Programma Nazionale di Ricerche in Antartide (PNRA)

Final project report

Project ID:	2002/4.1
Title:	Lithospheric discontinuities in Victoria Land. Geochemical-geochronological-structural study of lower Paleozoic igneous rocks and their bearings on the accretion and long-term evolution of the Antarctic plate.
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Duration:	2 anni
Assigne fuding:	€ 77.469,00

Activities and results

The early Paleozoic Ross Orogeny built up the overall structure of the margin of the East Antarctic Craton, resulting in a structural, geochronological and petrochemical segmentation. Indeed, adjacent crustal sectors are separated by fist-order discontinuities, such as the Lanterman and Priestley faults.
The Lanterman fault separates the Wilson and Bowers terranes. Along this terrane junction, the results from the petrochemical, structural and geochronological investigations of mafic-ultramafic rocks metamorphosed at variable grade, contributed to the reconstruction of geological models for crustal accretion in this orogen's sector. The Bowers terrane next to the Lanterman fault has been studied, leading to the formulation of a new scenario for the juxtaposition of terranes and exhumation of high-pressure rocks.
The Priestley fault within the Wilson terrane focused the emplacement of hybrid-mingled mantle and crustal magmas. The resulting igneous rocks have been investigated in a multidisciplinary effort, with production of a new geological map, as well as geochemical, isotopic and geochronological data, along with morphometric-fractal analysis of mixing-mingling evidence. The demonstration of Cenozoic activity of the Priestley fault indicate the importance and long duration of structural inheritance along the Antarctic margin.
The crustal sector south of the Priestley fault attracted studies on postcollisional magmatism, leading to models for the latest stages of the Ross Orogeny in Antarctica. Geochronological investigations on igneous and detrital to metamorphic micas stimulated new ongoing studies on the beginning of the Ross Orogeny in Victoria Land.
Overall, this research program contributed to new models on general aspects of the orogenic processes, particularly for the accretion of exotic terranes, the deep burial and exhumation of coupled mafic and felsic rocks, the postcollisional igneous activity. The unifying viewpoint of these studies is framed in the long-lasting geodynamic role of the first-order lithospheric discontinuities generated during the Ross Orogeny.

Products

A – papers in scientific magazines

1. Capponi, G., Carosi, R., Meccheri, M. and Oggiano, G., 2003a. Strain analysis and in the Millen Range area of northern Victoria Land, Antarctica. Geologisches Jahrbuch, Polar isuue No.9, F. Tessensohn and C.A. Ricci editors, B85: 225-251.
2. Capponi, G., Crispini, L., Di Vincenzo, G. and Palmeri, R., 2003c. Microtextural and petrological insight in shear zones from the Lanterman Range (NVL, Antarctica): contrasting metamorphic evolution at the contact between terranes. Terra Antartica reports, 9: 159-162.
3. Capponi, G., Kleinschmidt, G., Pertusati, P., Ricci, C.A. and Tessensohn, F., 2003d. Terrane relationships in the Mariner Glacier area of northern Victoria Land, Antarctica. Geologisches Jahrbuch, Polar isuue No.9, F. Tessensohn and C.A. Ricci editors, B85: 49-78.

4. Dallai, L., Ghezzo, C. and Longinelli, A., 2003a. Cenozoic Magmas Monitor Climate Change in Northern Victoria Land, Antarctica. Terra Antartica Reports, 9: 109-112.
5. Dallai, L., Ghezzo, C. and Sharp, Z.D., 2003b. Oxygen isotope evidence for crustal assimilation and magma mixing in the Granite Harbour Intrusives, northern Victoria Land, Antarctica. Lithos, 67: 135-151.
6. Dallai, L., Ghezzo, C., Turi, B. and Vesica, P., 2002. Oxygen isotope geochemistry of the Granite Harbour Intrusives, Wilson Terrane, northern Victoria Land, Antartica. Mineralogy and Petrology, 75: 223-241.
7. Di Vincenzo, G., Rocchi, S., Rossetti, F. and Storti, F., 2004. $^{40}Ar–^{39}Ar$ dating of pseudotachylytes: the effect of clast-hosted extraneous argon in Cenozoic fault-generated friction melts from the West Antarctic Rift System. Earth and Planetary Science Letters, 223: 349-364, doi:10.1016/j.epsl.2004.04.042.
8. Di Vincenzo, G., Viti, C. and Rocchi, S., 2003. The effect of chlorite interlayering on ^{40}Ar-^{39}Ar biotite dating: an ^{40}Ar-^{39}Ar laserprobe and TEM investigation of variably chloritised biotites. Contributions to Mineralogy and Petrology, 145: 643-658.
9. Ferraccioli, F., Bozzo, E. and Capponi, G., 2002a. Aeromagnetic and gravity anomaly constraints for an early Paleozoic subduction system of Victoria Land, Antarctica. Geophysical Research Letters, 29(10): 10.1029/20012001GLO14138.
10. Ferraccioli, F., Capponi, G. and Bozzo, E., 2003b. Revisiting tectonic models for an Early Palaeozoic subduction system from a potential field perspective over Victoria Land, Antarctica. Terra Antartica Reports, 9: 143-144.
11. Fioretti, A., Capponi, G., Black, L.P., Varne, R. and Visonà, D., 2005. Surgeon island granite SHRIMP zircon ages: a clue for the Cambrian tectonic setting and evolution of the Palaeopacific margin of Gondwana (northern Victoria Land, Antarctica). Terra Nova: doi: 10.1111/j.1365-3121.2005.00606.x.
12. Fioretti, A.M., Capponi, G., Black, L.P. and Visonà, D., 2003. Surgeon Island Granite: Implications for Regional Geological Evolution of Northern Victoria Land from Structural Observations and SHRIMP Zircon Dating. Terra Antartica Reports, 9: 171-176.
13. Ghiribelli, B., Frezzotti, M.L. and Palmeri, R., 2002. Coesite in eclogites of the Lanterman Range (Antarctica): evidence from textural and Raman studies. European Journal of Mineralogy, 14: 355-360.
14. Palmeri, R., Ghiribelli, B., Talarico, F. and Ricci , C.A., 2003a. Ultra-high-pressure metamorphism in felsic rocks: the garnet-phengite gneisses and quartzites from the Lanterman Range, Antarctica. European Journal of Mineralogy, 15(3): 513-525.
15. Perugini, D. and Poli, G., 2005. Viscous fingering during replenishment of felsic magma chambers by continuous inputs of mafic magmas: Field evidence and fluid-mechanics experiments. Geology, 33(1): p. 5-8, doi: 10.1130/G21075.1.
16. Perugini, D., Poli, G. and Rocchi, S., 2005. Development of viscous fingering between mafic and felsic magmas: evidence from the Terra Nova Intrusive Complex (Antarctica). Mineralogy and Petrology, 83: 151-166.
17. Rocchi, S., Capponi, G., Crispini, L., Di Vincenzo, G., Ghezzo, C., Meccheri, M., and Palmeri, R., 2003b. Mafic rocks at the Wilson-Bowers terrane transition and within the Bowers terrane: implications for a geodynamic model of the Ross Orogeny. Terra Antartica Reports, 9: 145-148.
18. Rocchi, S., Di Vincenzo, G. and Ghezzo, C., 2004. The Terra Nova Intrusive Complex (Victoria Land, Antarctica), with 1:50,000 Geopetrographic Map. Terra Antartica Reports, 10: 51.
19. Bracciali, L, Di Vincenzo, G., Rocchi, S., and Ghezzo, C., submitted. The Tiger Gabbro from northern Victoria Land, Antarctica: the roots of an oceanic arc within the early Palaeozoic margin of Gondwana.

B – book chapters

C - proceedings of international conferences

1. Bomparola, R.M., 2003. U-Pb Geochronology of the Granite Harbour Intrusives from the Wilson Terrane (northern Victoria Land – Antarctica), 9th International Symposium on Antarctic Earth Sciences, Potsdam (Germany), 8-12 September 2003, pp. 36.
2. Bomparola, R.M. et al., 2003. Chemical response of zircon to fluid infiltration and high-T deformation: Howard Peaks Intrusive Complex (northern Victoria Land, Antarctica), a case study, 9th International Symposium on Antarctic Earth Sciences, , Potsdam (Germany), 8-12 September 2003, pp. 35.
3. Brancolini, G., Ghezzo, C. and Morelli, A. (Editors), 2003. Proceedings of the Workshop on Antarctic Earth Sciences, Siena (Italy) 30/9/2002-2/10/2002, 8. Terra Antartica Reports, 184 pp.
4. Capponi, G. et al., 2002a. The meta-igneous rocks of the Barber Glacier area (northern Victoria Land, Antarctica): a clue to the enigmatic Borchgrevink orogeny? In: J.A. Gamble, D.N.B. Skinner and S. Henrys (Editors), Proceedings of the 8th International Symposium on Antarctic Earth Sciences, Royal Society of New Zealand Bulletin, pp. 99-104.
5. Capponi, G., Meccheri, M. and Pertusati, P., 2002f. Italian geological mapping in northern Victoria Land: the GIGAMAP project. In: J.A. Gamble, D.N.B. Skinner and S. Henrys (Editors), Proceedings of the 8th International Symposium on Antarctic Earth Sciences, Royal Society of New Zealand Bulletin, pp. 621-624.
6. Crispini, L. and Capponi, G., 2002. Albitite and listvenite in the Lanterman Fault Zone (northern Victoria Land, Antarctica). In: J.A. Gamble, D.N.B. Skinner and S. Henrys (Editors), Proceedings of the 8th International Symposium on Antarctic Earth Sciences, Royal Society of New Zealand Bulletin, pp. 113-119.

7. Capponi, G., Crispini, L., Di Vincenzo, G. and Palmeri, R., 2003b. Contrasting metamorphic evolution at the contact between terranes: microtextural and petrological evidence from shear zones in the Lanterman Range (northern Victoria Land, Antarctica), 9th International Symposium on Antarctic Earth Sciences, Terra Nostra, abstract pp.46., Potsdam (Germany), 8-12 September 2003, pp. 46.
8. Di Vincenzo, G., Viti, C. and Rocchi, S., 2002. The role of chlorite interlayering on 40Ar-39Ar biotite dating: an 40Ar-39Ar laserprobe and TEM investigation of variably chloritised biotites, 12th Goldschmidt Conference, pp. Geochim. Cosmochim. Acta, 66(15A), A182.
9. Federico, L., Capponi, G., Crispini, L. and Bradshaw, J.D., 2005. The Cambrian paleo-Pacific margin of Gondwana: a new scenario for the puzzling Ross Orogeny. , Mendoza 6-11/11/2005, Abstracts, 149, Gondwana 12, Mendoza, pp. 149.
10. Federico, L., Crispini, L. and Capponi, G., 2003. The Ross Orogeny in northern Victoria Land, Antarctica: geodynamic evolution and possible analogues, 9th International Symposium on Antarctic Earth Sciences, Potsdam (Germany), 8-12 September 2003, Potsdam (Germany), pp. 84-85.
11. Federico, L., Crispini, L. and Capponi, G., 2004a. The Cambrian paleo-Pacific margin of Gondwana: new scenario for the puzzling Ross Orogeny, 32nd International Geological Congress, Firenze, pp. 248-22, 1122.
12. Federico, L., Crispini, L. and Capponi, G., 2004b. The paleo-Pacific margin of Gondwana and the Ross Orogeny: a northern Victoria Land perspective, Frontiers and Opportunities in Antarctic Geosciences, Pontignano (Siena), Italy.
13. Federico, L. et al., 2004c. Capponi G., Carosi R., Casnedi R., Crispini L, Meccheri M., Musumeci G., Oggiano G., Pertusati P.C. & Salvini F. - 2004 - Geological maps of north Victoria Land (Antarctica), 32nd International Geological Congress, Firenze, pp. 284-64, 1266.
14. Ferraccioli, F., Capponi, G. and Bozzo, E., 2002b. Revisiting tectonic models for an Early Paleozoic subduction systemm from a potential field perspective over Victoria Land, Antarctica, Workshop "Scienze della Terra in Antartide", Pontignano 30/9-2/10, pp. 61-62.
15. Ferraccioli, F., Capponi, G. and Bozzo, E., 2003a. Imprints of Early Paleozoic subduction along the paleo-Pacific margin of Gondwana from aeromagnetics and gravity, Victoria Land (Antarctica), EGS-AGU-EUG Joint Assembly, Nice, April 2003, pp. 152.
16. Fioretti, A.M., Capponi, G., Black, L.P., Varne, R. and Visonà, D., 2002a. Inherited zircon pattern of Surgeon Island granite: evidence for Proterozoic crust at the eastern end of northern Victoria Land (Antarctica), Gondwana 11, Christchurch (NZ), 26-30 August 2002.
17. Fioretti, A.M., Capponi, G., Black, L.P. and Visonà, D., 2002b. Surgeon Island Granite: implications for regional geological evolution from structural observations and SHRIMP zircon dating, Workshop "Scienze della Terra in Antartide", Pontignano 30/9-2/10, pp. 71-72.
18. Palmeri, R. and Dallai, L., 2004. Preliminary stable isotope investigation of the ultra-high-pressure metamorphic rocks from the Lanterman Range, NVL, Antarctica, 32th International geological Congress, Firenze, August 20-28, pp. 1, 84/11.
19. Rocchi, S. et al., 2003a. Mafic rocks at the Wilson-Bowers terrane boundary and within the Bowers terrane: clues to the Ross geodynamics in northern Victoria Land, Antarctica., 9th International Symposium on Antarctic Earth Sciences, Potsdam (Germany), 8-12 September 2003, pp. 275-276.
20. Rocchi, S., Di Vincenzo, G., Fioretti, A.M. and Ghezzo, C., 2003c. Igneous activity during the waning stage of the Ross Orogeny in Victoria Land, 9th International Symposium on Antarctic Earth Sciences, Potsdam (Germany), 8-12 September 2003, Potsdam (Germany).
21. Rocchi, S., Di Vincenzo, G. and Ghezzo, C., 2003d. Geopetrographic map of Terra Nova Intrusive Complex (Victoria Land, Antarctica), 9th International Symposium on Antarctic Earth Sciences, Potsdam (Germany), 8-12 September 2003, Potsdam (Germany).
22. Roghi, G., Fioretti, A.M. and Capponi, G., 2003. Achritarchs in a thermo - metamorphosed sedimentary xenolith within Surgeon Island Granite (northern Victoria Land, Antarctica), 9th International Symposium on Antarctic Earth Sciences, Terra Nostra, abstract pp.46., Potsdam (Germany), 8-12 September 2003, pp. 278-279.
23. Rossetti, F. et al., 2003. Cenozoic right-lateral strike-slip faulting in North Victoria Land: and integrated structural, AFT and ^{40}Ar-^{39}Ar study, 9th International Symposium on Antarctic Earth Sciences - Antarctic Contribution to Global Earth Science, Potsdam (Germany), pp. 283-284.
24. Viti, C., Mellini, M. and Di Vincenzo, G., 2002. Nanotextures of laser-heated biotites, Cambridge Pub., EMPG IX Abstract volume, 105, pp. 105.

D – proceedings of national meetings and conferences

1. Calonaci, B., Di Vincenzo, G., Ricci, C.A. and Talarico, F., 2002. An ^{40}Ar-^{39}Ar investigation of micas from the Eisenhower Range (northern Victoria Land, Antarctica): implications for the deposition of the Priestley Formation and the tectono-metamorphic evolution during the Ross Orogeny, Workshop di Scienze della Terra in Antartide, Siena 30 settembre - 2 ottobre, pp. 125.
2. Capponi, G. and Crispini, L., 2004. Thrust geometry and kinematics along the Crosscut - Aorangi system: constraints for terranes boundary evolution in northern Victoria Land (Antarctica), Geoitalia, pp. 10.1474 / Epitome.01.0676.
3. Capponi, G., Crispini, L., Di Vincenzo, G. and Palmeri, R., 2002b. Contrasting amphibole compositions from metabasites of the Lanterman Fault zone, northern Victoria Land, Antarctica, Workshop di Scienze della Terra in Antartide, Siena, 30 settembre – 2 ottobre, pp. 101-102.

4. Capponi, G., Crispini, L., Di Vincenzo, G. and Palmeri, R., 2002c. Microtextural and petrological insight in shear zones from the Lanterman Range (NVL, Antarctica): contrasting metamorphic evolution at the contact between Terranes, Workshop di Scienze della Terra in Antartide, Siena, 30 settembre – 2 ottobre, pp. 101-102.
5. Carosi, R. and Di Vincenzo, G., 2002. Evidence for late-orogenic compressive tectonics during the Ross orogeny: constraints from structural and in situ 40Ar-39Ar laser analyses on the Mt.Emison shear zone (Northern Victoria Land, Antarctica), 81 Riunione Estiva S.G.I, Torino, pp. 87.
6. Palmeri, R., Ghiribelli, B., Talarico, F. and Ricci, C.A., 2002. Very-high pressure metamorphism in felsic rocks: the garnet-phengite gneisses and quartzites from the Lanterman Range (Antarctica). Workshop Scienze della Terra in Antartide, Workshop "Scienze della Terra in Antartide", Siena 30 settembre - 2 ottobre, pp. 103-104.
7. Palmeri, R., Talarico, F. and Ricci, C.A., 2003b. Ultra-high pressure metamorphism at the palaeo-Pacific margin of Gondwana: the Lanterman Range in Antarctica, 9th International Symposium on Antarctic Earth Sciences, Potsdam (Germany), 8-12 September 2003, pp. 249-250.
8. Palmeri, R., Talarico, F. and Ricci, C.A., 2005. UHP metamorphic conditions in garnet-bearing pyroxenites from Lanterman Range (northern Victoria Land): Petrology and P-T path, 7th IEC (International Eclogite Conference), Mitteilungen der Osterreichischen Mineralogischen Gesellschaft, Seggau, Austria, 3-9 July, pp. 124.
9. Perugini, D. and Poli, G., 2003b. Development of Viscous Fingering Patterns During Mingling/Mixing Processes Between Mafic and Felsic Magmas: evidence from late Ross intrusives in northern Victoria Land (Antarctica), 9th International Symposium on Antarctic Earth Sciences, Potsdam (Germany), 8-12 September 2003, Wellington, NZ, pp. 253-254.
10. Perugini, D. and Poli, G., 2004a. Vegetation Island Mafic-Felsic Associations (Terra Nova Intrusive Complex, Antarctica): An Example of Replenishment of a Felsic Magma Chamber by Continuous Influx of Mafic Magma Revealed by Field Evidence and Fluid-Mechanics Experiments, Frontiers and Opportunities in Antarctic Geosciences, Pontignano (Siena), Italy.
11. Perugini, D. and Poli, G., 2004b. Viscous Fingering Between Mafic and Felsic Magmas During Magma Interaction: Evidence from Northern Victoria Land Ross Intrusives (Antarctica), 4th International Conference on Fractals and Dynamic Systems in Geoscience, Kloster Seeon (Germany), pp. 88-92.
12. Perugini, D. and Poli, G., 2003a. Development of Viscous Fingering Patterns During Mingling/Mixing Processes Between Mafic and Felsic Magmas: evidence from late Ross intrusives in northern Victoria Land (Antarctica), Geoitalia 2003, Bellaria (RN), pp. 597-598.
13. Rocchi, S. et al., 2002. Mafic rocks at the Wilson-Bowers terrane transition and within the Bowers terrane: implications for a geodynamic model of the Ross Orogeny, Workshop di Scienze della Terra in Antartide, Siena 30 settembre - 2 ottobre, pp. 125.

E – thematic maps

1. Capponi, G., Crispini, L., Meccheri, M., Musumeci, G. and Pertusati, P., 2002d. Antarctic Geological 1/250,000 Map series. Mt. Joyce Quadrangle, (Victoria Land). Museo Nazionale dell'Antartide, Sezione di Scienze della Terra, Siena, Italy.
2. Capponi, G., Crispini, L., Meccheri, M., Musumeci, G. and Pertusati, P., 2002e. Antarctic Geological 1/250000 Map series. Relief Inlet Quadrangle, (Victoria Land). Museo Nazionale dell'Antartide, Sezione di Scienze della Terra, Siena, Italy.

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

U.O. 1. **S. Rocchi**, M. D'Orazio, M. Bertoli, M. Tamponi, I. Nardini.
U.O. 2. **C. Ghezzo**, R. Palmeri, M.L. Frezzotti, R.M. Bomparola, R. Biagini, G. Caprarelli.
U.O. 3. **G. Di Vincenzo**, A. Dini, G. De Grandis, G. Pardini.
U.O. 4. **G. Capponi**, L. Crispini, M. Meccheri, L. Federico.
U.O. 5. G. Poli, Perugini, M. Petrelli, N. Prosperini, C. Donati.

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