

AUSTRALIAN ACTIVITIES 2000-2002
Philip E. O'Brien, Geoscience Program Leader
Email: Phil.O'Brien@ga.gov.au

Title -Geomagnetic and seismological observatories

Chief Investigator - Dr. Peter Hopgood - Geoscience Australia (formerly AGSO)

Peter.Hopgood@ga.gov.au

Geomagnetic Observatories at Mawson and Macquarie Island, magnetic secular variation information from Davis and Casey, magnetic repeat stations in AAT and Heard Is (former observatories Wilkes, Heard).

For 1 minute data, log onto <http://www.ga.gov.au/oracle/geomag/minute.html> and select the station (Contact: Peter Hopgood)

Seismological Observatories at Mawson, Macquarie Island and Casey (former observatories Wilkes, Heard Is). Contact - Spiro Spiropoulos (email: Spiro.Spiropoulos@ga.gov.au)

For Raw waveform data via email, send an email to autoDRM@ausseis.gov.au. For instructions in using the facility, use the word help in the email.

Title - The deep structure of East Antarctica from broad-band seismic data

Chief Investigator DR Anya READING - Australian National University;

Anya.Reading@anu.edu.au

Deploy remote earthquake seismology stations. The earthquake seismic data will be used to produce seismic wavespeed anomaly maps across East Antarctica and determine lithospheric structure under the deployed stations

Title - AMISOR Geoscience - Sedimentation beneath the Amery Ice Shelf

Chief Investigator - Dr. Peter Harris - Antarctic CRC

P.Harris@utas.edu.au

This project aims to improve our understanding of sub-ice shelf sedimentation processes and the marine sediment palaeorecord by sampling beneath the Amery Ice Shelf and modelling sediment transport processes beneath it. A core has now been obtained that contains Holocene diatom ooze.

Title - Late Holocene precipitation record from Windmill Island lakes

Chief Investigator - A/prof. Andrew McMinn and Dr. Donna Roberts- Institute for Antarctic & Southern Ocean Studies, University of Tasmania.

Andrew.McMinn@utas.edu.au

This project examines Antarctic lake cores that record a history of precipitation in the preservation of climate sensitive microbial communities. These precipitation records are integrated with other climate proxies such as ice core temperature records and historical climate data using accurate dating of this lake sediment.

Title - Biogenic sediment history from diatom remains in cores along Wilkes Land

Chief Investigator - Dr. Leanne Armand - Institute for Antarctic & Southern Ocean Studies, University of Tasmania.

Leanne.Armand@utas.edu.au

This project examines the diatom floras in sea-floor sediments generated from the Italian/Australian mission along the George V Coast of Antarctica.

Title - Antarctic ice sheet history and stability: baseline palaeoclimate research on the Pagodroma Group, Prince Charles Mountains

Chief Investigator - A/prof. Andrew McMinn - Institute for Antarctic & Southern Ocean Studies, University of Tasmania, Dr. Jason Whitehead, University of Nebraska.
jm_whitehead@hotmail.com

- 1) Develop a detailed record of Neogene EAIS variations on a transect from the Antarctic interior to the continental slope by the analysis of marine sediments, discovered ~250 km inland from the Amery Ice Shelf edge.
- 2) Assess the thermal regime (and hence climate), ice dynamics, and the contribution of the ice sheet to global sea level fluctuations from inland Antarctic marine records.

Title - Palaeoenvironments of the Antarctic coast, from 50E to 120E

Chief Investigator - Dr. Damian Gore - Macquarie University, Damien.Gore@mq.edu.au
This project investigates marine, lake and land based repositories of information to reconstruct palaeoenvironment of the last 120,000 years at five ice free areas along the East Antarctic coastline using surface and lake bed sampling.

Title - Crustal rebound in the Lambert Glacier area

Chief Investigator - Dr. Paul Tregoning - Australian National University,
Paul.Tregoning@anu.edu.au

Aimed at improving mass balance models for the ice-ocean system and improved understanding of present sea-level change by GPS measurement of crustal rebound around the Lambert Glacier region.

Title - Geomorphological evolution of Heard Island

Chief Investigator - Dr. Kevin Kiernan - University of Tasmania; kevink@fpb.tas.gov.au

The primary aim of this project is to investigate the evolution of the Heard Island landscape and the natural geomorphological processes in operation. This project will enhance understanding of past climate change and assist in the management of geomorphological values of Heard Island by providing baseline data and improved understanding of material types and natural processes.

Title - Evolution of East Antarctic marine environment during the Neogene

Chief Investigator - Prof. Pat Quilty - University of Tasmania; P.Quilty@utas.edu.au
There has been considerable controversy over the variability of Antarctic environments during the Neogene. This project will contribute data from the diverse sedimentary rock sections that lie around the margins of Prydz Bay. The project will examine fossil-bearing sediments from the last 5 million years using well established techniques. This project has as one of its aims the study of an important group of microfossils - foraminifera - from the ODP drilling which was completed early in 2000. Another aspect will be the documentation of the details of some onshore landforms that developed during the same time.

Title - Early Cenozoic vegetation of East Antarctica

Chief Investigator - Prof. Pat Quilty¹ - University of Tasmania, Dr. E.M. Truswell² and Dr. M. Macphail³ - Australian National University

¹P.Quilty@utas.edu.au, ²liz.t@effect.net.au, ³mike.macphail@anu.edu.au

This project is examining the palynology Mesozoic and Cenozoic sediments obtained on ODP Leg 188 to understand the types of floras extant in Prydz Bay during the Mesozoic, in the Paleogene before the onset of Cenozoic glaciation and for evidence of any floras that persisted after the development of large-scale glaciation.

Title – Australian Antarctic and Southern Ocean Profiling Project

Chief Investigator – Mr Howard Stagg, Geoscience Australia

Howard.Stagg@ga.gov.au

The project aimed at collecting seismic, magnetic, gravity and bathymetric profiles approximately every 60 nm around the East Antarctic margin from 040°E to 160°E.

Data collected:

1. *Polar Duke* (58 days; 00/01):

- ~3500 km high-speed seismic, 370 cu. in. sleeve gun array, 600 m streamer
- similar additional amount of bathymetry
- ~16 000 km steamed

2. *Geo Arctic* (194 days; 00/01 & 01/02):

- ~20 000 km deep seismic, mag/gravity, bathymetry; 3660 cu. in. array, 3600 m streamer.
- ~100 successful sonobuoys
- ~40 000 km steamed

Processing of 2001/02 data is underway. Preliminary interpretation by GA is also underway with University of Sydney (magnetics) and Oxford (modelling of gravity and magnetics).

Title - The distribution of volatile and metallic elements in the Macquarie Island glasses and melt inclusions: Implications for fractional crystallisation and degassing during seafloor basaltic magmatism

Chief Investigator - Dr. Dima Kamenetsky - University of Tasmania

Macquarie Island basaltic glasses and melt inclusions represent the products of mantle melting, crystal fractionation and degassing in mid-ocean ridge environment. Geochemical analysis will quantify systematics of volatile and ore-forming elements in different magmatic processes and shed light on the origin of seafloor massive sulphide deposits.

Title - Structural evolution of Macquarie Island :Interpretation of marine geophysical data and structural mapping

Chief Investigator - Prof. Sharon Mosher - University of Texas; mosher@mail.utexas.edu

This project focuses on the evolution of the Macquarie Ridge Complex, an active tectonic plate boundary between the Pacific and Australian plates south of New Zealand. It investigates the processes by which this boundary changed from an active spreading center, forming new oceanic crust, to a major, strike slip transform plate boundary over the last 40 million years. The project involves fieldwork on Macquarie Island to provide ground truth for extensive marine geophysical data from the surrounding seafloor.

Title - Nature and Evolution of the Upper Mantle beneath Heard Island

Chief Investigator - Prof. Suzanne O'Reilly - Macquarie University;

soreilly@laurel.ocs.mq.edu.au

This project uses ultramafic xenoliths - samples of the mantle beneath Heard Island to study the formation and evolution of the Kerguelen-Heard Plateau to understand the development of this large igneous plateau.

Title - The strength of the lower continental crust; evidence from Stillwell Hills-Oygarden Group coastline

Chief Investigator - Dr. Geoff Clarke - University of Sydney

geoffc@mail.usyd.edu.au

The Oygarden Group - Stillwell Hills coastline is a tilted crustal block that spectacularly exposes how the lower crust behaved during continental convergence some 1000 million years

ago. This project aims to study lower crustal processes during continent convergence using structural mapping, metamorphic petrology and geochronology.

Title - Proterozoic and Palaeozoic evolution of the Rauer Group

Chief Investigator - Prof. Chris Wilson - University of Melbourne;

c.wilson@earthsci.unimelb.edu.au

This project is to investigate the processes related to the formation and dismemberment of the Gondwana landmass by structural mapping, metamorphic petrology and geochronology.

Title - Middle Neoproterozoic (~730 Ma) metamorphism of the Vestfold Hills Archaean Craton.

Chief Investigator - Dr. Brett Marmo - University of Sydney

Preliminary isotopic data from the margin of the Archaean Vestfold Hills Complex, Prydz Bay, supports the possibility that major period of crustal assembly occurred at ~750 million years ago in addition to known episodes at ~1000 Ma and ~500 Ma. This study will help to refine current regional models describing the assembly and stabilisation of the East Antarctic fragment of the Gondwana supercontinent.

FUTURE MAJOR PROJECTS

2002-2003

Title Prince Charles Mountains Expedition of Germany-Australia (PCMEGA)

Chief Investigators Prof Chris Wilson, University of Melbourne, Dr. Norbert Roland, BGR

- 1) Investigate the geological relationships across several major crustal boundaries in East Antarctica.
- 2) Provide ANTEC with GPS data relating to lateral motions of East Antarctica and to enhance the geodetic coverage of East Antarctica.
- 3) Undertake geophysical surveying using airborne gravity and aeromagnetic and ice radar techniques to measure ice thickness and facilitate the geological interpretations of terrain boundaries.
- 4) Conduct geomorphic mapping will document the glacial history of the southern Prince Charles Mountains.
- 5) Measure Cainozoic uplift rates of the Prince Charles Mountains using geochronology to provide boundary conditions for palaeoclimatic modelling of ice sheet development.

Publications database

An extensive, but probably not yet complete database of publications resulting from Australian National Antarctic Research Expeditions activities can be found on the web at <http://its-db.aad.gov.au/proms/pubn/>.