

Final project report

Project ID: 2002/4.11
Title: Morphology and Geology of Antarctic Margins – Wilkes Land and Antarctic Peninsula

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Duration: 2 years
Assigned funding: € 51.646,00

Activities and results

MOGAM project collected swath bathymetric and subbottom acoustic data from the George Vth Land, 145° - 143°E and 64°45' - 65°50'S, in 2006 with R/V OGS Explora, in an area of about 10,000 km², in 600-3500 meters of water depth. Data were collected using Reson SeaBat 8150 multibeam system, with 234 beams and frequency of 12 kHz and subbottom chirp II acoustic data were collected with sweep of 2-7 kHz. Regional studies on multichannel seismic profiles (e.g. Eittrheim et al., 1987; Escutia et al., 2005; Donda et al., 2007; Close et al., 2007) and detailed studies (De Santis et al., 2003; Donda et al., 2003), show a buried rugged morphology and seismic facies (e.g channel-levee) under the continental slope and rise, suggesting a more dynamic setting in the past when the glacial environment was dominated by meltwater processes and deposition by temperate or polythermal glacial systems.

The MOGAM project was set up to investigate the relationship between the modern and recent sea bed depositional processes, in particular in relationship to the inferred downslope cascade pathways of the High Salinity Shelf Water produced along the coast today (Gordon and Tchernia, 1972; Rintoul, 1998; Bindoff et al., 2000, 2001). The production of deep water from the George Vth shelf has a key role in the formation of Antarctic Bottom Water, one of the water masses that regulate the global thermohaline circulation.

Joint Australian and PNRA WEGA project (1999-2002 Brancolini e Harris, 2000) data from the continental shelf, slope and upper rise of the George Vth Land document bottom current activity since the Last Glacial Maximum and during past cycles. Detailed geology and geophysical study in the Mertz-Ninnis Trough have revealed clear signature of present bottom current activity (Harris et al., 2001) and significant changes in the bottom current production throughout the Holocene warmest time interval (3000-5000 years, Harris and Beaman, 2003; Presti et al., 2003, 2005). Signals of bottom current downslope flow and of its variations in past glacial and interglacial cycles, have been also detected in slope sediments, back to Isotopic stage SI16 (Busetto et al., 2003; Macrì et al., 2005; Damiani et al., 2006; Caburlotto et al., 2006).

MOGAM survey shows that the continental slope and rise seaward of the Mertz-Ninnis Glacial valley sill is actually incised by a complex network of converging submarine canyons (the Jussieu Canyon system), some of which directly connected to the shelf depression. This sea bed character differ from that observed in other Antarctic margins (e.g. the Antarctic Peninsula) that generally show gullies across the shelf edge, smooth slope morphology and channel systems incising the upper rise.

The peculiar morphology of the George Vth margin sea floor likely reflects the intense dynamics of dense water spilling off the shelf and flowing down the continental slope, probably channelled within the canyons. The strata truncation along the flanks of the canyons, the exhumation of buried, relict features along the present slope and thick turbiditic deposit (up to 1 m) recovered from the Jussieu Canyon levees in the rise would suggest that erosive processes still strongly affect the George V Land margin. In analogy with other areas of dense water production, we believe that shelf water cascading currents driven by salinity contrast and also entraining fine organic and terrigenous particles, might have the capacity for reshaping submarine canyon floors and carrying sediment to the deep sea environment.

Programma Nazionale di Ricerche in Antartide (PNRA)

Products

A – papers in scientific magazines

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B – book chapters

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C - proceedings of international conferences

1. De Santis L., A. Caburlotto, D. Accettella, A. Cova, M. Presti, F. Loreto Submarine geomorphology and depositional processes along the George V Land continental slope and upper rise (East Antarctica), oral presentation, European Geosciences Union EGU, Wien, Austria, 15-20 April 2007
2. De Santis L., G. Brancolini, D. Accettella, A. Cova, A. Caburlotto, F. Donda, C. Pelos, F. Zgur, M. Presti (2007), New insights into submarine geomorphology and depositional processes along the George V Land continental slope and upper rise (East Antarctica)– Oral Presentation. Ondine Proceedings of the 10th ISAES X, edited by A. K. Cooper and C. R. Raymond et al., USGS Open-File Report 2007-1047, Extended Abstract 061, 5 p., Santa Barbara, CA (USA) 25-August-1 September 2007
3. De Santis L., A. Caburlotto, M. Presti, D. Accettella, A. Cova, (2007), Submarine geomorphology and bottom current signature on antarctic sediment: examples from the George Vth continental shelf and slope (east Antarctica), Oral Presentation, XXIV General Assembly of the International Union of Geodesy and Geophysics, IUGG, Perugia, Italy, 2-13 July 2007

D – proceedings of national meetings and conferences

1. De Santis L., G. Brancolini, D. Accettella, A. Cova, A. Caburlotto, F. Donda, M. Presti F. Zgur, Submarine geomorphology and depositional processes along the George V Land continental slope and upper rise (East Antarctica), Geoitalia Sesto Forum Italiano di Scienze della Terra, Federazione Italiana Scienze della Terra FIST, Oral Presentation, Sessione T 22 - Evoluzione glaciale Cenozoica delle regioni polari ottenuta da studi geologici e geofisici, Rimini 12-14 settembre 2007.

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

1) *Research task*: Sedimentological analyses

Renata Lucchi assegno ricerca OGS
Andrea Caburlotto dottoranda OGS-Università di Siena
Massimo Presti dottorando Univ. Trieste
Patrizia Macri' dottoranda ING Roma-Università di Bologna

2) *Research task*: Mineralogical analyses

Isabella Memmi Professoressa Università di Siena
Giovanna Giorgetti ricercatore Università di Siena
Damiano Damiani dottorando Università di Siena

3) *Research task*: Analysis of morphological and geophysical data

Laura De Santis Ricercatore OGS
Giuliano Brancolini Primo Ricercatore OGS
Federica Donda Dottoranda OGS-Università di Siena
Carla De Cillia tecnologa OGS

Date:

21 April 2008

Notes

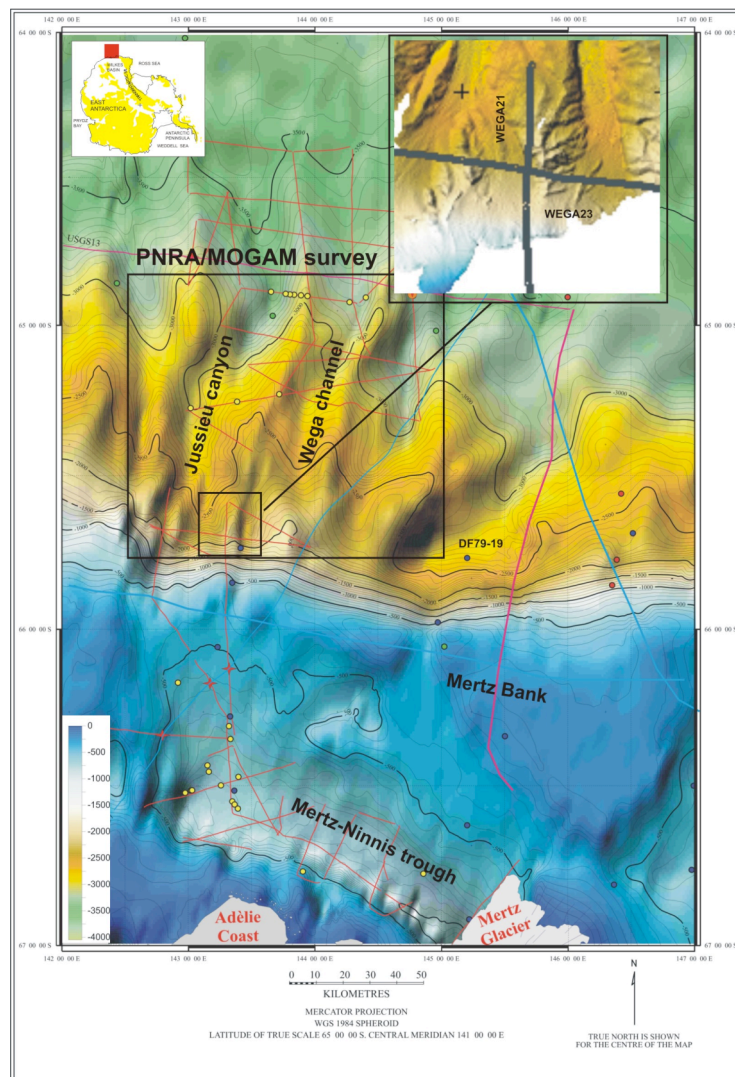


Figure 1. Bathymetric map of the George Vth Land margin (Caburlotto et al., 2006, modified). The upper right inset shows a detail of the upper slope as imaged by swath bathymetric data collected by the PNRA/MOGAM cruise in 2006 by OGS Explora. The red, blue and pink thin lines show the location of existing multichannel seismic data and the yellow and blue dots show sediment core location. The red stars are the proposed IODP proposal 482 Rev. sites (Escutia et al., 1997).

Programma Nazionale di Ricerche in Antartide (PNRA)

References

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