

Final project report

<i>Project ID</i>	2002/2.05
<i>Title</i>	<i>Observatory geomagnetism and seismology at the Italian scientific bases</i>
<i>Principal investigator</i>	<i>Andrea Morelli</i>
<i>Institution</i>	<i>Istituto Nazionale di Geofisica e Vulcanologia</i>
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<i>Duration</i>	2 years
<i>Assigned funding</i>	181.600 Euro

Activities and results (max 3000 characters)

The project had been focused on the continuation and improvement of geophysical observatory activities, also carried on in the past by the same research group. Geomagnetic and seismographic observatories had been installed at Mario Zucchelli Station (MZS) about 20 years ago, and had been operating since then. We had also been engaged in similar efforts to create analogous observatories at Concordia Station. The goal of the present project has thus been to carry on, and develop, the activities undertaken until then. To this extent, we continued the more-than-decadal time series recorded at MZS, arranging for the actions needed to implement upgrades and perform regular maintenance operations, and to finish the preparation of observatories at Concordia in view of winter-over operations. Such endeavors have been pursued during project development. We finalized the installation of the permanent geophysical observatories at Concordia Station (in collaboration with the French team from EOST, Strasbourg), including seismographic and geomagnetic sensors and data acquisition systems. Both observatories have been working and acquiring data during the winter-overing at Concordia. Observatory systems at Mario Zucchelli Station have also been upgraded; in particular the geomagnetic observatory was definitely moved from the old location to the new one, because of the growing human activity of the base and the ensuing electromagnetic noise.

A seismic field campaign, with temporary operation of portable seismographs, has been conducted in cooperation with New Zealand to detect, locate and monitor micro-seismicity associated with the fast-flowing outlet tongue of the David Glacier. The research showed that the earthquakes are due to seismic stick-slip behavior at the ice-rock interface (see publication list).

In Italy, we validated the data collected in the field, and delivered to specific databases. A web portal has been set up to make data available to the community (antartica.bo.ingv.it). Geomagnetic annuaries have regularly been published. Data are available for geomagnetic observatories at http://roma2.rm.ingv.it/it/risorse/osservatori_geomagnetici/25/osservatorio_magnetico_di_stazione_mario_zucchelli, and http://roma2.rm.ingv.it/it/risorse/osservatori_geomagnetici/26/osservatorio_magnetico_di_stazione_concordia. The data have also been used to conduct research on the deep structure of the Antarctic continent, its tectonics, microseismicity, variations of the geomagnetic field at different frequencies. Technological activities and scientific results have been published in the literature, and presented at meetings (see reference list).

Products

A – papers in scientific magazines

- Cafarella L., Di Mauro D., Lepidi S., Meloni A., Palangio P., L. Santarelli, 2008. Geomagnetic Observation Result, 2005-2006, National Antarctic Research Program Earth Science Group, Terra Nova Bay, Antarctica.
- Pietrolungo M., Lepidi S., Cafarella L., Santarelli L., Di Mauro D., 2008. Comparison of daily variation characteristics at three Antarctic geomagnetic observatories within the polar cap, Ann. Geophys., 26,

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- 2179–2190, 2008
- Faccenna C., F. Rossetti, Thorsten W. Becker, S. Danesi, 2008. Recent extension driven by mantle upwelling beneath the Admiralty Mountains (East Antarctica). *Tectonics*, 27, TC4015, doi:10.1029/2007TC002197.
 - A. Morelli and S. Danesi, 2004. Seismic imaging of the Antarctic continental lithosphere. *Global and Planetary Change*, Vol.42 (1-4), 155-165.
 - Cafarella L., Di Mauro D., Lepidi S., Meloni A., Palangio P., L. Santarelli, 2004. Geomagnetic Observation Result, 2000-2001. National Antarctic Research Program Earth Science Group, Terra Nova Bay, Antarctica.
 - Cafarella L., Di Mauro D., Zirizzotti A., 2004. L'osservatorio geomagnetico presso la base italiana Stazione Mario Zucchelli in Antartide, Rapporti Tecnici INGV, n. 26, 47 p.
 - Lepidi S., L. Cafarella, P. Palangio, L. Santarelli, 2005. The Earth's passage of coronal mass ejecta on October 29-31, 2003: ULF geomagnetic field fluctuations at very high latitude. *Mem. S.A.It.*, vol 76, pp 998.
 - Schott J.J., Di Mauro D., Peres A., Cafarella L., Magno L., Zirizzotti A., Meloni A., 2005. Towards the opening of a magnetic observatory at Dome C (Antarctica). *Proceedings of XIth IAGA WORKSHOP ON GEOMAGNETIC OBSERVATORY INSTRUMENTS, DATA ACQUISITION AND PROCESING*, Nov 9-17 2004.
 - Cafarella L., Di Mauro D., Lepidi S., Meloni A., Palangio P., L. Santarelli, 2007. Geomagnetic Observation Result, 2001-2002 and 2002-2003, National Antarctic Research Program Earth Science Group, Terra Nova Bay, Antarctica.
 - Cafarella L., Di Mauro D., Lepidi S., Meloni A., Palangio P., L. Santarelli, 2007. Geomagnetic Observation Result, 2002-2004 and 2004-2005, National Antarctic Research Program Earth Science Group, Terra Nova Bay, Antarctica.
 - Danesi S., S. Bannister and A. Morelli, 2007. Repeating earthquakes from rupture of an asperity under an Antarctic outlet glacier. *Earth and Planet. Sc. Lett.*, vol. 253, n. 1-2, 151-158.
 - Lepidi S., Cafarella L., Santarelli L., 2007. Low frequency geomagnetic field fluctuations at cap and low latitude during October 29-31, 2003. *Annals of Geophysics*, Vol. 50.
 - Meloni A., Cafarella L., P. De Michelis and R. Tozzi, 2007. The contribution of geomagnetic observatories and Magnetic Models to the study of secular variation and jerks in Antarctica, Geological Survey and The National Academies; USGS OF-2007-1047, Short Research Paper 071, doi:10.3133/of2007-1047.srp071
 - Santarelli L., Cafarella L., Lepidi S., Di Mauro D., Meloni A., Palangio P., 2007. Fourteen years of geomagnetic daily variation at Mario Zucchelli Station (Antarctica). *Annals of Geophysics*, Vol. 50, April 2007.
 - Cafarella L., D. Di Mauro, S. Lepidi, A. Meloni, M. Pietrolungo, L. Santarelli, J.J. Schott, 2007. Daily variation at Concordia station (Antarctica) and its dependence on IMF conditions. *Annales Geophysicae* 25, pp. 2045-2051.
 - Santarelli L., Lepidi S. and Cafarella L., 2007. Propagation of low frequency geomagnetic field fluctuations in Antarctica: comparison between two polar cap stations. *Annales geophysicae*, 25, 2405-2412.
 - Cafarella L., Di Mauro D., Lepidi S., Meloni A., Palangio P., L. Santarelli, 2007. Geomagnetic Observation Result, 2001-2002 and 2002-2003, National Antarctic Research Program Earth Science Group, Terra Nova Bay, Antarctica.
 - Cafarella L., Di Mauro D., Lepidi S., Meloni A., Palangio P., L. Santarelli, 2007. Geomagnetic Observation Result, 2002-2004 and 2004-2005, National Antarctic Research Program Earth Science Group, Terra Nova Bay, Antarctica.

B – book chapters

- Pondrelli S., L. Margheriti and S. Danesi, 2005. Seismic anisotropy beneath Northern Victoria Land from SKS splitting analysis, Antarctica, *Contr. to Global Earth Sciences*, Springer-Verlag Berlin Heidelberg Eds, 155-161.
- Schott J.J., Di Mauro D., Peres A., Cafarella L., Magno L., Zirizzotti A., Meloni A., 2005. Towards the opening of a magnetic observatory at Dome C (Antarctica), *Proceedings of XIth IAGA Workshop on Geomagnetic Observatory Instruments, Data Acquisition and Processing*, Nov 9-17 2004.
- 2007
- Cafarella L., De Lauretis M., Di Mauro D., Francia P., Lepidi S., Meloni A., Palangio P., Piancatelli A., Santarelli L., Vellante M. and Villante U., 2007. ULF Geomagnetic Pulsations at High Latitudes: the Italian Contribution, *PUBLS. INST. GEOPHYS. POL. ACAD. SC.*, Monographic Volume, C-99 (398), XII IAGA Proceedings, Belsk, 2006, pp. 360-365
- Casula G., S. Danesi, M. Dubbini and L. Vittuari, 2007. Tidal forcing on David Glacier and Drygalski Ice Tongue. Contribution to 'Antarctica: A Keystone in a Changing World', edited by A. K. Cooper and C. R. Raymond ISSN: 0196-1497, doi:10.3133/of2007-1047, EA009, 1-4.
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- Cafarella L., D. Di Mauro, S. Lepidi and A. Meloni, 2008. Geomagnetic observatories in Antarctica; state of the art and a perspective view in the global and regional frameworks, Contribution to 'Geodetic and Geophysical Observatories in Polar Regions – Overview in the IPY Perspective', Springer-Verlag Berlin Publ., A. Capra and R. Dietrich Eds., ISBN: 987-3-540-74881-6
- Danesi S., M. Dubbini, A. Morelli and L. Vittuari, 2008. Joint geophysical observations of ice stream dynamics. Contribution to 'Geodetic and Geophysical Observatories in Polar Regions – Overview in the IPY Perspective', Springer-Verlag Berlin Publ., A. Capra and R. Dietrich Eds., ISBN: 987-3-540-74881-6

C - proceedings of international conferences

- SIF XCIV CONGRESSO NAZIONALE, GENOVA 22-27 SEPT S. Danesi, Eventi sismici e dinamiche glaciali osservati presso il David Glacier, Antartide
- IGC 33RD, OSLO 6-14 AUG S. Danesi, A. Morelli, S. Bannister, Peculiar low-magnitude seismicity beneath David Glacier, Antarctica
- FIRST RESULTS FROM THE IHY 2007, 2-6 JUNE 2008, SOZOPOL, BULGARIA. Perrone L., Cafarella L., Lepidi S., Meloni A., Study of a geomagnetic storm and a polar cap absorption event recorded on January 2005 at Mario Zucchelli Station, Antarctica
- JOINT SCAR-IASC OPEN SCIENCE CONFERENCE, 8 - 11 JULY 2008, ST PETERSBURG, RUSSIA
- Perrone L., Lepidi S., Cafarella L., Meloni A. Study of a geomagnetic storm and a polar cap absorption event recorded on January 2005 at Mario Zucchelli Station, Antarctica
- L. Cafarella, D. Di Mauro, S. Lepidi, M. Pietrolungo, Daily variation characteristics at Arctic and Antarctic geomagnetic observatories
- L. Cafarella, S. Lepidi, M. Pietrolungo, L. Santarelli Azimuthal propagation of low frequency geomagnetic field fluctuations in the polar cap: comparison between two Antarctic stations
- AGU Fall Meeting, San Francisco 13-17 Dec 2004, S. Danesi, S. Bannister, A. Morelli, M. Hagerty, A. Delladio, N.M. Pagliuca, David Glacier, North Victoria Land, 2003-04 Local Seismicity Monitoring Campaign
- XXVIII SCAR Open Science Conference, Bremen, 25-31 Jul 2004, Santarelli L., Cafarella L., Di Mauro D., Lepidi S., Meloni A., Palangio P., Fifteen years of geomagnetic field observations at Terra Nova Bay
- XXVIII SCAR Open Science Conference, Bremen, 25-31 Jul 2004, Lepidi S., L. Cafarella, P. Palangio, L. Santarelli, Low frequency geomagnetic field fluctuations at different high latitude stations during october 29-31, 2003
- XXVIII SCAR Open Science Conference, Bremen, 25-31 Jul 2004, Danesi S., S. Bannister, A. Delladio, M. Hagerty, A. Morelli, N.M. Pagliuca, David Glacier, North Victoria Land, 2003-04 local seismicity monitoring campaign
- 35th COSPAR SCIENTIFIC ASSEMBLY PARIS, FRANCE, 18- 25 Jul Lepidi S., L. Cafarella, P. Palangio, L. Santarelli, Low Frequency Geomagnetic Field Fluctuations at Different High Latitude Stations During October 29-31, 2003
- AGU Joint Assembly, Montreal 17-21 May, Schott J.J., Di Mauro D., Peres A., Cafarella L., Magno L., Zirizotti A., Meloni A. and Cantin J.M.: First absolute measurements and magnetic field records at Dome C (Antarctica)
- EGU General Assembly, Vienna 24-29 Apr, Lepidi S., L. Cafarella, P. Palangio, L. Santarelli, Low frequency geomagnetic field fluctuations at very high and low latitude during October 29-31, 2003
- EGU General Assembly, Vienna 24-29 Apr, Santarelli L., L. Cafarella, S. Lepidi, P. Palangio, A comparison between low frequency geomagnetic field fluctuations observed within the polar cap
- Solar Variability and Earth climate, Roma 27 Jun-1 Jul, Lepidi S., L. Cafarella, P. Palangio, L. Santarelli, The Earth's passage of coronal mass ejecta on october 29-31, 2003: geomagnetic field fluctuations at very high latitude
- IAGA 2005 Scientific Assembly, Toulouse 18-29 Jul, Santarelli L., Cafarella L., Di Mauro D., Lepidi S., Meloni A., Palangio P., Geomagnetic field observations at Mario Zucchelli Station, Terra Nova Bay, Antarctica,
- AGU Fall Meeting, San Francisco 11-15 Dec, S. Danesi, M. Dubbini, A. Morelli, L. Vittuari, S. Bannister, Joint Seismological and Geodetic Observations on David Glacier, South Victoria Land, Antarctica
- 3rd EGU General Assembly, Vienna 2-7 April, S. Danesi, S. Bannister, A. Morelli (invited oral communication), Peculiar seismicity in Antarctica swarms of glacial earthquakes with a recurrent magnitude under David Glacier, Victoria Land
- 3rd EGU General Assembly, Vienna 2-7 April, Santarelli, L.; Cafarella, L.; Di Mauro, D.; Lepidi, S., Geomagnetic field observations in Antarctica at the geomagnetic observatories at Terra Nova Bay and DomeC
- 3rd EGU General Assembly, Vienna 2-7 April, Santarelli L., Cafarella L., Lepidi S., Low frequency geomagnetic field fluctuations in Antarctica: comparison between two polar cap stations

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- XXIX SCAR Hobart 9-19 July, Amata E., Alfonsi L., Cafarella L., Candidi M., Coco I., Consolini G., De Lauretis M., Di Mauro D., De Franceschi G., Marcucci M.F., Massetti S., Meloni A., Francia P., Romano V., Vellante M., Villante U., Observations of ionospheric and magnetospheric phenomena from the polar regions. The Italian contribution to IPY
- XXIX SCAR Hobart 9-19 July, Cafarella L., De Lauretis M., Di Mauro D., Francia P., Lepidi S., Meloni A., Palangio P., Piancatelli A., Santarelli L., Vellante M., Villante U., Geomagnetic pulsations at high latitudes: the Italian contribution.
- XXIX SCAR Hobart 9-19 July, Cafarella L., Di Mauro D., Di Persio M., Lepidi S., Meloni A., Santarelli L., Zirizzotti A., Bordais P., Schott J.J., Geomagnetic field observations at Mario Zucchelli Stations and DomeC geomagnetic observatories (Antarctica)
- XII IAGA WORKSHOP ON GEOMAGNETIC OBSERVATORY INSTRUMENTS, DATA ACQUISITION AND PROCESSING, Belsk June 19- 24
- Cafarella L., Di Mauro D., Di Persio M., Lepidi S., Meloni A., Santarelli L., Zirizzotti Bordais P., Schott J.J., Geomagnetic field observations at Mario Zucchelli stations and DomeC geomagnetic observatories (Antarctica)
- XII IAGA WORKSHOP ON GEOMAGNETIC OBSERVATORY INSTRUMENTS, DATA ACQUISITION AND PROCESSING, Belsk June 19- 24, Lepidi S., Cafarella L., De Lauretis M., Di Mauro D., Francia P., M. Meloni A., Palangio P., Piancatelli P., Santarelli L., Vellante M., Villante U., ULF geomagnetic pulsations at high latitudes: the Italian contribution.
- ISAES X, Santa Barbara 25-31 Aug, Casula G., S. Danesi, M. Dubbini and L. Vittuari, Tidal forcing on David Glacier and Drygalski Ice Tongue
- ISAES X, Santa Barbara 25-31 Aug, Meloni A., Cafarella L., P. De Michelis and R. Tozzi, The contribution of geomagnetic observatories and Magnetic Models to the study of secular variation and jerks in Antarctica
- IUGG Perugia 2-13 Jul, Cafarella L., D. Di Mauro, S. Lepidi, A. Meloni, M. Pietrolungo, L. Santarelli, Comparison of daily variation characteristics at different Antarctic geomagnetic observatories and their dependence on IMF conditions
- IUGG Perugia 2-13 Jul, Santarelli L., S. Lepidi, L. Cafarella, Propagation of low frequency geomagnetic field fluctuations in Antarctica: comparison between two polar cap stations

D – proceedings of national meetings and conferences

E – thematic maps

F – patents, prototypes and data bases

G – exhibits, organization of conferences, editing and similar

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

- Research Fellowship: "Analisi comparata delle variazioni del campo magnetico terrestre registrate presso l'osservatorio di Baia Terranova ed altri osservatori antartici", Dr. Manuela Pietrolungo

Research units

1. (Resp.: Cafarella Lili)

Nome/Name	Qualifica/Role	Istituto/Institute
Lili Cafarella	Tecnologo	INGV
Domenico Di Mauro	Ricercatore	INGV
Lepidi Stefania	Ricercatore	INGV
Achille Zirizzotti	Tecnologo	INGV

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2. (Resp.: Di Mauro Domenico)

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Lili Cafarella	Tecnologo	INGV
Meloni Antonio	Dir. Ricerca	INGV
Zirizzotti Achille	Tecnologo	INGV

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Andrea Morelli	Dirigente di ricerca	INGV
Alberto Delladio	Primo Tecnologo	INGV
Antonello Piombo	Ricercatore	Università di Bologna
Stefania Danesi	Ricercatore	INGV
Nicola Mauro Pagliuca	Ricercatore	INGV

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Andrea Morelli	Dirigente di ricerca	INGV
Marco Olivieri	Ricercatore	INGV
Lucio Badiali	Ricercatore	INGV

5. (Resp.: Pondrelli Silvia)

<i>Name</i>	<i>Position</i>	<i>Institute</i>
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Alberto Delladio	Primo Tecnologo	INGV
Nicola Mauro Pagliuca	Ricercatore	INGV
Stefania Danesi	Ricercatore	INGV

Date:

Notes