

Application of the African Mineral and Energy Resources Classification and Management System (AMREC) to mineral and anthropogenic resources: Case studies from Namibia

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INTRODUCTION

Many African countries depend on revenue from the mining industry for their economic development. The mining industry is characterized by pervasive uncertainty and volatile commodity prices; exhaustible reserves; political, social and environmental risks; and pervasive information asymmetries.¹ Consequently, the revenue of mineral-dependent countries is high-risk and uncertain, which makes fiscal planning and revenue management complex for those countries.²

Demand for various minerals is expected to increase significantly in the coming decade. Most of this demand will be driven by ambitious climate action. The World Bank estimates that, by 2050, demand for minerals such as graphite, cobalt and lithium will increase by up to 500% of 2018 demand.³ Evaluating and classifying the amount or “stock” of raw materials contained in the geological terrain of mineral-dependent countries is therefore essential to determine what role these countries will play in meeting global mineral demands.

This paper presents the results of Namibian case studies, testing the applicability of the African Mineral and Energy Resources Classification (AMREC) to abandoned mines and exploration projects. Existing published and unpublished publicly available data were used as the primary source of information to classify the projects. Based on the United National Framework Classification for Resources (UNFC), AMREC classifies resources based on three criteria namely, environmental-socio-economic viability (E-axis), technical feasibility (F-axis), and degree of confidence (G-axis).

Mining in Namibia

Namibia is a resource-dependent country, and the mining industry makes a substantial contribution to gross domestic product (GDP). In 2021, the industry contributed 9.1% to GDP and spending on exploration amounted to N\$806.4 million.³ Mining activities in Namibia began more than 400 years ago and Namibia has been a significant producer of various minerals and metals, such as diamonds, uranium, copper, zinc, gold, lead, semi-precious stones and industrial minerals. Many historical mining sites have been left unrehabilitated and pose environmental and socioeconomic risks to host communities.

¹ Daniel, P., Keen, M., McPherson, C. P. and Dawson, B. (2010). *The taxation of petroleum and minerals: principles, problems and practice*. Abingdon: Routledge.

² Brown, O., Crawford, A. and Gibson, J. (2008). Boom or Bust: How commodity price volatility impedes poverty reduction, and what to do about it. International Institute for Sustainable Development.

³ COM (2022) 2021 Annual Review: Chamber of Mines of Namibia.

In 2004, Namibia had an inventory list of 260 abandoned mines sites,⁴ many of which have not been subject to a thorough study and classification of their risks. The past decade has seen extensive exploration activities in Namibia and renewed interest in the re-opening of abandoned mines.

These exploration activities have highlighted various issues pertaining to social acceptance and approval; environmental management; long-term economic sustainability; and resource inventory management and reporting. The raised objections are valid, as history demonstrates that poor classification, development, management and utilisation of natural resources causes adverse environmental and socioeconomic effects on communities and governments, not just in Namibia but also globally.

CASE STUDIES

Abenab and Abenab West mines (Abenab Vanadium Project)

The Abenab and Abenab West mines are abandoned lead vanadate mines in Otavi Mountainland, Namibia. Abenab mine, which closed in 1947, produced 1.83 Mt of ore, with a grade of 1.03 weight% of V₂O₅, for approximately 102,000 tonnes of concentrate (18% V₂O₅, 13% Zn and 42% Pb); Abenab West mine, which closed in 1958, produced approximately 74,000 tonnes of concentrate, grading 13% V₂O₅ and 72% lead.

Various companies have explored these mines since closure to ascertain economic mineralization in the tailings, the open pit and underground sites. The AMREC classification indicates that the Abenab Vanadium Project is not environmentally and socially viable, since no comprehensive social-environmental impact assessment has been conducted. In terms of technical feasibility, gravity extraction can recover high-grade concentrate of vanadium pentoxide, lead and zinc from the ore, but further investigations are needed to develop a downstream flowsheet to justify mining development and gravity concentration on the site. The current inferred resource is classified according to the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) code and has been mapped accordingly. The Abenab Vanadium Project is classed as E2c, F2.1, G3. Project classification at the date of evaluation (2022) is a “potentially viable project with pending development”.

Berg Aukas

Berg Aukas is an abandoned base metal mine that began producing eluvial vanadium ores from small opencast workings in 1925 but ceased operations in 1928 after reaching groundwater level. Between 1958 and 1978, an estimated 2.3 million tonnes of ore at an average grade of 15% zinc, 3.9% lead and 0.85% vanadium was produced from the mine. The mine has a high level of geological confidence based on a 2014 CRIRSCO indicated mineral resource estimate of 1.23 million tonnes at 15.47% zinc, 3.84% lead and 0.33% vanadium oxide and a probable reserve estimate of 1.7 million tonnes at 11.16% zinc, 2.76% lead and 0.23% vanadium oxide. The project is classed as not socially and environmentally viable because there is no prospective plan to restore the contaminated environment to a viable aspect and there is insufficient information to determine the social viability of the project. Using the bridging document, the project is classed as E2, F2, G2.

Oamites Mine

Operations at the Oamites copper mine ceased in 1984 due to exhaustion of the ore reserve. The site is characterised by two huge tailings dumps with a volume of approximately 5.5 million tonnes. It is believed that there is economic copper unrecovered in the tailings. However, the economic potential of the tailings and the unmined Western section of the Oamites orebody has not yet been investigated. Oamites tailings and ore deposits are not environmentally, socially and economically viable due to respiratory health hazard recorded among members of the National Defence Force residing at the mine, economic uncertainties of the remaining ore deposit and suitable methods to extract ore from tailings. The degree of confidence in the geological knowledge and mineral resources of the Oamites abandoned

⁴ Hahn, L., Solesbury, F. and Mwiya, S. (2004). Assessment of potential environmental impacts and rehabilitation of abandoned mine sites in Namibia. *Communications of the Geological Survey of Namibia*, 13, 85–92.

mine is low, so further exploration is necessary. The mine is classed as E3.2, F4.1, G4.1, representing an exploration project that is non-active at the date of evaluation.

CONCLUSION

The AMREC provides an efficient approach to systematically evaluating and classifying the selected abandoned mines using the information and data from various published and unpublished reports in the public and private domain. However, data gaps – particularly in terms of environmental and socio-economic impact studies – complicate the classification decision-making. Limitations to the application of AMREC include data gaps and the lack of harmonisation of datasets from different sources. Nevertheless, the application of AMREC has the potential to provide insight to various stakeholders, leading to a sustainable approach to mineral resource management and extraction.



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Mary Barton is a Namibian based Geoscience Consultant at Odikwa Investments CC. She has more than 10 years' experience in the mining industry with combined experience from both the regulatory and the commercial side. Her interests include exploration; geological modelling; mineral ore systems; financial and risk analysis of mineral projects; and mineral revenue management. Mary is the African Regional Councilor for the International Association on the Genesis of Ore Deposits and is registered with the South African Council for Natural Science Professionals and the Geological Society of South Africa.

