# Final project report

<i>Project ID: Title:</i>	2002/3.9 WIBEM (WIlkes Basin Eastern Margin): geophysical exploration of the Wilkes Subglacial Basin Eastern margin
Principal investigator: Institution:	Bozzo Emanuele Dipartimento per lo Studio del Territorio e delle sue Risorse, Univ. Genova, I
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Duration: Assigned funding:	2 years € 52.000,00

# **Activities and results**

The Wilkes Subglacial Basin is a broad depression over 400 km wide at the George V Coast and 1200 km long. Geology, lithospheric structure and tectonics of the Basin are only partially known because the Basin is buried beneath the East Antarctic Ice Sheet and is located in a remote region which makes geophysical exploration logistically challenging. The contrasting hypothesis regarding the origin of the Basin required the acquisition of high-resolution geophysical data over the Basin itself. New international geophysical exploration of the Basin initiated within 1999-2001 PNRA Program . The WIBEM project comes up to the necessity of accomplishing further geophysical work along the margin of the Wilkes Subglacial Basin to provide fundamental constraints both upon the nature of the Basin itself and upon relationships between the Basin, the Transantarctic Mountains and the inherited structural framework. In Antarctica the WIBEM project required planning and execution during the 2003/04 Antarctic campaign of aerogeophysical and ground geological and geophysical work in an area located between Reeves Neve'(73.30'S) and Oates Land (71.00'S). The longitude of the investigation area spanned 161E and 153E. WIBEM geophysical surveys consisted of aeromagnetic surveys, radar measurements, gravity stations, seismological and GDS ground arrays. These activities were supported by the Talos Dome remote camp located between Frontier Mts and Daniels Range region. These surveys were complemented by GPS data and structural geology and petrology observations along the Transantarctic chain margin. The research units of the WIBEM project were three: i) Exploration Geophysics with potential methods (mag., grav) and elettromagnetics (GDS); ii) Antarctic lithosphere dynamics by passive seismology studies; iii) Structural Geology, Petrology and methamorphic rocks geochronology. The first task of the data processing in Italy was to provide new geophysical constraints at the margin of the East Antarctic polar plateau where data are totally lacking. The main objectives were: a) Establish the continuity (or the lack of continuity) of the Central Victoria Land boundary-Matusevich or Central Victoria Land boundary-Ushakov boundary, at the margin of the Wilkes Subglacial Basin, using aeromagnetic anomaly data; investigate the nature of this boundary i.e. establish if it represents an old inactive boundary related to a Ross orogenic event or a major boundary reactivated by extensional or transtensional (?) tectonics along the margin of the Wilkes Subglacial Basin.(b) Verify the presence (or the lack) of Beacon and Ferrar rocks in the Basin and in particular faulting of the Beacon-Ferrar layer (c) Determine if there is a ramp in the Moho across the margin of the Basin by using gravity and seismological data. (d) Determine if there are deep thermal anomalies connected with recent Mesozoic/Cenozoic rifting processes along the margin of the Basin by using seismological and geomagnetic depth sounding (GDS). (e) Estimate the thickness of possible additional sediments (post-Beacon) in the Basin and relative faulting, if present and detectable by using magnetic and gravity data.(f) Compute integrated geophysical models of the Transantarctic Mountains-Wilkes Subglacial Basin transition in North Victoria Land.

Some of the above objectives are discussed in the products listed in the following, others are in progress.

# **Products**

#### A – papers in scientific magazines

- 1. FERRACCIOLI F. & BOZZO E. (2003). Does Cenozoic strike-slip faulting of the Transantarctic Mountains/Ross Sea Rift region extend to the eastern margin of the Wilkes Subglacial Basin, Terra Antartica Rep. 9, 9-10.
- FERRACCIOLI, F. AND BOZZO E., (2003). Cenozoic strike-slip faulting from the eastern margin of the Wilkes Subglacial Basin to the western margin of the Ross Sea Rift: an aeromagnetic connection. Intraplate Strike-Slip Deformation Belts (Storti, F., Holdsworth R.E., & Salvini F., eds). Geological Society, London, Special Publications, 210, 109-133.
- 3. PIANA AGOSTINETTI, N., AMATO, A., CATTANEO, M., DI BONA, M., (2004). Crustal Structure of Northern Victoria Land from receiver Function Analysis. Terra Antarctica, 11 (1), 5-14.
- 4. ARMADILLO E., F. FERRACCIOLI, G. TABELLARIO and E. BOZZO (2004). Electrical structure across a major icecovered fault belt in Northern Victoria Land (East Antarctica). Geophysical Research Letters, ,31, L10615, pp.4.
- 5. BOZZO E. (2004). Scientific results from the Joint German-Italian Antarctic Expedition second part. TERRA ANTARTICA REPORTS , vol. 11, pp. 3-93.ISSN 1122-8628. SIENA C.A .RICCI (ITALY).
- 6. F. TALARICO, R. FINDLAY, N. RASTELLI 'Metamorphic evolution of the Koettlitz Group in the Koettlitz-Ferrar Glaciers region (southern Victoria Land, Antarctica)' (2005) Terra Antartica, Vol.12, 3 23
- D. CASTELLI, G. OGGIANO, F. TALARICO, E. BELLUSO, F. COLOMBO 'Mineral Chemistry and Petrology of the Wilson Terrane Metamorphics from Retreat Hills to Lady Newnes Bay, Northern Victoria Land, Antarctica' ( 2005) Geologisches Jahrbuch, B85, Vol.b85, 67 - 88
- STUMP, B. GOOTEE, F. TALARICO, W. VAN SCHMUS, P. BRAND, K. FOLAND, M. FANNING 'Correlation of Byrd and Selborne Groups, with implications for the Byrd Glacier discontinuity, central Transantarctic Mountains, Antarctica' (2004) NEW ZEALAND JOURNAL OF GEOLOGY AND GEOPHYSICS, Vol.47, 157 - 171
- 9. U. SCHÜSSLER, F. HENJES-KUNST, F. TALARICO, T. FLÖTTMANN 'High-grade crystalline basement of the northwestern Wilson Terrane at Oates Coast: new petrological and geochronological data and implications for its tectonometamorphic evolution' (2004) Terra Antartica, Vol.11, 15 34
- 10. F. TALARICO, R. PALMERI, C. A. RICCI 'Regional metamorphism and P-T evolution of the Ross Orogen in Northern Victoria Land (Antarctica): a review.' (2004) Periodico di mineralogia, Vol.73, 185 196
- 11. R. PALMERI, F. TALARICO, C. A. RICCI 'UHP metamorphic conditions in garnet-bearing pyroxenites from Lanterman Range (northern Victoria Land): Petrology and P-T path' (2005) Mitteilungen der Osterreichischen Mineralogischen Gesellschaft, Vol.B150, 124 124
- 12. ROLAND N.W., LÄUFER A.L., ROSSETTI F. (2004) Revision of the Terrane Model of Northern Victoria Land (Antarctica). Terra Antartica, 11, 55-65.

#### **B** – book chapters

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## C - proceedings of international conferences

- 1. FERRACCIOLI F., BOZZO E., (2003). Aeromagnetic connection between the Wilkes Subglacial Basin, the Transantarctic Mountains and the Ross Sea Rift (Antarctica). EGS-AGU-EUG Joint Assembly Nice, France, April 2003, Vol 5.
- FERRACCIOLI, F., & E. BOZZO, (2003). Is there a link between Cenozoic strike-slip faulting of the Transantarctic Mountains/Ross Sea Rift and the eastern margin of the Wilkes Subglacial Basin?. ISAES IX, Potsdam, Germany, 90-91.
- 3. ARMADILLO E., E. BOZZO, G. CANEVA, G. TABELLARIO (2004). GDS investigations from the Rennick Graben to the western side of the Wilkes subglagial basin, Antarctica. EGS Joint Assembly Nice, France.
- 4. PIANA AGOSTINETTI, N., ROSELLI, P., CATTANEO, M., AMATO A. (2005). Moho-depth and subglacial sedimentary layer thickness in the Wilkes Basin from Receiver Function Analysis. IASPEI . General Assembly, October 2.9, 2005, Chile
- 5. ROSSETTI F., TECCE F., ALDEGA L., BRILLI M., FACCENNA C..(2005) P-T deformation history and paleo-fluid conditions during orogenic construction in a low-grade terrane: the Early Paleozoic Robertson Bay accretionary complex (north Victoria Land, Antarctica). Convegno: GEOITALIA 2005, Settembre 2005, Spoleto, Abstract Volume.
- TECCE F., ROSSETTI F., FACCENNA C. (2005) Fluid flow and P-T conditions during accretionary complex formation: constraints from fluid inclusions from the Early Paleozoic Robertson Bay. Terrane (North Victoria Land, Antarctica). Convegno: ECROFI XVIII, luglio 2005, Siena, Italy, Abstract Volume.

#### Programma Nazionale di Ricerche in Antartide (PNRA)

- F. TALARICO, G. DI VINCENZO, G. KLEINSCHMIDT 'A Major Crustal Discontinuity in George V Land: New Petrological and 40Ar-39Ar Data and New Research Opportunities' (2004), 23 - 23, workshop Frontiers and Opportunities in Antarctic Earth Sciences, siena (italia) dal 29/8/2004 al 31/8/2004
- D proceedings of national meetings and conferences
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- E thematic maps
- F patents, prototypes and data bases
- G exhibits, organization of conferences, editing and similar
- H formation (PhD thesis, research fellowships, etc.)
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### **Research units**

U.O. 1 - Responsabile: Egidio Armadillo Istituto di afferenza: DIPTERIS, Univ. Genova Compito di ricerca: Exploration Geophysics with potential methods (mag., grav) and elettromagnetics (GDS) Elenco di ricercatori dell'Unità di ricerca: Damaske Detlef, BGR, D Reitmayr Gernot BGR, D Armadillo Egidio, DIPTERIS, I Bozzo Emanuele DIPTERIS, I Caneva Giorgio " Fausto Ferracioli BAS, UK Tabellario Giovanni DIPTERIS, I Zunino Enzo, "

U.O. 2 -Responsabile: Franco Talarico Istituto di afferenza: DISTER, Univ. Siena Compito di ricerca: Structural Geology, Petrology and methamorphic rocks geochronology Elenco di ricercatori dell'Unità di ricerca: Talarico Franco, DISTER, I Lotta Domenico, " Tavernelli Enrico, " Rastelli Nadia, Museo Naz. Antartide, I Rubatto Daniele, Austr.Nat.Univ, Canberra Gootee Brian, Arizona State Univ.,

U.O. 3 - Responsabile: Alessandro Amato Istituto di afferenza: INGV,Roma Compito di ricerca: Antarctic lithosphere dynamics by passive seismology studies Elenco di ricercatori dell'Unità di ricerca: Amato Alessandro, INGV, I Augliera Paolo, " Cattaneo Marco, " Cimini Giovanni, " De Martin Martina " Pondrelli Silvia, " Piana Agostinetti Nicola, "

#### Date: 15 December 2008

#### Notes

#### International cooperations:

The WIBEM project was a collaborative research which involved in the field: PNRA researchers (DIPTERIS of Genoa, INGV of Rome, DISTER of Siena, the DSG of Rome3, OGS of Trieste,) and BGR (Germany) researchers (geophysicists and geologists).