Magnetic anomalies near the axial part of the North Fiji Basin

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Magnetic data obtained in STARMER project

The STARMER project is the short saying for the Japan and France scientific cooperation program and the word comes from the short for Science and Technology Agency of Japan (STA) and French Institution for Research and Environmental studies of the Sea (IFREMER). This project is conducted by research organizations of Japan, France and the South Pacific countries. The joint program is provided by STA and IFREMER in cooperation with the Committee for the Coordination of Joint Prospecting for the Mineral Resources in South Pacific Offshore Areas (CCOP/SOPAC). Both sides includes several organizations respectively. Table. I indicates the names of organizations which participated this program. The results of STARMER project (phase I) are compiled in topographic maps (Auzende et al., 1992) and in a special issue of Marine Geology.

Proton precession magnetometer was used in STARMER project for total geomagnetic intensity, which was from 1987 to1991, and STCM (shipboard three component magnetometer) is also used in NEW STARMER program, which is going from 1992. Total geomagnetic intensity data is available from 8 cruises including French cruises, 3 component geomagnetic data is obtained in NOFI cruises in 1994. Fig. 1.shows all the ship tracks concerning the STARMER project with the cruise names.

Results

A detailed magnetic anomaly map around the central rift area in the North Fiji Basin was compiled from 8 STARMER cruises(Fig.2). The data range is almost 900 km in length, 22°S to 12°30'S, 100 km in width, 171°E to 176°E. Detailed magnetic structure analysis was applied for the data around the rift axis, which revealed 5 or 6 segments along the 900 km rift axis (Joshima et al.,1994). Inversion trials were done on the grid data using Okuma's method (Okuma et al.,1994) and good coincidence with topographic features, which were shown in shaded relief map made by Kishimoto(1991)'s method, was obtained (Fig.3). The results of inversion indicate that the lineations which correspond to Olduvai event were recognized in this area broadly, but not so common for Gauss epoch. The central rift system seems to have started its spreading from around the end of Gauss normal epoch or the beginning of Matuyama reversed epoch (2.5 Ma). The other topics is that the data indicates well the magnetic features of propagating rift with a transformfault in the southernmost area. The features are referred by Maillet et al. (1989) and theoretically by Hey et al. (1986).

All magnetic data available in the North Fiji Basin was compiled in Fig.4 as track lines and Fig.5 as magnetic anomaly map. Among these data aeromagnetic one seems to have some error in their positioning (Cherkis, 1980). Tanahashi (1995) took notice on their triangle linear lines which shoud have relation to propagating rifts and might be caused by intermittent propagation of rifts and it means that the magnetic features in the North Fiji Basin are very complicated.

STCM measurements in northern North Fiji Basin

3 component geomagnetic data were obtained around the axial area of the northern North Fiji Basin (South Pandora Ridge and Tripartite Ridge) during the NOFI cruise by L'Atalante. Survey area, full covered 1 box and several transects, using multi-narrow beam system EM 12 whose swath range is almost 20km for both side at 4000m deep basins and able to show the reflective intensity of the sea bottom ranges 200 km NS and 700 km EW. 3 component geomagnetic measurements indicate rather good coincidence with the direction of ridges shown in EM 12's image map Fig.6 indicates both the boundary vectors calculated from STCM data using Seama (1992)'s method and geological map studied from EM 12's image map (Ruellan et al., 1996) resemble each other.

Remarks

Magnetic anomaly studies based on the grid data needs dense survey lines whose interval should be 2 or 3 miles. STCM becomes useful when the interval of survey lines is broader than 4 mile in these day's topographic surveys such as GLORIA, EM12 and so on, whose side range is becoming broader and broader as technology, particularly the electronics and computer, is improved.

Acknowledgement

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Table. 1 Organizations related in STARMER project

STARMER Project (1987-1991)	New STARMER Project(1993-1997)
France	France
IFREMER* ,ORSTOM * * , ENS * * *	IFREMER,ORSTOM,INSU/CNRS
UBO****, INSU/CNRS*****	
Japan	Japan
STA,GSJ#,JAMSTEC##,NIES###	STA,GSJ, JAMSTEC,HDJ
HDJ####, UT#####,ORI ######	UT,ORI,IFT
IFT#######	
South Pacific	
CCOP/SOPAC%,DMR of Fiji%%	SOPAC,DMR of Fiji

* Institute of Research and Environmental Studies of the Sea

** French Institute for Scientific Research and Cooperation Development

*** Ecole Normale Superieure

**** University of Western Brittany

*****National Institute of Sciences of' the Universe/National Center for Scientific Research

\# Geological Survey of Japan

\## Japan Marine Science and Technology center

\### National Institute for Environmental Studies

\#### Hydrographic Department of Japan

\##### University of Tsukuba

\###### Ocean Research Institute, University of Tokyo

\####### Institute for Future Technology

% Formerly Committee for the Coordination of Joint Prospecting for Mineral Resources in South Pacific Offshore Areas, now SOPAC (the South Pacific Applied Geoscience Commission

%% Department of Mineral Resources of Fiji

Ship's track lines in STAMER Project

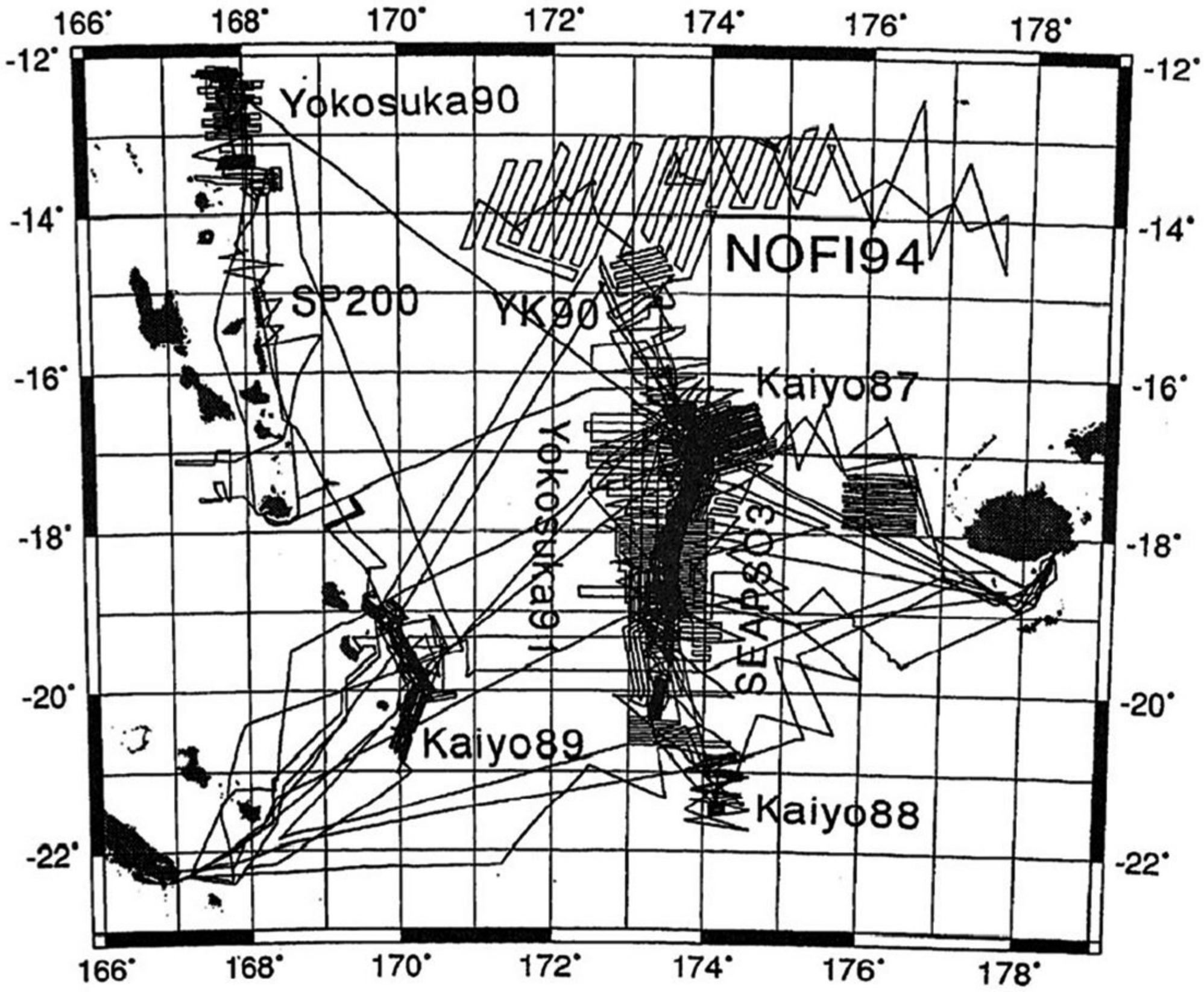

Fig.1 Distribution of ship's tracks in STARMER Project. Cruise names were written near the block of ship's tracks.

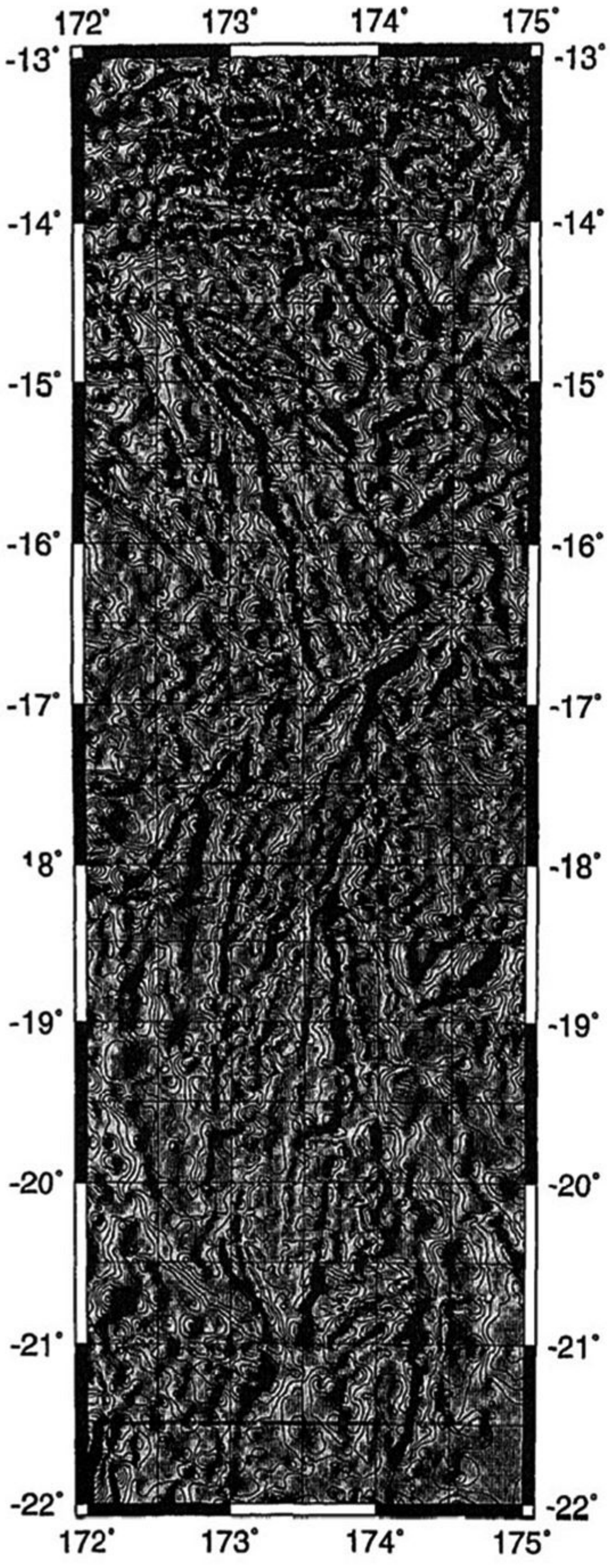

Fig.2 Compiled magnetic anomaly data near the axial area. Contour interval is 100 nT. Shaded relif of magnetic anomaly is also shown with light from the direction of 300°.

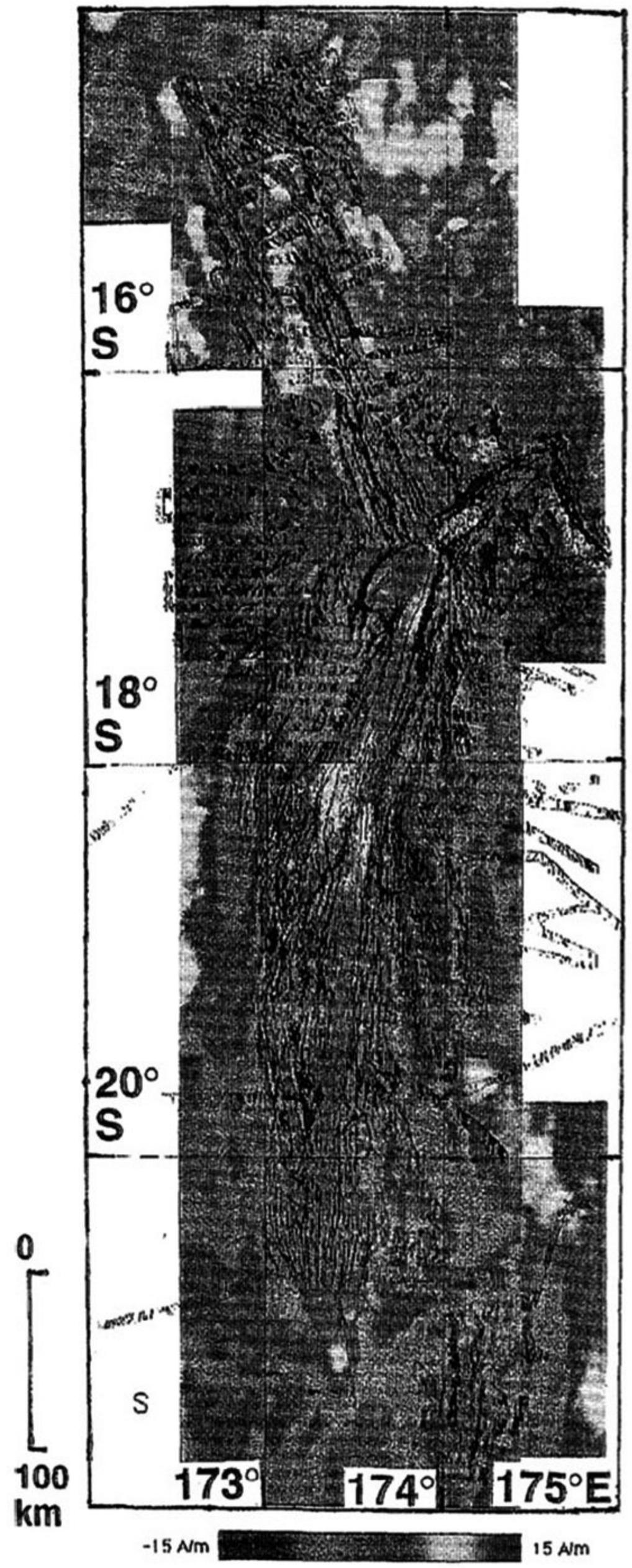

Fig.3 Results of inversion near the axial part in the North Fiji Basin.

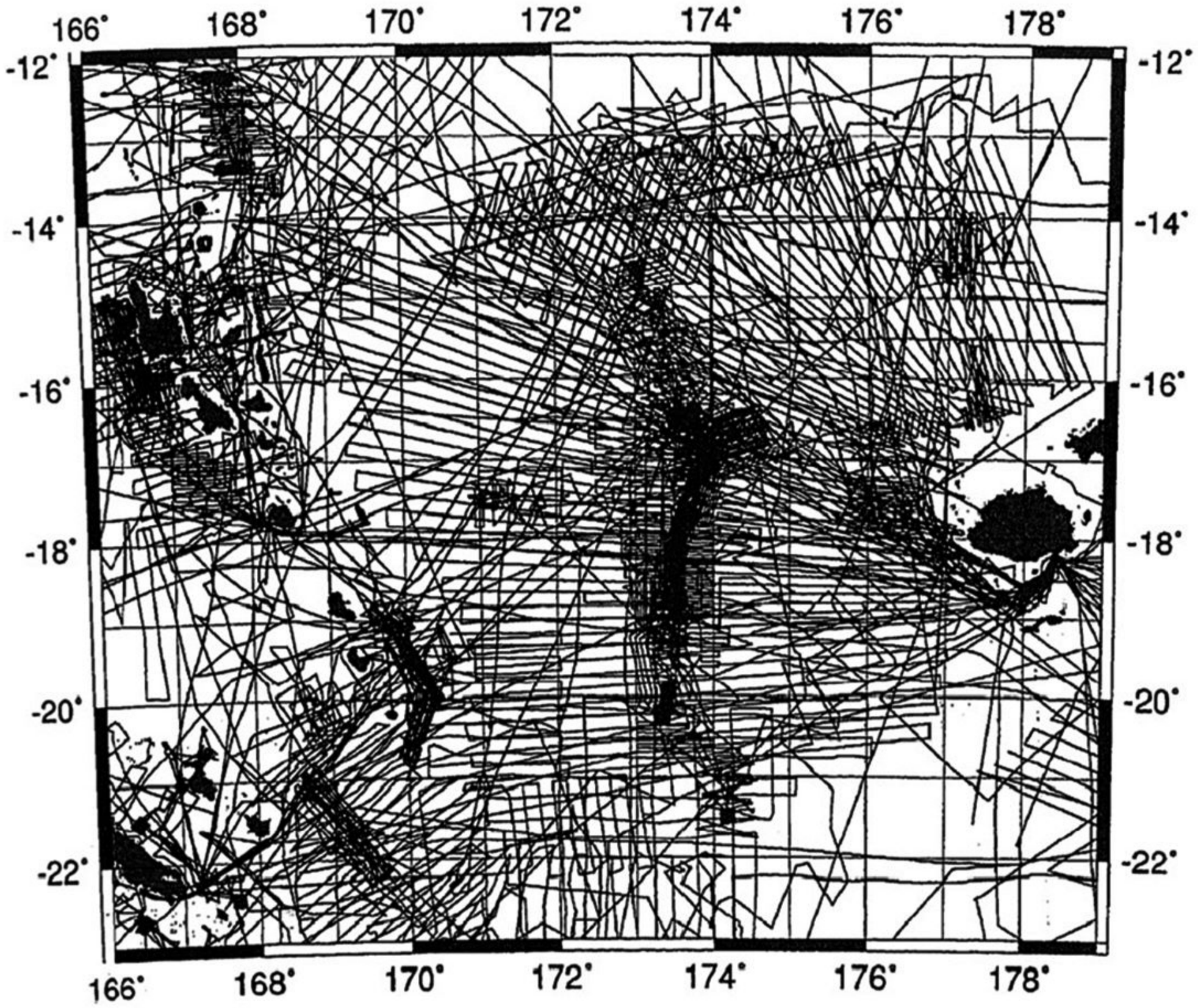

Fig.4 All ship's tracks compiled in this study including aeromagnetic survey lines.

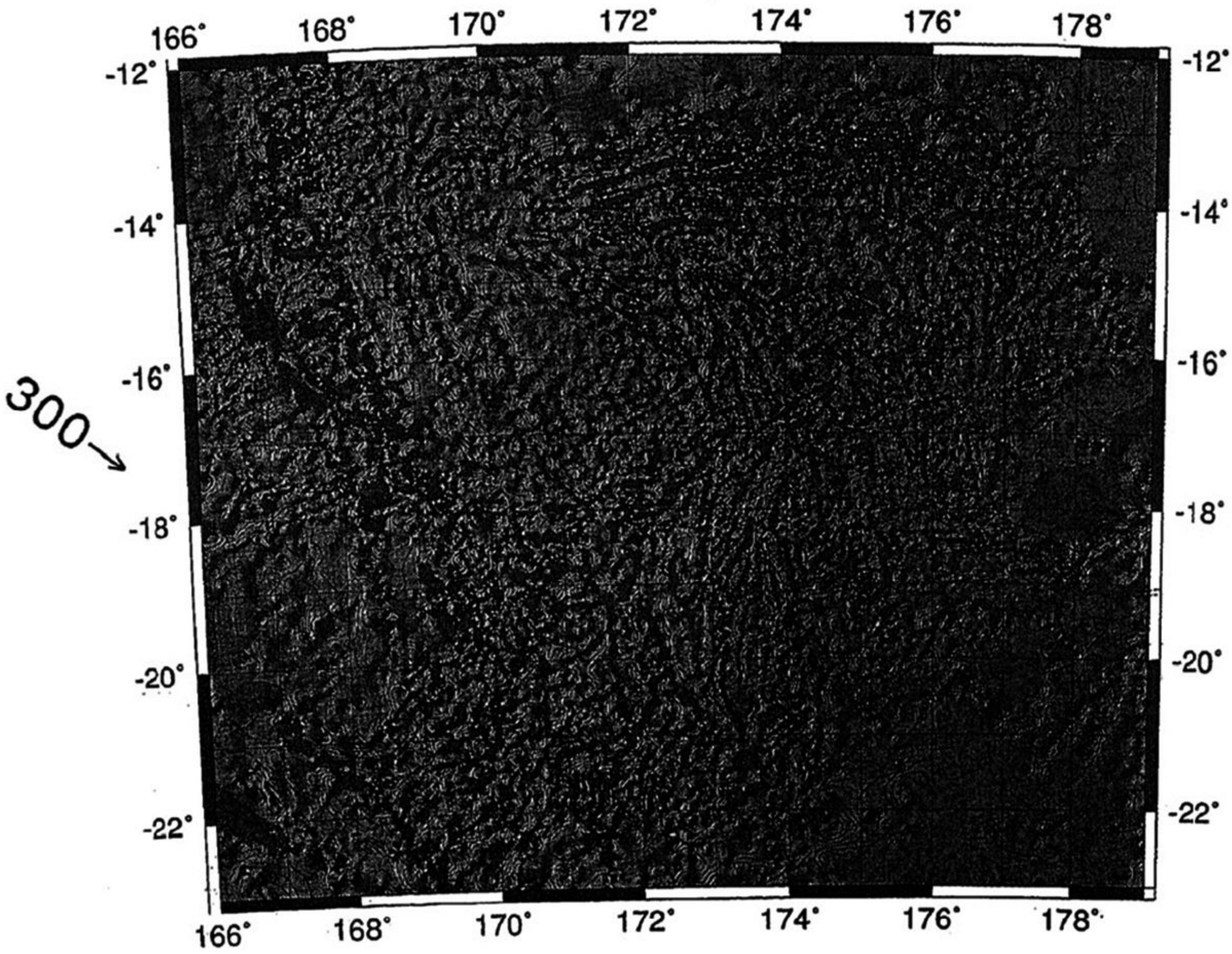

Fig.5 Compiled magnetic anomaly data in the North Fiji Basin. Shading is added from the direction of 300°.

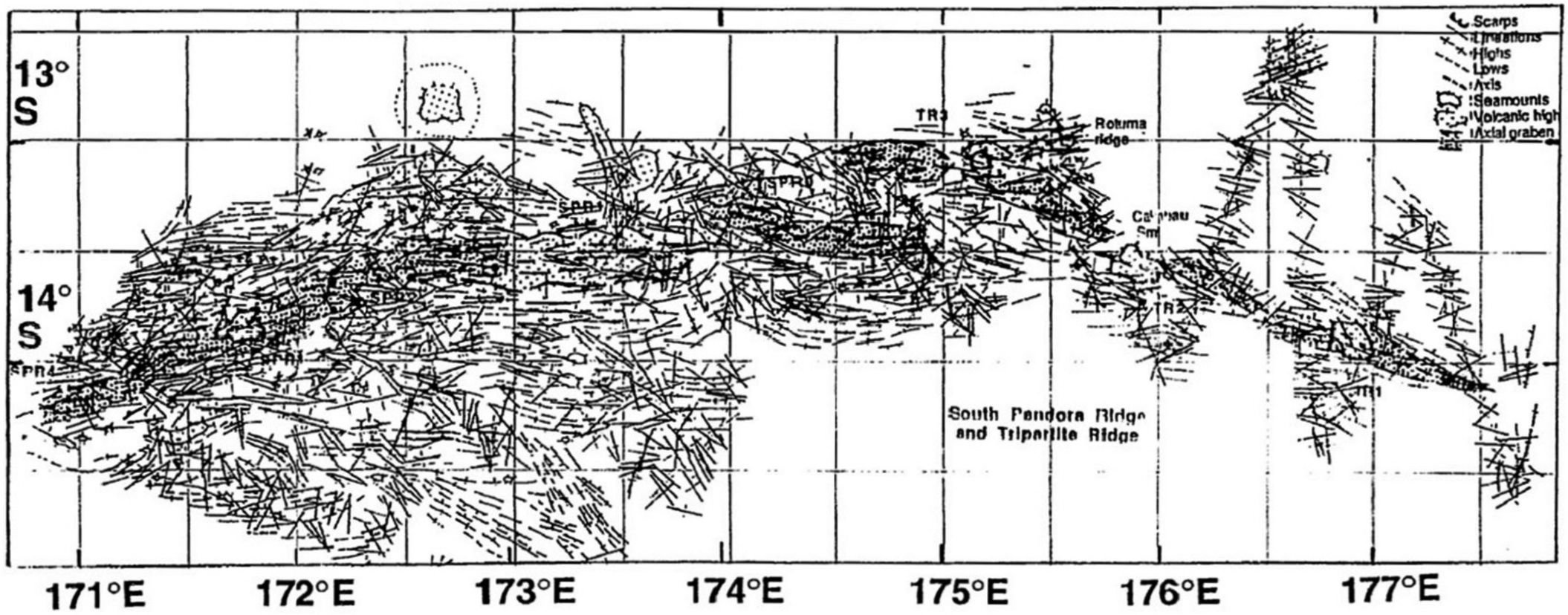

Fig.6 Boundary vector map (red bar indicates drection of boundary) calculated from STCM data and geologic feature map (black figure).

References

Auzende, J.-M., Honza, E., Maze, J.-P. and the STARMER Group, 1992. Comments on the seabeam map of the North Fiji Basin Ridge between 16°10'S and 21°40'S. Ofioliti, 17: 43-53 . Cherkis, N.Z.,1980. Aeromagnetic investigations and sea floor spreading history in the Lau Basin and Northern Fiji Plateau.UN ESCAP, CCOP /SOPAC Tech. Bull.,3: 37-45.

Hey, R.N., Kleinrock, M.C., Miller, S.P., Atwater, T.M. and Searle, R.C., 1986. Sea Beam/Deep-Tow investigation of an active oceanic propagating rift system, Galapagos 95.5°W. Jour. Geophys. Res., 91:3369-3393.

Joshima, M.,Iwabuchi Y., Ookuma, S.,1994. anomaly partterns around the central rift area in the North Fiji Basin: Inversion approach for detailed structure.Marine Geology,116:89-100

Kisimoto, K.,1991.Imaging of 2-dimensionally mapped data on PCs. Jour. Japan Soc. Mar. Surv. Tech.,3, 2: 1-8.

Maillet,P.,Monzier, M., Eissen, J.-Ph. and Louat, R.,1989. Geodynamics of an arcridge junction: the case of the New Hebrides Arc /North Fiji Basin. Tectonophysics, 165:251 -268.

Malahoff,A.,Feden,R.H.and Fleming, H. S., 1982.Magnetic anomalies and tectonic fabric of marginal basins north of New Zealand. Jour. Geophys.Res.,87:4109 - 4125.

Okuma,S.,Makino,M.,Nakatsuka,T., 1994. Magnetic intensity mapping in and around Izu-Oshima Volcano, Japan.J our. Geomag. Geoclectr., 46:541-556

Ruellan E.,Lagabrielle Y., Tanahashi, M.,and the Shipboard Party, 1996. yields surprises about seafloor spreading in back-arc basins.EOS Trans.,77:365-370.

Seama, N., 1992 Studies of vector geomagnetic anomalies in the oceans.,Jour Japan Soc. Marine Surv.Tech., 4,2:41-49.

Tanahashi, M., 1994.Tectonics of the spreading center in the North Fiji Basin. Bull. Geol. Surv. Japan, 45: 173-234.