

GEOLOGICAL SURVEY OF NAMIBIA

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Exploration, Mining and the Environment in the Context of a National Geological Survey

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Ministry of Mines and Energy



EARTH SCIENCES FOR NAMIBIA'S SUSTAINABLE DEVELOPMENT

Environmental Geology

Geology underlies everything....

- ◆ **Applied science:** Practical application of geology in the solving of environmental problems
- ◆ **Multidisciplinary:** Closely related to engineering geology and environmental geography
- ◆ **Study of the interaction of humans with the geological environment:** biosphere, lithosphere, hydrosphere, and atmosphere
- ◆ **Application of geological information to solve conflicts:** minimize environmental degradation, maximize possible advantageous conditions resulting from use of the natural and modified environment

EARTH SCIENCES FOR NAMIBIA'S SUSTAINABLE DEVELOPMENT

Environmental Geology

Environmental geology includes:

- ◆ managing geological and hydrogeological resources such as fossil fuels, minerals, water (surface and ground water) and land (land use planning)
- ◆ studying the earth's surface through the discipline of geomorphology
- ◆ defining and mitigating exposure of natural hazards on humans
- ◆ managing industrial and domestic waste disposal and minimizing or eliminating effects of pollution
- ◆ performing associated activities, also involving litigation

Duties of National Geological Surveys in Environmental Compliance

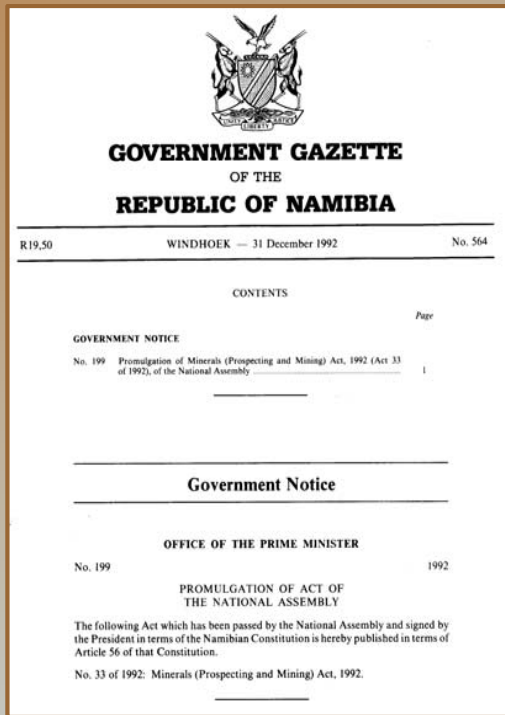
Environmental geology is used to:

- Monitor active mines
- Monitor exploration activities
- Strategically assess developments in the minerals sector
- Implement strategic environmental management plans
- Manage exploration and mining in protected areas
- Monitor abandoned mines and assess their risks
- Engage in environmental remediation
- Minimise the negative impact of small scale mining
- Assist in urban and land use planning
- Advise on waste disposal
- Assist in coastal zone management
- Assist in governance of the marine environment
- Geo-Heritage

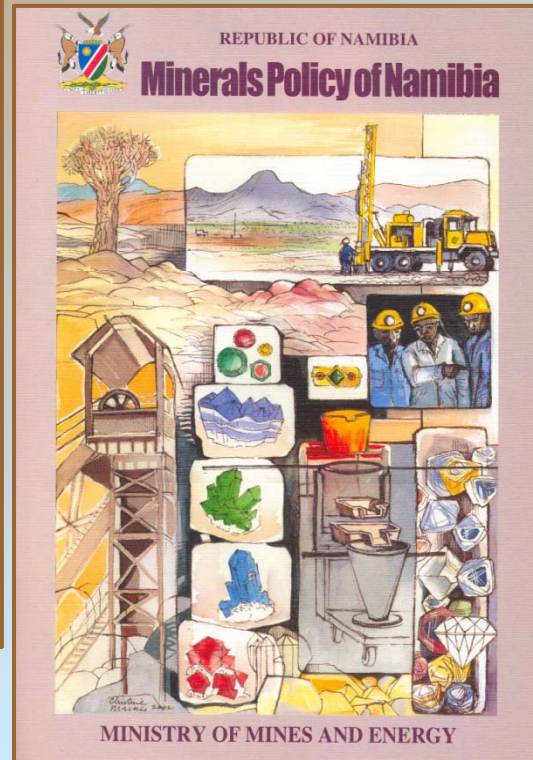




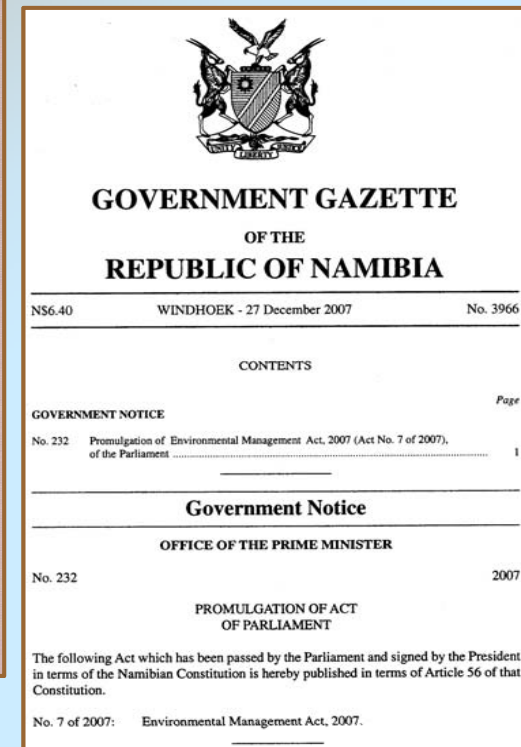
Legislation and Policies



Minerals Act, 1992



Minerals Policy, 2001



Environmental Management Act, 2007

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Monitoring of active mines

The Geological Survey of Namibia is involved in environmental monitoring of all major mining operations in Namibia:

- ◆ Langer Heinrich
- ◆ Namdeb
- ◆ Navachab
- ◆ Okorusu
- ◆ Otjihase
- ◆ Rössing
- ◆ Rosh Pinah
- ◆ Skorpion
- ◆ Trekkopjie
- ◆ Tsumeb Smelter



Most Namibian
mines are
ISO 14000 certified

Monitoring of active mines

How?

- ◆ Scrutinize EIA and EMP
- ◆ Independent inspections and environmental monitoring campaigns
- ◆ Quantitative and qualitative description of contamination
- ◆ Proposal for and triggering of remediation and rehabilitation
- ◆ Development of monitoring tools



Monitoring of active mines

Otjihase

Problem: Acid mine drainage

Effluent water:

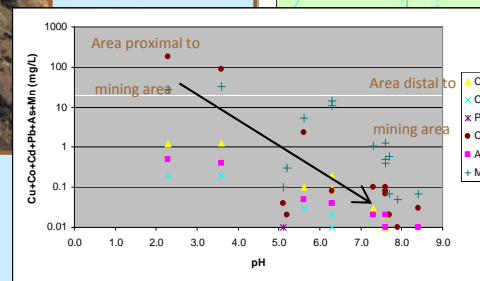
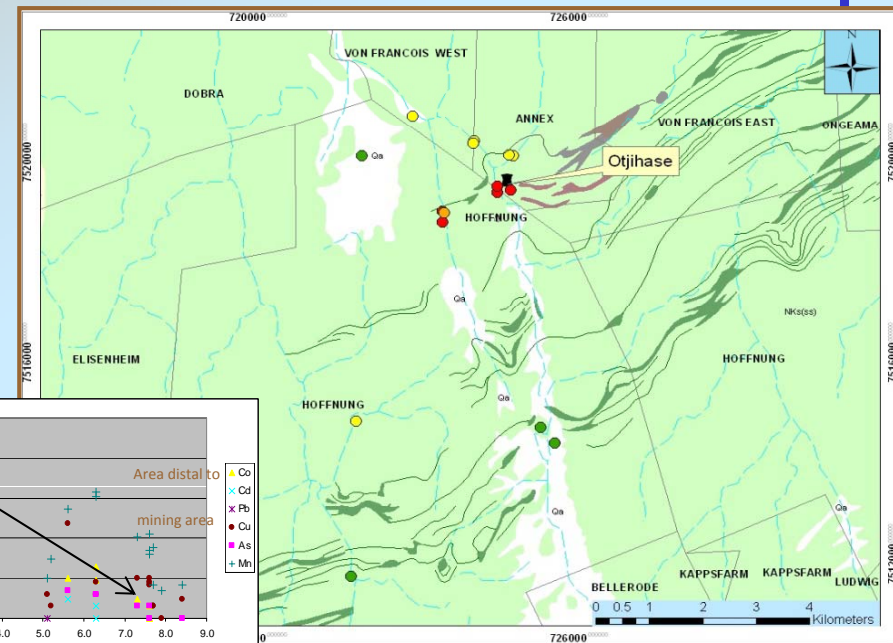
pH 2 to 4

Mg 1300 mg/l

SO₄ 8500 mg/l

Cd 200 µg/l

Cu 13000 µg/l



Monitoring of active mines

Navachab



- ◆ Groundwater monitoring
- ◆ Surface water sampling
- ◆ Cyanide analysis
- ◆ Development of monitoring tools (e.g. fingerprinting of mine effluents)

Monitoring of exploration activities

Baseline sampling:

- **Stream sediment sampling**
- **Soil sampling**
- **Water sampling**



Assessing environmental damage and engaging with relevant authorities

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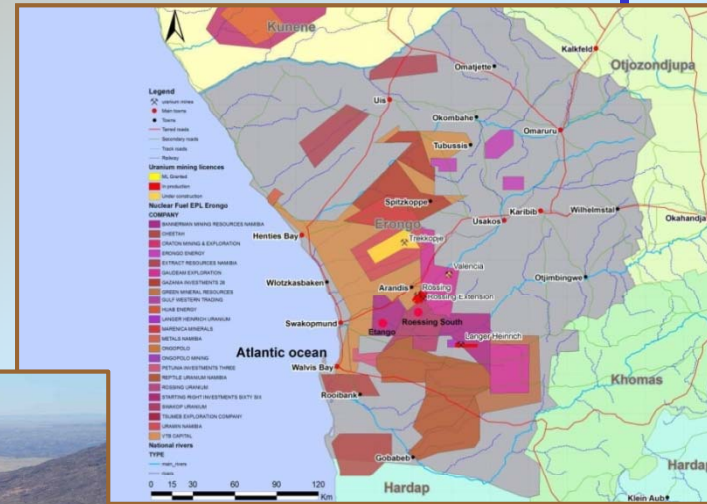
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Strategic assessment of mineral developments



The Uranium SEA



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Strategic assessment of mineral developments

Key Issues

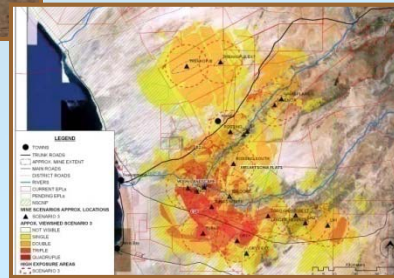
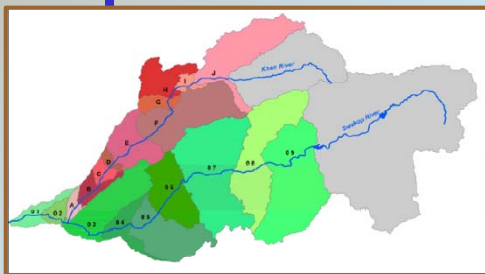
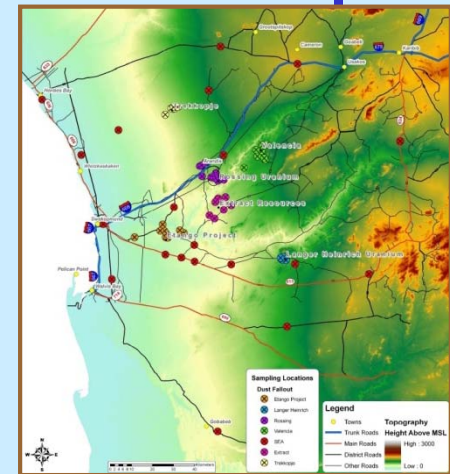
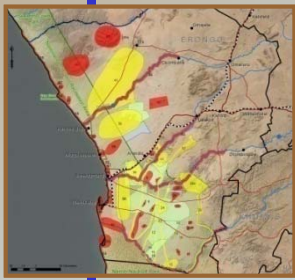
1. Water
2. Power
3. Infrastructure
(Transportation, Schooling, Housing)
4. Competing land use and regional economy
5. Health, medical services, radiation and safety
6. Environment, heritage
7. Mine closure, rehabilitation and post-mining land uses



Strategic assessment of mineral developments

Objectives

- ◆ Provide an overall baseline (Erongo Region)
- ◆ Evaluate *cumulative*, *synergistic* and *antagonistic* impacts for economic, social and biophysical considerations
- ◆ Provide a framework for public input and stakeholder cooperation
- ◆ Help individual mines to consider bigger picture – without losing individual focus
- ◆ Improve regional and local planning
- ◆ Provide a framework for optimising benefits and minimising negative impacts



**Key findings:
Opportunities**

Economic benefits:

- Increased government revenues
- Accumulation of foreign reserves
- Stimulus to the whole Namibian economy
- Infrastructural development and upgrading
- Growth in coastal towns
- Improved power supply to coastal areas
- Long-term water supply to coastal areas

Social benefits:

- Employment and entrepreneurship
- Skills development
- Public-private partnerships for social upliftment projects
- Greater awareness of radiation risks, health, safety and upgraded health care facilities
- More schools
- More opportunities for HDIs

Natural environment

- Opportunities for research and training



**Key findings:
Constraints**

Timely availability of desalinated water

Availability of skills

Sufficient social amenities and services

Capacity of physical infrastructure (roads, port, rail,
power)

Environmental and heritage protection

National Park

Conflicts with tourism and public recreation

Capacity of government – all ministries and levels



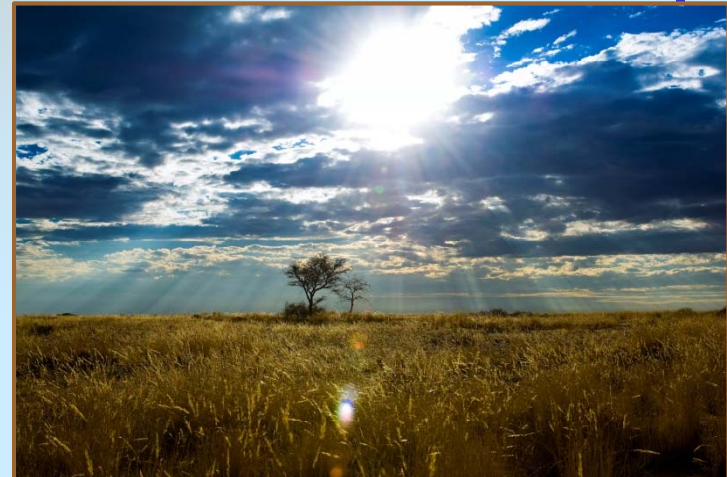
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Implementation of strategic environmental management plans

STRATEGIC ENVIRONMENTAL MANAGEMENT PLAN (SEMP)

➤ The logic consequence of a Strategic Environmental Assessment is guidance on how sustainability principles can be mainstreamed throughout the life cycle of activities and projects

➤ Such guidance is provided through a SEMF which is overseen by a broad-based SEMF Steering Committee and managed by a dedicated SEMF office



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Implementation of strategic environmental management plans



SEMP Steering Committee (SEMP SC)
MME-GSN (Chair), MME-DM, GSN-BGR, MET, MoHSS, MLRGHRD, NPC, MAWF, NMWU, Erongo Regional Council, Chamber of Mines, AEB, Municipalities, NACOMA, Civil Society



SEMP Office (GSN)

Secretariate for SEMP implementation (meetings, reports)
Advice to MME (Minister, MPMRAC) on sustainability parameters
Facilitating dialogue between stakeholders and SEMP SC



SEMP Team

Working groups of key persons from Government and specialists
Monitoring, compilation and assessment of information

Regular Monitoring

Groundwater
GSN/DWA

Radiation+Air
GSN+MoHSS

**Ecology,
Sense of Place**
MET/Gobabeb

Tourism
MET/TASA

Health
MoHSS

Regular Consultation

Water Supply
NAMWATER

Electricity Supply
NAMPOWER

**Mining and Exploration
companies,
Chamber of Mines**

Transport infrastructure
MoWT/ Roads/ TransNamib

Social infrastructure
MoE/Municipalities

Housing infrastructure
Municipalities

Consultation

**Political decision
makers**

Local experts

NGOs

Civil Society

International experts

**Regional and urban
land use planners**

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EQO 5: Air quality & Radiation	Aims of this EQO: Workers and the public do not suffer significant increased health risks as a result of radiation exposure from the Uranium Rush			MH & IH
Desired outcome	Target	Indicators	Reporter	Status
2. Annual human exposures to particulate concentrations are acceptable (IFC Standard)	Ambient PM10 concentrations at public locations and mines should not exceed the required target/limit to be set for the Erongo Region for both annual and 24-hour averages. The target/limit should be based on international guidelines but should consider local environmental, social and economic conditions	<p>Ambient PM10 monitoring ($\mu\text{g}/\text{m}^3$) at Swakomund,</p> <p>Collection of an accredited meteorological station at Swakopmund measuring hourly average wind speed, wind direction, temperature, solar radiation, humidity and rainfall.</p>	<p>NRPA</p> <p>SEMP</p>	<ul style="list-style-type: none"> met A PM10 Sampler machine in Swakopmund is up and running and the first batch of data has been collected. The data has been interpreted in the assessment portion of the report. Met not within the mandate of SEMP to dictate that a meteorological station be built. Meteorological data to be obtained at Meteorological office in WB. (MH to contact JH for info on how to get more data) SEMP suggests that some of the data be obtained from the PM-10 sampler and radon and progeny machine situated at the NamWater facilities in Swakopmund.

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Implementation of strategic environmental management plans



Ministry of Mines and Energy



Geological Survey of Namibia
Bundesanstalt für Geowissenschaften und Rohstoffe (BGR)

Strategic Environmental Management Plan (SEMP) for the Central Namib Uranium Rush 2012 Annual Report

March 2014
Prepared by



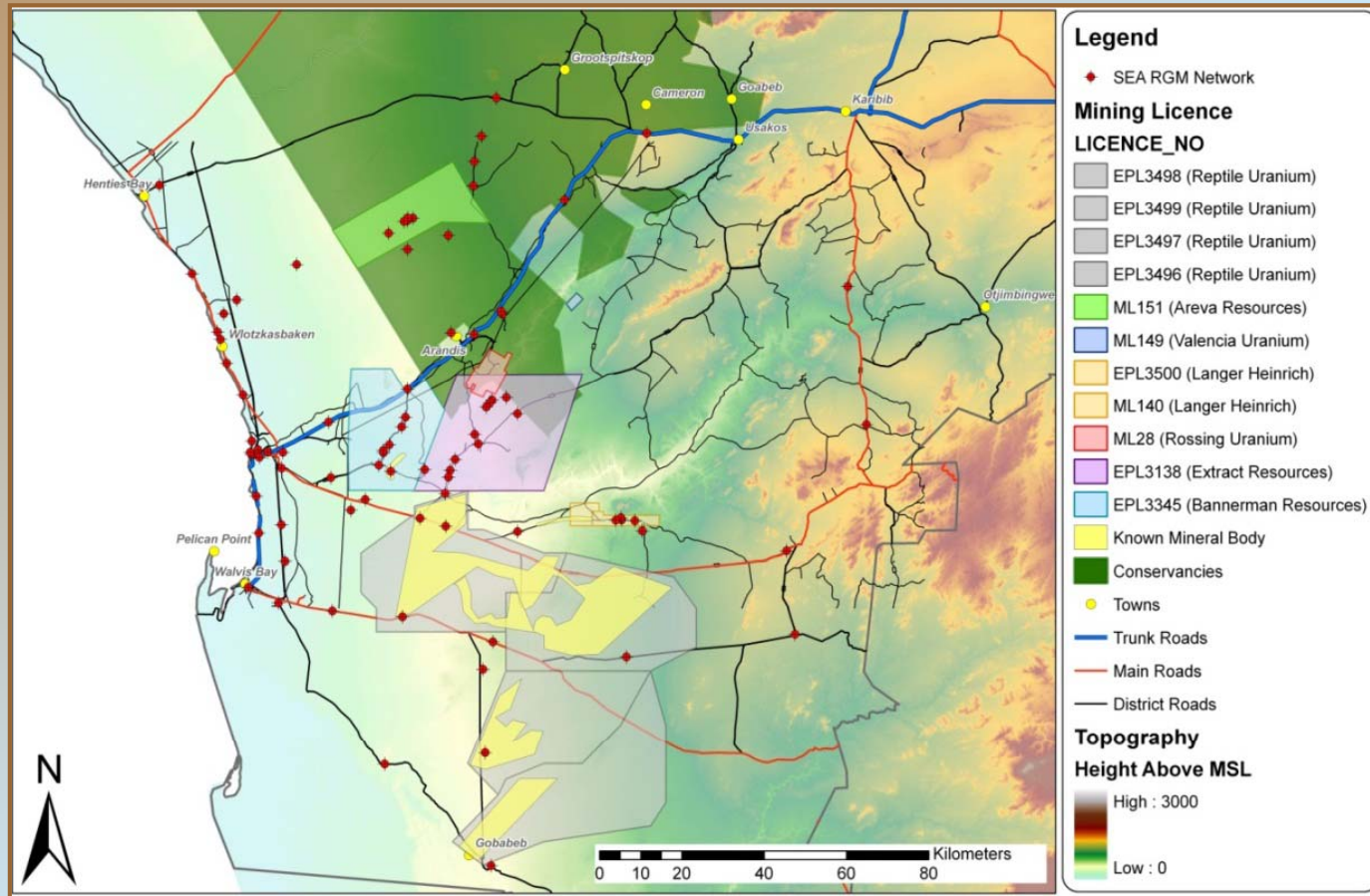
Geological Survey of Namibia



**Third SEM Report
about to be released**

EARTH SCIENCES FOR NAMIBIA'S SUSTAINABLE DEVELOPMENT

Implementation of strategic environmental management plans





Implementation of strategic environmental management plans

The focus of the SEMP reports is on the assessment of compliance with Environmental Quality Objectives (EQOs). Relevant data are presented to support the assessment.

125 indicators for the various EQOs are assessed according to a following colour-coded system:



<i>Status:</i>	NOT MET	IN PROGRESS	MET	EXCEEDED
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5.	Air quality and radiation
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Aims of this EQO: Workers and the public do not suffer significant increased health risks as a result of radiation exposure from the Uranium Rush.

Desired outcome 5.1	Annual radiation exposures to the public via air are not significantly increased as a result of the Uranium Rush.
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Target 5.1.1	More accurate public dose assessments shall demonstrate that the cumulative radiation dose to members of the public does not exceed 1 mSv/a, or that the dose to members of the public does not exceed 0.25 mSv/a for contributions from any single operation.
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Indicator 5.1.1.3	Radon exhalation rates from ground through continuous monitoring
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Status:	
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More than 100 passive radon gas monitors were placed in the Erongo region at locations surrounding the current and proposed future mining operations as well as in areas where people live. The radon monitoring locations, some of which coincide with the dust fallout buckets are shown in Figure 1. The radon gas monitors (RGMs) were placed on a 2-monthly deployment rotation from August 2009 to August 2011. Radon gas monitoring was discontinued in August 2011 as the SEMP Office felt the necessary baseline data had been collected.

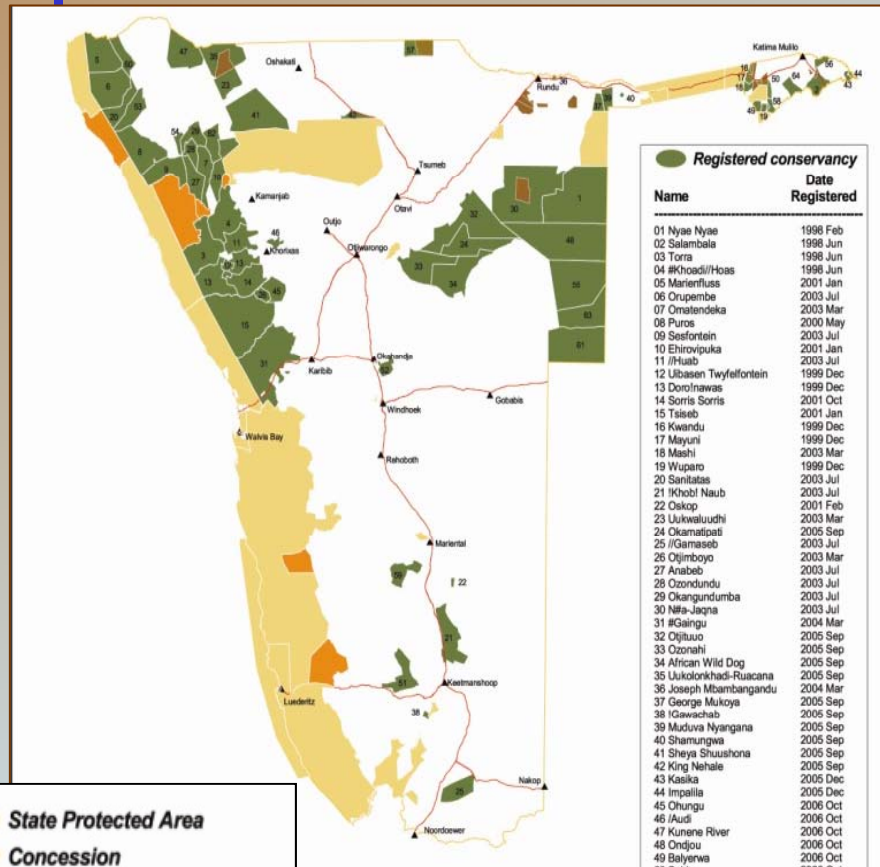
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Management of exploration and mining in protected areas

Communal Conservancies + National Parks in Namibia



42% of the country enjoys a state of conservation (IUCN requirement = 15%)

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Management of exploration and mining in protected areas

Hon Netumbo Nandi-Ndaitwah: *"We cannot have natural resources and not use them, but they must be used sustainably"*

With the high % of protected areas in Namibia, it is not possible to ban exploration and mining in National Parks.

- ◆ Diamonds: Skeleton Coast Park, Sperrgebiet Park , Namibian Islands Marine Protected Area
- ◆ Uranium: Dorob National Park, Namib-Naukluft Park
- ◆ Zinc: Sperrgebiet Park
- ◆ Salt: Dorob Park
- ◆ Dimension Stone: Dorob Park, Namib Naukluft Park
- ◆ Gypsum: Namib Naukluft Park
- ◆ Copper: Namib Naukluft Park
- ◆ Phosphate: Namibian Islands Marine Protected Area
- ◆ Semi-precious stones: Brandberg Monument + Spitzkuppe Heritage Area



Management of exploration and mining in protected areas

ECONOMIC IMPORTANCE

	Production	Turn-over	Tax	Royalty	Employment
Diamonds	1 471 000 cts	5 026 m	594 m	503 m	1651
Uranium	1 678 t	1 400 m	----	32.2 m	268
Zinc	151 688 t	2524 m	14.8 m	11.6 m	682
Salt	872 000 t	352 m	7.7 m	6.6 m	131
Total		9302 m	616.5 m	553.5 m	2732

Contribution to GDP

Diamonds 3.6%

Other 5.4

Total 9% (10%)



Contribution to

Taxes + Royalties

1 170 million

= 75.19%

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Management of exploration and mining in protected areas



Cooperation between the Ministry of Mines & Energy + the Ministry of Environment & Tourism

- MET representation on Mineral Rights Committee
- Conference on Mining in Protected Areas
- Development of a Policy on Exploration and Mining in Protected Areas
- NACOMA
- Environmental Rehabilitation Sign-off
- MME Vice-Chair of the Environmental Investment Fund
- Park Advisory Committee

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Monitoring of abandoned mines and assessment of their risks



- ◆ For more than 140 years, mining and exploration was undertaken without due consideration of the environment
- ◆ Environmentally friendly legislation and policies were only introduced after Namibian Independence in 1990

240 Abandoned mine sites and prospects in the country today!!

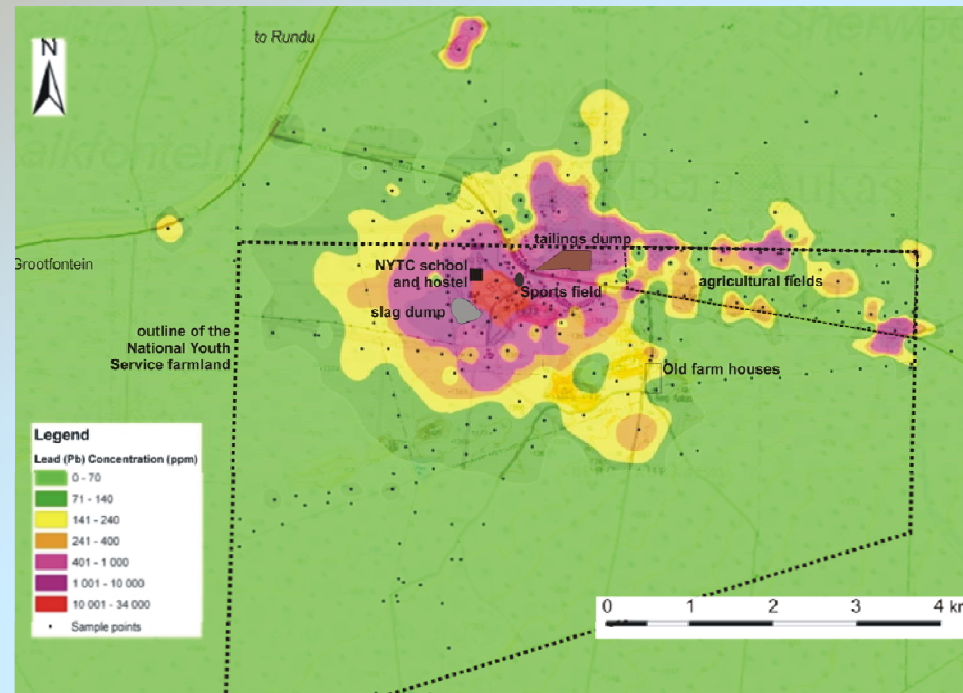
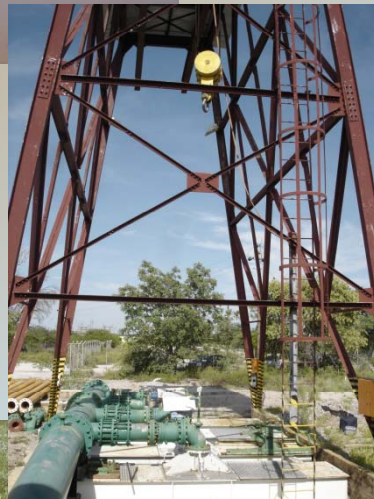
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Monitoring of abandoned mines and assessment of their risks

Environmental monitoring: Berg Aukas



Lead concentrations in top soil

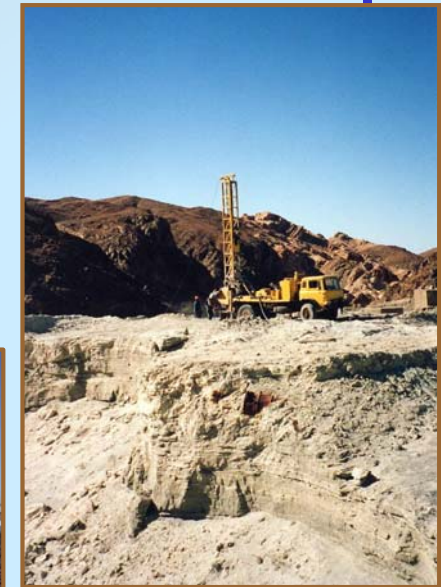
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Oamites and Namib Lead

Monitoring of abandoned mines and assessment of their risks



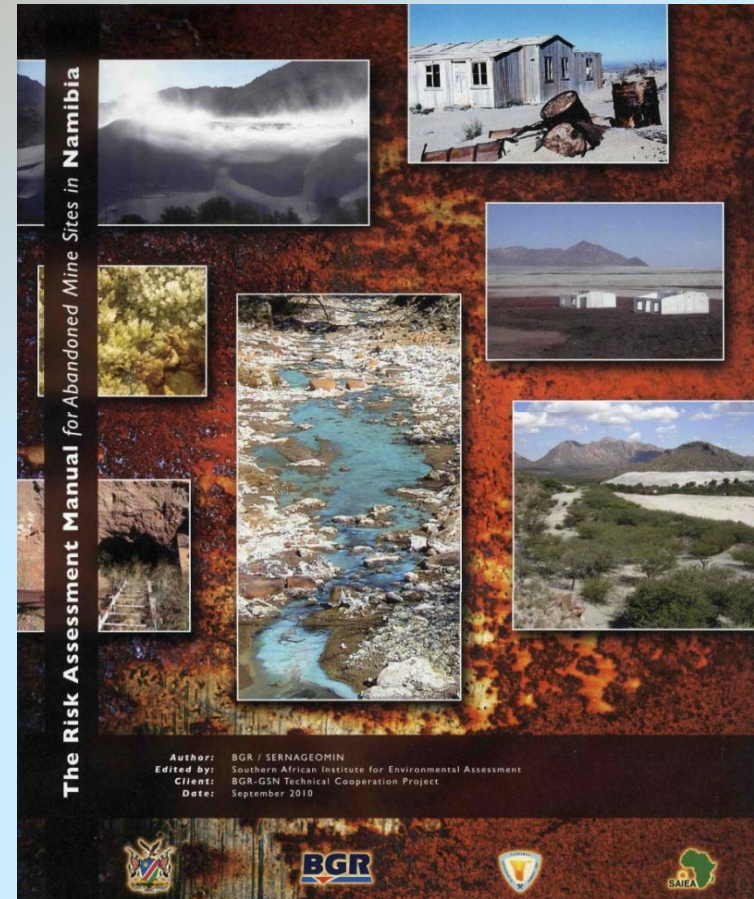
Remaining metals in tailings
= Resource!

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Monitoring of abandoned mines and assessment of their risks

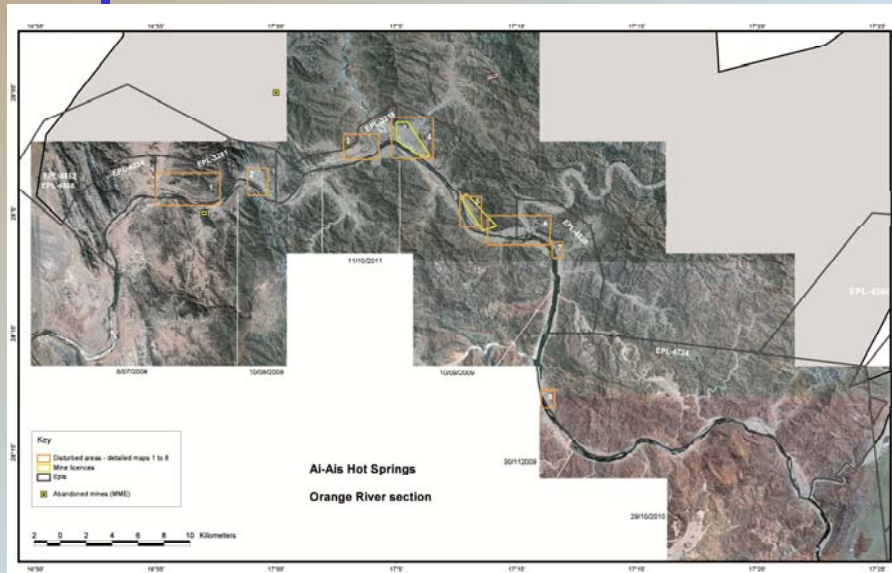
- ◆ Database
- ◆ One by one approach for remediation based on broad knowledge of geology and
- ◆ unconventional thinking
- ◆ Triggering remediation by reprocessing

**Risk Assessment Manual
for Abandoned Mine Sites
in Namibia**



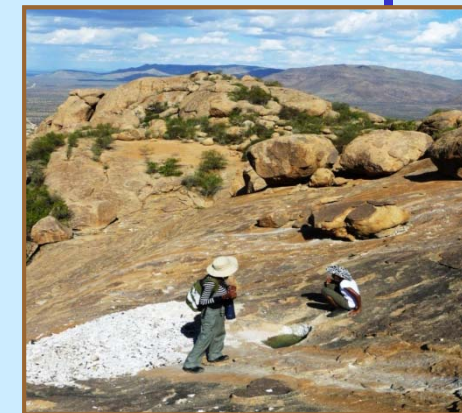
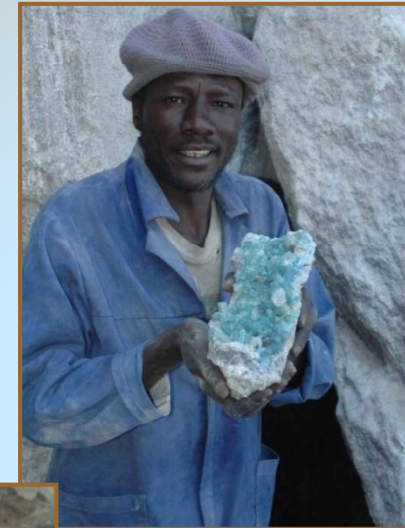
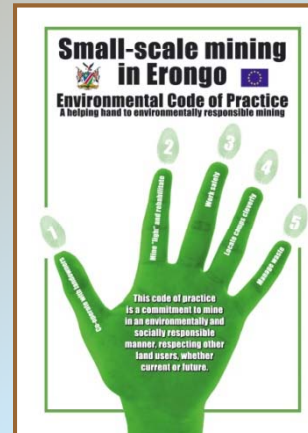
Environmental remediation

- ◆ Environmental rehabilitation sign off
- ◆ Tailings dam stabilisation
- ◆ Mine closure planning
- ◆ Alternative land use



Minimising the negative impact of small scale mining

- ◆ Organisation of small-scale miner groups in cooperatives
- ◆ Advice in mining and processing
- ◆ Advice in mineral and value determination
- ◆ Adding value
- ◆ Improvement of marketing
- ◆ Environmental code of conduct



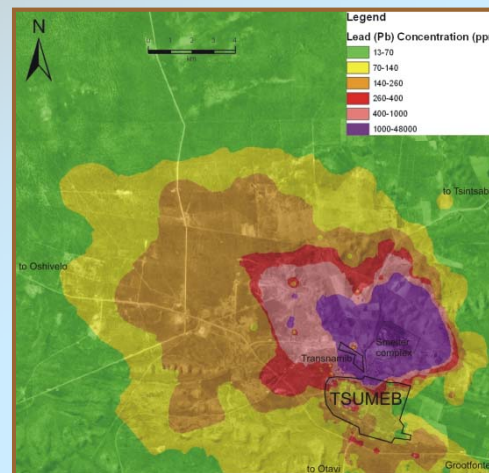
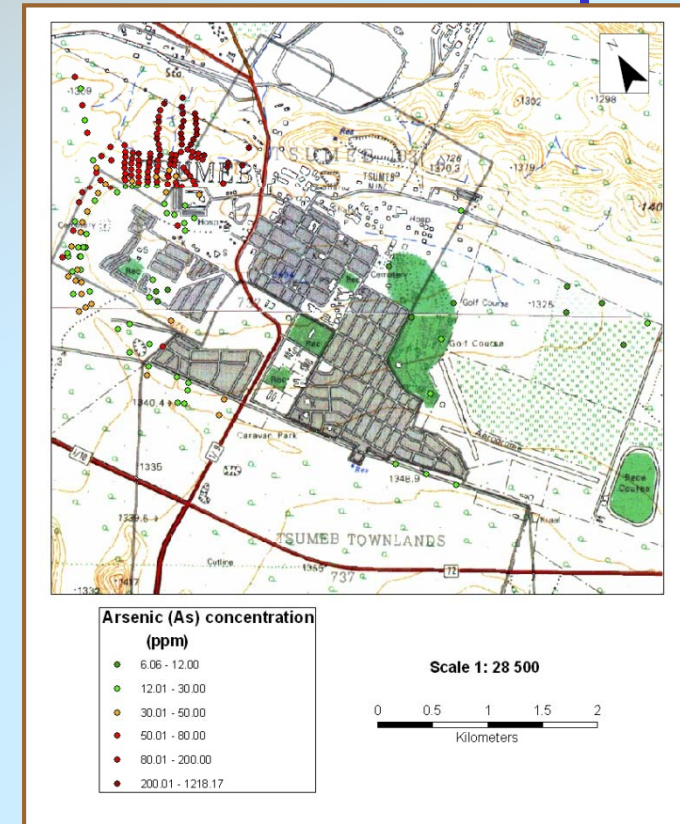
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Urban and land use planning

Environmental monitoring: Tsumeb



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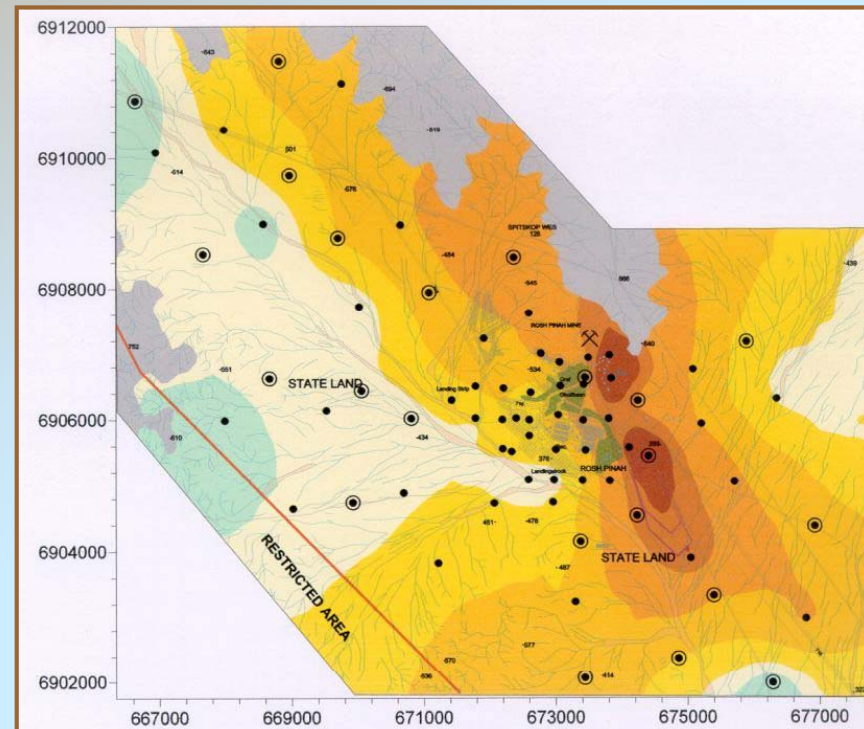
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Urban and land use planning

Rosh Pinah: Arsenic concentration in soils

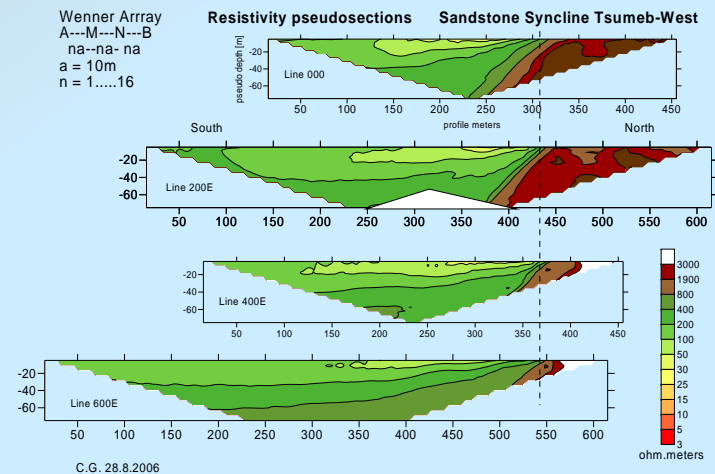


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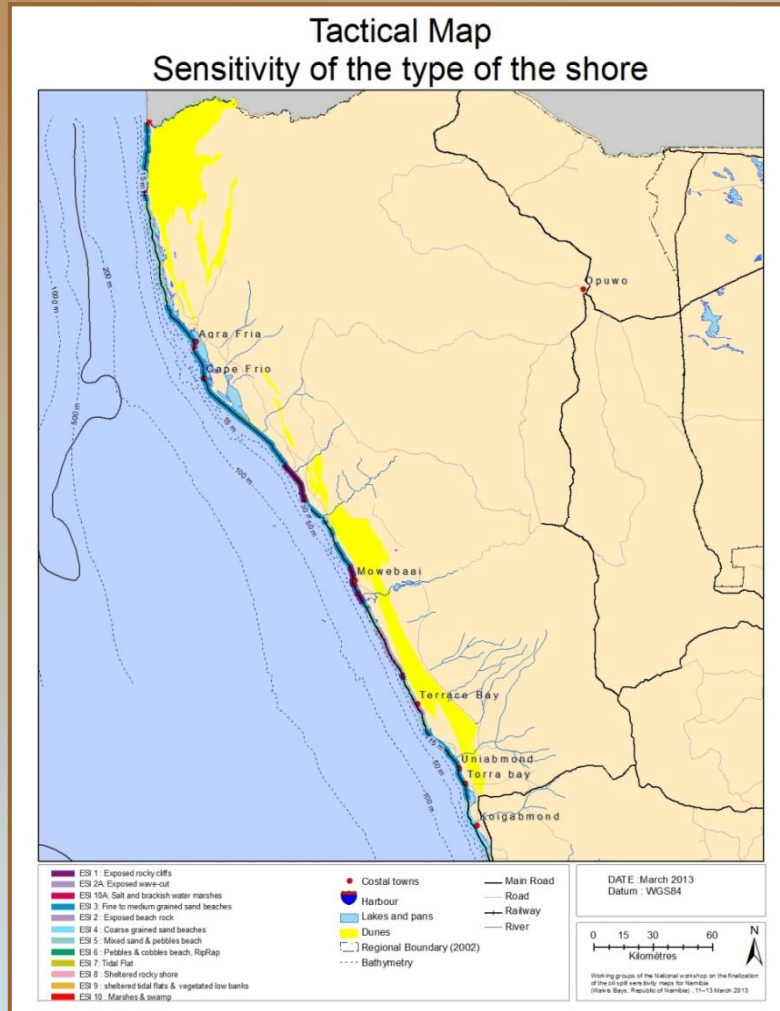
Waste disposal



- Management of existing waste disposal sites
- Delineation of new waste disposal sites



Coastal zone management



- **Nacoma**
- **National coastal oil sensitivity mapping**



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Governance of the marine environment



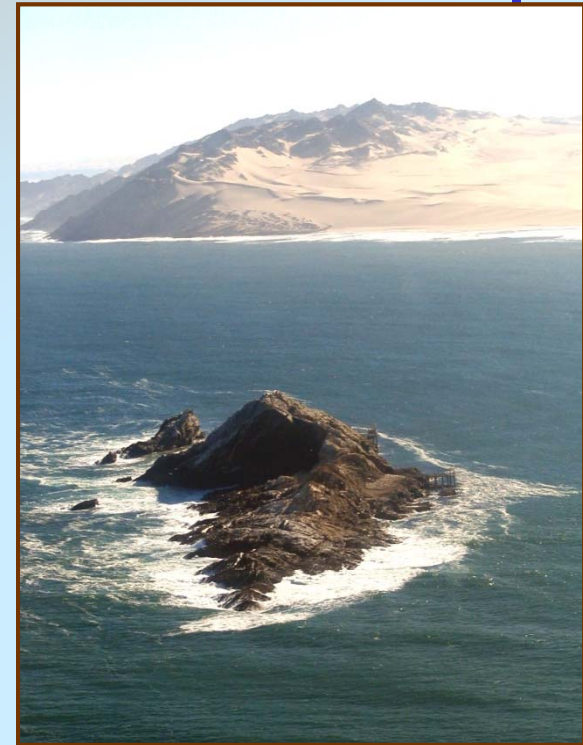
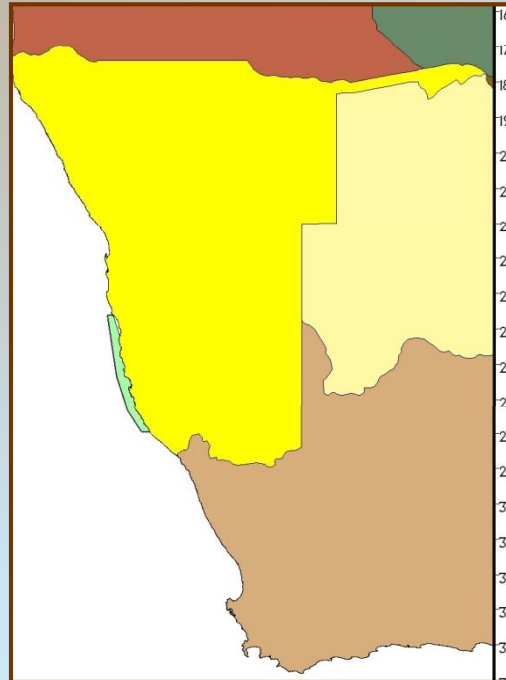
- ↔ Marine diamond mining
- ↔ Marine phosphate exploration and planned mining



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Governance of the marine environment

Namibian Islands' Marine Protected Area



**Meob to Sinclair Island
200 m water depth**



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Governance of the marine environment

BENGUELA CURRENT COMMISSION

MANAGEMENT OF MINING AND DRILLING ACTIVITIES

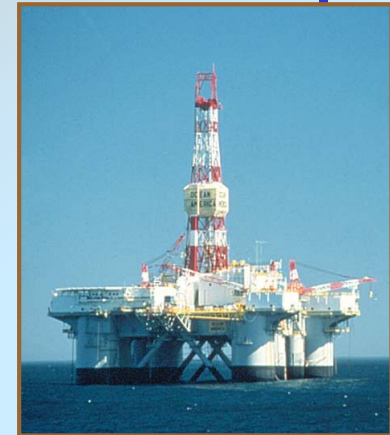
- Regional Consultation Framework
- Policy Harmonization
- Cumulative Impact Assessment

MANAGEMENT OF POLLUTION

- Harmonizing environmental quality objectives
- Oil pollution contingency plans and regional policy

MAINTAINANCE OF ECOSYSTEM HEALTH + PROTECTION OF BIOLOGICAL DIVERSITY

- Vulnerable species and habitats
- Ballast water policy
- Marine biological diversity conservation



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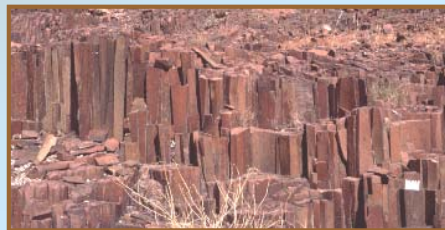
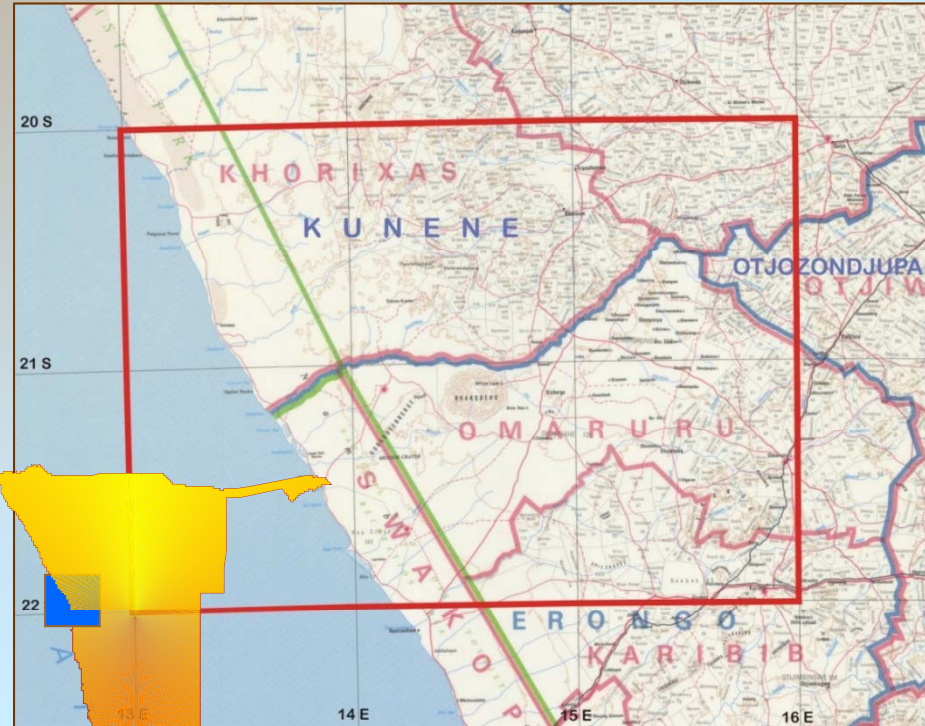
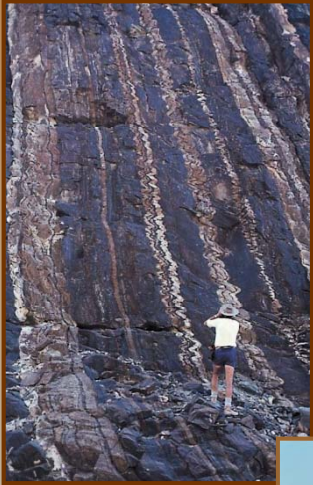
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Geoheritage

GONDWANALAND GEOPARK



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THANK YOU!

Namibia has been blessed with an abundance of mineral resources and a breathtaking, but highly sensitive, natural environment. The Ministry of Mines and Energy is committed to the development of both for the benefit of the Namibian people, guided by the conviction that this is possible if sound scientific principles are applied.

EARTH SCIENCES FOR NAMIBIA'S SUSTAINABLE DEVELOPMENT