

Final project report

<i>Project ID</i>	2004/8.03
<i>Title</i>	CLIMA IV - Ventilation processes in the Ross Sea
<i>Principal investigator</i>	Prof. Giancarlo Spezie
<i>Institution</i>	Università degli Studi di Napoli "Parthenope"
<i>Email</i>	giancarlo.spezie@uniparthenope.it
<i>Duration</i>	3 years
<i>Assigned funding</i>	280.000,00 Euro

Activities and results

We carried out three oceanographic surveys in the Ross Sea and adjacent areas during the period 2004-2010 focused on the formation of deep and bottom waters. To realize such topics we focused our attention on the atmospheric- oceanic processes in the polynya areas, on the thermohaline changes over the shelf, on the ventilation processes at the shelf break between the outflow of (new) shelf waters and the inflow of (old) deep waters of oceanic regime carried by the Antarctic Circumpolar Current.

During the austral summer 2005-06 we performed a basin scale multidisciplinary (bio-geo-chemical and physical) oceanographic survey to recover the existing moorings in the Ross Sea and to redeploy all of them for a further season as well as to extend the hydrographic surveys obtained during previous cruises in strategic areas of the Ross Sea in order to study the origin and the fate of the shelf water and their role in the AABW formation. Moreover we collect XBT, CTD/LADCP data and water samples also during transfer between New Zealand to the Ross Sea; underway continuous surface (-5 m) salinity and temperature measurements were made along all the cruise track.

During the austral summers 2007-2008 and 2009-2010 only the mooring activity (recover/redeploy) in the Ross Sea was performed.

Main results obtained concern:

- Identification of the source areas and major pathways of the shelf waters observed south of the slope front; this includes waters formed by exchange with the atmosphere as well as by interaction with ice shelves.
- The identification and quantification of biomarkers associated with the waters of shelf and are tied to specific biological activity.
- The quantification of the flow of particulate matter in relation to the physical structure.
- The definition of the concentration, the characteristics and processes of the benthic layer influenced by water dynamics.
- The estimate of the penetration of anthropogenic CO₂ and the role of the Ross Sea in the global budget.
- The quantification exporter of vertical particulate matter (biogenic and lithogenic components).
- The definition of a carbon budget inclusive of passive transport processes, active transfer and recirculation through the planktonic food webs.
- The role of labile Fe and Cu in modulating the primary production in Terra Nova Bay polynya
- Study the structure of the slope front and the exchanges across the front.
- Surface heat budget of the Ross Sea (ocean-ice-atmosphere).
- Estimations of the mean time between formation of these waters and exchange across the slope front.
- Analysis of the dynamics and interannual variability of the ACC and related thermal fronts, including the generation of eddies.

Products

A – papers in scientific magazines

1. Bergamasco A., Defendi V., Budillon G., Spezie G. 2004, "DOWN FLOW OBSERVATIONS NEAR CAPE ADARE SHELF-BREAK". *Antarctic Science*, Vol. 16, 2: 199 – 204.
2. Budillon G., Salusti E., Tucci S. 2006, "THE EVOLUTION OF DENSITY CURRENTS AND NEPHELOID BOTTOM LAYERS IN THE ROSS SEA (ANTARCTICA)". *Journal of Marine Research*, 64(4): 517-540.
3. Campanelli A., Massolo S., Grilli F., Marini M., Paschini E., Rivaro P., Artegiani A., Jacobs S.S., "VARIABILITY OF NUTRIENT AND THERMAL STRUCTURE IN SURFACE WATERS BETWEEN NEW ZEALAND AND ANTARCTICA, OCTOBER 2004 – JANUARY 2005". *Polar Research*, *in press*.
4. Capello M., Budillon G., Cutroneo L., Tucci S. 2009, "THE NEPHELOID BOTTOM LAYER AND THE DYNAMICS OF THE WATER MASSES AT THE SHELF-BREAK OF THE WESTERN ROSS SEA". *Deep Sea Research II*, 56: 843-858, doi:10.1016/j.dsr2.2008.10.032.
5. Capello M., Budillon G., Ferrari M., Tucci S. 2004, "SUSPENDED MATTER VARIABILITY IN RELATION TO WATER MASSES IN TERRA NOVA BAY (ROSS SEA—ANTARCTICA)". *Chemistry and Ecology*. ISSN 0275-7540, Vol. 20 (Supplement 1): S7–S18.
6. Catalano G., Budillon G., La Ferla R., Povero P., Ravaioli M., Saggiomo V., Accornero A., Azzaro M., Carrada G.C., Giglio F., Langone L., Mangoni O., Misic C., Modigh M. 2009, "THE ROSS SEA". Book - "Carbon and Nutrient Fluxes in Continental Margins. A Global Synthesis". Series: Global Change - The IGBP Series. Liu, K.-K.; Atkinson, L.; Quiñones, R.; Talaue-McManus, L. (Eds.), XII, 500 p. ISBN: 978-3-540-92734-1
7. Celussi M., Bergamasco A., Cataletto B., Fonda Umani S., Del Negro P. 2010, "WATER MASSES BACTERIAL COMMUNITY STRUCTURE AND MICROBIAL ACTIVITIES IN THE ROSS SEA (ANTARCTICA)". *Antarctic Sci*, 22(4): 361 – 370. (doi:10.1017/S0954102010000192)
8. Celussi M., Cataletto B., Fonda Umani S., Del Negro P. 2009, "DEPTH PROFILES OF BACTERIOPLANKTON ASSEMBLAGES AND THEIR ACTIVITIES IN TWO DIFFERENT AREAS OF THE ROSS SEA (ANTARCTICA)". *Deep Sea Res, Part I*, 156: 2193 – 2205 (doi:10.1016/j.dsr.2009.09.001)
9. Celussi M., Paoli A., Crevatin E., Bergamasco A., Margiotta F., Saggiomo V., Fonda Umani S., Del Negro P. 2009, "SHORT-TERM UNDER-ICE VARIABILITY OF PROKARYOTIC PLANKTON COMMUNITIES IN COASTAL ANTARCTIC WATERS (CAPE HALLETT, ROSS SEA)". *Estuar Coast Shelf S* 81: 491-500 (doi:10.1016/j.ecss.2008.12.014)
10. Celussi M., Balestra C., Fabbro C., Crevatin E., Cataletto B., Fonda Umani S., Del Negro P. 2008, "ORGANIC MATTER DEGRADATIVE POTENTIAL OF *HALOMONAS GLACIEI* ISOLATED FROM FRAZIL ICE IN THE ROSS SEA (ANTARCTICA)". *FEMS Microb Ecol* 65(2): 504-512 (DOI:10.1111/j.1574-6941.2008.00551.x)
11. Fonda Umani S., Monti M., Bergamasco A., Cabrini M., De Vittor C., Del Negro P. 2005, "PLANKTON COMMUNITY STRUCTURE AND DYNAMICS VERSUS PHYSICAL STRUCTURE FROM TERRA NOVA BAY TO ROSS ICE SHELF (ANTARCTICA)". *J Mar Syst* 55(1-2): 31- 46
12. Fusco G., Budillon G., Spezie G. 2009, "SURFACE HEAT FLUXES AND THERMOHALINE VARIABILITY IN THE ROSS SEA AND IN TERRA NOVA BAY POLYNYA". *Continental Shelf Research*, 29: 1887-1895. doi:10.1016/j.csr.2009.07.006
13. Kern S., and Aliani S., *In Press*, "A COMPARISON BETWEEN POLYNYA AREA AND ASSOCIATED ICE PRODUCTION WITH MOORING-BASED MEASUREMENTS OF TEMPERATURE, SALINITY, AND CURRENTS IN THE SOUTHWESTERN ROSS SEA, ANTARCTICA." *Annals of Glaciology*
14. Malandrino M., Mentasti M., [Giacomino A.](#), [Abollino O.](#), [Dinelli E.](#), [Sandrini S.](#), Tositti L, 2010, "TEMPORAL VARIABILITY AND ENVIRONMENTAL AVAILABILITY OF INORGANIC CONSTITUENTS IN AN ANTARCTIC MARINE SEDIMENT CORE FROM A POLYNYA AREA IN THE ROSS SEA". *Toxic Env Chem* 92 (3): 453-475
15. Manno C., Tirelli V., Accornero A., Fonda Umani S. 2010, "POTENTIAL REDUCTION OF THE *LIMACINA HELICINA* FAECAL PELLETS CONTRIBUTION TO THE CARBON PUMP (TERRA NOVA BAY, ANTARTICA)". *J Plank Res*, 32: 145 – 152. (doi:10.1093/plankt/fbp108)
16. Manno C., Sandrini S., Tositti L., Accornero A. 2007, "FIRST STAGES OF DEGRADATION OF *LIMACINA HELICINA* SHELLS OBSERVED ABOVE THE ARAGONITE CHEMICAL LYSOCLINE IN TERRA NOVA BAY (ANTARCTICA)". *J Mar Syst* 68 (1-2): 91-102
17. Massolo S., Rivaro P., Frache R.. 2009, "SIMULTANEOUS DETERMINATION OF CFC-11, CFC-12 AND CFC-113 IN SEAWATER SAMPLES USING A PURGE AND TRAP GAS-CHROMATOGRAPHIC SYSTEM". *Talanta*, doi:10.1016/j.talanta.2009.08.021
18. Massolo S., Messa R., Rivaro P., Leardi R. 2009, "ANNUAL AND SPATIAL VARIATIONS OF CHEMICAL AND PHYSICAL PROPERTIES IN THE ROSS SEA SURFACE WATERS (ANTARCTICA)". *Continental Shelf Research*, doi:10.1016/j.csr.2009.10.003
19. Rivaro P., Bergamasco A., Budillon G., Frache R., Hohmann R., Massolo S., Spezie G. 2004, "CHLOROFUOROCARBON DISTRIBUTION IN THE ROSS SEA WATER MASSES". *Chemistry and Ecology*. ISSN 0275-7540, Vol. 20 (Supplement 1): 1-13.
20. Rivaro P., Massolo S., Bergamasco A., Castagno P., Budillon G., 2010, CHEMICAL EVIDENCE OF THE CHANGES OF THE ANTARCTIC BOTTOM WATER VENTILATION IN THE WESTERN ROSS SEA BETWEEN 1997 AND 2003. *Deep-Sea Research I* 57, 639–652.

Programma Nazionale di Ricerche in Antartide (PNRA)

21. Rivaro P., Ianni C., Massolo S., Abelloschi M. L., De Vittor C., Frache R., "DISTRIBUTION OF DISSOLVED LABILE AND PARTICULATE IRON AND COPPER IN TERRA NOVA BAY POLYNYA (ROSS SEA, ANTARCTICA) SURFACE WATERS IN RELATION TO NUTRIENTS AND PHYTOPLANKTON GROWTH". *Continental Shelf Research, accepted for publication.*
22. Sandrini S., Ait-Ameur N., Tositti L., Rivaro P., Massolo S., Touratier F., Goyet C., 2007, "ANTHROPOGENIC CARBON DISTRIBUTION IN THE ROSS SEA (ANTARCTICA)". *Antarctic Science*, 19(3), 395-407.

B – book chapters

1. Budillon G. 2006, "OCEANOGRAPHY OF THE ROSS SEA". *Encyclopedia of the Antarctic*, 2 vols., ed. Beau Riffenburgh. New York: Routledge. Copyright © Routledge, an imprint of the Taylor and Francis Group.

C - proceedings of international conferences

--

D – proceedings of national meetings and conferences

--

E – thematic maps

--

F – patents, prototypes and data bases

--

G – exhibits, organization of conferences, editing and similar

1. Budillon G., Bergamasco A., Aliani S., Capello M., Del Negro P., Meloni R., Rivaro P. (2006). *Il respiro vitale del Mare di Ross*. Darwin, 13, 12-20.
2. "III International Conference on the Oceanography of the Ross Sea Antarctica", Venezia (ITALY), 10 - 14 Ottobre 2005.
3. "AnSlope - CLIMA Workshop", Lamont-Doherty Earth Observatory (New York - USA), 13-15 June 2006.
4. "CLIMA – AnSlope Workshop", Università Parthenope (Napoli - ITALY), 20-22 April 2009.

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

1. Crevatin E. Mineralizzazione della sostanza organica nelle diverse masse d'acqua presenti nel Mare di Ross.
2. Celussi M. Prokaryotes in the Ross Sea: patterns of diversity and activity in seawater and sea – ice.
3. Serena Massolo. Studio dei processi di formazione di acque profonde e dei meccanismi di ventilazione nel Mare di Ross mediante l'impiego di cloro fluoro carburi in relazione ad altri parametri chimico-fisici.
4. Roberta Messa. Ruolo dell'Oceano Meridionale negli scambi di CO₂ antropica tra oceano e atmosfera.
5. Emanuela Rusciano. Variabilità termalina nella polynya di Baia Terra Nova in relazione alla copertura di ghiaccio ed al forzamento atmosferico
6. Yuri Cotroneo. Studio della variabilità della Corrente Circumpolare Antartica da dati in situ e telerilevati
7. Giuseppe Aulicino. Implementazione di un algoritmo per la stima dello spessore del ghiaccio marino e della neve, ed analisi del loro contributo negli scambi di calore all'interfaccia oceano-atmosfera.
8. Pasquale Castagno. Processi di ventilazione di acque profonde dal Mare di Ross - Antartide

Research units

Responsabile / Principal investigator: Giorgio BUDILLON
Istituto di afferenza: ULR CoNISMA - Università di Napoli PARTHENOPE
Indirizzo / Address: Via De Gasperi, 5 - 80133 Napoli
Tel.: 081 5476584 Fax: 081 55476515
e-mail: giorgio.budillon@unparthenope.it

Responsabile / Principal investigator: Antonio ARTEGIANI (Stefano ALIANI)
Istituto di afferenza: CNR Istituto di Scienze Marine (ISMAR)
Indirizzo / Address: Largo Fiera della Pesca - 60123 Ancona
Tel.: 071 2078836 Fax: 071 55313

Programma Nazionale di Ricerche in Antartide (PNRA)

Responsabile / Principal investigator: Roberto FRACHE (Paola RIVARO)
Istituto di afferenza: ULR CoNISMA - Universita' di Genova - Dipartimento di Chimica e
Chimica Industriale
Indirizzo / Address: Via Dodecaneso 31 - 16146 Genova
Tel.: 010 3536186 Fax: 010 3536190
e-mail: frache@chimica.unige.it

Responsabile / Principal investigator: Sergio TUCCI
Istituto di afferenza: ULR CoNISMA - Universita' degli Studi di Genova - DipTeRis
Indirizzo / Address: C.so Europa 26 - GENOVA
Tel.: 010/3538135 Fax: 010/352169
e-mail: tucci@dipteris.unige.it

Responsabile / Principal investigator: Serena FONDA UMANI
Istituto di afferenza: ULR CoNISMA - Universita' di Trieste - Laboratorio di Biologia Marina
Indirizzo / Address: Dip. di Biologia, v. Giorderi, 10, 34243 Trieste, Italy
Tel.: 040 224 400 Fax: 040 224 437
e-mail: labbio@univ.trieste.it

Date: 23/2/2011

Notes