

Application of the AMREC-UNFC Framework to Anthropogenic Mineral Resources: Insights from Namibian Case Studies

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PanAfGeo+

The Pan-African Support to Geological Sciences and Technology

UNFC-AMREC



**African
Union**



What is AMREC?

AMREC is the African Mineral and Energy Resources Classification and Management System — a continent-wide framework for the sustainable governance of Africa's resource base.

☐ Built on UNFC

Adapts the UN Framework Classification (E × F × G axes) to African contexts; Each axis reflects a different dimension of project maturity and viability.

☐ Includes PARC

Pan-African Resource Reporting Code for stock exchange & financial disclosures

☐ Aligned to AMV

Implements the Africa Mining Vision; transparent, equitable resource exploitation

☐ Supports SDGs

Integrates Agenda 2063 and Sustainable Development Goals into resource management

Anthropogenic Mineral Resources

- **Definition:** Anthropogenic Mineral Resources are mineral-bearing materials that have been created, modified, or relocated by human activity, and may be recovered for economic value.

❑ Mine Tailings

Residual slurry from ore processing; often contain copper, gold, REEs at sub-economic but recoverable grades.

❑ Processing Residues

Slag heaps, leach residues, and smelter by-products containing recoverable metal values.

- Namibia has a long history of mining, which has left behind significant anthropogenic deposits that are now being reconsidered for their economic value. Classic examples include:

- Tsumeb Smelter Slag (Copper and Rare Metals)
- Historical Copper Mine Tailings (Matchless and Otjihase)
- Oamites Mine tailing dump (Copper)

❑ Waste Rock Dumps

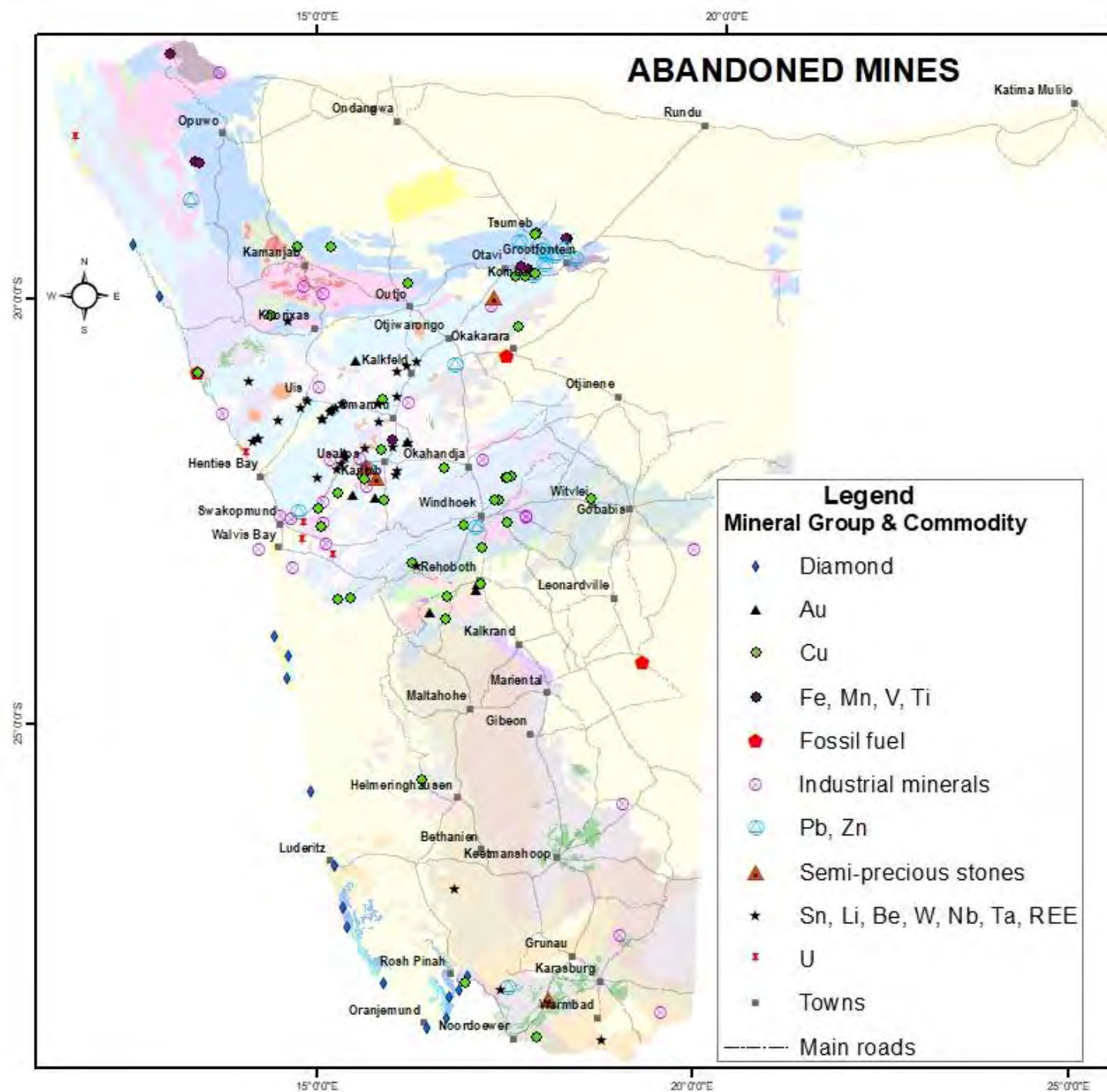
Overburden and low-grade material stockpiled during mining; reclassified as resource when processing economics improve.



Why AMREC Matters for Anthropogenic Mineral Resources

- Provides a standardized classification language for waste-derived resources
- Enables transparent reporting to investors and regulators
- Supports circular economy by treating mine waste as classifiable assets
- Combats Illicit Financial Flows (IFF) by documenting full resource inventory





The Geological Survey of Namibia has an inventory list of 157 abandoned mine sites representing a legacy of liabilities, but also a hidden resource pool for re-extraction

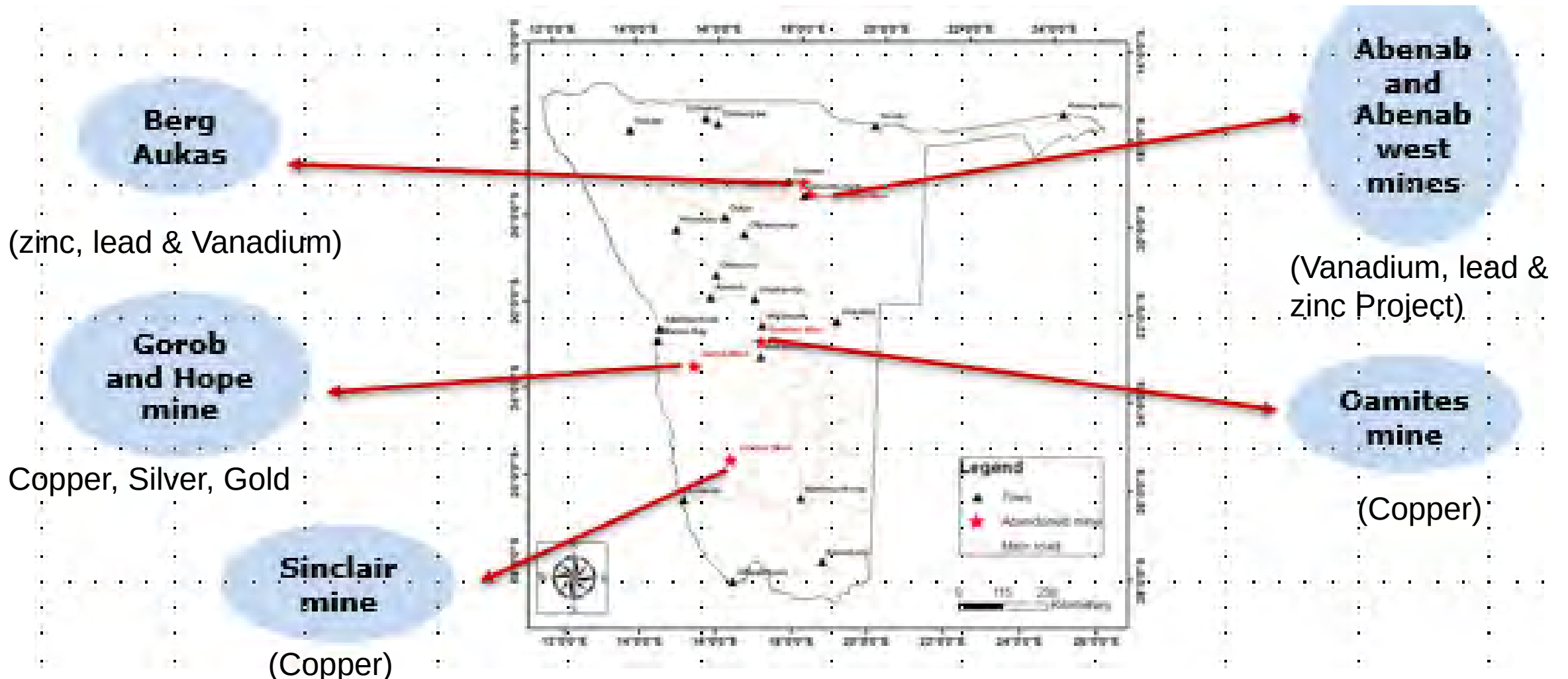
Mine	Operator (s)	Location	Lat	Long	Primary mineral (s) (Commodity)	Host	Secondary mineral (s) (s)	Regional Geology	Site Geology	Mining method	Site description	Mining comments	Closure date
Amud Mine	Amud Mining Co. (Pty) Ltd.	Amud	25.0000	15.0000	Diamond	Amud	Diamond	Amud	Amud	Open-pit	Amud	Amud	Amud
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Application of the AMREC-UNFC Framework

❑ Case Study Objective:

Testing the applicability of the African Mineral and Energy Resources Classification (**UNFC-AMREC**) to some abandoned mines.



Application of the AMREC-UNFC Framework

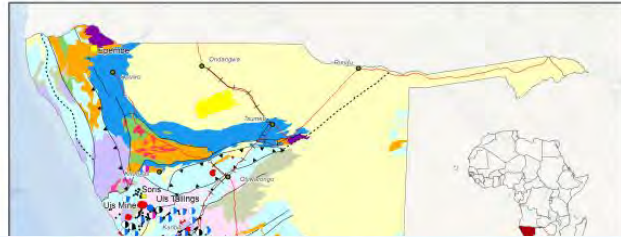
❑ Materials:

Peer-reviewed scientific literature, publicly available materials, Earth Data Namibia (EDN) and UNFC-AMREC documents



Commodity & Host Geology

Tin and niobium-tantalum mineralisations in Namibia are often associated with one another, but may also occur independently. Cassiterite (tin) as well as columbite-tantalite (niob-tantal) deposits are predominantly hosted within rare-metal pegmatites that occur in two different areas in Namibia (Fig. 1), namely the Namaqua Metamorphic province in southern Namibia (e.g. Tantalite Valley) as well as northeast-trending pegmatite belts in the central portion of the Damara Orogen (e.g. Uis Tin Mine). Disseminated cassiterite and tantalite mineralisation are hosted within both zoned and unzoned pegmatites, oftentimes related to replacement or so-called greisen zones. Other minerals of economic interest that may be associated within the rare-metal pegmatites are lithium- and bismuth-minerals, beryl, tourmaline and to a lesser extent feldspar.



Earth Data Namibia

Mining

Mineral Licenses

Mineral Provinces

Mines, Plants, Dumps

Environment

Sites of environm. Concern

Field Work

Resources and Exploration

Mineral Deposits/Occurrences

Geochemistry

Drill Holes

Geology

Geological Map 1:1.000.000

Geological Map 1:250.000

Report and Documents

Reports

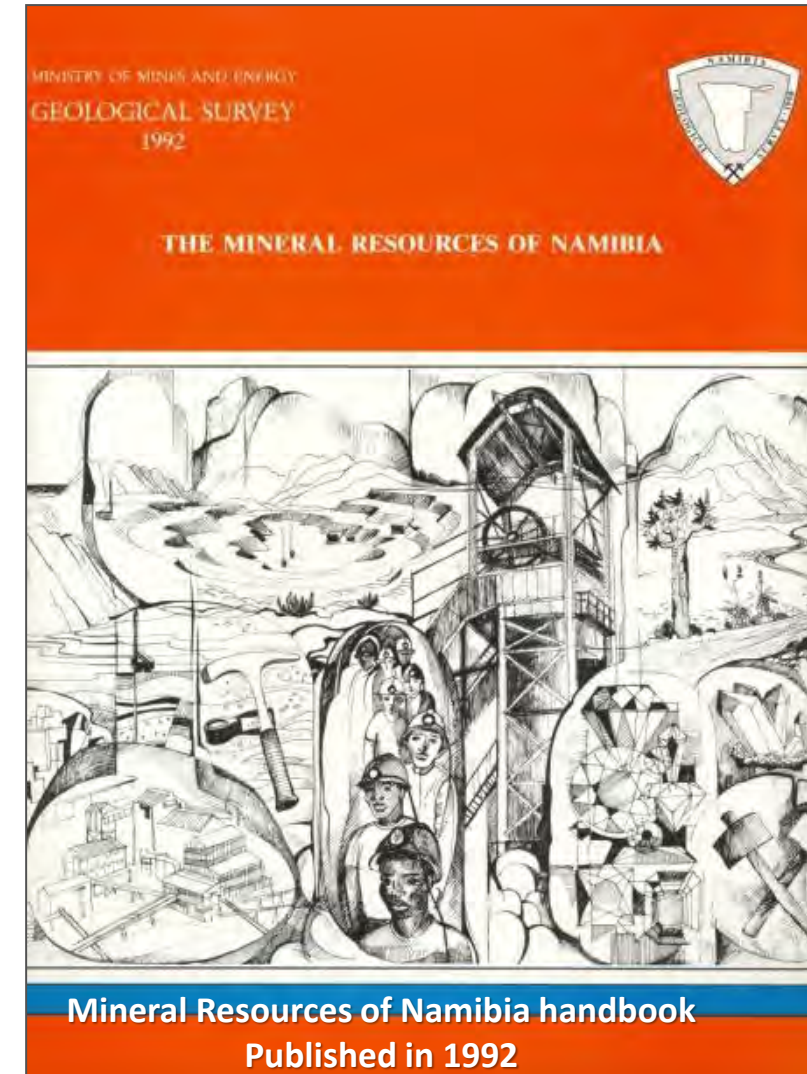
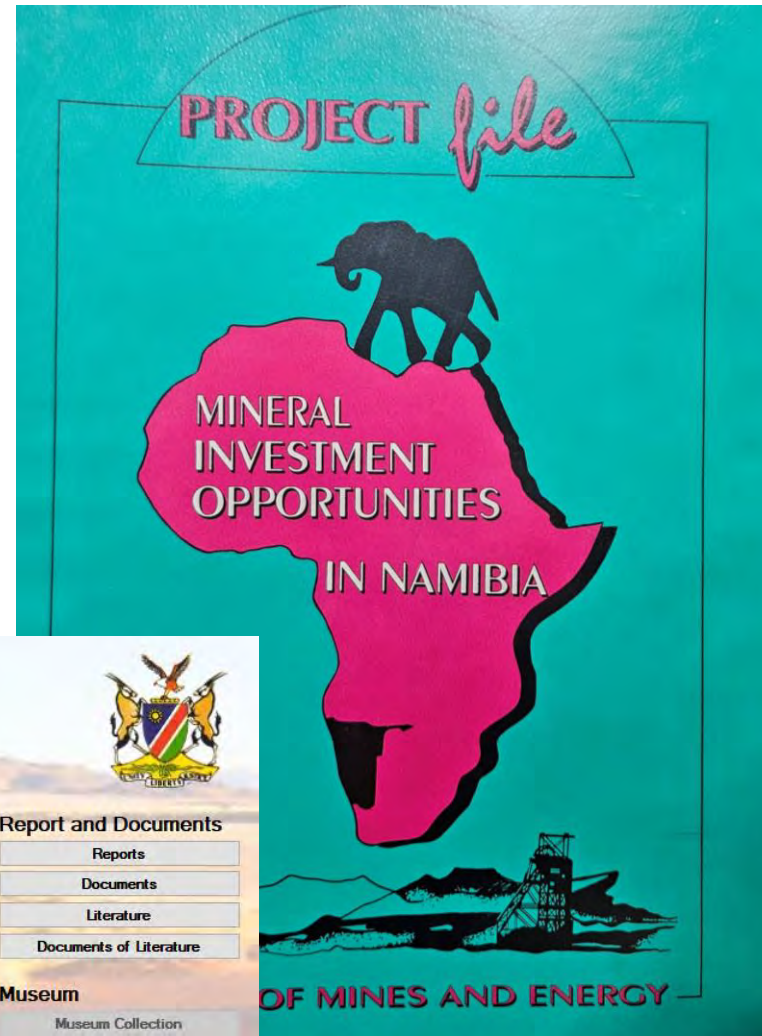
Documents

Literature

Documents of Literature

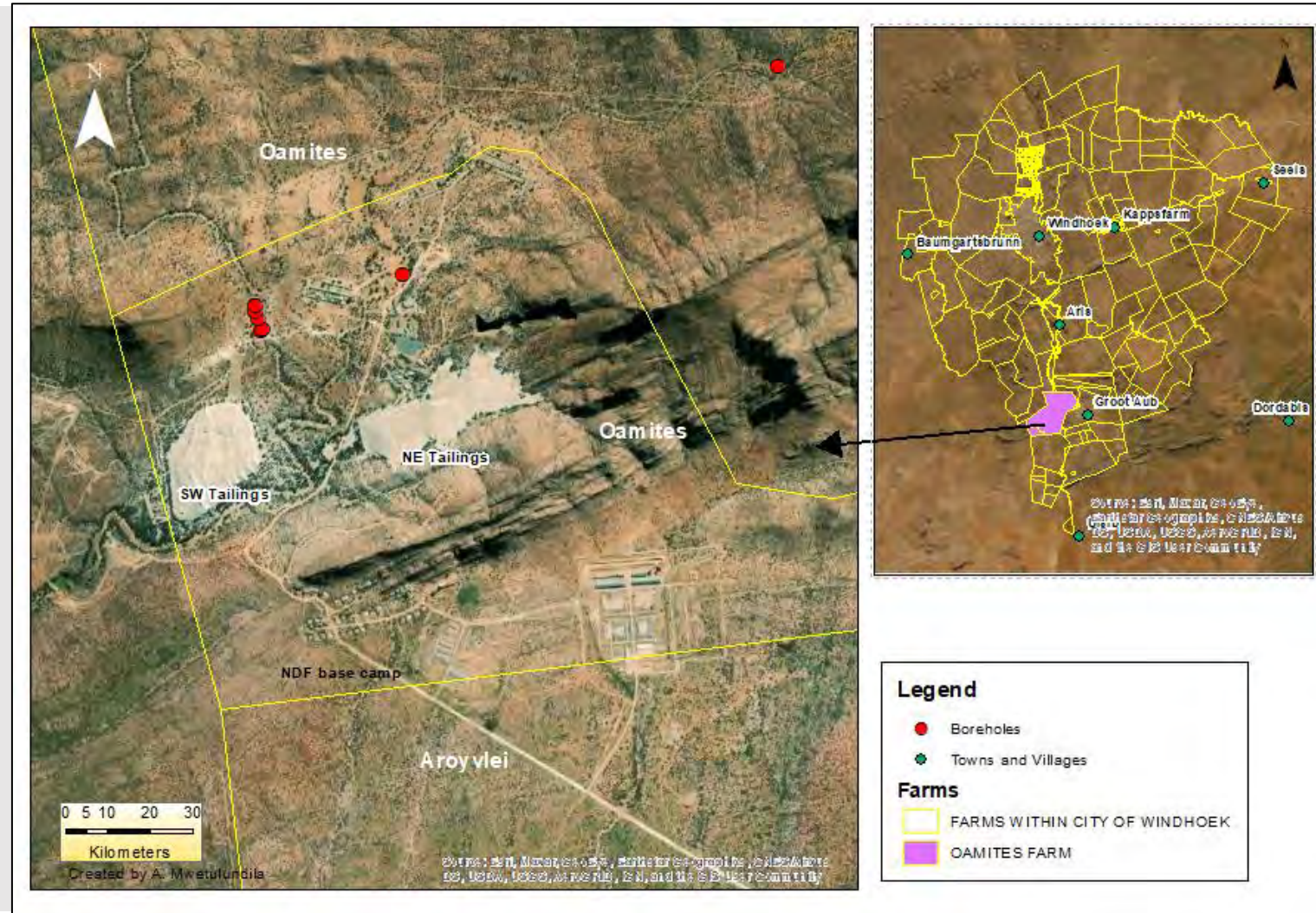
Museum

Museum Collection



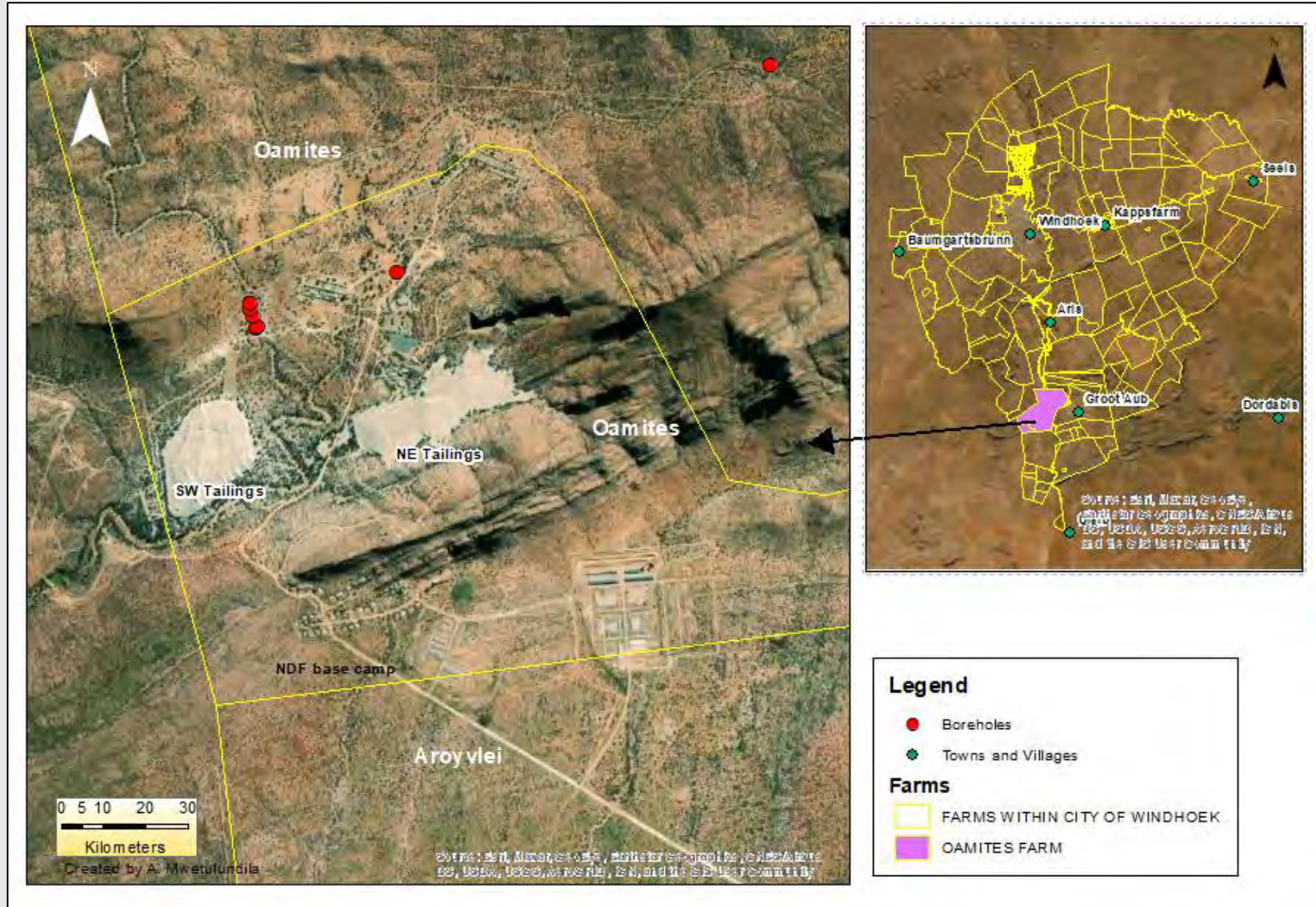
Case study: Oamites Mine

- ❑ The Oamites Abandoned Mine is located approximately 50km south of Windhoek.
- ❑ Discovered between 1960 and 1962 by Rand mines company
- ❑ Mining operation done between 1971 and 1984 as underground mine with floatation plant
- ❑ Produce about 6.6Mt of concentrate (35.6% Copper and 14.8 g/t Silver)
- ❑ Ceased operation in 1984 due to exhaustion of the ore reserve



Case Study: Oamites Mine

- **Post abandoned in 1984:** Infrastructure is currently used as a base camp by the Namibian Defense Force.
- **Known Characteristics:** Two huge tailings dumps and a deep collapsed stope. The mine tailings are estimated to contain approximately 5.5 million tones of tailings with a height of about 6 m.
- **Major hazardous potential:**
 - Severe wind-erosion of the tailing's dumps.



Case Study: Oamites Mine



Oamites
abandoned mine
site under windy
conditions: dunes
with a height of
up to 6 m formed
on the western
tailing dump
(5.5Mt)

Sources: Hasheela, et al, 2014

Case Study: Oamites Mine (Copper)

Environmental-Socio-Economic Viability (E-axis)

Category E3:

Reasoning for classification

- *Oamites mine tailings are not environmental and social viable, due to observed human health hazards.*
- *There is insufficient data to rule out the possibility of Acid Mine Drainage (AMD) from the tailings. .*
- *Western section of the Oamites orebody was deemed uneconomic historically. No exploration activity is being conducted to determine whether it is now economical viable.*

Technical Feasibility (F-axis)

Category F4: Reasoning for classification

- *The High-Pressure Leachate (HPL) method has not yet been demonstrated to be technically feasible for extracting copper concentrates from the Oamites tailings.*
- *The stopes were collapsed and filled. The re-opening of the mine may require more funds to develop the mine to access the Western section if deemed economic.*

Degree of confidence (G-axis)

Category G4:

Reasoning for classification

- *The Western section of the Oamites orebody was deemed uneconomic prior to the closure of the mine in 1984.*
- *Further data acquisition and re-evaluation according to todays' market value and technical method of extraction may be needed to determine the viability of the mining of the Oamites deposit.*
- *Secondly, there is no factual evidence that the Oamites tailings can produce copper concentrate sufficient for the market.*
- *Low level of geological confidence*

CHALLENGES AND OPPORTUNITIES

Challenges

❑ Data Harmonization

Existing national databases use different formats; converting legacy classification data to AMREC's E-F-G system requires substantial effort

❑ Government-Industry Alignment

Private companies accustomed to JORC / NI 43-101 / SAMREC

❑ Capacity Gaps

Geological survey is understaffed and lack trained AMREC practitioners

Opportunities

❑ Unified National Inventory

An opportunity to have a national resource inventory in one classification system.

❑ Circular Economy

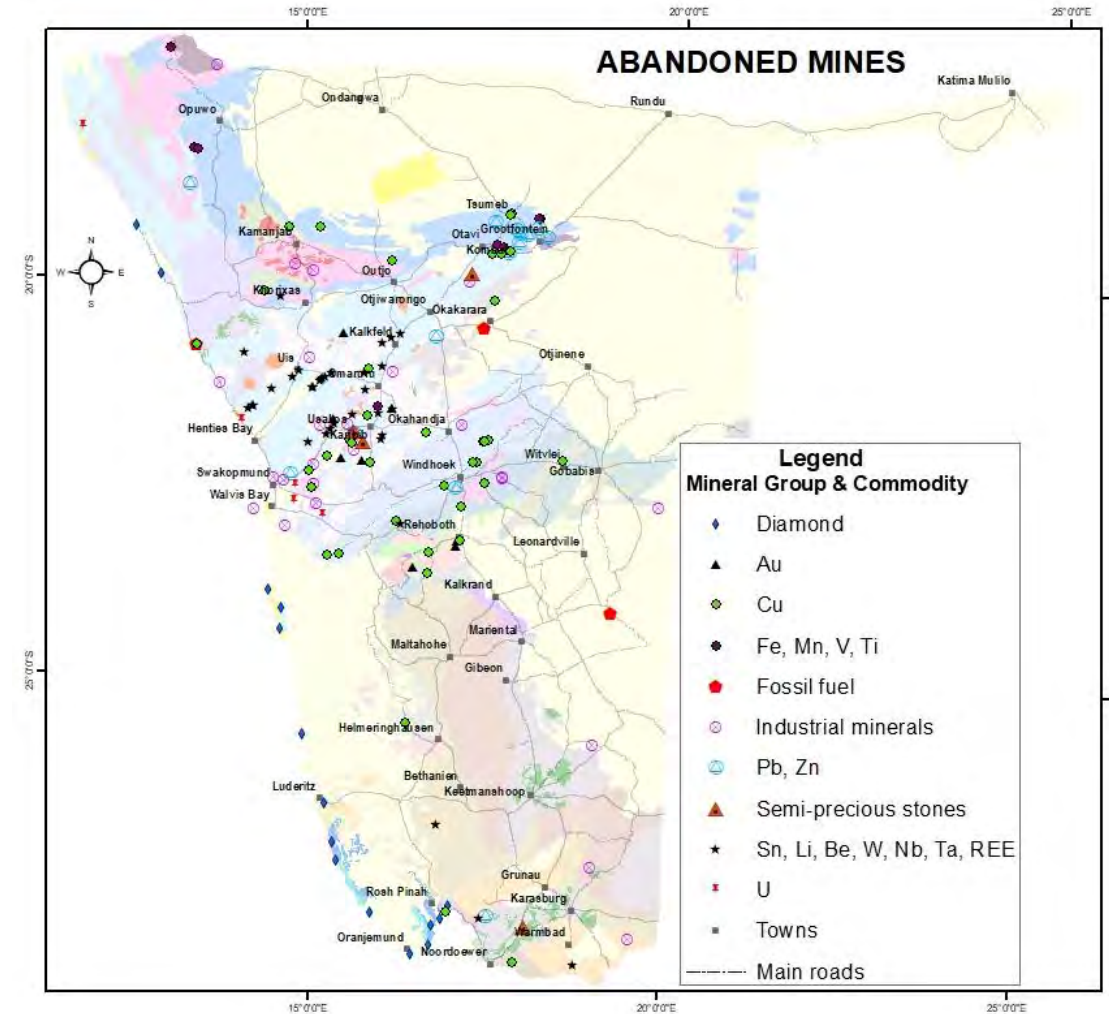
Formalizing mine tailings as classified anthropogenic resources opens new recovery projects and reduces environmental liability.

❑ IFF Mitigation

Transparent, standardized reporting reduces Namibia's Illicit Financial Flow losses from the mining sector.

SUMMARY

- AMREC-UNFC provides Namibia with a unified E-F-G classification language for anthropogenic mineral resources
- Anthropogenic mineral resources (mine tailings) can be formally classified, enabling their recognition as assets in national resource accounts
- Advancing the circular Mineral Economy in Namibia
- Complete national AMREC-UNFC classification inventory covering all Anthropogenic mineral resource



Thank You for your attention

