic map shows more refinements than previous ones, as expected from a larger data set. The fossil ridge in the Wharton Basin is clearly defined; spreading ceased at anomaly 18 young (38.5 Ma), and, perhaps, as late as anomaly 15 (35 Ma). Symmetric anomalies are observed on both flanks of the fossil ridge up to anomaly 24 (54 Ma), preceded by a slight reorganization of the spreading compartments between anomalies 28 and 25 (64 - 56 Ma) and a more stable phase of spreading between anomalies 34 and 29 (83 - 64 Ma). Earlier, a major change of spreading direction is clearly seen in the bending fracture zones; interpolating in the Cretaceous Quiet Zone between anomaly 34 in the Wharton Basin and anomaly M0 off Australia leads to an age of Ĩ00 Ma for this reorganization. Anomalies 20 to 34 are clearly identified in the western part of the Central Indian Basin. The interpretation is more difficult in the compartments located immediately west of the Ninetyeast Ridge, where multiple ridge jumps have been proposed to explain complex anomaly patterns. In a different way, we recognize a continuous sequence of anomalies 20 to 34, although the anomalies 25 to 29 seem to be wider and display complex boundaries.