South African National Antarctic Programme

SANAP

understand, develop, conserve

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EXPLORING A POLAR WILDERNESS

Research to preserve the Antarctic region for future generations

* SANAP research includes Antarctica, the Prince Edward Islands (ie Marion Island and Prince Edward Island), Gough Island and parts of the Southern Ocean. The Southern Ocean extends from the coast of Antarctica north to 60 degrees south latitude, where it joins the Atlantic, Indian, and Pacific Oceans.

SECTION 1

The last true wilderness

It is less than 200 years since the first person set foot on Antarctica. Since then, a slow but steady stream of explorers and scientists, including several thousand South Africans, have been working on and studying the world's coldest continent, as well as the surrounding Southern Ocean and islands. The region is harsh, desolate and extreme, but also fragile and vulnerable. Much of the proudly South African effort here is aimed at protecting this delicate wilderness.

The mission of the South African National Antarctic Programme (SANAP) is to increase our understanding of the natural environment and life in the area through appropriate research, science and technology. This is necessary to optimise present and preserve future options for South Africa (SA) in the region and to enhance predictive capability in areas of national and international relevance. SANAP ensures that SA remains party to informed decision-making on matters in the region.

The Antarctic, sub-Antarctic islands and Southern Ocean play a crucial role in global climate processes. Exposed to all five oceans and occupying a pivotal spot on the planet, the region is a huge living laboratory, an unspoilt window on global climate change, planetary weather and untainted biology. The region may hold the key to stopping global warming (surely the biggest long-term question facing humanity). The implications of SANAP research for South Africa and Africa are monumental. Stewardship of Antarctica and the Southern Ocean Islands for the children of South Africa, the people of Africa - and in fact - the entire planet is paramount.

SECTION 2

How we got involved and why

South Africa's involvement in Antarctica and the sub-Antarctic islands dates back to the earliest voyages of discovery, due to the then Cape of Good Hope's position as a stopover for explorers, whalers and sealers.

After World War II South Africa became more formally involved, undertaking meteorological expeditions to the Prince Edward Islands. A permanent weather base was established on Marion and the annexation by SA of these islands was concluded in 1948. In 1959 the first South African National Antarctic Expedition (SANAE) was undertaken, establishing a permanent presence on Antarctica that endures to this day.

International responsibility - the treaty

South Africa, along with eleven other countries, is a founder member of the Antarctic Treaty of 1959. This treaty, of which there are some 45 member nations, establishes the legal framework for the management of the region. Signatories undertake to ensure that the Antarctic region will be used for peaceful and scientific purposes only and to protect and preserve the environment.

The most recent treaty consultative meeting was held in Cape Town in 2004. At these annual meetings, decisions are made by consensus (not by vote) of all consultative member nations. Issues discussed in Cape Town included operationalisation of the Antarctic Treaty Secretariat, tourism and other non-governmental activities in the region, as well as the development of a liability regime related to the Antarctic environment.

Over the years, South Africa has become party to various activities pertaining to the Antarctic, including the Scientific Committee on Antarctic Research (SCAR). SCAR is an international body operating within the International Council of Science (ICSU) framework. SANAP, via SCAR, submits an annual report to ICSU. Several South Africans participate in international SCAR working groups, groups of specialists and capacity building programmes to promote the involvement of young scientists.

SECTION 3

Awesome desolation - the bases at SANAE IV, Marion and Gough

During the first South African National Antarctic Expedition (SANAE) expedition in 1959/60, the South Africans took over the evacuated Norwegian base in the Dronning Maud Land region of Antarctica (some 4000km south of Cape Town). The bases on the edge of the ice shelf were replaced at various intervals, until the South African base moved inland and the current SANAE IV was built on Vesleskarvet - a nunatak or dark rocky outcrop peeping out of the white snow.

- Antarctica is the coldest place on Earth and is almost entirely covered in ice.
- The continent was discovered in 1820.
- Although it is the fifth largest continent, Antarctica has no population.
- It is the continent with the highest average altitude (2500m), and the lowest average humidity.
- A staggering 80% of the world's freshwater lies frozen in the Antarctic.

South Africa maintains a base on Marion Island in the Southern Ocean just over 2 000km south-east of Cape Town. Marion Island and Prince Edward Island, twin peaks of a volcano, form the Prince Edward Islands group. The islands were annexed by South Africa in 1947. South Africa has announced its intention to proclaim a **major marine protected area around the Prince Edward Islands.** This will be one of the largest areas of its kind in the world and will be patrolled by the 83-metre environmental protection vessel, the Sarah Baartman - due for delivery at the end of 2004.

Gough Island is a British protectorate and is largely uninhabited, except for the people at the South African meteorological station, which operates as part of an agreement between South Africa and the United Kingdom.

Key roleplayers

In 2003, Cabinet approved the transfer of the scientific research functions of SANAP from the Department of Environmental Affairs and Tourism (DEAT) to the Department of Science and Technology (DST). DEAT however retains responsibility for all logistics and infrastructure. The National Research Foundation (NRF) becomes the agency responsible for grant making on

behalf of the DST. SANAP slips neatly into the NRF's vision of bringing knowledge to life, especially its aim of 'a prosperous South Africa and African continent both steeped in a knowledge culture and proud contributors to the well-being of humanity'.

SECTION 4

Objectives

SANAP plays a crucial role in conserving this living laboratory - the coldest, windiest and driest place on Earth. Studies done in the Antarctic are inextricably linked to our understanding of the entire Earth system and signals in Antarctica indicate past and future global changes. SANAP recognises the global and national importance of safeguarding the environment of the Antarctic and Southern Ocean and protecting the integrity of ecosystems, both marine and terrestrial, in the region. The programme takes cognisance of the presence of natural resources (both renewable and non-renewable) and the increased interest in their possible utilisation (both consumptive and non-consumptive).

The new challenges

Funding of Antarctic research has come a long way since The Royal Society of South Africa presented a token 25 pounds to Robert F Scott towards scientific work on his 1913 expedition to Antarctica. South Africa's funding of research connected to the Antarctic received a 30% boost in 2004/2005 and DEAT has committed itself to increasing its annual funding to R10 million in the near future.

As of 2005, DEAT and DST have agreed to some exciting additions to the research opportunities offered by SANAP. The research community is challenged to "break the ice" (without the SA Agulhas this time) and thrash out creative ideas and new directions. Researchers in the social sciences (politics, international relations, and sociologists), humanities (literary studies, visual arts and cultural studies) and law (Law of the Sea) as well as engineering can now participate in SANAP.

The new research themes for SANAP are:

- **Antarctica: A Window into Geospace**
- **Climate Variability: Past, Present and Future**
- **Biodiversity Responses to Earth System Variability**
- **Engineering a Sustainable Presence in Antarctica**
- **The History, Sociology and Politics of Antarctic Research and Exploration**

As a biodiversity hotspot, scientific activities in Antarctica, the islands and the Southern Ocean have never been more exciting. The controversial issues of tourism, krill harvesting, bioprospecting and mining; the avenues for law research; the possibility of a virtual national facility or 'Antarctic institute'; the opportunities offered by competitive advantage; the threat of pollution; research into other human impacts and plans to draw industry into the SANAP equation all present research opportunities.

SECTION 5

Modern day explorers

Melodie Mcgeoch - conservation ecology, University of Stellenbosch (US)
“I was privileged to be the first woman team leader on Marion. This team was also the first predominantly female team to work there. We were examining the effect of climate change on the widespread cushion plant, a keystone plant species. Our greatest achievements to date include experimental testing of climate change impacts on the island. It's a privilege to work in an area largely untouched by human activity, where starkness, peace and the splendour of the landscape never fail to amaze. The allure of being able to understand how a system works, the interactions between species and how these change over space and time, adds to the magic."

Azwianewi Makhado - marine mammal and seabird conservation, DEAT
"My work within SANAP involves investigating the impact of seals on seabirds on the islands offcoast of South Africa including the Prince Edward Islands. My interest in working with marine mammals and seabirds especially in remote places like the sub-Antarctic region encouraged me to get involved in SANAP. I really enjoyed monitoring the conservation and population status of both seals and seabirds, and the interaction between the two species."

Johan van de Merwe - meteorology, SA Weather Service
"The South African Weather Service maintains manned weather stations on Gough and Marion islands and Antarctica. We do full surface and upper air observations, backed by an automatic weather station. We also participate in the international buoy deployment programmes. This provides information for weather forecasting and research. I have been in this game since 1969, and what I like most - without any doubt – is returning from a voyage to find my wife waiting for me in Cape Town."

Tankiso Modise - physics, CSIR
I got involved in SANAP to do science at the end of the world. I operated the Antarctica Magnetosphere and Ionosphere Ground-based Observations (AMIGO) programme for the University of KwaZulu-Natal, as well as the Aurora programme and the OZONE monitoring programme.
When the sun is long down, if the young moon has set, the star mother with her kids will come. They are not entirely alone; something has accompanied them, the Southern Lights, the Aurora.
The sun sank in the ice. The days grew shorter. The darkness of the winter was approaching. Finally, the last of the sunsets was seen, so why not have a small gathering at the Sastrugi Inn - friendship for life.'

Ludwig Combrinck - space geodesy, Hartebeesthoek Radio Astronomy Observatory (HartRAO)
"HartRAO has installed a dual frequency GPS receiver on Marion Island as part of the International GPS Service (IGS) global network. A tide gauge will be installed during 2005. Geodetic* monuments or markers on the island will be upgraded to facilitate crustal dynamics and related research. We are relatively new in the SANAP arena, but plan to contribute with long-term projects and additional scientific infrastructure. I enjoy the Antarctic because of the freshness of nature, which is awesome!"
* Geodetics: the measurement and mapping of Earth's surface, its gravitational field and geodynamic phenomena (polar motion, earth tides, and crustal motion).

Rob Crawford - seabird conservation, DEAT

"Our work aims to establish the conservation status of seabirds breeding on the Prince Edward Islands and contributing to the Ecosystem Monitoring Programme of the Commission for the Conservation of Antarctic Marine Living Resources. Our greatest achievements include collaborative publication of a suite of papers documenting the conservation status of seabirds and seals at the Prince Edward Islands in the African Journal of Marine Science. Another highlight is the demonstration of large decreases of several species of seabirds that forage near the islands when breeding, thought to be due to climate change."

Isabelle Ansorge - oceanography, University of Cape Town (UCT)
"We have been looking at the interaction of the South-West Indian Ridge on the oceanographic environment in which the Prince Edward islands lie. Data demonstrate that directly in the lee of this ridge system, intermediate sized features such as eddies, meanders and rings are formed. These eddies are responsible for highly productive, nutrient rich surface waters and pushing these water masses into the islands vicinity, which top predators utilise during their foraging excursions. Ours is a highly productive, multi-disciplinary programme run on minimal funding! We have an ability to train undergraduate students in handling and analysing oceanographic data that no other country enjoys. What I like most about working in the Antarctic are the high seas, icebergs and storms! It's magnificent and a privilege to be there."

Lukhanyiso Vumazonke - marine biology, SAIAB
I was an MSc student working on the general biology on the sub-Antarctic shrimp at the Prince Edward Islands. The shrimp is one of the most important benthic invertebrates and is regarded as an important food source for many top predators in the area. Given its importance in this food web, the aims of my project were to contribute to the ongoing, broader research programme around the islands. Biology was one of my strongest subjects at school, although I wanted to become a medical doctor, the invitation to participate in Antarctic cruises led to the idea of pursuing marine biology as a career. I enjoy the fact that I get to work outdoors, travel to exotic places and not having to wear a suit also contributes to the attraction of working in Antarctica.

Steven Chown - zoology and ecology, US
"Our research at Marion Island concerns the effects of rapid and ongoing climate change on the interactions between indigenous and invasive species. It fits into a broad framework of examining biodiversity patterns and responses to environmental change across Southern Ocean Islands. A highlight for me has been providing the most completely documented South African (and possibly global) ecosystem to date. This allowed us to demonstrate that interactions between climate change, invasion and human visitor frequency to the islands do mean increasing conservation concerns that need to be addressed. There is a beauty to the islands that is extraordinary, and once it has grasped one's attention the hold is never relinquished."

Doug Butterworth - mathematics, UCT
"Our SANAP involvement has been primarily the evaluation and application of alternative multi-species modelling approaches to reflect the dynamics of the major Antarctic marine species and their interactions. Highlights include the development of the approach adopted by the Commission for the Conservation of Antarctic Marine Living Resources to set initial catch limits for the developing Antarctic krill harvest (potentially the world's largest fishery). Another is the evaluation of an international sighting survey and related data to estimate abundances and trends in the population sizes of major baleen whale species, including indications of

recovering populations of heavily depleted resources such as the blue and humpback whales, and a possibly related decrease in minkes."

Avinash Bisnath - geology, UCT
"I am involved in looking at the tectono-thermal evolution of the Gjelsvikfjella area. This involves sampling rocks with specific emphasis on conducting geochemical analysis, petrological studies and dating selected samples to gain an understanding of the evolution of the area and its role in the reconstruction of Gondwana and possibly older supercontinents. The rare opportunity to visit Antarctica teaches one a great deal and helps you appreciate things back home that most people overlook, such as a rainy day."

Harm Moraal - physics, Northwest University
Our work entails counting cosmic rays (very high energy charged particles from the cosmos) with a neutron monitor, to determine how the ever-varying activity on the sun affects them. This solar activity has a host of important influences on Earth and potentially on its climate. Our work includes cutting ice from the ice shelf in Antarctica, to view indirect cosmic ray records dating back thousands of years. We also study the properties of a layer in Earth's atmosphere, known as the ionosphere, measuring incoming radio energy to reveal how the ionosphere affects radio communication and is related to other upper atmospheric properties such as the ozone content, and how it contributes to "space weather". Antarctica offers excellent and highly diverse scientific opportunities in an adventurous environment. It teaches young people a unique style of self-reliance and personal management, to become dynamic scientific leaders in society."

Michelle Smith - seismicity, Council for Geoscience
"The primary function of the seismological equipment at SANAE IV is to monitor earthquakes. The data is made available to the international seismological community to be used in the location of moderate to large global earthquakes and to the Comprehensive Nuclear Test Ban Treaty Organisation's data centre for discrimination between earthquakes and explosions when needed. Seismic noise in the region is extremely low, producing clear data for analysis."

Paul Sumner - geography and meteorology, University of Pretoria (UP)
"We study environmental responses to climate change on Marion Island to arrive at an understanding of the sub-Antarctic geomorphic* environment (in a climate change context). Environmental conditions are critical controls on geomorphic activity in the Antarctic and their action needs to be fully understood. Investigations into contemporary conditions show the area to be a distinct periglacial environment. The island offers exciting opportunities for contemporary and palaeoenvironmental research into abiotic (non-living, physical and chemical) responses to climate change."
* Geomorphic: of or resembling the Earth, its shape or surface configuration.

Gavin Doyle and Hartwig Frimmel - geology, UCT
"Our physics and meteorology work and is done largely from the comfort of SANAE IV. Almost every summer however, a small team of geologists, from a South African university, goes out on snowmobiles to spend up to two months in the mountains of Dronning Maud Land - the region of Antarctica closest to South Africa. Their task: to map rock formations, and collect samples and field data for analysis. Africa and Antarctica were once firmly attached as a portion of the Gondwana Supercontinent. The geology of Dronning Maud Land is a continuation of the geology of South Africa and Mozambique. It is perhaps fitting that SANAE IV is perched on top of a piece of Karoo Dolerite - a piece of home from home! We seek out pieces of evidence that help answer questions about the processes that formed the Earth.

Antarctica provides us with important pieces of the puzzle, which are pristine in their exposure and a live view of glacial processes that shaped large parts of the world."

Quote snippet:
Antarctic deep-ocean water carries nutrients that feed economically important fisheries in many parts of the world. Without it South African pilchard fisheries for example would cease to exist.

SECTION 6

SANAP - alive with possibilities

SANAP opens doors to a multitude of careers including:

- **Researchers** - in the fields of geospace, geology, climatology, biodiversity, engineering, physics, biology, history, sociology, politics and international relations, as well as literary studies, visual arts, cultural studies and law;
- **Diesel Mechanics** - are responsible for the general maintenance of the bases. Knowledge and experience of power plants, carpentry and welding are recommended and, for Antarctica, experience in Earth moving equipment is essential;
- **Medical Doctors** - who are registered general practitioners;
- **Medical Orderly/Nurses** - who are registered or have been operational medical orderlies in the national defence force. Experience in casualties is recommended;
- **Meteorology Technicians** - with an appropriate qualification and registration as an engineering technician;
- **Field Assistants** - students in the natural sciences or persons studying in this field will receive preference;
- **Radio/Electronic Technicians** - experience in HF and computer communication networks (LAN/ WAN);
- **Electrical, Electronic or Mechanical Engineers** - a degree with at least two years practical experience;
- **Industrial Technicians** - such as qualified electronic/electric/mechanical technicians with at least two years experience.

Appointments are temporary and, in the case of logistic support personnel, last about 15 to 18 months. In scientific posts the periods of appointment vary but generally extend over several years. The time spent on one of the Islands or in the Antarctic itself is usually a year.

Successful candidates undergo training in the field of work for which they are appointed, as well as team training to ensure members are "expedition ready". Courses include: cooking, fire fighting, first aid, self development and photography. Lectures on life under Antarctic/ Island conditions are arranged.

Protective clothing for use during the expedition is issued in Cape Town free of charge and most items remain the property of the recipient. At the bases most amenities are provided free of charge.

DEAT coordinates the logistics, training, maintenance of the bases, the three annual relief voyages, provision of logistic support to expeditions, appointment as well as payment of salaries of personnel overwintering at bases. South Africa's polar research vessel, the SA

Agulhas undertakes the relief voyages to and from the three stations namely: SANAE IV (Antarctica) - December to February; Marion Island - April to May, and Gough Island - September to October.

Weather buoys are deployed on behalf of the Weather Service on all relief voyages, and assistance in weather models and forecasting is provided. In addition, Automatic Weather Stations (AWS) are serviced on several sub-Antarctic islands.

SECTION 7

Renewal, partnerships and the people

- Representing an area of competitive advantage for South Africa, Antarctic Islands and Oceans is one of five themes earmarked by government for long-term research and a commensurate increase in funding. Focusing on **the renewal of SANAP**, the vision is to create a demographically balanced programme that strives for internationally competitive research, promotes interdisciplinary activities and creates links with other African countries. (South Africa is the only African country with a presence in Antarctica.) The mission of SANAP is to produce maximum human capital, innovation and economic growth, while increasing its international profile, influence and public visibility.
- **Cape Town - Gateway to Antarctica:** Building on its historical status as a stopover for ships on their way to Antarctica, SANAP markets Cape Town, with its harbour and excellent infrastructure, as the gateway to Antarctica. Eight countries already use the mother city as a gateway. The city has a wealth of commercial, educational and industrial activities, one of the world's largest dry docks and excellent ship repairing facilities.
- DST is **engaging industry** as a potential partner in promoting SANAP research and attracting learners to careers in science. Initiatives are underway to identify and exploit comparative advantage in both commercial and research opportunities that involve industry.
- **International cooperation** at all levels will receive special attention.
- Participation in **International Polar Year 2007 - 2008** is a priority. See: www.ipy.org
- **Public education** will ensure that South Africans play a more active role in the country's Antarctic endeavours in future. Integrated public education programmes at all levels of society will ensure that everyone becomes a part of the magic of our remotest wilderness areas.
- There will be a special focus on the **youth** at primary, secondary and early tertiary level.

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