

Final project report

Project ID: 2002/3.11
Title: TIMM: Tectonics and Interior of Mt. Melbourne area

Principal investigator: Egidio Armadillo
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Duration: 2 years
Assigned funding: € 25.000,00

Activities and results

The regional significance of Mt. Melbourne is high because of its key location at the transition between the uplifted Transantarctic Mountains and one of the largest, active(?) continental rift systems in the world, the West Antarctic Rift System.

During the 2002-2003 Italian Antarctic campaign a high-resolution aeromagnetic survey over Mt. Melbourne volcano was performed. This helicopter-borne survey was flown at low-altitude and in drape-mode configuration (305 m above terrain) with a line separation less than 500 m. This is a pioneering high-resolution draped survey over the Antarctic continent.

More inland, a transect of 10 magnetovariational stations was carried out across the Deep Freeze Range, crossing the Priestley and David glaciers. Sample interval of the magnetic field was 3 seconds, spacing between stations about 50 km and mean occupation time about two weeks for each station.

Additionally, in the frame of the UK-Italian ISODYN-WISE project (2005-06), an airborne ice-sounding radar survey was flown over the Mt. Melbourne volcano to image the subglacial topography.

The data set was completed by considering the gravimetric stations deployed around the volcano and in its region during the 90' for monitoring density variations.

All the data have been processed to obtain new high resolution magnetic and gravimetric anomaly maps of Mt. Melbourne. Magnetovariational data were inverted to obtain a 2D/3D image of electrical conductivity below the volcano.

Our new high-resolution magnetic maps reveal the largely ice-covered magmatic and tectonic patterns in the Mt. Melbourne volcano area. We combine the sub-ice topography with images and models of the interior of Mt. Melbourne volcano, as derived from the high resolution aeromagnetic data, land gravity and magnetovariational data. Our new geophysical maps and models provide a new tool to study the regional setting of the volcano.

Products

A – papers in scientific magazines

1. F. FERRACCIOLI, ARMADILLO E., A. ZUNINO, E. BOZZO, S. ROCCHI, P. ARMIENTI (in stampa). Magmatic and tectonic patterns over the Northern Victoria Land sector of the Transantarctic Mountains from new aeromagnetic imaging. TECTONOPHYSICS, ISSN: 0040-1951
2. F. FERRACCIOLI, ARMADILLO E., T. JORDAN, E. BOZZO, H. CORR (in stampa). Aeromagnetic exploration over the East Antarctic Ice Sheet: a new view of the Wilkes Subglacial Basin. TECTONOPHYSICS, ISSN: 0040-1951
3. ARMADILLO E., F. FERRACCIOLI, A. ZUNINO AND E. BOZZO. (2007). Aeromagnetic anomaly patterns reveal buried faults along the eastern margin of the Wilkes Subglacial Basin (East Antarctica). In: ALAN COOPER, CAROL RAYMOND, AND THE TH ISAES EDITORIAL TEAM. Antarctica: A Keystone in a Changing World, Online Proceedings of the 10th ISAES. ISBN: 978-1-411-31788-8. doi:[10.3133/of2007-1047.srp091](https://doi.org/10.3133/of2007-1047.srp091): USGS (UNITED STATES). U.S. Geological Survey Open-File Report 2007-1047 Short Research Paper 091 (peer reviewed) URL: <http://pubs.usgs.gov/of/2007/1047/srp/srp091/>.
4. ARMADILLO E., F. FERRACCIOLI, A. ZUNINO, E. BOZZO, S. ROCCHI, P. ARMIENTI. (2007). Aeromagnetic search for Cenozoic magmatism over the Admiralty Mountains Block (East Antarctica). In: ALAN COOPER,

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- CAROL RAYMOND, AND THE TH ISAES EDITORIAL TEAM. Antarctica: A Keystone in a Changing World, Online Proceedings of the 10th ISAES. ISBN: 978-1-411-31788-8. doi:[10.3133/of2007-1047.srp075](https://doi.org/10.3133/of2007-1047.srp075): USGS (UNITED STATES). U.S. Geological Survey Open-File Report 2007-1047 Short Research Paper 075 (peer reviewed) URL: <http://pubs.usgs.gov/of/2007/1047/srp/srp075/>.
- ARMADILLO E., E. BOZZO, G. CANEVA, A. MANZELLA, G. RANIERI (2007). Imaging deep and shallow structures by electromagnetic sounding moving from the Transantarctic Mountains to the Wilkes Subglacial Basin. TERRA ANTARTICA REPORTS, vol. 13; p. 65-74, ISSN: 1723-7211
 - CORR H, FERRACCIOLI F, FREARSON N, JORDAN T, ROBINSON C, ARMADILLO E., CANEVA G, BOZZO E, TABACCO I (2007). Airborne radio-echo sounding of the Wilkes Subglacial Basin, the Transantarctic Mountains, and the Dome C region. TERRA ANTARTICA REPORTS, vol. 13; p. 55-63, ISSN: 1723-7211
 - JORDAN T, FERRACCIOLI F, CORR H, ROBINSON C, CANEVA G, ARMADILLO E., BOZZO E, FREARSON N (2007). Linking the Wilkes Subglacial Basin, the Transantarctic Mountains, and the Ross Sea with a new airborne gravity survey. TERRA ANTARTICA REPORTS, vol. 13; p. 37-54, ISSN: 1723-7211
 - ARMADILLO E., E. BOZZO, G. CANEVA, F. FERRACCIOLI, G. TABELLARIO (2006). Recent aeromagnetic and deep electromagnetic exploration project in East Antarctica. TERRA ANTARTICA, vol. 12; p. 167-176, ISSN: 1122-8628
 - ARMADILLO E., F. FERRACCIOLI, G. TABELLARIO, E. BOZZO (2004). Deep electrical resistivity sounding across a major ice covered fault belt in Northern Victoria Land (East Antarctica). GEOPHYSICAL RESEARCH LETTERS, vol. 31, ISSN: 0094-8276
 - ARMADILLO E., E. BOZZO, G. CANEVA (2003). Deep electrical resistivity investigations across the Rennick Graben and Oates Land by geomagnetic soundings. TERRA ANTARTICA, vol. 10; p. 171-178, ISSN: 1122-8628
 - F. TALARICO, ARMADILLO E., F. FERRACCIOLI, N. RASTELLI (2003). Magnetic petrology of the Ross Orogen in Oates Land (Antarctica). TERRA ANTARTICA, vol. 10; p. 197-220, ISSN: 1122-8628

B – book chapters

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C - proceedings of international conferences

- ARMADILLO E., M. GAMBETTA, F. FERRACCIOLI, H. CORR, E. BOZZO. New geophysical views of Mt. Melbourne Volcano (East Antarctica). In: American Geophysical Union - 2009 Joint Assembly
- BOZZO E, ARMADILLO E., M.GAMBETTA (in stampa). ELECTRICAL CONDUCTIVITY IMAGING OF CRUSTAL STRUCTURES IN NORTHERN VICTORIA LAND, ANTARCTICA. In: IAGA 2009
- ARMADILLO E., FERRACCIOLI F, BOZZO E (2009). Deep electrical conductivity studies in East Antarctica. In: Exploring Frontier regions in East Antarctica during IPY and beyond - Cambridge
- ARMADILLO E., F. FERRACCIOLI, E. BOZZO, A. ZUNINO (2008). NEW AEROMAGNETIC ANOMALY COMPILATION OVER NORTHERN VICTORIA LAND (EAST ANTARCTICA). In: SCAR/IASC IPY Open Science Conference - St. Petersburg, Russia
- ARMADILLO E., F. FERRACCIOLI, E. BOZZO (2008). Exploring deep electrical conductivity from the Transantarctic Mountains to the Wilkes Subglacial Basin. In: Geological and Geophysical investigations from the Transantarctic Mountains to Dome C - Genova
- C. MOSS, F. FERRACCIOLI, T. JORDAN, A.B. WATTS, ARMADILLO E., E. BOZZO (2008). USING NEW AIRBORNE GRAVITY DATA TO EVALUATE UPLIFT MECHANISMS FOR THE TRANSANTARCTIC MOUNTAINS. In: SCAR/IASC IPY Open Science Conference - St. Petersburg, Russia
- F. FERRACCIOLI, ARMADILLO E., A. ZUNINO, E. BOZZO, S. ROCCHI, P. ARMIENTI (2008). Magmatic and tectonic patterns over the Northern Victoria Land sector of the Transantarctic Mountains from new aeromagnetic imaging. In: Geological and Geophysical investigations from the Transantarctic Mountains to Dome C - Genova
- F. FERRACCIOLI, ARMADILLO E., A. ZUNINO, E. BOZZO, S. ROCCHI, P. ARMIENTI (2008). Magmatic and tectonic patterns over the Transantarctic Mountains region in light of new aeromagnetic imaging. In: Geological and Geophysical investigations from the Transantarctic Mountains to Dome C - Genova
- FERRACCIOLI F, ARMADILLO E., T. A. JORDAN, E. BOZZO, H. F. J. CORR, C. ROBINSON (2008). Exploring a frontier region in East Antarctica with new geophysical data: the Wilkes Subglacial Basin. In: Geological and Geophysical investigations from the Transantarctic Mountains to Dome C - Genova
- MOSS T, T. A. JORDAN, F. FERRACCIOLI, A. B. WATTS, ARMADILLO E., E. BOZZO (2008). Using new airborne gravity data to evaluate uplift mechanisms for the Transantarctic Mountains. In: Geological and Geophysical investigations from the Transantarctic Mountains to Dome C - Genova
- ARMADILLO E., F. FERRACCIOLI, A. ZUNINO, E. BOZZO (2007). Aeromagnetic evidence for a major fault belt at the transition between the Transantarctic Mountains and the Wilkes Subglacial Basin. In: IUGG XXIV General Assembly. Perugia
- Armadillo E., E. Bozzo, G. Caneva, G. Tabellario. GDS investigations from the Rennick Graben to the western side of the Wilkes subglacial basin, Antarctica. EGS Joint Assembly Nice, France, April 2004
- Armadillo E., E. Bozzo, F. Ferraccioli, G. Tabellario and G. Caneva. High resolution aeromagnetic anomaly mapping over Mt. Melbourne volcano, EAST Antarctica. 32° Congresso Internazionale di Geologia Firenze, Fortezza da Basso dal 20 al 28 Agosto 2004

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14. Armadillo E., E. Bozzo, G. Caneva, G. Tabellario. Crustal features of the rennick graben structure and southern continuation of the meso-cenozoic fault system from gds investigation and other geophysical constraints. 9th International Symposium on Antarctic Earth Sciences, September 8-12 2003, Potsdam, Germany.
15. Armadillo E., E. Bozzo , G. Caneva, F. Ferraccioli, G. Tabellario, S. Urbini. DRAPED AEROMAGNETIC SURVEY OVER MT. MELBOURNE VOLCANO 9th International Symposium on Antarctic Earth Sciences, September 8-12 2003, Potsdam, Germany.

D – proceedings of national meetings and conferences

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E – thematic maps

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F – patents, prototypes and data bases

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G – exhibits, organization of conferences, editing and similar

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H - formation (PhD thesis, research fellowships, etc.)

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Research units

Egidio Armadillo	DIPTERIS, Università di Genova
Fauso Ferraccioli	British Antarctic Survey, Cambridge
Fulvio Merlanti	DIPTERIS, Università di Genova
Massimo Verdoya	DIPTERIS, Università di Genova
Stefano Urbini	INGV, Roma
Giorgio Caneva	DIPTERIS, Università di Genova
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Notes