

A new tectonic model between the Madagascar Ridge and Del Cano Rise in the Indian Ocean

Taichi Sato¹, Yoshifumi Nogi^{2, 3}, Hiroshi Sato⁴ and Masakazu Fujii^{2, 3}

1 Geological Survey of Japan, AIST, Tsukuba Center7, 1-1-1 Higashi, Tsukuba-shi, Ibaraki 6 305-8567, JAPAN, taichi-sato@aist.go.jp

2 Geoscience Group, National Institute of Polar Research, 10-3, Midori-cho, Tachikawa-13 shi, Tokyo 190-8518, JAPAN

3 Department of Polar Science, School of Multidisciplinary Sciences, The Graduate 16 University for Advanced Studies, SOKENDAI, 10-3 Midori-cho, Tachikawa-shi, Tokyo 17 190-8518, JAPAN

4 Department of Business Administration, Senshu University, 2-1-1, Higashimita, Tama-20 ku, Kawasaki-shi, Kanagawa 214-8580, JAPAN

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Introduction

We have several supplementary figures for our manuscript. Figure S1 indicates the vertical gravity gradient map of the survey area. We mainly used this figure to identify seafloor lineaments. Figure S2 shows the newly interpreted as well as the previously identified isochrons in the survey area. Figure S3 indicates the magnetic anomaly profiles of the DI and IG segments. This figure shows the identified seafloor ages from Chron 1 to 31, which will support our presented tectonic history between the seafloor ages from Chron 21 to 30. Figure S4 indicates the histogram of the magnetic boundary strike diagrams (MBSDs). This figure shows the timing of when the spreading direction changed; therefore, this will also support our presented tectonic history between seafloor ages from Chron 21 to 30. Figure S5(a) shows the total and vector magnetic anomaly profiles obtained during the survey of KH1007 cruise. The survey line is the same as the one shown in Figure 3b. MBSDs plotted on the seafloor bathymetry are also shown in Figure S5(b).

Table S1 indicates the spreading rates and directions of the DI and IG segments. This table also supports our seafloor spreading model.

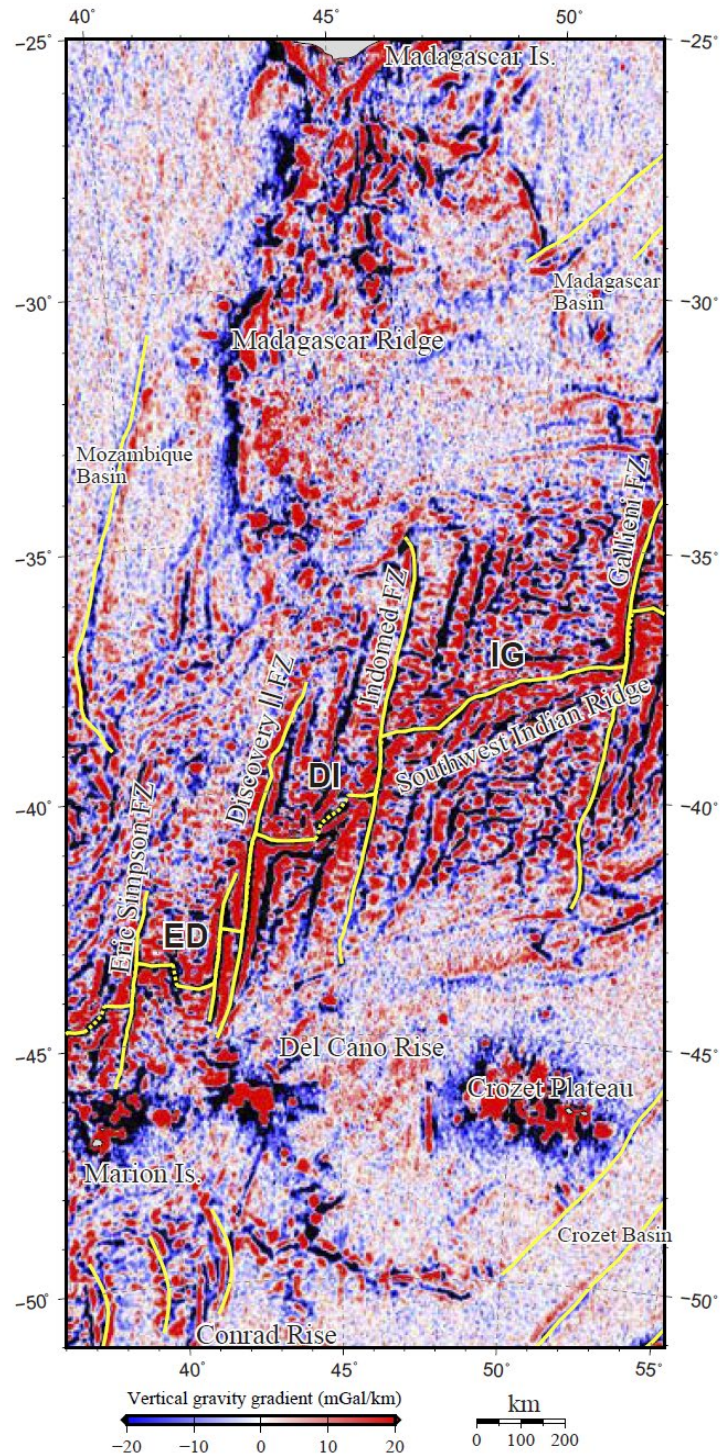


Figure S1. Vertical gravity gradient map (Sandwell et al., 2014) of the survey area. The solid yellow lines indicate the Southwest Indian Ridge (SWIR), transform faults, and primary fracture zone traces.

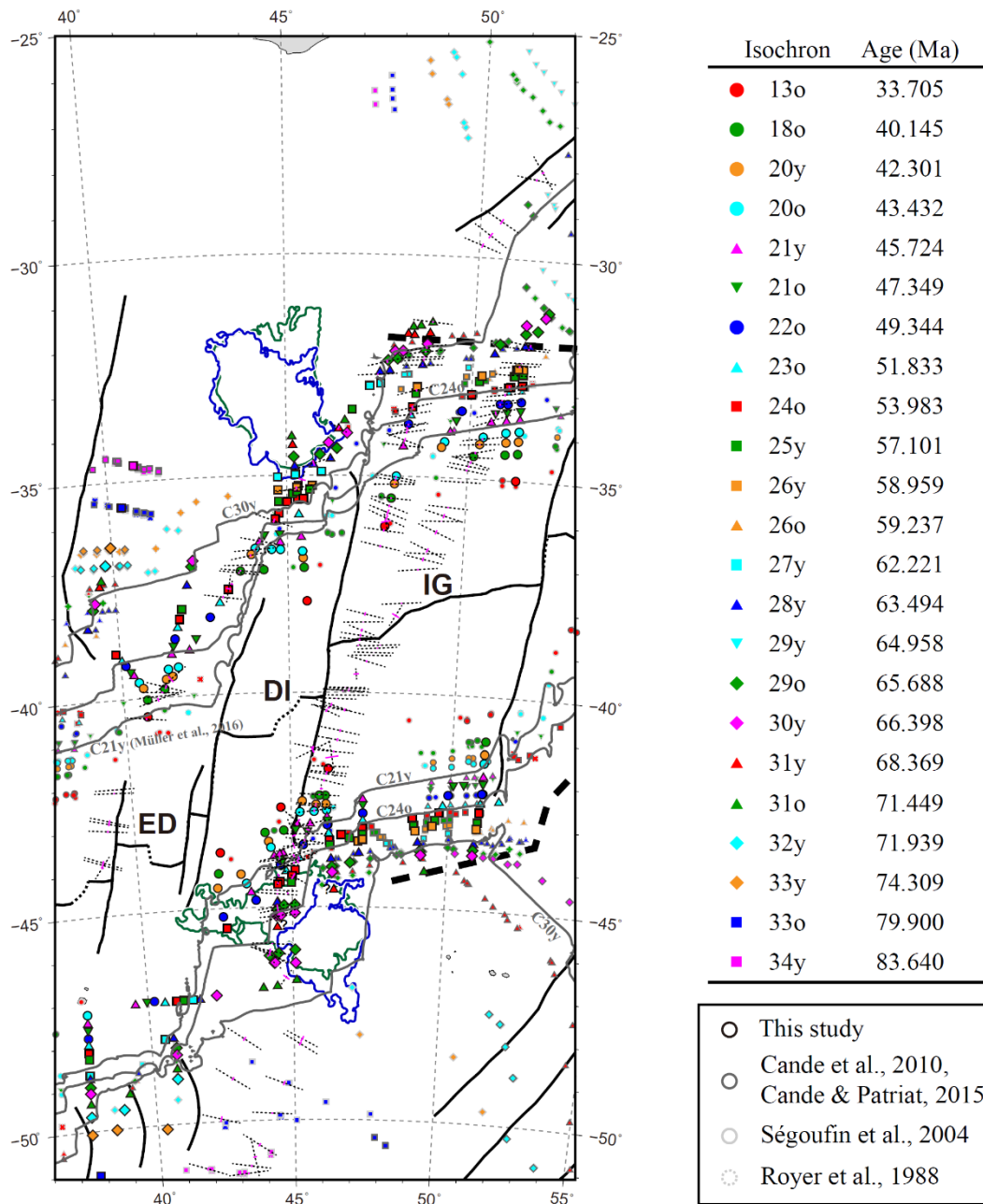


Figure S2. Newly interpreted isochrons in the survey area. Other data which had been previously identified are also plotted. The geomagnetic polarity reversal timescale of Ogg (2012) was used. Thin gray lines indicate the seafloor ages of Chron 21 (45.7-47.4 Ma) and Chron 30 (66.4 -68.2 Ma) extracted from the global age model (Müller et al., 2016). Magnetic boundary strike diagrams (MBSD) are also overlaid. Dashed black lines indicate the azimuth of the strikes, and their length indicate the cosine of the inclination. Thin

purple lines indicate angular standard deviation; longer lines indicate larger standard deviations.

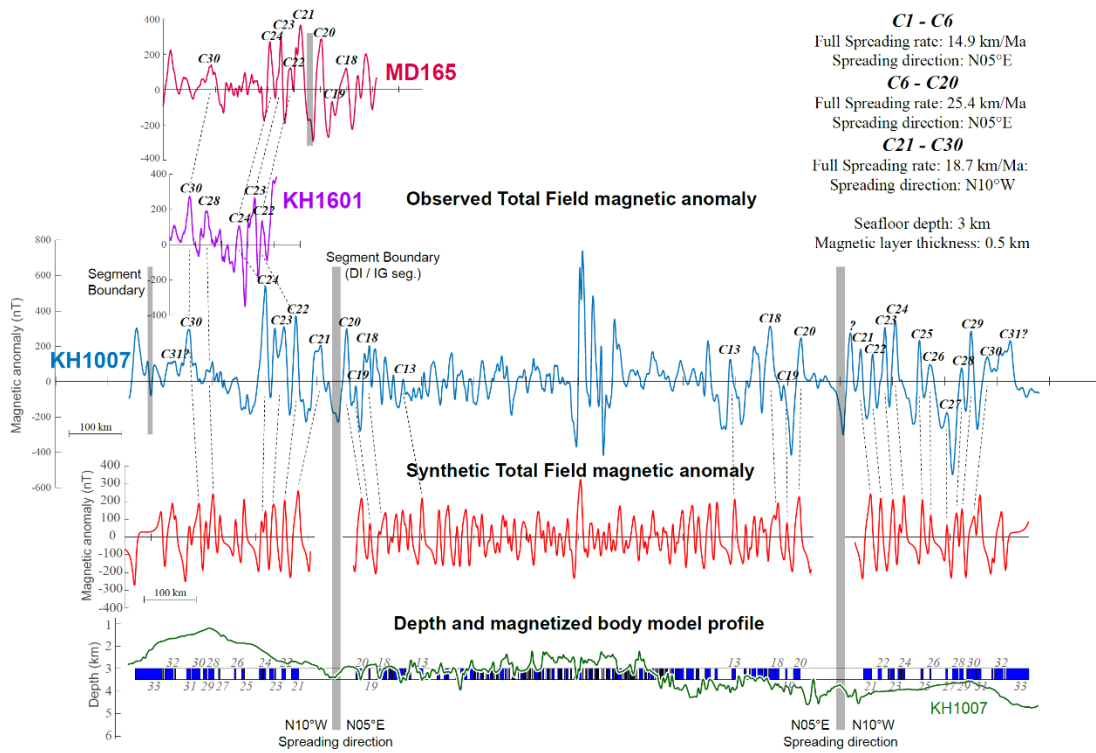


Figure S3. The observed (Top) and synthetic (middle) magnetic anomaly profiles of the DI and IG segments. The horizontal axis indicates the distance along the survey line. The depth profile and the magnetized body model shown in the bottom is extracted along the profile of KH1007.

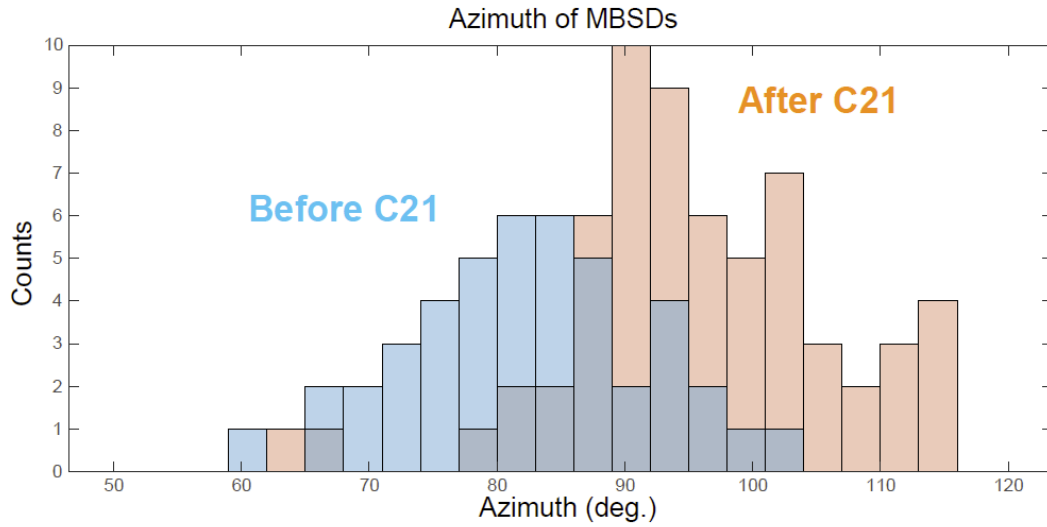


Figure S4. Histogram of the magnetic boundary strike diagrams (MBSDs). An MBSD with a higher ISDV (in this study, we chose a threshold of 40 nT/km of ISDV) would represent the direction of a magnetic boundary: therefore, the orthogonal direction of the MBSD should be equal to the spreading direction.

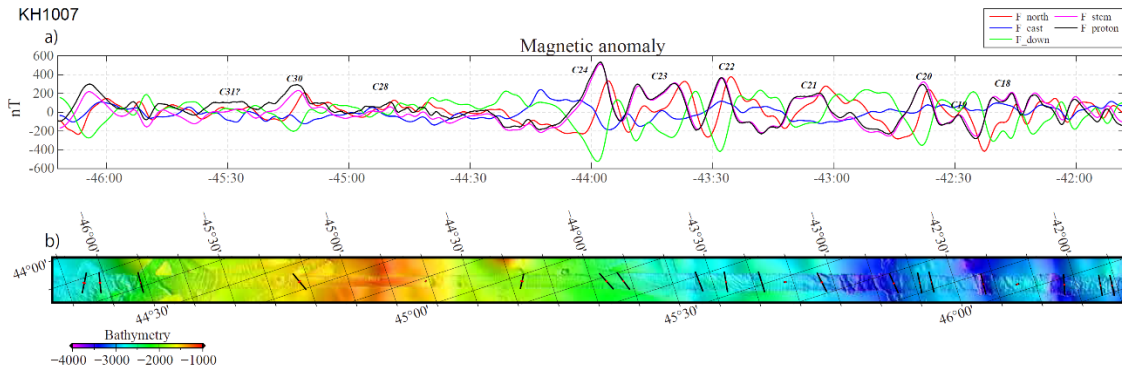


Figure S5. (a) Total and vector magnetic anomaly profiles along the survey line of KH1007 cruise. This survey line is the same as shown in Figure 3b. **(b)** MBSDs calculated using the data obtained from the KH1007 cruise overlaid on the seafloor bathymetry. Solid black lines indicate the azimuth of the strikes, and their length indicate the cosine of the inclination. Thin red lines indicate the angular standard deviation; longer lines indicate larger standard deviations.

Spreading rates and directions of DI and IG segments

	North (km/Ma)	South (km/Ma)	Total (km/Ma)	Asym (%)	Direction (deg.)
C30 - C21					
IG segment	9.8 (0.8)	8.9 (1.9)	18.6	52/48	N10°W
DI segment	9.9 (0)	7.7 (0.5)	17.6	56/44	N10°W
C20 - C6					
IG segment	12.9 (0.6)	12.5 (0.2)	25.4	51/49	N5°E
DI segment	14.5 (0)	-	-	-	-
C6 - C1					
IG segment	7.1 (0.2)	7.8 (0.2)	14.9	48/52	N5°E
DI segment	-	-	-	-	-

Table S1. Spreading rates and directions of DI and IG segments. The values in parentheses indicate the standard deviations.