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Recent progress in magnetic anomaly mapping over Victoria Land (Antarctica) and the GITARA 5 survey

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Abstract: Magnetic anomaly mapping is used to interpret crustal structure and tectonic evolution of Victoria Land and of the adjacent Ross Sea. Previous interpretation of magnetic anomalies verified seismic and gravimetric findings in the Ross Sea by placing additional constraints both on crustal structure and magmatism of the West Antarctic rift system. An aeromagnetic map of the central-southern part of Victoria Land produced in the framework of the GITARA project, provides new crustal images of part of the Transantarctic Mountains rift shoulder. The map was interpreted to study the transition between the Wilson Terrane and the Precambrian East Antarctic Craton, the extent and distribution of Jurassic tholeiitic magmatism, and the occurrence of post-Jurassic faulting oblique to the rift basins. A compilation with adjacent aeromagnetic data was recently used to study the structures inherited from the Palaeozoic terranes and their reactivation as major fault zones separating different crustal blocks along the TAM rift shoulder. Additional aeromagnetic coverage over a 35 500 km^2 sector of northern Victoria Land was acquired during the GITARA 5 (1996/97) survey. The flight altitude was 9000 ft and profile line spacing was 4.4 km for the regional grid and 2.2 km for the detailed one, with a tie line interval of 22 km. Standard processing techniques, optimized with microlevelling procedures were applied to the data to produce a 1:250 000 magnetic anomaly map. The processed GITARA 5 magnetic dataset is a new tool to study the structure of the Rennick Graben, and its relationship to the Palaeozoic Wilson Terrane-Bowers Terrane and Robertson Bay Terrane suture zone. The new map also represents important progress towards a magnetic anomaly compilation over the whole of Victoria Land, since it links previous efforts near the Pacific Coast with those near the Ross Sea.

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Key words: GITARA 5 survey, magnetic anomaly mapping, Victoria Land

Introduction

Magnetic surveys over Victoria Land play an important role in the understanding of the geological structure and tectonic evolution of the transition between the active West Antarctic Rift System (Behrendt *et al.* 1992) and the East Antarctic Craton. This transition area is presently marked by the Transantarctic Mountains (TAM), a topographically elevated range bounded to the west by the Polar Plateau and extending across Antarctica from the Ross Sea to the Weddell Sea (Fig. 1).

Early aeromagnetic work performed in the 1960s consisted of widely spaced and poorly located profiles over the Transantarctic Mountains and adjacent Ross Sea (Behrendt & Bentley 1968). An aeromagnetic map was produced from data collected in the 1970s in the McMurdo region in the surroundings of Ross Island (Pederson *et al.* 1981). However, it was not until 1984/85 that improvements in navigational accuracy led to a regional aeromagnetic campaign over Victoria Land performed during the GANOVEX IV (German Antarctic North Victoria Land Expedition). Magnetic anomaly maps at 1:250 000 scale were produced from that dataset (BGR & USGS 1987). Interpretation of the anomalies revealed a broad range of tectonic provinces both within and bordering the Ross Sea (Bosum *et al.* 1989). Since then several aeromagnetic GANOVEX campaigns have been undertaken contributing to the geophysical reconnaissance of Victoria Land (Damaske 1994). Ground magnetic measurements collected during four Italian expeditions (1985–89) provided new constraints both on geological structure and on rock magnetic properties in the Terra Nova Bay region (Bozzo *et al.* 1989, Bozzo & Meloni 1992). Individual magnetic profiles were also carried out during the 1989/90 campaign in the Mariner Glacier region as part of the geological investigation of the southern part of the Wilson Terrane–Bowers Terrane suture zone (Bozzo *et al.* 1995a). During the summers of 1991–94, three GITARA (German ITalian Aeromagnetic Research in Antarctica) helicopter-borne surveys were flown covering an area of 50 000 km^2 between Terra Nova Bay and Granite Harbour (Bozzo *et al.* 1995b). A 1:250 000 scale magnetic anomaly map was compiled over the central-southern part of Victoria Land by integrating these three datasets (Bozzo *et al.* 1997a, 1997b).

In this paper, after a brief review of interpretations of

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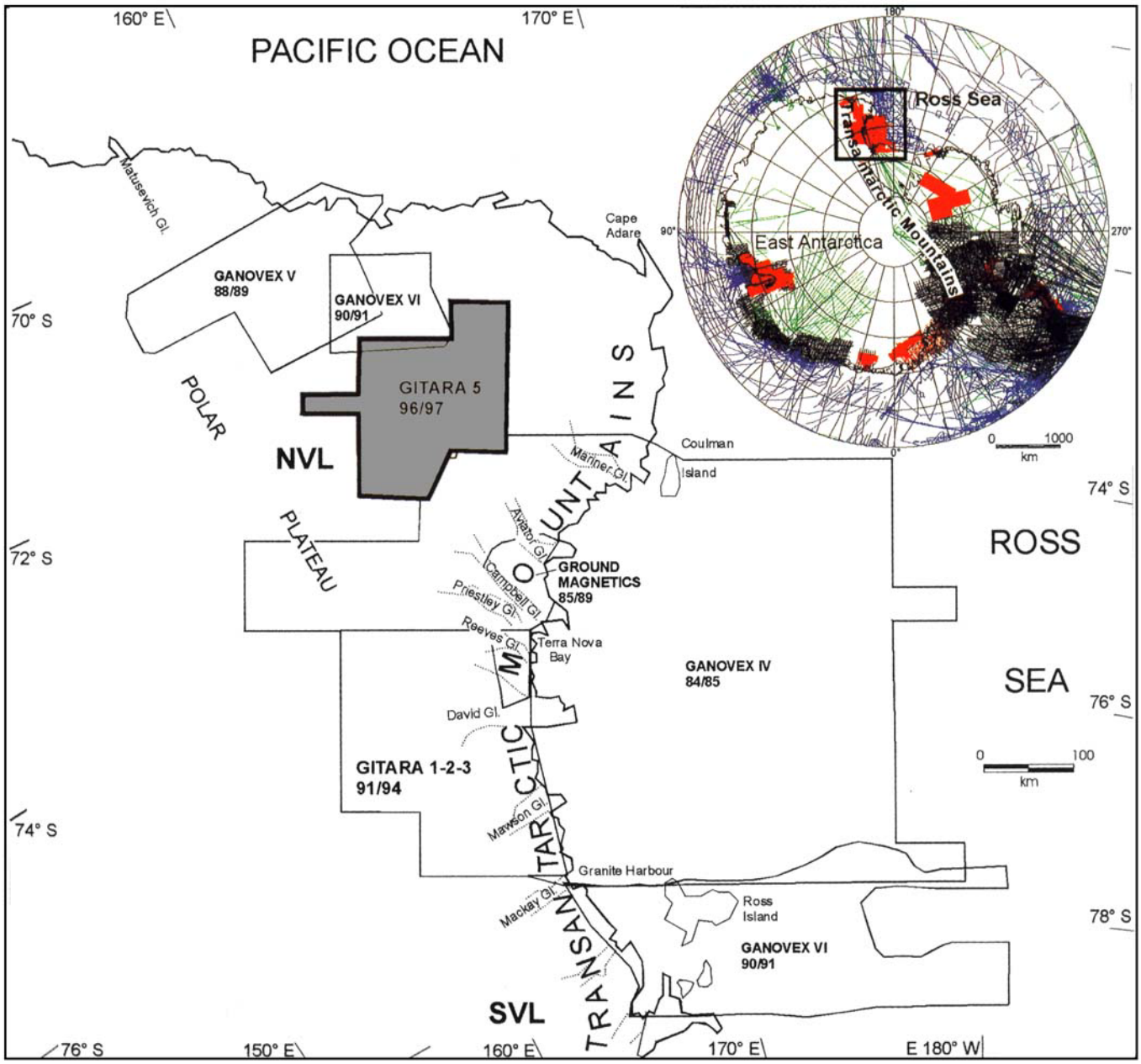


Fig. 1. Location of aeromagnetic and ground magnetic surveys over Victoria Land and adjacent part of the Ross Sea, updated to 1997. The new GITARA 5 survey is shaded in grey. The black square in the right corner indicates the study area superimposed on a map indicating the distribution of aeromagnetic and marine magnetic track lines over the whole Antarctic continent and surrounding oceans south of 60°S (modified from Chiappini *et al.* 1998).

combined magnetic anomaly maps of Victoria Land and adjacent Ross Sea, we present the newly compiled map of the GITARA 5 aeromagnetic survey carried out over northern Victoria Land during the 1996/97 field season.

Geological framework

The TAM represent one rift shoulder of the West Antarctic Rift System (Behrendt *et al.* 1993). In Victoria Land their uplift is generally accepted as being linked to Cenozoic and Mesozoic extensional tectonics of the Ross Sea embayment (Davey & Brancolini 1995, Fitzgerald & Baldwin 1997). The TAM are underlain by an older Neoproterozoic–early Palaeozoic contractional mountain belt, the Ross Orogen (Goodge 1995, Tessensohn 1997). The TAM may also be superimposed upon a Jurassic rift (Schmidt & Rowley 1986, Wilson 1993).

In northern Victoria Land three tectono-metamorphic

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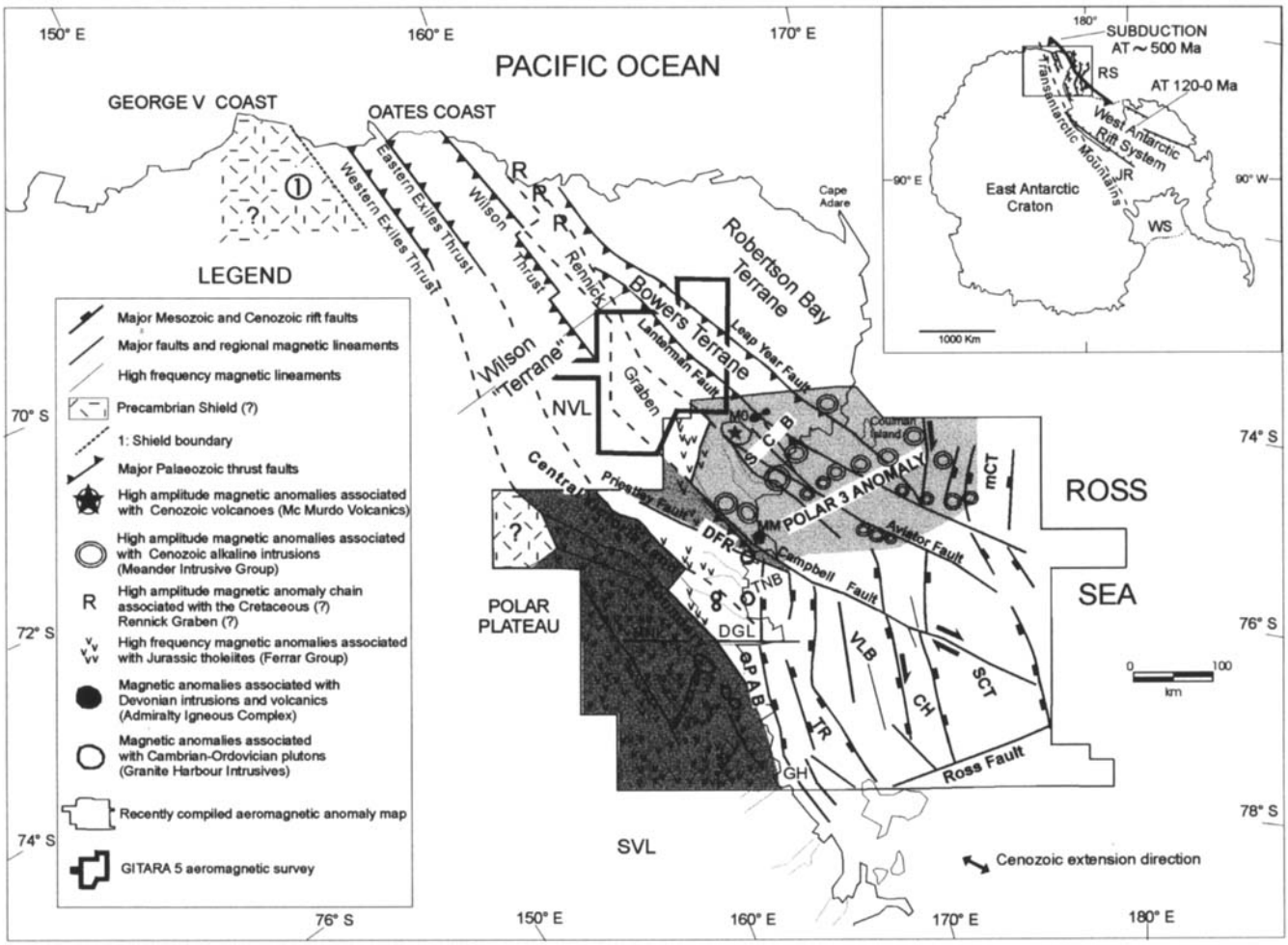


Fig. 2. Tectonic map of Victoria Land adjacent to the Ross Sea rift basins (modified from Ferraccioli & Bozzo in press). The Central Victoria Land Boundary is interpreted from aeromagnetic data as separating the Prince Albert Mountains block (PAB) to the south from the Terra Nova Bay (TNB) and Deep Freeze Range (DFR) crustal blocks to the north. Other prominent magnetic lineaments correspond to the Priestley and Campbell faults along the western shoulder of the Rennick Graben. The latter fault zone and the high-amplitude anomalies of the Southern Cross Block (SCB) may continue to the north in the area of the new GITARA 5 survey.
Abbreviations: DGL = David Glacier Lineament, TR = Terror Rift, VLB = Victoria Land Basin, CH = Central High, SCT= southern Central Trough, mCT mid-Central Trough, MO and MM = Mount Overlord and Mount Melbourne volcanoes, GH = Granite Harbour, NVL and SVL = northern and southern Victoria Land.

terranes have been recognized as belonging to the Ross Orogen (Fig. 2): the Robertson Bay Terrane (RBT), the Bowers Terrane (BT) and the Wilson Terrane (WT). The RBT and BT are interpreted as allochthonous terranes with respect to the East Antarctic Craton and are characterized by very low-grade to low-grade metasedimentary and metavolcanic rocks of Cambrian-Ordovician age, intruded by granitoids of Devonian age, the Admiralty Intrusives (Borg & Stump 1987). The metamorphic rocks of the autochthonous WT are also intruded by Cambro–Ordovician granitoids, the Granite Harbour Intrusives (Ghezzo *et al.* 1989). The structural architecture of the basement terranes is dominated by NW–SE trending thrusts and/or strike slip faults which form a complex pop-up structure (Flöttmann & Kleinschmidt 1993).

A major erosional unconformity surface, the Kukri Peneplain, separates the basement complexes from the overlying sedimentary rocks of the Devonian-Jurassic Beacon Supergroup (Woolfe & Barrett 1995). In the Jurassic, widespread extrusion and intrusion of tholeiitic rocks, known as the Kirkpatrick Basalt and the Ferrar Dolerite, occurred at the present site of the TAM (Elliot 1992).

Several lines of evidence for a Cretaceous thermal event in Victoria Land, leading to the formation of the Rennick Graben (Fig. 2) have been reviewed by Tessensohn (1994), who further interpreted the graben as representing a major pull-apart basin formed during the early stages of Ross Sea rifting.

An extensional to transtensional tectonic setting characterized the TAM-Ross Sea area during the Cenozoic.

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This tectonic framework is reflected in both well-developed normal and strike-slip faulting and rift-related alkaline igneous rocks (LeMasurier & Thomson 1990, Wilson 1995, Salvini *et al.* 1997).

Recent magnetic results over Victoria Land

Previous magnetic data over the Ross Sea part of the West Antarctic Rift System shows N-S to NNW-SSE fabric interpreted as Cenozoic volcanic rocks emplaced along rift faults and ENE-WSW trends possibly marking transfer faults (Fig. 2) linking offset segments of the rift itself (Damaske *et al.* 1994, Behrendt *et al.* 1996). Overall the magnetic data acquired off-shore Victoria Land supplements seismic and gravity data in the interpretation of the tectonic and magmatic patterns of the Cenozoic Ross Sea rifting phases (Salvini *et al.* 1997).

Much less is known about the crustal structure and tectonic evolution of Victoria Land because the TAM rift flank and the older Jurassic, Palaeozoic and Precambrian(?) features are commonly buried under ice-cover, seismic coverage is limited (O'Connell & Stepp 1993, Della Vedova *et al.* 1997) and gravity stations are still sparse (Reitmayr 1997). The GITARA magnetic anomaly map (Bozzo *et al.* 1997a) of the Prince Albert Mountains area contributes towards the geological reconnaissance of the central-southern part of Victoria Land (Fig. 2) by:

i) showing a regional NW-SE trending magnetic anomaly named the "GITARA Anomaly complex" (Bozzo *et al.* 1997c) and interpreted as Palaeozoic intrusive rocks within the Wilson Terrane (probably a suite of the Granite Harbour Intrusives) rather than previously inferred Precambrian rocks (Bosum *et al.* 1989),

ii) displaying high-frequency magnetic anomaly patterns, which reveal the considerable extent of Jurassic tholeiitic magmatism, partially buried under ice-cover, and

iii) revealing high- frequency NE-SW to NNE-SSW magnetic lineations oblique to the N-S to NNW-SSE Ross Sea rift basins (Ferraccioli *et al.* 1997) and correlated with inferred post-Jurassic faulting (Capponi *et al.* in press). A prominent WNW-ESE magnetic trend also corresponds to the David Glacier Lineament, independently interpreted by Mazzarini *et al.* (1997) as a major transfer structure formed in the Jurassic and possibly reactivated in the Cenozoic.

Compilation of the GITARA dataset over the Prince Albert Mountains with the adjacent GANOVEX IV survey (Chiappini *et al.* in press) highlights the segmentation of the Transantarctic Mountains into different crustal blocks and their relationship to faults inherited from the Palaeozoic terranes (Fig. 2): the Southern Cross block (SCB), the Deep Freeze Range block (DFR) flanking the Rennick Graben, the Terra Nova Bay area (TNB) and the Prince Albert Mountains block (PAB) (Ferraccioli & Bozzo in press).

Several geological and tectonic targets which may be investigated in the area of the new GITARA 5 survey stem directly from this recent magnetic interpretation. They serve to:

i) identify the northward extent and distribution of Cenozoic alkaline volcanic and intrusive rocks (if present) detected to the south over the SCB,

ii) delineate the extent and distribution of Jurassic volcanic rocks, within the central part of the Rennick Graben block, place new constraints on the faults bordering the graben itself, and identify possible strike-slip faulting inferred from geological data,

iii) verify the southward prolongation of an anomaly chain detected in previous aeromagnetic data (see Fig. 1 for location) near the Pacific Coast (R in Fig. 2) and interpreted as revealing intrusives associated with the Rennick Graben itself (Damaske & Bosum 1993), and

iv) establish if there is a magnetic contrast between the Wilson Terrane, the Bowers Terrane and the Robertson Bay Terrane, as may be case to the north (Damaske 1994), or confirm the lack of magnetic contrast imaged near the Ross Sea (Bosum *et al.* 1989, Bozzo *et al.* 1995a).

The GITARA 5 survey

The GITARA 5 aeromagnetic survey was carried out during the XII ITALIANTARTIDE expedition (1996–97) within the framework of the PNRA (Progetto Nazionale delle Ricerche in Antartide).

A 35 500 km^2 area over the central part of Rennick Glacier, Freyberg Mountains and the adjacent Evans Névé was successfully surveyed in November 1996. The layout of the aeromagnetic campaign followed closely that of the previous GITARA and GANOVEX campaigns to assure the maximum compatibility between the datasets. Profile lines were flown in a WNW-ESE direction at 9000 ft altitude for most of the survey with the exception of individual areas within the Rennick Glacier area where topographic obstacles required a higher flight altitude (10 000–11 000 ft). Two different spacings were adopted: 4.4 km for the regional grid and 2.2 km for a more detailed grid, tie-lines were 22 km apart (Fig. 3). The closer line spacing was employed in the detailed grid to image better the boundaries between the Wilson Terrane, the Bowers Terrane and the Robertson Bay Terrane. Some lines of the detailed grid were also extended across the Rennick Graben. The ratio of 1:5 between the tie-lines and the profiles adopted for the previous surveys, which was found to be a good compromise between spatial resolution of the anomalies and logistic constraints (Damaske 1989) was not maintained for the detailed grid owing to logistic restrictions.

A Squirrel B2 helicopter was used to perform the survey.

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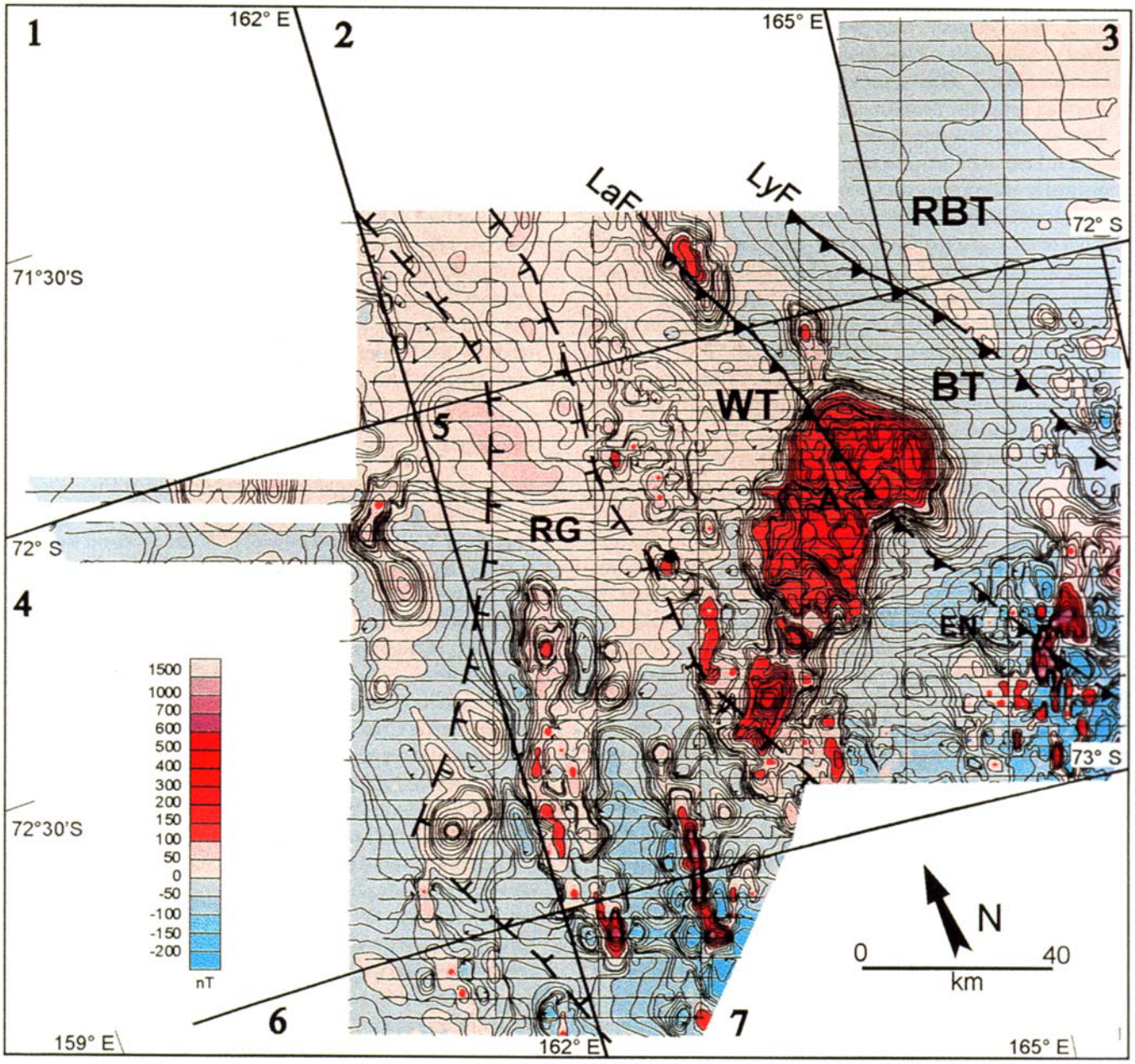


Fig. 3. Total field aeromagnetic anomaly map of the GITARA 5 survey superimposed on a simplified structural map. Abbreviations: LyF = Leap Year Fault, LaF = Lanterman Fault, RBT = Robertson Bay Terrane, BT = Bowers Terrane, WT = Wilson Terrane, RG = Rennick Graben, EN = Evans Névé. The black point indicates the Mount Jackman remote camp. Numbering (1–7) refers to the US Geological survey topographical base of the anomaly map.

The total field magnetic data were acquired with an optically pumped caesium magnetometer in towed bird configuration with a sensitivity of 0.001 nT and sampling rate of 10 Hz. Positioning relied upon a differential GPS system with an update rate of 1 sec and a post-processing accuracy of about 10 m. A digital acquisition system was used to acquire and monitor the magnetic and positioning data. Proton-precession magnetometers were set up at Terra Nova Bay and at the Mount Jackman remote camp to choose the best flight window and to monitor the external magnetic field variations during the survey (Bozzo *et al.* 1998).

Processing and mapping

A data-quality check and preliminary pre-processing were performed in the field to ensure the highest possible reliability and effectiveness of the later processing. All further processing was performed at the Dipartimento Scienze della Terra of the University of Genoa. After differential GPS corrections were

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applied, the magnetic data were corrected for long-term diurnal variations by subtraction of low-pass filtered (60 min) base station data. IGRF removal for the epoch 1996.11 was performed using the provisional IGRF 1995 model.

Shorter-term time-dependant variations not removed by the magnetic base-station correction were minimised by means of statistical levelling processes which involved both tie-line and profile- line levelling. Further improvement in noise reduction parallel to the flight lines was achieved by microlevelling the dataset, as had been performed also for the previous GITARA surveys over the TAM. The approach we applied involves the application of a low-pass Butterworth Filter and a directional filter in frequency domain (Ferraccioli *et al.* 1998).

The processed magnetic anomaly data were then gridded by using a weighted average procedure with a radius of 6 km from each grid point and a grid cell size of 440 m. This grid cell size is the same as the one used for the adjacent surveys and, though small, it does not appear to cause strong aliasing between lines in most areas. A multiple levels technique (5, 25, 100 nT intervals) was adopted for contouring so as not to obscure individual contours in areas of high magnetic gradient for the original magnetic anomaly map which was produced at 1:250 000 scale. The 1:250 000 topographical base was provided by the US Geological survey and includes the following sheets which are indicated with numbers in Fig.3: Daniels Range (1), Mount Soza (2), Ebbe Glacier (3), Welcome Mountain (4), Freyberg Mountains (5), Sequence Hills (6) and Mount Murchison (7). The map is part of the 1: 250 000 Geomagnetic Map Series of the Museo Nazionale Delle Ricerche in Antartide which includes the previous GITARA maps (Bozzo *et al.* 1997a). A reduced version of the GITARA 5 map with 10, 25, 100 nT contour levels is shown in Fig.3.

Preliminary interpretation

The magnetic map (Fig.3) is superimposed upon a simplified tectonic sketch map for a preliminary interpretation of the anomaly patterns (Ferraccioli *et al.* 1999). The most prominent high-frequency magnetic anomalies (with peaks reaching 1500 nT) occur in the almost entirely ice- covered Evans Névé sector (EN). This anomaly pattern closely resembles the one detected over outcrops of Cenozoic volcanic rocks of the SCB farther to the south (Fig. 2). Relatively lower-amplitude anomalies with peaks of about 500 nT are detected along the axial part of the Rennick Graben. The sources for these anomalies are the Jurassic Kirkpatrick basalts which crop extensively in the previously surveyed southern part of the graben; more moderate anomalies (< 100 nT) correspond to Jurassic Ferrar sills. From the structural point of view it is interesting to note that a prominent NW-SE trending magnetic lineament seems to correspond to the Leap Year Fault separating the Robertson Bay Terrane from the Bowers Terrane. Subtle high-frequency positive anomalies occur along the eastern side of this boundary. The Lanterman Fault, which separates the Wilson Terrane from the Bowers Terrane, also seems to have a clear magnetic signature in the northern part of the survey area, where it divides a more positive region to the west from a negative regional anomaly field over the Bowers Terrane. A 40 km wide positive magnetic anomaly, with no obvious geological source and designated here as "anomaly A", seems to cross-cut the Wilson–Bowers suture zone. To the south, within the SCB, magnetic anomalies cross-cutting the Wilson–Bowers suture zone have been interpreted as being associated with Devonian age Admiralty Intrusives (Fig. 2). From the GITARA 5 magnetic map it also appears that the eastern shoulder of the Rennick Graben may be close to the position inferred from geology, while the ice-covered western shoulder may have an entirely different, possibly step-like, geometry.

Conclusions

Recent magnetic anomaly mapping has revealed its usefulness in the definition of crustal structure and tectonic development of parts of Victoria Land as well as of the adjacent Ross Sea. In particular, the GITARA anomaly maps (Bozzo *et al.* 1997a, 1997b) over central-southern Victoria Land furnish a new picture of the Prince Albert Mountains sector of the TAM rift shoulder. Combination with the adjacent GANOVEX IV survey shows possible segmentation of the TAM crustal blocks and its relationship to pre-existing structure along the East Antarctic Craton margin (Ferraccioli & Bozzo in press). The magnetic maps also give us indications of the extent and distribution of Jurassic tholeiitic rocks beneath the ice-cover and on post-Jurassic faulting oblique to the Ross Sea rift basins (Ferraccioli *et al.* 1997).

The area covered by the more recent 1996/97 GITARA 5 survey is a key area in northern Victoria Land since it features the central part of the Rennick Graben and the junction between the Wilson–Bowers and Robertson Bay terranes. Preliminary interpretation of anomaly patterns presented here suggests that this survey will contribute towards the more general study of the possible relationships between Mesozoic and Cenozoic(?) rift-related features, such as the Rennick Graben and older structures bordering the Palaeozoic terranes.

The GITARA 5 survey has successfully fulfilled the target of linking previous campaigns near the Pacific Coast and near the Ross Sea Coast. This is particularly important since a regional magnetic compilation effort for the entire Ross Sea area has been initiated within the framework of the INTRAMAP (INtegrated Transantarctic mountains Ross sea Area Magnetic Anomaly Project) project as part of the continental scale Antarctic Digital Magnetic Anomaly Project (Chiappini *et al.* in press, Johnson *et al.* 1997, Chiappini *et al.* 1998).

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References

Behrendt, J.C. & Bentley, C.R. 1968. Magnetic and gravity maps of Antarctica. *American Geographical Society Antarctic Map Folio Series*, no. 9, scale 1:15 000 000, 9 plates.

Behrendt, J.C., LeMasurier, W.E. & Cooper, A.K. 1992. The West Antarctic Rift System - a propagating rift "captured" by a mantle plume? *In* Yoshida, Y., Kaminuma, K. & Shiraishi, K., *eds. Recent progress in Antarctic earth science.* Tokyo: Terra Scientific Publishing Company, 315–322.

Behrendt, J.C., Damaske, D. & Fritsch, J. 1993. Geophysical characteristics of the West Antarctic rift system. *In* Damaske, D. & Fritsch, J., *eds. German Antarctic North Victoria Land Expedition 1988/89.* Geologisches Jahrbuch, **E47**, 49–101.

Behrendt, J.C., Saltus, R., Damaske, D., McCafferty, A., Finn, C.A., Blankenship, D. &. Bell, R.E. 1996. Patterns of late Cenozoic volcanic and tectonic activity in the West Antarctic rift system revealed by aeromagnetic surveys. *Tectonics*, **15**, 660–676.

BGR & USGS. 1987. *Total magnetic anomaly map: Victoria Land/ Ross Sea, Antarctica.* 1:250 000. Hannover: Federal Institute for Geosciences and Natural Resources (BGR) & United States Geological Survey (USGS). 7 sheets.

Borg, S.G. & Stump, E. 1987. Paleozoic magmatism and associated tectonic problems of northern Victoria Land, Antarctica. *In* McKenzie, G.D., *ed. Gondwana six: structure, tectonics and geophysics. American Geophysical Union Geophysical Monograph*, **40**, 67–75.

Bosum, W., Damaske, D., Roland, N.W., Behrendt, J.C. & Saltus, R. 1989. The GANOVEX IV Victoria Land/Ross Sea aeromagnetic survey: interpretation of the anomalies. *In* Damaske, D. & Dürbaum, H.J., *eds. German Antarctic North Victoria Land Expedition 1984/ 85.* Geologisches Jahrbuch, **E38**, 153–230.

Bozzo, E. & Meloni, A. 1992. Geomagnetic anomaly maps of central Victoria Land (East Antarctica) from ground measurements. *Tectonophysics*, **212**, 99–108.

Bozzo, E., Caneva, G., Colla, A., Meloni, A. & Romeo, G. 1989. *Total magnetic field anomaly of the area between Aviator Glacier and Drygalski Ice Tongue, Victoria Land, East Antarctica.* Map 1:250.000. Rome: Programma Nazionale di Ricerche in Antartide (PNRA), Consiglio Nazionale delle Ricerche (CNR) - Ente Nazionale Energie Alternative (ENEA).

Bozzo, E., Caneva, G., Capponi, G. & Colla, A. 1995a. Magnetic investigations of the junction between Wilson and Bowers terranes (northern Victoria Land, Antarctica). *Antarctic Science*, **7**, 149–157.

Bozzo, E., Caneva, G., Colla, A., Ferraccioli, F., Gambetta, M., Chiappini, M., Meloni, A. & Damaske, D. 1995b. Aeromagnetics in the area between Terra Nova Bay and Granite Harbour, Victoria Land (Antarctica): data processing and production of magnetic anomaly maps. *XXI International Union of Geodesy and Geophysics (IUGG) General Assembly*, Boulder, Colorado, 2– 14 July 1995, IAGA Symposia, GAA61M, Antarctic Magnetic Anomalies, A181.

Bozzo, E., Caneva, G., Colla, A., Damaske, D., Ferraccioli, F., Gambetta, M., Meloni, A. & Moeller, H.D. 1997a. Total magnetic anomaly map of Victoria Land (central-southern part). *Compiled by* Ferraccioli, F. & Gambetta, M. *In* Bozzo, E. & Damaske D., *eds. Antarctic Geomagnetic 1:250 000 map series*, Museo Nazionale dell'Antartide-Sez. di Scienze della Terra, Siena, Italy, Ministero dell'Università e della Ricerca Scientifica e Tecnologica- Programma Nazionale delle Ricerche in Antartide, Sheets A–B.

Bozzo, E., Caneva, G., Chiappini, M., Colla, A., Damaske, D., Ferraccioli, F., Gambetta, M., Moeller, D. & Meloni, A. 1997b. Total magnetic anomaly map of Victoria Land (central-southern part), Antarctica. *In* Ricci, C., *ed. The Antarctic region: geological evolution and processes.* Siena: Terra Antarctica Publication, 1165–1166.

Bozzo, E., Ferraccioli, F., Gambetta, M., Caneva, G., Damaske, D., Chiappini, M. & Meloni, A. 1997c. Aeromagnetic regional setting and some crustal features of central-southern Victoria Land from the GITARA surveys. *In* Ricci, C., *ed. The Antarctic region: geological evolution and processes.* Siena: Terra Antarctica Publication, 591–596.

Bozzo, E., Caneva, G., Gambetta, M. & Chiappini M. 1998. Aeromagnetic survey (GITARA 5) on Lanterman-Evans Névé-Salamander Range. *Terra Antartica Reports*, **2**, 47–52.

Capponi, G., Crispini, L., Meccheri, M., Musumeci, G., & Pertusati, P.C. In press. Antarctic Geological 1: 250 0000 Map Series. Mount Joyce Quadrangle (Victoria Land). German Italian Geological Antarctic Map Program (GIGAMAP). Pertusati, P.C. & Tessensohn, F. *coordinators.* Museo Nazionale dell'Antartide - Sez. di Scienze della Terra, Siena, Italy, Ministero dell'Università e della Ricerca Scientifica e Tecnologica- Programma Nazionale delle Ricerche in Antartide.

Chiappini, M., Ferraccioli, F., Bozzo, E., Damaske, D. & Behrendt, J.C. In press. INTRAMAP: INtegrated Transantarctic Mountains and Ross Sea Area Magnetic Anomaly Project. *Second International Workshop on Antarctic Digital Magnetic Anomaly Compilation (ADMAP), Rome, 29 September–2 October 1997. Annali di Geofisica.*

Chiappini, M., von Frese, R.R.B. & Ferris, J. 1998. Effort to develop magnetic anomaly database aids Antarctic research. *EOS Transactions*, **79**, 290.

Damaske, D. 1989. Spatial resolution of the aeromagnetic flight grid-North Victoria Land, Antarctica. *In* Damaske, D. & Dürbaum, H.J., *eds. German Antarctic North Victoria Land Expedition 1984/85.* Geologisches Jahrbuch, **E38**, 91–110.

Damaske, D. 1994. Aeromagnetic surveys over the Transantarctic Mountains and the Ross Sea area. *Terra Antartica*, **1**, 503–506.

Damaske, D. & Bosum, W. 1993. Interpretation of the aeromagnetic anomalies above the lower Rennick Glacier and adjacent Polar Plateau west of the USARP Mountains. *In* Damaske, D. & Fritsch, J., *eds. German Antarctic North Victoria Land Expedition 1988/89.* Geologisches Jahrbuch, **E47**, 139–152.

Damaske, D., Behrendt, J.C., McCafferty, A., Saltus, R. & Meyer, U. 1994. Transfer faults in the western Ross Sea: new evidence from the McMurdo Sound/Ross ice shelf aeromagnetic survey (GANOVEX VI). *Antarctic Science*, **6**, 359–364.

Davey, F.J. & Brancolini, G. 1995. The Late Mesozoic and Cenozoic structural setting of the Ross Sea region. *Antarctic Research Series*, **68**, 167–182.

Della Vedova, B., Pellis, G., Trey, H., Zhang, J., Cooper, A.K., Makris, J. & ACRUP Working Group. 1997. Crustal structure of the Transantarctic Mountains, Western Ross Sea. *In* Ricci, C., *ed. The Antarctic region: geological evolution and processes.* Siena: Terra Antarctica Publication, 609–618.

Elliot, D.H. 1992. Jurassic magmatism and tectonism associated with Gondwanaland break-up: an Antarctic perspective. *In* Storey, B.C., Alabaster, T. & Pankhurst, R.J., *eds. Magmatism and the causes of continental break-up.* Geological Society Special Publication, No. 68, 165–184.

Ferraccioli, F. & Bozzo, E. In press. Inherited crustal features and tectonic blocks of the Transantarctic Mountains: an aeromagnetic perspective (Victoria Land - Antarctica). *Journal of Geophysical Research.*

https://doi.org/10.1017/S0954102099000279 Published online by Cambridge University Press

FERRACCIOLI, F., BOZZO, E., GAMBETTA, M., CANEVA, G., DAMASKE, D., CHIAPPINI, M., MELONI, A. & DELLA VEDOVA, B. 1997. Aeromagnetic interpretative crustal context of the Transantarctic Mountains for the ACRUP Geophysical transect (Antarctica). *Terra Nova,* **9**, 220.

FERRACCIOLI, F., BOZZO, E., CANEVA, G., GAMBETTA, M., CHIAPPINI, M., DAMASKE, D. & MELONI A. 1999. A tectonic perspective of newly acquired GITARA 5 (96/97) aeromagnetic data and its utility for ongoing magnetic anomaly compilation of Victoria Land (Antarctica). *Second International Workshop on Antarctic Digital Magnetic Anomaly Project (ADMAP), 29 Sept. –2 Oct. 1997.* Report II of the SCAR/IAGA Working Group on the Antarctic Digital Magnetic Anomaly Project (ADMAP II). Rome: Publication Istituto Nazionale di Geofisica, 13–14.

FERRACCIOLI, F., GAMBETTA, M. & BOZZO, E. 1998. Microlevelling procedures applied to regional aeromagnetic data: an example from the Transantarctic Mountains (Antarctica). *Geophysical Prospecting,* **46**, 177–196.

FITZGERALD, P.G. & BALDWIN, S. 1997. Detachment fault model for the evolution of the Ross Embayment. *In* RICCI, C., *ed. The Antarctic region: geological evolution and processes.* Siena: Terra Antarctica Publication, 555–564.

FLÖTTMANN, T. &. KLEINSCHMIDT, G. 1993. The structure of Oates Land, Antarctica. *In* DAMASKE, D. & FRITSCH, J., *eds. German Antarctic North Victoria Land Expedition 1988/89.* Geologisches Jahrbuch, **E47**, 419–436.

GHEZZO, C., BALDELLI, C., BIAGINI, R., CARMIGNANI, L., DI VINCENZO, G., GOSSO, G., LELLI, A., LOMBARDO, B., MONTRASIO, A., PERTUSATI, P. & SALVINI, F. 1989. Granitoids from the David Glacier-Aviator Glacier segment of the Transantarctic Mountains, Victoria Land, Antarctica. *Memorie Società Geologica Italiana,* **33**, 143–160.

GOODGE, J.W. 1995. Ross Orogen: crustal structure and plate tectonic significance. *LIRA Workshop - Dallas, Texas 20–23 October 1994. Terra Antartica,* **2**, 71–77.

JOHNSON, A.C., VON FREEZE, R.R.B. & THE ADMAP WORKING GROUP. 1997. Magnetic map will define Antarctica's structure. *EOS Transactions,* **78**, 185.

LEMASURIER, W.E. & THOMSON, J.W. 1990. Volcanoes of the Antarctic Plate and Southern Oceans. *Antarctic Research Series,* **48**, 487 pp.

MAZZARINI, F., SALVINI, F. & DELLA VEDOVA, B. 1997. Crustal segmentation of the Transantarctic Mountains rift shoulder along the David Glacier lineament, Victoria Land (Antarctica). *In* RICCI, C., *ed. The Antarctic region: geological evolution and processes.* Siena: Terra Antarctica Publication, 565–569.

O'CONNELL, D.H. & STEPP, T.M. 1993. Structure and evolution of the crust at the Transantarctic Mountains–Ross sea crustal transition: results from the Tourmaline Plateau seismic array of the GANOVEX V ship-to-shore seismic refraction experiment. *Geologisches Jahrbuch,* **E47**, 229–276.

PEDERSON, D.R., MONTGOMERY, G.E., MCGINNIS, L.D. & ERVIN, C.P. 1981. Aeromagnetic survey of Ross Island, McMurdo Sound and the Dry Valleys. *Antarctic Research Series,* **33**, 7–25.

REITMAYR, G. 1997. Gravity studies of Victoria Land and adjacent oceans, Antarctica. *In* RICCI, C., *ed. The Antarctic region: geological evolution and processes.* Siena: Museo Nazionale dell' Antartide, 597–602.

SALVINI, F., BRANCOLINI, G., BUSETTI, M., STORTI, F., MAZZARINI, F. & COREN, F. 1997. Cenozoic geodynamics of the Ross sea region, Antarctica: crustal extension, intraplate strike-slip faulting, and tectonic inheritance. *Journal of Geophysical Research,* **B102**, 24 669–24 696.

SCHMIDT, D.J. & ROWLEY, P.D. 1986. Continental rifting and transform faulting along the Jurassic Transantarctic rift, Antarctica. *Tectonics,* **5**, 279–291.

TESSENSOHN, F. 1994. The Ross Sea Region, Antarctica: structural interpretation in relation to the evolution of the Southern Ocean. *Terra Antarctica,* **1**, 553–558.

TESSENSOHN, F. 1997. Shackleton Range, Ross Orogen and SWEAT hypothesis. *In* RICCI, C., *ed. The Antarctic region: geological evolution and processes.* Siena: Terra Antarctica Publication, 5–12.

WILSON, T.J. 1993. Jurassic faulting and magmatism in the Transantarctic Mountains: implications for Gondwana breakup. *In* FINDLAY, R.H., BANKS, M.R., UNRUG, R. & VEEVERS, J.J., *eds. Gondwana 8 - assembly, evolution, and dispersal.* Rotterdam: A.A. Balkema, 563–572.

WILSON, T.J. 1995. Cenozoic transtension along the Transantarctic Mountains-West Antarctic Rift boundary, southern Victoria Land, Antarctica. *Tectonics,* **14**, 531–545.

WOOLFE, K.J. & BARRETT, P.J. 1995. Constraining the Devonian to Triassic tectonic evolution of the Ross Sea sector. *Terra Antartica,* **2**, 7–21.

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