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New magnetic anomaly map of the East Antarctic continental margin

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Marine magnetic survey coverage of the southern part of Indian Ocean is to a certain extent limited for defining the magnetic pattern of the continental margin of East Antarctica. The USA research vessels collected the bulk of the marine magnetic data in the beginning of 1960's. During the succeeding years Australian, German, Japanese, Russian and other international scientific programs made major contributions to the network of marine magnetic data. Since the beginning of new century only two nations (Russian and Australian) have acquired the marine magnetic data in the southern part of Indian Ocean. The marine surveys in the Cosmonaut Sea, the western part of the Cooperation Sea in the Davis and Mawson Seas were accomplished by the PMGRE in 2000-2009 field seasons. The marine magnetic data collected during two seasons (2001-2002) within the AASOPP Project which was established in early 2000 to define the outer limits of the continental shelf offshore of the Australian Antarctic Territory (AAT) covered the full length of the AAT from 40OE to 160OE.

The new magnetic anomaly map of the East Antarctic continental margin incorporates all available data acquired by the international community since the IGY 1957-58 through to 2009. Results of the compilation do not radically alter recent models describing first-order motions between the Antarctic, Australian and Indian plates, but they help to resolve uncertainties in early break-up history of opening between these plates.

The timing and direction of early seafloor spreading in the area off the Antarctic margin, once conjugate to part of the Southern Greater Indian margin and to Australian margin, along the largely unknown region of the Enderby Basin, Davis Sea and Mawson Sea has been analyzed by many authors using different data sets. It is highly likely that spreading in the Enderby Basin occurred around the same time as the well documented M-sequence (anomalies M10 to M0) off the Perth Basin, Western Australia (Powell et al. 1988). The history of the early spreading is complicated further by the likelihood of one or several ridge jumps in which most early seafloor crust was transferred to the Antarctic plate and the Elan Bank micro-continent was isolated from the Indian continent (Muller et al. 2001). Additionally, a large amount of the seafloor crust is now probably overprinted by igneous activity associated with the Kerguelen Plume, which began forming the Kerguelen LIP from about 120-110 Ma.

However all available results of interpretations do not match to the magnetic anomaly pattern which can be distinguished by the newly compiled map. Our observations suggest that this is especially correct to the Enderby Basin and to lesser degree for the region that was conjugate to Australia. The prominent magnetic anomaly boundary signal and sharp basement step correlated with the MacRobertson Coast Anomaly or the Enderby Basin Anomaly (Golynsky et al., 2007) is not observed elsewhere in the Enderby Basin, Princess Elizabeth Trough or Davis Sea. In the central Enderby Basin there some evidences for an abandoned 'fossil' spreading centre that might continue to the west of the Kerguelen Plateau, east of Gunnerus Ridge. The estimated timing of its extinction corresponding to the early surface expression of the Kerguelen Plume at the Southern Kerguelen Plateau around 120 Ma and the subsequent formation of the Elan Bank microcontinent. Alternatively, the ridge jump occurred only in the central Enderby basin, due to the proximity of the Kerguelen plateau, whereas seafloor spreading continued in the western Enderby basin and conjugate south of Sri Lanka basin.