

Detection of seafloor structures in the South Indian Ocean: New constraints on the initial break-up

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We obtained new constraints on the initial opening between Antarctica and India from newly processed digital images of the satellite derived marine gravity.

The ocean floor surrounding Antarctica records the history of the Gondwana break-up. However, seafloor structures around Antarctic were poorly resolved because of the paucity of data coverage. Key structures of several areas were still ambiguous even in the recently published gravity images based on GEOSAT, ERS and TOPEX/Poseidon altimetry data. To obtain more detailed information than previously retrieved, we examined the applicability of the GEOSAT/GM 10 Hz sampled altimetry data and found that the data contained more detailed sea floor information than that derived from previous marine gravity images. We then decided to calculate gravity grids using the 10 Hz sampled data. We also avoid any data filtering in the process to prevent information loss. Following these strategies, we first produced gravity anomaly images around Antarctica of 0-360E, 40-72S. In the next step of data processing, we applied a combination of image processing techniques, i.e., binarization and clustering, for the obtained gravity image.

Using the obtained images, we clarified layout of NNE-SSW trending parallel lineaments between the Gunnerus Ridge and the Conrad rise in the West Enderby Basin. The lineaments are bounded on north and south side by WNW-ESE shorter lineaments, and they form rectangular segments continuously aligned from west to east. At the center of each rectangular segment, some structural tracks traverse the NNE-SSW lineaments perpendicularly. Judging from the layout of those structures, the tracks are considered to be an extinct ridge system and the lineaments are the traces of fracture zones which were accompanied by the ridge system. If the existence of the ridge is true, the chronology of the seafloor creation at the south of the Conrad Rise should be advanced to the early stage of the break-up. Moreover, spreading direction suggested from the trend south of the Conrad Rise was different from the previously assumed spreading direction of the West Enderby basin. It implies that, in the reconstruction of Gondwana, fitting between Antarctica and India requires considerable modification. Seafloor structures obtained in this study imply that the initial stage of the evolution of the South Indian Ocean differs from that previously assumed.