



Scientific Research at SANAE

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1. Introduction

South Africa is one of the 12 original signatories to the Antarctic Treaty, and the South African National Antarctic Programme (SANAP) has been actively involved in Antarctica since 1960. SANAE IV (71° 40' S 2° 51' W), the fourth national base, is manned by ten overwintering personnel, and is managed and administered by the Department of Environmental Affairs (DEA). The science component is managed by the Department of Science and Technology (DST), in conjunction with the National Research Foundation (NRF). With almost no man made interference, the pristine Antarctic continent is the best place for science research and development. The continent is an outdoor laboratory, with the extreme environment suitable as the harshest testing facility on Earth.

2. Physical Sciences

2.1 SANSA Space Science

The South African Southern Hemisphere Auroral Radar Experiment (SHARE) radar at SANAE IV has been part of SuperDARN (Super Dual Auroral Radar Network) since 1997. SuperDARN is an international Radar network for studying the Earth's upper atmosphere, ionosphere and connection into space, with radars observing the northern and southern auroral regions. During the Austral Summer of 2013/14, the South African National Space Agency (SANSA) became the second organization to install the T3 implementation of the all-digital HF Radar in the SuperDARN network. The new radar, which replaced the previous radar at SANAE IV (71°40'37.67"S, 2°49'41.09"W), was based on the Australian design from La Trobe University. The new radar was fully built and tested at SANSA Space Science in Hermanus, South Africa and it was funded through grants from the South African National Research Foundation and SANAP. SANAE IV's strategic location close to the South Atlantic Anomaly makes the data invaluable for geospace observations.

2.2 North-West University

The University of North West studies the properties and structure of ionospheric plasma conditions, and electron and proton precipitation into the atmosphere from the magnetosphere. The supporting instruments include an 8x8 imaging riometer, 30MHz and 52.4MHz double antenna, wide angle riometers, two three component magnetometers and auroral sensors. One 6NM64 neutron monitor and a neutron moderated detector are used as ground based recorders of cosmic rays at SANAE, monitoring present solar activity and offering nearly continuous datasets for almost four Sun cycles. The Fimbulisen ice shelf near SANAE is used for ice core sampling, where the occurrence of the isotope ¹⁰Be, produced by cosmic rays, serves as a historic indicator of solar activity.

2.3 University of KwaZulu-Natal – Space Physics Research Institute (SPRI)

SPRI jointly operates and maintains a large array of installations, including four Very Low Frequency (VLF) systems: One broadband VLF antenna, an automatic whistler detector, a narrowband VLF system and a new AWESOME (Atmospheric Weather Electromagnetic System for Observation Modelling and Education) VLF receiver, with the ability to monitor both broad and narrowband signals. Lightning strikes are monitored by the new real-time World Wide Lightning Detector Network (WWLLN) node, and variations in the Earth's magnetic field with periods greater than two seconds are measured by a pulsation magnetometer.

3. Earth Sciences

Geological research is largely focussing on correlating rock units and comparing the geological evolution of the Ahlmannryggen and Sverdrupfjella areas of western Dronning Maud Land with rocks in central and northern Mozambique. The two areas were juxtaposed prior to the breakup of the Gondwana Supercontinent ~180Ma ago.



Deformed pillow lavas in the basaltic-andesite Straumnsnutane Formation in the Straumnsnutane area of the Ahlmannryggen. Similar rocks are seen in the Espungaberra area of central Mozambique

4. Biological Sciences

The Centre for Invasion Biology of Stellenbosch University undertook a study to describe and understand fine-scale variation in genetic diversity in Antarctic micro arthropod populations and to ascertain how much risk of genetic homogenisation is likely to be associated with human movement between nunataks. This is vital if the role of humans as vectors for transport of organisms (alien or otherwise) in the region is to be fully understood. A pilot study at Robertskollen nunatak (71°28' S, 3°15'W) investigated the fine scale genetic diversity of an endemic oribatid mite *Maudheimia wilsoni*. Using the CO1 gene, this study found that within that one nunatak group some populations only 300m apart had 1.5% sequence divergence, which equates to isolation of half a million years meaning that this diversity pre-dates interglacial cycles. Further research is being undertaken to establish how this pattern translates to a landscape scale.



Mite Collection near SANAE

5. Oceanographic Sciences

The meridional overturning circulation (MOC) is a global system of surface, intermediate, and deep ocean currents. Researchers have identified 34.5°S in the South Atlantic as the latitude most crucial to any examination of how interocean exchange influences the MOC. Part of the South Atlantic MOC (SAMOC) initiative includes deploying a transbasin mooring line along 34.5°S that will over time span the entire South Atlantic. Known as the South Atlantic MOC Basin- ide Array (SAMBA), this mooring array captures the Agulhas ring corridor and is aimed at monitoring long-term physical and chemical changes within the western and eastern boundary current systems as well as the effect of interocean exchange on the MOC (Full basin- wide arrays, such as SAMBA, provide crucial data through long-term monitoring that will be key to understanding how the ocean and the MOC influence global climate.

6. Environmental Management

The Directorate: Integrated Environmental Authorisations of DEA is responsible for the compliance monitoring and auditing of all SANAP operations and activities in Antarctica. This unit also reviews all Initial or Comprehensive Environmental Evaluations that are required by the Protocol on Environmental Protection to the Antarctic Treaty.

SANAP's Environmental Policy governs all scientific and logistic operations, and states: "It is our policy that the maintenance of a South African presence in Antarctica shall have no permanent negative consequence on the Antarctic Environment, and that every participant in SANAP shall, as far as possible, have safe and healthy working conditions in a clean environment and that safety considerations shall take preference over all other activities".