

Five years in the life of Central Namib rock.

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Summary

The gravel and rocky plains of the Central Namib Desert represent a hostile environment for rock, with salt, temperature changes, fog and lichens all known to be important weathering agents. Over time, weathering produces much debris (including silt-sized material) and sculpts weird features out of the rock. This project aims to elucidate the changes in weathering rates and processes, and associated micro-environmental conditions, across an East-West transect through the Central Namib Desert over at least a five year period. Phase 1 of the project (started in March 1999) involves the deployment of Karibib Marble blocks and rock surface temperature probes at 5 sites within the Namib Naukluft Park, and at 8 sites within the coastal fog belt north of Swakopmund. Phase 2 of the project will involve studies of lichen recolonisation and growth rates at sites within the lichen zone, and phase 3 (planned for 2000) will comprise adding Damara Granite blocks and additional micro-environmental sensors to all existing sites.

Phase 1

Within the Namib Naukluft Park five sample sites have been set up as follows:

Kleinberg: Within Met. Station fenced site: 10 Karibib Marble blocks (5 resting on ground surface, and five on platform at 30 cm above surface) + Tiny Tag data logger and rock surface temperature probe attached to additional Karibib Marble block

Vogelfederberg: Within Met. Station fenced site: 10 Karibib Marble blocks (5 resting on ground surface, and five on platform at 30 cm above surface) + Tiny Tag data logger and rock surface temperature probe attached to additional Karibib Marble block

Swartbankberg: Adjacent to highest fog collector: 10 Karibib Marble blocks (5 on marble debris/ soil, and 5 on marble outcrop)

Gobabeb: By automatic weather station: 10 Karibib Marble blocks (5 resting on ground surface, and five on platform at 30 cm above surface) + Tiny Tag data logger and rock surface temperature probe attached to additional Karibib Marble block

Ganab: Within Met. Station fenced site: 10 Karibib Marble blocks (5 resting on ground surface, and five on platform at 30 cm above surface) + Tiny Tag data logger and rock surface temperature probe attached to additional Karibib Marble block

Additionally 8 sites are being set up along a short (4 – 5 km long) East-West transect from the coast across a salt pan area onto the lichen fields 11km north of Swakopmund saltworks. At each site 5 Karibib Marble blocks are being placed on the pavement surface, and at 1 site a Tiny Tag data logger and rock surface temperature probe will also be deployed.

Aims and methods

The aim of Phase 1 is to use a local rock cut into standard sized blocks to compare weathering after a few years at sites across an East-West transect. All blocks have been pre-weighed before exposure, and weathering will be assessed by re-weighing and, more importantly, by examining exposed blocks using Scanning Electron Microscopy and Energy Dispersive Analysis of X-Rays to show the micro-scale progress of weathering. Rock surface temperature probe data will be collected every 3 hours over a 16-18 month period initially. The data will be compared with rock surface temperature data from probes attached to the automatic weather stations (at Gobabeb, Kleinberg), and with standard meteorological data collected at each site – in order to provide detail on the micro-environmental conditions experienced by the rock blocks.

Equipment specification and maintenance needs:

1. Karibib Marble Blocks: 3 x 3 x 15 cm cut blocks. One side is polished and this side faces downwards. The polished face has also been numbered with indelible pen, although this is not expected to last more than a few weeks! **If blocks are moved, they should be replaced with polished side downwards.**
2. Exposure rack: 30 cm high yellow plastic 'rack' (actually, a laundry basket) is used to support the 5 above-ground samples. At all sites (except Kleinberg) it has 4 small holes bored into the upper surface to prevent water ponding in the event of rainfall. **Holes could be bored into the Kleinberg basket, and also the baskets checked every few months to ensure they are still standing.** Life expectancy < 2 years.
3. Tiny Tag data loggers and Gemini rock surface temperature probes: The loggers are covered in a plastic bag, white cloth and buried under a cairn of stones/ earth under the laundry baskets. They should operate for 2 years. The probes are attached to the top surface of the marble block with duct tape and araldite and are shaded from direct sun with aluminium foil. **They could be checked every month to ensure that they are still shaded, and properly aligned on the top surface.** A copy of the GLM 2.0 software needed to download the data + a cable to connect the logger to a serial port on a laptop + brief instructions on the loggers will be left with Joh Henschel in case I cannot download the data.

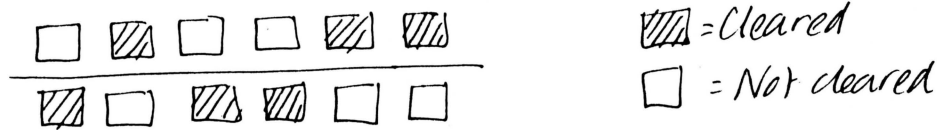
Phase 2

At Kleinberg site a trial is planned to investigate lichen recolonisation and growth rates on the lichen field. This trial can then be expanded to other sites. It has been designed to complement Joanne Daneel's M.Sc. project.

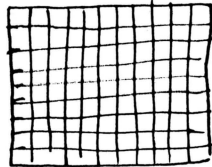
Experimental design:

1. Establish 6 pairs of 1 x 1 m marked quadrats (marked with stakes at corners) within relatively homogeneous lichen field. The quadrats could either be

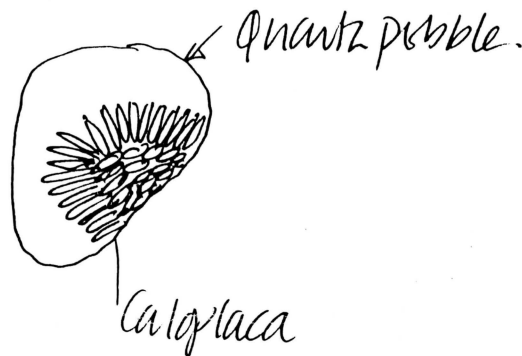
randomly located, or at regular intervals (say every 10 m) along a randomly located*transect.



2. As shown in the diagram above, one of each pair should be cleared of stones and obvious lichen cover, and the stones removed in plastic bags. In the laboratory the lichens should be removed with boiling water/ scrubbing (following the methods in Daneel's thesis). The stones should then be replaced on the quadrat surface.
3. The other quadrat in each pair should be monitored for lichen cover using a quadrat marked in 10 cm subsquares (see diagram below). The cover of lichens in each 10 x 10cm subsquare should be recorded as a percentage of the area covered.



4. The quadrats need only be remeasured every year.
5. Additionally, 10 quartz pebbles covered with a clear thallus of *Caloplaca* (the orange lichen – see diagram below) should be selected from outside the quadrats and placed in a 30 x 30 cm marked quadrat. A close-up photograph should be taken of these once a year, to allow estimation of the area covered by the lichen, and thus the growth rate over time. Flattish pebbles are best for this.



Downloading data from Tiny Tag data loggers attached to rock surface temperature probes on Karibib marble blocks.

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Location and specification

1. Loggers have been set up at Gobabeb, Ganab, Kleinberg and Vogelfedeberg meteorological stations between 28th and 30th March 1999.
2. Loggers have been set to record every 3 hours until memory full (the specification says they can hold 16000 readings). The batteries (3.6v .5 AA size Lithium (Saft LS 14250, Tadiran TL-2150/S, Sonnenschein SL-750 or equivalent) should last for 2 years.
3. To download data you need to load the GLM software onto a laptop, and connect logger to laptop with cable. The GLM software is easy to follow, but essentially you need to open the connection, then download the data, then restart the logger to follow the same programme as before. I have left the GLM software + cable with Joh Henschel. I will send out spare batteries in case.
4. It would be good if Joh could download the data from the Gobabeb logger in around 6 months time (around the beginning of October 1999) as a test.

I can be contacted as follows:

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