

Final project report

Project ID: 2002/5.3
Title: *Permafrost and Global change II*

Principal investigator: Prof. Mauro Guglielmin
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Duration: two years
Assigned funding: € 92.900,00

Activities and results

Field work in Antarctica: The Project analysed the impact of climate change through three different main goals: i) Understanding of the interactions between permafrost, vegetation and climate and analyses of the potential feedbacks along environmental gradients in several sites included in international network as RiSCC, CALM e GTN-P (Victoria Land, and Signy Island-Antarctic peninsula); ii) Understanding of the genesis of the main permafrost related features (icing blisters, frost mounds and ice wedges) occurring in Victoria Land and their use to contribute to the paleoclimatic reconstruction of the area; iii) Understanding of weathering processes responsible of the formation of varnish, weathering rind and weathering features such as tafoni, grooves and pits.

To achieve these goals two Antarctic campaigns (2002-2003 and 2003-2004) with four researchers (of which one as foreigner guest) the first and five researchers the latter. The first research team was composed by Mauro Guglielmin, Cannone Nicoletta, Strini Andrea and Angelique Prick while the latter by Andrea Strini and Fabio Bajo in the first leg of the season and Rossana Raffi, Roberto Seppi e Simone Segal on the third leg. In both the campaigns the monitoring of the CALM grids of Boulder clay was performed and also the data download of the permafrost monitoring stations was performed. During the first campaign the relationships between permafrost and vegetation and climate were analysed on the vegetation permanent plots (VPP) already installed, on the 121 points of the CALM grid of Boulder Clay and on 6 new VPP added to the latitudinal network between 72° e 77° S. In addition a ground probing radar campaign was performed to detect the active layer thickness and to understand the internal structure of the frost mounds, icing blisters and rock glaciers along the North Victoria Land.

A multidisciplinary approach (vegetational, chemical, geomorphological, thermic and hygrometric analyses) has been applied to analyse the weathering processes on granite surfaces along the latitudinal transect between Granite Harbour e Apostrophe Island. During the second campaign the nature of the ground ice and of the main permafrost related features was analysed through the coring of some frost mounds, icing blisters, rock glacier and the digging of several trenches on ice wedges with the sampling of the ground ice. Among the performed cores the longest was the 11 m long core of the Upper Victoria Valley that revealed the absence of dry permafrost. At Signy station dataloggers were installed to monitor the active layer and vegetation buffering effect in cooperation of BAS.

Laboratory investigations in Italy:

In Italy the research was focused on the analyses, the validation and the archiving of permafrost and active layer thermal regime data and on the analyses of the samples of vegetation, soils, ground ice collected in the Antarctic campaigns. In particular, with international cooperation (Alfred Wegener Institute) the chemical, granulometrical and bacterial composition of the soils collected in the active layer of all the permanent vegetation plots was determined. Chemical, cristallographical and isotopical composition of the ground ice was determined. Microscopical, chemical and vegetational compositions of the varnish and of the weathered surfaces sampled within different sites and landforms were also performed.

Between 2 and 8 July 2003 the Vth SCAR-RiSCC Workshop was organised at Varese and a selection of the presentations has been published on Terra Antartica Report.

Products

A – papers in scientific magazines

1. BRANCALEONI L., STRELIN J., GERDOL R. 2003. Relationships between geomorphology and vegetation patterns in subantarctic andean tundra of Tierra del Fuego. *Polar Biology*, 26: 404-410.
2. CANNONE N. 2004. Minimum area assessment and different sampling approaches for the study of vegetation communities in Antarctica. *Antarctic Science*, 16(2): 157 - 164.
3. CANNONE N., GUGLIELMIN M., GERDOL R., 2004. Relationships between vegetation patterns and periglacial landforms in north-western Svalbard. *Polar Biology*, 4: 1 - 22.
4. FRENCH HM., GUGLIELMIN M. 2002A. Cryogenic grooves on a granite nunatak, Northern Victoria Land, Antarctica, *Norsk Geografisk Tidsskrift*, 56, 112-116.
5. FRENCH HM, GUGLIELMIN M. 2002B. Observations on Granite Weathering Phenomena, Mount Keinath, Northern Victoria Land, Antarctica. *Permafrost and Periglacial Processes* 13: 231-236.
6. GUGLIELMIN M. 2004. Observation on permafrost ground thermal regimes from Antarctica and the Italian Alps, and their relevance to global climate change. *Global and Planetary Change* 40: 159-167.
7. GUGLIELMIN M., CAMUSSO M, POLESELLO S., VALSECCHI S AND TERUZZI M. 2002. A note on the ice crystallography and geochemistry of a debris cone, Northern Foothills, Antarctica. *Permafrost and Periglacial Processes*, 13 (1), 77-82
8. GUGLIELMIN M., FRENCH H.M., DRAMIS F. 2003 Permafrost e forme periglaciali nelle Northern Foothills (Baia Terra Nova, Terra Vittoria Settentrionale, Antartide). *Il Quaternario*, 16 (2), 151-157.
9. GUGLIELMIN M., FRENCH H.M. 2004. Ground ice in the Northern Foothills, northern Victoria Land, Antarctica, *Annals of Glaciology*, 39, 495-500
10. RAFFI, R., STENNI, B., FLORA, O., POLESELLO S., CAMUSSO, M. 2003. Ice-wedge evidence in the Mesa Range (Northern Victoria Land, Antarctica). *Terra Antarctica Reports*, 8, 149-152.
11. RAFFI R. 2003 Ice wedges in the Terra Nova Bay region (Northern Victoria Land, Antarctica) Distribution and morphological features, *Terra Antarctica Reports*, 8, 143-148.
12. RAFFI, R., STENNI, B., FLORA, O., POLESELLO S., CAMUSSO, M. 2004. Growth processes of an inland ice wedge, Mesa Range, northern Victoria Land, *Annals of Glaciology*, 39,379-385.
13. VALT M., CAGNATI A., FENTI G., TOMASELLI A 2002. L'influenza del manto nevoso sul permafrost in Antartide. *Neve e Valanghe*, 45, 50-57

B – book chapters

1. CANNONE N., GUGLIELMIN M. 2003. Vegetation and permafrost: sensitive systems for the development of a monitoring program of climate change along an Antarctic transect. In: Huiskes, A.H.L., Gieskes, W.W.C., Rozema, J., Schorno, R.M.L., Van der Vies, S.M., Wolff, W.J. (Editors): *Antarctic Biology in a Global Context*. Backhuys Publishers, Leiden: 31 - 36.

C - proceedings of international conferences

1. GUGLIELMIN M., BALKS M. PAETZOLD R. 2003. Towards an antarctic active layer and permafrost monitoring network , *Proceedings of the 8th International Conference on Permafrost*, Zurich, Switzerland, 21 – 25 July 2003, Balkema Publishers, Lisse 367-372.

D – proceedings of national meetings and conferences

1. CANNONE N., M. GUGLIELMIN 2003. Edmonson Point: a key area for monitoring climate change through the sensitive permafrost soil and vegetation system. In, edited by C. M. Harris, S. M. Grant: *Science and Management at Edmonson Point Wood Bay, Victoria Land, Ross Sea: Report on the Workshop held in Siena, Italy, 15 April 2003*: 8 – 9.

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

1. ORGANIZZAZIONE Vth SCAR-RISCC Workshop 2-8July 2003 Varese.
2. CANNONE N. 2002 Methods for the study of terrestrial environments: general site description. In: *RISCC Manual*. Version 1.0. Edited by Huiskes A., pubblicato nel sito web ufficiale del Progetto internazionale dello SCAR "RISCC" (Regional Sensitivity to Climate Change in Antarctic Terrestrial and Lymnetic Ecosystems): 33; 183 - 185.

Programma Nazionale di Ricerche in Antartide (PNRA)

3. CANNONE N. 2002 Ecosystems and community studies: Community description. In: RiSCC Manual. Version 1.0. Edited by Huiskes A., pubblicato nel sito web ufficiale del Progetto internazionale dello SCAR "RiSCC" (Regional Sensitivity to Climate Change in Antarctic Terrestrial and Lymnetic Ecosystems): 48 – 52; 189 – 199.
4. GREMMEN N., CANNONE N. 2002. Ecosystems and community studies: RiSCC vegetation studies – sampling design and methods. In: RiSCC Manual. Version 1.0. Edited by Huiskes A., pubblicato nel sito web ufficiale del Progetto internazionale dello SCAR "RiSCC" (Regional Sensitivity to Climate Change in Antarctic Terrestrial and Lymnetic Ecosystems): (<http://www.riscc.aq>): 35 – 45.
5. GUGLIELMIN M., 2002. Active Layer monitoring protocol for Antarctica. In: RiSCC Manual. Version 1.0. Edited by Huiskes A., pubblicato nel sito web ufficiale del Progetto internazionale dello SCAR "RiSCC" (Regional Sensitivity to Climate Change in Antarctic Terrestrial and Lymnetic Ecosystems) (<http://www.riscc.aq>): 61-66.

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

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Research units

ORO-GUG

- Prof. Mauro Guglielmin
- Prof. Renato Gerdol
- Dr. Nicoletta Cannone
- Dr. Davide Boschi
- Dr. Fabio Baio
- Prof. Antonio Di Guardo
- Prof. Alessandro Fumagalli

ORO-DRA

- Prof. Francesco Dramis
- Prof. Carlo Bisci
- Prof. Giuseppe Cappelli
- Dr. Elena Pettinelli

ORO-RAF

- Prof. Rossana Raffi
- Prof. Sirio Cicacci
- Prof. Enrico Miccadei
- Sig. Simone Segà

ORO-POL

- Dr. Stefano Polesello
- Dr. Marina Camusso
- Dr. Sara Valsecchi

ORO-CAG

- Anselmo Cagnati
- Mauro Valt
- Stefano Fenti
- Alvisè Tomaselli

ORO-BIN

- Prof. Alfredo Bini
- Dr. Andrea Strini
- Dr. Paola Tognini
- Dr. Luisa Zuccoli
- Dr. Alfredo Lozej

Date:
