



Horizon Europe Framework Programme (HORIZON)

D9.3 – MOZAMBIQUE case study

WP9 - Task 9.4

Date [22/12/2023]

Patrícia Represas¹, Cátia Prazeres, Maria João Batista, Pedro Gonçalves, Carla Fortes

¹LNEG



Funded by
the European Union

Disclaimer

The content of this deliverable reflects only the author's view. The European Commission is not responsible for any use that may be made of the information it contains.

Document information

Grant Agreement / Proposal ID	101057832
Project Title	EU-Africa Partnership on Raw Material Value chains
Project Acronym	AfricaMaVal
Project Coordinator	Guillaneau Jean-Claude (jc.guillaneau@brgm.fr) - BRGM
Project starting date (duration)	1st June 2022 (42 months)
Related Work Package	WP9
Related Task(s)	Task 9.4
Lead Organisation	BRGM
Contributing Partner(s)	LNEG
Due Date	January 2024
Submission Date	January 2024
Dissemination level	

History

Date	Version	Submitted by	Reviewed by	Comments
07/12/2023	Draft	LNEG – M.J. Batista	BRGM – C. Zammit	Typos, structure & content to review
18/12/2023	V1	LNEG – M.J. Batista	BRGM – C. Zammit	Main processing units table + Prospectivity mapping
21/12/2023	V2	LNEG – M.J. Batista	BRGM – C. Zammit	WP3 content + Project opportunities
22/12/2023	FINAL	LNEG – M.J. Batista	BRGM – C. Zammit	Final Introduction – Conclusion
08/01/2024	FINAL	BRGM – C. Zammit	BRGM. J. Melleton	



Table of Contents

1. Extended Critical Raw Materials (ECRM) supply potential of Mozambique	9
1.1. Inventory of the ECRM	9
1.1.1. Geological setting.....	9
1.1.2. Known ore deposits and occurrences	10
1.2. Prospectivity and mineral high potential mapping	11
1.2.1. Selection of the ECRM for mineral prospectivity	11
1.2.2. Mineral high potential areas	12
1.3 Ore processing and refining capacities.....	15
2. Assessment of the ECRM value chain	17
2.1. Characterisation of the value chain for primary and secondary raw materials	17
2.1.1. List of the mining and recycling projects.....	17
2.1.2. Existing ESG indicators.....	18
2.1.3. Status of economic links between the formal and informal sectors.....	19
2.2. Identification of the bottlenecks along the value chain	19
3. Investment/financing prospects for ECRM projects in the Mozambique.....	22
3.1. Fiscal, legislative and regulatory context for in-country financings	22
3.2 Macroeconomic context for in-country financings	25
3.3 Political context for in-country financings.....	31
4. Assessment of social, environmental, and governance challenges	36
4.1. Country-level assessment and context.....	36
4.1.1. Context	36
4.1.2. Mineral and Mining Policies	37
4.1.3. Mining Regulations	37
4.1.4. Taxation and Royalties	39
4.1.5. Environment.....	39
4.1.6. Social.....	40



4.2. Assessment of the Mozambican Mining Regime with Respect to ESG objectives	41
5. Business network between the European Union and Mozambique	42
5.1. Assessment of the upstream and downstream business ecosystem	42
5.1.1. Context, formal and informal players	42
5.1.2. Relationships at local or regional levels	42
5.2. Building new B2B relations	44
5.3. Promoting local content and enabling mining cluster actors	44
5.3.1. Relevant institutions for the development of a Mozambique-focused critical minerals network	44
5.3.2. Academic institutions and other training establishments in the field of geosciences and mining	45
6. Energy and digital transition: develop a strategy for the EU and Africa Partnership	47
7. Opportunities for responsible investments	49
7.1. Identification of individual exploration, mining and refining projects	49
7.2. ASM sector country profiles	50
Country profiles on ASM sector developments and investment	50
Conclusion	51
References	52

List of Figures

Figure 1: Mineral occurrences in Mozambique overlaying simplified map of geological ages (source SIGAfrique)	11
Figure 2: Worldwide Governance Indicators (WGI) of Mozambique and Sub-Saharan Africa countries (data from World Bank)	20
Figure 3: Logistics Performance Index (LPI) score for Mozambique and Sub-Saharan Africa countries (data from World Bank)	20
Figure 4: Mozambique and Sub-Saharan Africa countries scores for the six key dimensions of LPI (data from World Bank)	21
Figure 5: Mozambique results from the 2022 Fraser Institute Annual Survey of Mining Companies	21



Figure 6: Mozambique - Historical GDP per capita from 2011 to 2021 & projected estimations from 2022 to 2030.....	26
Figure 7: Mozambique - Historical and projected nominal GDP and real GDP (Sources: S&P)	26
Figure 8: Mozambique - Historical and projected real GDP growth (Sources: S&P).....	26
Figure 9: Mozambique - Distribution of GDP across economic sectors from 2011 to 2021 [%] ...	27
Figure 10: Mozambique - Foreign direct investment net, net inflows, net outflows from 2013 to 2022.....	28
Figure 11: Mozambique - Historical official exchange rate (Metical per US\$, period average) (Source: World Data Bank)	29
Figure 12: Mozambique - Historical and projected data on inflation indicators (S&P Global, 2022)	29
Figure 13: Mozambique - Historical and projected data public debt and debt/GDP (S&P Global, 2022).....	30
Figure 14: Mozambique - Historical and projected data on public debt interest payment (S&P Global, 2022)	30

List of Tables

Table 1: Criteria allowing the assessment of DBA-RF modelling	12
Table 2: List of the main processing units.....	16
Table 3: A list of the major ECRM Mining projects in Mozambique.....	17
Table 4: The various license types available for the mining sector of Mozambique.....	38
Table 5: Projects selected to be presented as fact sheets in WP7	49



Abbreviations and Acronyms

Acronym	Description
AfCFTA	African Continental Free Trade Area
ASM	Artisanal and Small-Scale Mining
AU	African Union
CACM	Centre for Arbitration, Conciliation and Mediation
CIT	corporate income tax
DBA	Disc-based association
DNGM	National Directorate of Geology and Mines
DTT	Double Tax Treaties
ECRM	Extended Critical Raw Materials
EPA	Economic Partnership Agreement
ESG	Environmental, social and governance
FDI	Foreign Direct Investment
GDP	Gross domestic product
ICSID	International Centre for Settlement of Investment Disputes ()
INAMI	Mozambican mining sector are: National Institute of Mines
INSS	Social Security Institute
IPM	Mining Production Tax Imposto sobre a Produção Mineira
IRRM	Resource Rent Tax
ISS	Surface Tax

LNG	Liquified Natural Gas
Ministry of Mineral Resources and Energy	MIREME
MPM	Mineral Prospectivity Mapping
MZN	Mozambican metical
OHADA	Organization for the Harmonization of Business Law in Africa
RF	Random Forest
SADC	Southern African Development Community
VAT	Value added tax
WHT	withholding tax
WP	Work Package

Wording

Mineral prospectivity: “Mineral potential mapping is concerned with quantifying and mapping the likelihood that mineral deposits are present in a study area. It is synonymous to mineral prospectivity mapping, which is concerned with quantifying and mapping the likelihood that mineral deposits may be found by exploration in a study area.”

Keywords

ECRM, Mineral potential, Ore processing, Refining capacities, Recycling units, Value chain, Primary raw material, Secondary raw material, Bottlenecks, Finance, Investment, Sustainability, ESG, Land-use, Taxation, Mining regulation, Mining policies, Child labour, Responsible extraction, Mozambique, Pan-African

Executive Summary

This report provides an overview of the key aspects regarding mineral resources, supporting regulations and institutions, as well as any related provisions in the prospecting of Extended-Critical Raw Materials (ECRMs) in Mozambique. The report is an integral part of the larger AfricaMaVal programme project and, in that context, provides this country overview specifically aimed at European Union (EU) investors and decision-makers.

Mozambique is endowed in various raw materials, with an enormous number of small occurrences identified, including ECRM. The focus of this report is the most promising ECRMs, including beryllium, coking coal, copper, natural graphite, rare earth elements and titanium. Other raw materials as bauxite, lithium, niobium, tantalum and phosphate are also considered. This report gives an overview of the geological settings that favour the presence of the considered ECRM in Mozambique. The predictability mapping allows to visualize the major potential area or trends for each ECRM.

The potentialities of the value chains are shown, as well as insights into the regulations for financing, including taxation and royalties and give an overview about the macroeconomic context of Mozambique.

The assessment will also include value chain for these critical minerals therefore activities such as exploration, extraction, processing, and recycling will be evaluated. Fiscal regulation as well as the macroeconomic and political context will be scanned to give an overview of the country regime. ESG regulations and challenges will be depicted for the investors to better understand the background and questions to address when it comes to launch activities on the ground. A list of downstream to upstream actors related to the mining sector will assist deciders to build their Business-to-Business network. This country profile will try to address the needs of the EU green deal according to the country strategies and planification.



1. Extended Critical Raw Materials (ECRM) supply potential of Mozambique

1.1. Inventory of the ECRM

1.1.1. Geological setting

Mozambique is characterized by main geological differences between north and south. The northern part of the country comprises the older, crystalline rocks, mainly proterozoic, whilst the southern part is entirely phanerozoic, with the central region hosting archaic, proterozoic and phanerozoic terrains.

The crystalline basement of Mozambique shows three major tectonic blocks, East, West and South Gondwana, that are the result of collision and amalgamation of the different Gondwana blocks, during the Pan-African orogeny. The East and West blocks are separated from the South block by the Lúrio Belt and by the Sanângoè Shear Zone, respectively. The crystalline basement comprises a heterogeneous assemblage of paragneisses, granulites, migmatites, orthogneisses and often metamorphic igneous rocks (Koistinen et al, 2008).

The Archaean terrane comprise the eastern and northeastern part of the Zimbabwe craton, occupying a zone a few tens of kilometers wide and c. 300 km long next to the state boundary between Zimbabwe and aging > 2500 Ma (Vasconcelos, 2014). In addition to dominant TTG gneiss lithology, the Archaean in Mozambique contains the eastern extensions of the Odzi-Mutare-Manica Greenstone Belt around Manica and the Cronley-Munhinga Greenstone Belt c. 50 km south of Manica (Koistinen et al, 2008).

Paleoproterozoic units are spread in three regions; Manica, along the border with Zimbabwe around archaic units; Tete region; and by the Lake Niassa. Mesoproterozoic intrusive and supracrustal units compose most of the northern region and a large extension of the central part of the country. A Mesoproterozoic gabbro-anorthosite body occupies an extensive area around and north of the city of Tete (Vasconcelos, 2014). As for Neoproterozoic units, they also occur in all the northern region, although not outcropping as much. They comprise supracrustal groups and the Ocuá allochthonous complex of the Lúrio Belt.

The phanerozoic terrains correspond to the Karoo Supergroup and the East African Rift System. The Karoo Supergroup is divided into Lower Karoo (sedimentary) and Upper Karoo (Sedimentary and igneous) and goes from Upper Carboniferous to Jurassic. It deposited in deep intracratonic tectonic depressions (Vasconcelos, 2014). From the Jurassic it starts the opening of the Indian Ocean, together with the break-up of Gondwana lead to the opening of two major sedimentary basins, the Mozambique Basin and the Rovuma Basin.

The Lower Karoo Group consists of a thick sequence of sandstones and argillites with coal seams close to the base. Bimodal lava flows principally comprise the Upper Karoo Group. The Cretaceous volcano-sedimentary Lupata Group, terrestrial Sena Formation, carbonatites and associated alkaline rocks generally top the Karoo grabens. The East Africa Rift Sequence, initiated from Tertiary continental clastic



formations and followed by Neogene volcanic events, forms the youngest cover together with colluvial and alluvial deposits of the Quaternary (Pekkala et al, 2008).

1.1.2. Known ore deposits and occurrences

Among the 34 raw materials assessed as ECRM by the EU in the new list of 2023, 22 ECRMs have been identified to varying degrees in Mozambique. Those will be briefly described below, associated **with active mines**:

Coking Coal – Two active mines are described, while 38 deposits are identified.

Rare Earth Elements, Niobium, Beryllium, Lithium, Tantalum, Tin, Bismuth - REE, Nb, Be, Li, Ta, Sn, Bi, Sr – This group of elements are related to pegmatitic contexts in Mozambique. Some pegmatite fields are actively mined presently, with a special focus in the Alto Lingonha pegmatite field.

Rare Earth Elements - There is also an association to carbonatites and alkaline rocks, and, to a smaller degree, to alluvial placers deposits.

Copper (Cu) – Two active mines (Mundongwara and Cacanga), related to gold mineralization, and 85 occurrences are known.

Titanium (Ti) – A large amount of small alluvial Ti occurrences exist in Mozambique. There is a mine operating in Moma, and circa 124 mineralizations are identified hosting Ti as the main raw material of interest, but dozens of other deposits exist that contain Ti as possible coproducts, mostly associated with other heavy minerals in alluvial contexts, or in iron deposits.

Bauxite – Bauxite is mined from one deposit, although it is identified in 12 other occurrences in the country.

Natural Graphite – Graphite is mined in the Cabo Delgado Province. There are also 33 deposits, and 36 occurrences are identified in Mozambique, all in the northern part of the country.

Other ECRM occurrences with no evidence of past and current mining activities:

Phosphate Rock (P) – 17 deposits are described within different environments, however with little information associated. Additionally, 5 occurrences have been identified.

Fluorspar (Fl) – 11 deposits are known, mainly in veins or associated with carbonatitic rocks, and additionally 9 vein occurrences are identified in the country.

Silicon (Si) – Silicon deposits are identified in pegmatitic contexts. There are 8 such deposits recognized, having the above mentioned pegmatitic raw materials as secondary products. Nevertheless, there is one deposit related to gold deposits and one occurrence of unknown origin.

Cobalt (Co) – Cobalt occurs in 4 deposits from different contexts, mainly in association with other metals, and in 5 occurrences.

Vanadium (V) – Vanadium is a promising raw material in Mozambique. It occurs in 6 deposits, associated whether to iron/titanium or to graphite, and in 4 occurrences, associated to base metals.



Manganese (Mn) – 4 deposits are known in sedimentary contexts and 4 occurrences are identified without further information.

Magnesium – (Mg) -Magnesium is pointed in 3 deposits in mafic contexts.

Platinum (Pt) – Platinum was described in 2 deposits and 2 occurrences.

Baryte – There are 2 baryte deposits described in Proterozoic rocks in Mozambique.

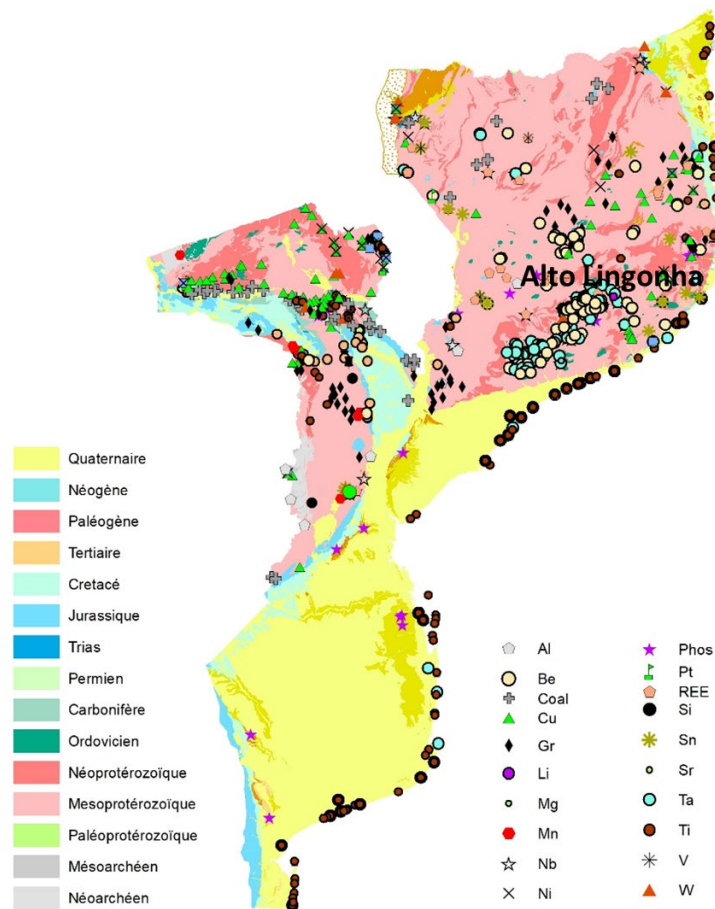


Figure 1: Mineral occurrences in Mozambique overlaying simplified map of geological ages (source SIGAfrrique).

1.2. Prospectivity and mineral high potential mapping

1.2.1. Selection of the ECRM for mineral prospectivity

Among the ECRMs present in Mozambique, 6 ECRMs were selected for mineral prospectivity mapping (MPM): **beryllium, coking coal, copper, natural graphite, rare earth elements, titanium** and 5 others were chosen as optional elements: **bauxite, lithium, niobium, tantalum** and **phosphate**.

The choice of these commodities was constrained by the dataset used, as it needs at the very least more than 10 occurrences for a given ECRM to perform a correct prediction. The MPM was performed using the Disc-based association (DBA) grid method coupled to Random Forest (RF) method (see Vella, 2022). This method focusses on the local spatial associations of geological variables and features of various natures to describe the relationships between the predictors and the mineralization. This allows the identification of geological environments in the study area around each node of the DBA grid, and the integration of both quantitative and non-quantitative spatial data, such as geophysical anomaly maps and location of geological map units, respectively. Then, RF classification is used here to perform a generalization of complex geological environments and features and evaluate their likelihood to host potential mineralization occurrences by giving a score comprised between 0 (low potential) and 1 (high potential).

In Mozambique, the data used for MPM are:

- SIGAfrigue Geological maps at 1:2,000,000 scale
- SIGAfrigue mining database.

The DBA grid for predictive modelling is mainly defined by **five parameters**:

- Size of cell – d ;
- Search radius for lithologies – R ;
- R/d ratio,
- Search radius for mineral occurrences – R_1 . It can be null, in this case the search radius will be restricted to the cell size (d)
- Search radius for faults – R_2 . It can be null, in this case the search radius will be restricted to the cell size (d) or it can take into account the cumulative length of faults present in the cell size (d).

In order to maximize the grid resolution while minimizing overlaps and cells with only on lithology, the parameters of DBA grid for all the commodities used in this study are as follows: $d = 5000$ m, $R = 10000$ m, $R/d = 2$, $R_1 = 5000$ m, $R_2 = 5000$.

1.2.2. Mineral high potential areas

Mineral high potential areas were highlighted for the four studied ECRMs in Mozambique. The criteria allowing the assessment of DBA-RF modelling can be found in the table below. All the favorability maps can be found in the **Appendix_1.2_MPM_MOZAMBIQUE**.

Table 1: Criteria allowing the assessment of DBA-RF modelling

Mozambique	TN	FN	FP	TP	TPR	FPR	PPA (%)	Precision (%)	Accuracy (%)	J-score	Threshold
Natural graphite	30975	7	1429	190	0.964467	0.0440995	4.96611	11.7	95.6	0.92	0.433
REE	29922	16	2461	202	0.9266055	0.0759967	8.16846	7.6	92.4	0.855	0.399
Titanium	29869	9	2437	286	0.9694915	0.0754349	8.3525	10.5	92.5	0.894	0.425
Copper	30799	4	1545	253	0.9844358	0.0477677	5.51517	14.1	95.2	0.94	0.476
Coking coal	31376	1	1108	116	0.991453	0.0341091	3.75449	9.5	96.6	0.983	0.399
Beryllium	30915	5	1349	332	0.9851632	0.0418113	5.15628	19.8	95.8	0.946	0.444
Phosphate	32103	1	430	67	0.9852941	0.0132173	1.52449	13.5	98.7	0.987	0.502
Niobium	31678	4	747	175	0.9776536	0.0230378	2.82787	19	97.7	0.971	0.431

Lithium	31563	2	862	174	0.9886364	0.0265844	3.17782	16.8	97.3	0.968	0.399
Bauxite (Al)	32398	1	167	35	0.9722222	0.0051282	0.61961	17.3	99.5	0.967	0.532
Tantalum	31585	1	804	211	0.995283	0.0248232	3.1134	20.8	97.5	0.975	0.495

Notes: True Positive (TP) and True Negative (TN) correspond to the number of grid cells which are correctly predicted by the RF model (i.e. mineralized and non-mineralized cells, respectively). Inversely, False Positive (FP) and False Negative (FN) correspond to the number of grid cells which are incorrectly predicted by the RF model (i.e. mineralized instead of non-mineralized cells and non-mineralized instead of mineralized cells, respectively). **FP could correspond to mineral high potential areas.** True positive rate (TPR), also called “Recall”, correspond to $TP/(TP+FN)$, False positive rate (FPR) correspond to $FP/(FP+TN)$, Percentage of prospective area (PPA) correspond to $(TP+FP)/All$, Precision correspond to $TP/(TP+FP)$, Accuracy correspond to $(TP+TN)/All$ and J-score correspond to $TPR - FPR$.

Natural Graphite

Graphite in Mozambique occurs exclusively in the northern part of the country. All the major graphite-bearing areas occur in high-grades metamorphic zone, metasedimentary contexts, or contact metamorphism zones, although epigenetic occurrences may occasionally be found (Lächelt, 2004). The main occurrences are the Angónia area (Angónia Group), that holds several occurrences, the Monapo Klippe structure, the Ancuabe deposit (Chiquita Group of the Chiúre Supergroup), the occurrences associated to the Lúrio Belt (in the Mirrote Group of the Lúrio Supergroup) and the Morrola structure (also in the Mirrote Group of the Lúrio Supergroup).

REE

Rare Earth Elements in Mozambique are predominantly associated with pegmatites and to a lesser degree to alkaline ring intrusions, carbonatites or placers (Lächelt, 2004). In the Alto Lingonha field, for example, although the REE-bearing pegmatites may coexist with the other types of pegmatites, they tend to follow characteristic trends and mineralogy associated with radioactive minerals. All rare-earth pegmatites belong to the group of unzoned pegmatites (Lächelt, 2004).

Nepheline syenites and carbonatites in Mozambique are known for hosting REE-bearing minerals and /or Nb/Ta-bearing minerals. It is the case of Chirua Alkaline Province and the Cone Negose, Mount Muambe and Xiluvo carbonatites. As for REE-bearing minerals found as placers, there is potential for monazite concentration along the coastline of the Zambezia and Nampula provinces (Lächelt, 2004).

In Metarica and Marrupa (NYF type – Nb, Y, F), some pegmatites have REE contents. The same happens in the Marirongoé pegmatite field, with both REE-bearing minerals and beryl (Marques, 2011). Other fields where it also occurs are the Inchope-Doerói aplite-pegmatite field and other in the Candica and Guro District.

Titanium

Titanium in Mozambique occurs mainly in association to Iron, in the mesoproterozoic anorthosites, in the archaic banded iron formations in Manica, or in costal deposits of heavy sands, as placer deposits, widespread in the Quaternary sands in the country. For the latter case, the most important deposits are Topuito in the north and Chibuto in the south (Vasconcelos, 2014). Enrichments of the heavy minerals, ilmenite, rutile and zircon are found all along the coast in both aeolian and beach sand, although more frequently in the vicinity of the major rivers. Sediments result from weathering and dismantling of Precambrian igneous and metamorphic rocks from the Mozambique Pan-African mobile belt.

Copper

In Mozambique, the main copper deposit is situated in Mundongwara mine, Manica. Hydrothermal, hydrothermal–metamorphic, hydrothermal–volcanic mineralization are associated with greenstones of the Manica Group. Other important occurrences are Fíngoè and Chíduè (paleo-mesoproterozoic) (Lächelt, 2004). Nevertheless, copper appears as a by-product in other occurrences namely iron occurrences.

Coal

Mozambique hosts coal deposits in the Moatize basin and in the Mucanha-Vúzi basin in the Tete region. This is one of the world's largest unexplored coal provinces. There is also potential in the areas of Sanangoe-Mefideze, Baixo Chire and Maniamba basins between Moatize and the Malawi border, as well as the Espungabera sub-basin, near the Zimbabwean border, along the M'Pote River (Lehto and Gonçalves, 2008).

The Moatize basin comprises sediments of the Ecca group within the Karoo Supergroup units. The coal-bearing Moatize Formation and the overlying Matinde Formation were deposited during Permian as part of the Lower Karoo sedimentary history. The productive series in the Moatize basin is thought to have six main coal layers. The deposit is overlaid by Quaternary alluvial deposits, gravel and sand, along the Zambeze and Rovuboe rivers, with a thickness that goes up to 50m.

The Karoo sedimentary sequence in the Espungabera sub-basin is superposed on the northern marginal zone of the Limpopo mobile belt. The productive series occurs near the surface, but block faulting is common, making the resource evaluation without geophysics and drilling quite unreliable. In addition, the location of the Espungabera coalfields is very remote, far from potential industrial users in Mozambique (Lehto and Gonçalves, 2008).

Beryllium

Beryllium is found as precious stone (beryl ?), in pegmatitic veins, and as so, it occurs in association to albite, columbo-tantalite, and Li-bearing minerals. It can be found in the various types of pegmatites.

Pegmatites in Mozambique occur mainly in the north and northeast of the country in the Zambézia and Nampula provinces, commonly intruded in Proterozoic rocks. Authors usually distinguish pegmatites between chemically and mineralogically homogeneous or zoned. The main deposit is the Alto Lingonha pegmatite field, that extends for 170 Km (Marques, 1989), in a wide range of widths. In Alto Lingonha, pegmatites are LCT type (Li, Cs, ta) with extensive hydrothermal substitution (Marques, 2017). The pegmatites occur as dispersed dykes that can present smaller apical extensions emanating from pegmatitic masses of large dimensions. Some pegmatites that occur in Mueda (Cabo Delgado).

Bauxite (secondary)

Four bauxite ore types are described in Mozambique: white saprolitic bauxite, light brown saprolitic bauxite, brown ferruginous, saprolitic bauxite and white kaolinitic clay with concretionary white bauxite. In Mozambique bauxite occurs in the mount Snuta in the Serra de Moriangane, in Serra Vumba, in Chimanimani-Rotanda, Serra Saira (Zuira) and around Catandica in Manica Province (Lächelt, 2004). The Moriangane deposit is the most important in the country. The bauxite in this area overlies a hornblende syenite intrusion and is made up by a few lenticular bodies with limited lateral extent that are up to 20m thick (Callaghan 2002a).

In the Zambezi Corridor, bauxite occurs at Mount Salambidua in the Tete Province, and Mount Maúzo, Mount Derre and others in the Zambézia Province. The nepheline syenite intrusions here may be capped with bauxite and of these Mount Maúzo represents the best known deposit (Lächelt, 2004).

Lithium, Niobium, Tantalum (secondary)

As these substances commonly share the same enrichment context, they were investigated individually, but also grouped as a whole. They are hosted by pegmatites, which can also contain REE minerals, micas, tungsten, or beryllium, as stated before. Granitic pegmatites are found in several complexes in Mozambique, but are most common within the Marrupa, Lalamo and Nampula Complexes. Pegmatites in the two former complexes are located within felsic orthogneisses, whereas pegmatites in the easternmost part of the area are hosted in metasupracrustal rocks in the Nampula Complex (Bingen et al, 2007).



Tantalum and Niobium minerals are known to occur in the Alto Lingonha pegmatites. Columbite, tantalite and columbite-group minerals are described. Lithium ore is well studied in those pegmatites, some with economic studies.

Phosphate (secondary)

As for phosphate raw materials, only some guano was recovered from caves of Tertiary limestones in the Inhambane Province, or sedimentary occurrences in Cretaceous and Tertiary sediments of the Mozambique and Rovuna Basins (Lächelt, 2004). However, several phosphate deposits and apatite occur, whether associated to metasomatic mineralizations, alkaline intrusions and carbonatites (eg. Cone Negose, Mont Muambe), or pegmatites (eg. Monte Fema) (Callaghan, 2002). Although phosphates are studied in some deposits because of their role as penalizing, they also show potential to be used directly or mildly processed locally for agricultural uses.

1.3 Ore processing and refining capacities

Regarding ore processing facilities, Mozambique has several facilities for substances on the ECRM list, specifically graphite, aluminum, and coal processing (Plaza-Toledo, 2018). Graphite, a major asset for Mozambique, is processed in Cabo Delgado province in the north. Additionally, there is another processing plant under construction in Niassa province. Aluminum is processed from bauxite in a facility located in Vila de Manica (Plaza-Toledo, 2018), and there is also a processing facility near Maputo. Coal processing takes place in Moatize, Tete province, where various types of coal are separated.

The mineral industry in Mozambique presents a diverse and substantial capacity across various critical raw materials, highlighting its crucial position in the global supply chain. The country's mineral landscape encompasses aluminum production powered by bauxite, significant coal mining operations, and the extraction of precious gemstones and graphite. This landscape showcases established operations alongside potential areas for growth.

Bauxite Extraction and Refinement

Bauxite production has exhibited noticeable fluctuations over recent years from 1451 mt in 2016 to 5000 mt in 2018. The major operating company, Mina Alumina Lda., which operates in Vila de Manica and possesses an annual capacity estimated as 12,000 metric tons, indicating potential for higher production. This vital resource is fundamental to aluminum production and export.

Aluminum Production

Mozambique Aluminum SARL, owned by South32 Ltd., Mitsubishi Corp., Industrial Development Corp. of South Africa Ltd., and the Mozambique Government, operates the Mozal smelter in Beluluane, boasting an annual capacity of 561,000 metric tons. This facility plays a pivotal role in aluminum production, utilizing bauxite as a key input.



Tantalum and Niobium

Tantalum production totals approximately 22 000 mt/y, while Niobium production stands at roughly 4 000 mt/year. Noventa Ltd. is the main contributor to production through its mine at Marropino, alongside several artisanal miners at Muiane.

Graphite

Graphite production in Mozambique has shown substantial growth, transitioning from no reported production in 2016 to a noteworthy figure of 106,773 mt in 2018. This significant increase illustrates the emerging presence and potential of the graphite mining industry within the country. The GK Ancuabe Graphite Mine SA and Syrah Resources Ltd. are notable contributors to this expanding sector, with GK Ancuabe Graphite Mine SA operating in Ancuabe and Syrah Resources Ltd. managing the Balama graphite operation in Cabo Delgado Province.

Coal Mining and Production:

Vale Moçambique, International Coal Ventures Private Ltd., Jindal Steel & Power Ltd., and Beacon Hill Resources plc are major players in coal mining across various locations, contributing to an annual capacity of millions of metric tons. The Moatize Mine in Tete Province, specifically, achieved an annual capacity of 22,000,000 metric tons, significantly bolstering the country's coal output.

Potential Challenges in ECRM Utilization

Despite its abundant reserves of ECRM minerals, Mozambique faces challenges in optimizing extraction, refining, and exportation. Infrastructural limitations, technological advancements, and sustainable mining practices remain focal areas for development.

Table 2: List of the main processing units

Name processing entity	Processing Facility	Status	ECRM	Owner	Operator	Products	Capacity
Balama Graphite Operation	Plant	Active	Natural graphite, Vanadium Lanthanides	Syrah Resources Ltd Mozambique	Syrah Resources Ltd.	Graphite concentrate	350 mt/y
Benga-Moatize Magnetite Processing Plant	Plant	Active	Coking coal	International Coal Ventures Private Ltd Tata Steel Ltd. (35%)	International Coal Ventures Private Ltd.	Metallurgical and thermal coal	75 mt/y
Chirodzi Coal Mine	Plant	Active	Coking coal	Jindal Steel & Power Ltd.	Jindal Steel & Power Ltd.	Metallurgical and thermal coal	2500 mt/y
Moatize Coal Mine	Plant	Active	Coking coal	Vulcan Minerals Inc. Mozambique	Vulcan Minerals Inc.	Metallurgical and thermal coal	22000 mt/y
Moma Mineral Sands Mine	Plant	Active	Lanthanides	Kenmare Resources plc	Kenmare Resources plc	Heavy Mineral Concentrate	1200 mt/y

Mozal Smelter	Smelter	Active	Bauxite	South32 Ltd The Industrial Development Corporation of South Africa Ltd Mitsubishi Corp. Mozambique	South32 Ltd.	Aluminum	585 mt/y
Muiane Mineral Sands Mine	Plant	Temporarily On Hold	Tantalum Lithium	Novak Holdings Ltd	Novak Holdings Ltd.	Concentrate	456 mt/y

2. Assessment of the ECRM value chain

2.1. Characterisation of the value chain for primary and secondary raw materials

Mozambique's industrial sector, led by Mozal's aluminum production, is relatively weak, while the extractive industries hold historical significance. These extractive sectors, including coal, base metals, petroleum, natural gas, and minerals, made up 68.3% of the country's industrial output in 2019. Despite contributing 6% to total tax revenue in 2019, the mining sector faces infrastructure challenges, a hurdle the government aims to address through initiatives like the Nacala Corridor Railway project to stimulate investment and enhance GDP growth.

2.1.1. List of the mining and recycling projects

MOZAL, an aluminium smelter in Mozambique, signifies the area's industrial revival, driven by substantial foreign investment and operated by South32. This pivotal venture, a partnership between the government and foreign investors, underscores the versatile applications of aluminium in construction, transportation, and electronics, portraying it as a pivotal component for future industries.

In parallel, the Monte Muambe Rare Earth Elements (REE) Project displays promising potential in critical minerals. Altona's commitment to exploration, aiming to secure 70% ownership, highlights its focus on high-grade zones for open-pit mining. The project emphasizes the significance of neodymium and praseodymium oxides for renewable energy technology. With plans for an 18-year operation involving advanced recovery methods, the project anticipates contributing to the global rare earth elements market, underscoring Mozambique's potential in this sector.

The following is a list of ECRM mining and processing projects of interest operating in Mozambique.

Table 3: A list of the major ECRM Mining projects in Mozambique

Project name	ECRM	Owner(s)	Operator	Development stage	Activity status	Reserves
Moma	Lanthanides Titanium	Kenmare Resources plc	Kenmare Resources plc	Operating	Active	8 806 Mt



Mutamba	Titanium	Rio Tinto Group	Rio Tinto Group	Prefeas/Scoping	Active	4 345 Mt
Corridor	Titanium	MRG Metals Ltd	MRG Metals Ltd	Prefeas/Scoping	Active	2 394 Mt
Balama	Natural graphite Vanadium	Triton Minerals Ltd	Triton Minerals Ltd	Feasibility Started	Active	1 563.1 Mt
Balama	Natural graphite Vanadium Copper Lanthanides	Syrah Resources Limited Mozambique	Syrah Resources Ltd	Operating	Active	1 035.7 Mt
Tete	Vanadium Manganese Titanium	Baobab Resources Plc International Finance Corporation	Baobab Resources Plc	Feasibility Started	Active	759 Mt
Moatize	Coking coal	Vulcan Minerals Inc. Mozambique	Vulcan Minerals Inc.	Operating	Active	716.5 Mt
Chirodzi	Coking coal	Jindal Steel & Power Ltd	Jindal Steel & Power Ltd	Operating	Active	700 Mt
Montepuez Central	Natural graphite Vanadium Copper	Tirupati Graphite plc	Tirupati Graphite plc	Construction Started	Active	158.2 Mt

2.1.2. Existing ESG indicators

ESG policies are incorporated in various scattered legal statutes. The Mining Law and the Mining Law Regulations enshrine certain industry-specific ESG principles, but there are no express ESG regulations for the mining sector.

The Environment-Mining activities are by nature subject to stringent environmental rules. In Mozambique, in addition to the general environmental laws and regulations, holders of mineral rights are also subject to industry-specific environmental regulations until mine closure and rehabilitation.

The government has approved the Regulation for Programs and Projects Inherent to the Reduction of Emissions from Deforestation and Forest Degradation Conservation and Increase of Carbon Reserves (REDD+), which aims to define sustainability rules in the reduction of greenhouse gas emissions.

The Sustainability: the general principle of worker protection, both in the sense of privacy and in the guarantees of protection required for specific works such as mining, is embodied in both general labor legislation and in the legislation governing mining labor relations. The scattered local content rules found in the Mining Law and the Mining Law Regulations also play a pivotal role in creating the best social practices for development of mining activities in the country to the benefit of local communities.

The Governance: companies operating in Mozambique are increasingly adopting anti-corruption measures within their organizations, through the implementation of procedures that aim to make employees aware of situations conducive to corruption and the associated risks. Investment from foreign investors subject to strict anti-bribery and anti-corruption laws (e.g., FCPA and UK Anti-Bribery Act) has also contributed to a marked increase in the implementation of high standards of control of corruption. It is also worth mentioning that Mozambique has recently made amendments to the country legislation on the prevention of money laundering and financing of terrorism.

2.1.3. Status of economic links between the formal and informal sectors

Based on the recent government census (2021), the ASM sector majorly contributes to the production of gold, construction materials (sand, stones, clay) and gemstones. In Zambezia, one of the northern regions of Mozambique, 14 artisanal mine sites producing tantalum were identified. Extraction of tantalum is associated with rudimentary methods, posing limitation to further advancing the potential of tantalum production. In 2021 official data registered trade of about 19500 kg of tantalum. Existing information and interviews with stakeholders suggest that production and trade of tantalum remain largely informal. Although the mining law foresees designation of areas dedicated to ASM production, challenges persist in the access to mining permits for ASM organisations, including delayed permitting processes and overlapping requests with existing, but dormant exploration permits.

A comprehensive overview on the ore deposits and production parameters of ECRMS currently recovered by artisanal and small-scale mining in Africa is already available as part of the deliverable 1.4. While a more detailed analysis of the ASM sector role in the production of ECRMs in Mozambique, including major challenges and investment opportunities on production, social, governance and environmental impacts and value chain, will be available as part of deliverable 7.2.

2.2. Identification of the bottlenecks along the value chain

The business environment in Mozambique presents significant challenges, as noted by the International Trade Administration. Despite potential for long-term investment, the stability created by the Central Bank's efforts and political commitments to attract large investments conflicts with a bureaucratic system unresponsive to private sector needs, particularly for smaller businesses. Companies consistently highlight the business environment and the scarcity of skilled labor as major hurdles in Mozambique. Moreover, a hierarchical decision-making approach further hampers market efficiency in the country.

According to the World Bank, the Worldwide Governance Indicators (WGI) for Mozambique reflect a deterioration in the control of corruption, government effectiveness, political stability and absence of violence, regulatory quality, rule of law, and voice and accountability (figure 2). However, there seems to be a slight improvement in the last years, but still with a lower performance than the overall of Sub-Saharan Africa countries.



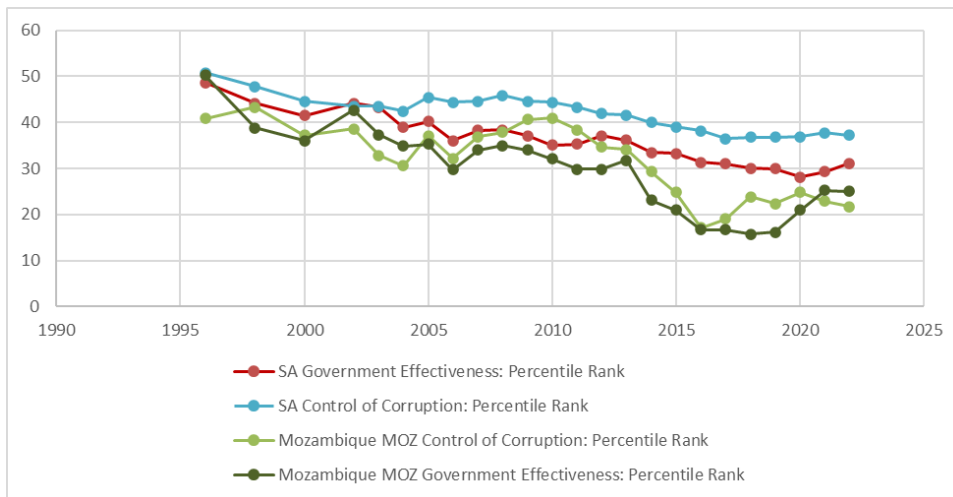


Figure 2: Worldwide Governance Indicators (WGI) of Mozambique and Sub-Saharan Africa countries (data from World Bank)

Overall Logistics Performance Index (LPI) score seems to have improved in the year 2016. However, there is no more recent information available. The increase in the global LPI score seems to be mainly due to an increase in the ease of arranging competitively priced shipments, which is even better than in the Sub-Saharan Africa countries group. The least favorable index refers to the quality of trade and transport infrastructure, which does not show any evolution over time.

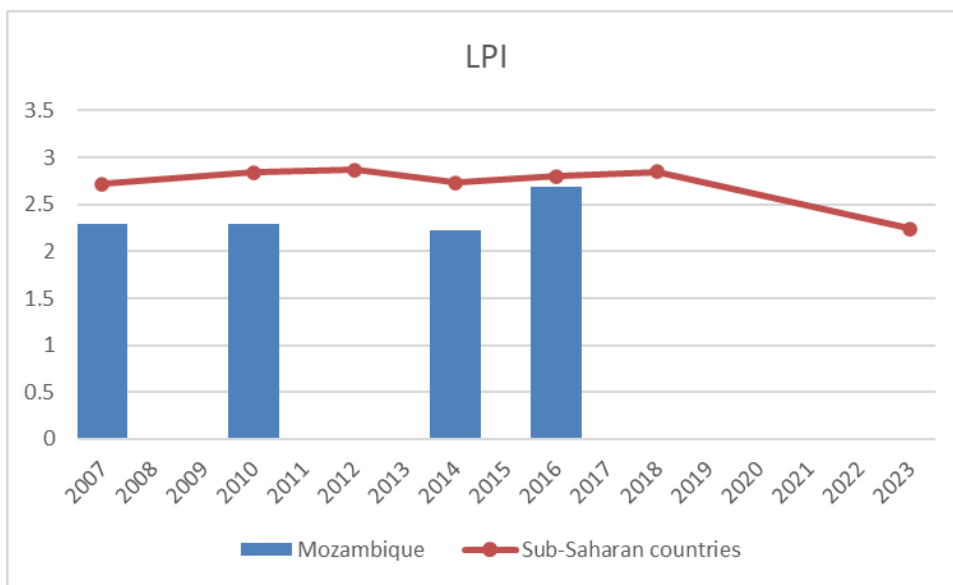


Figure 3: Logistics Performance Index (LPI) score for Mozambique and Sub-Saharan Africa countries (data from World Bank)

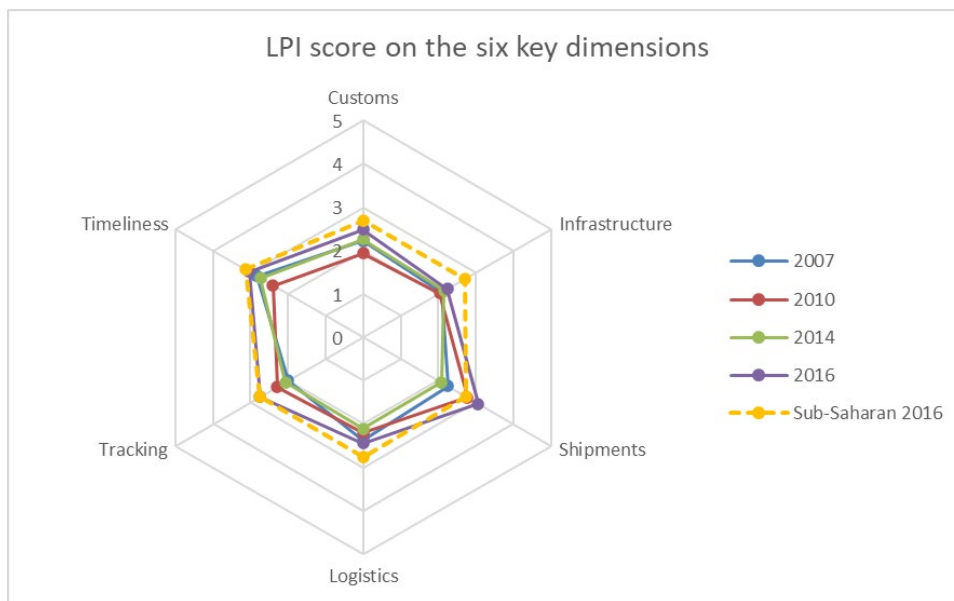


Figure 4: Mozambique and Sub-Saharan Africa countries scores for the six key dimensions of LPI (data from World Bank)

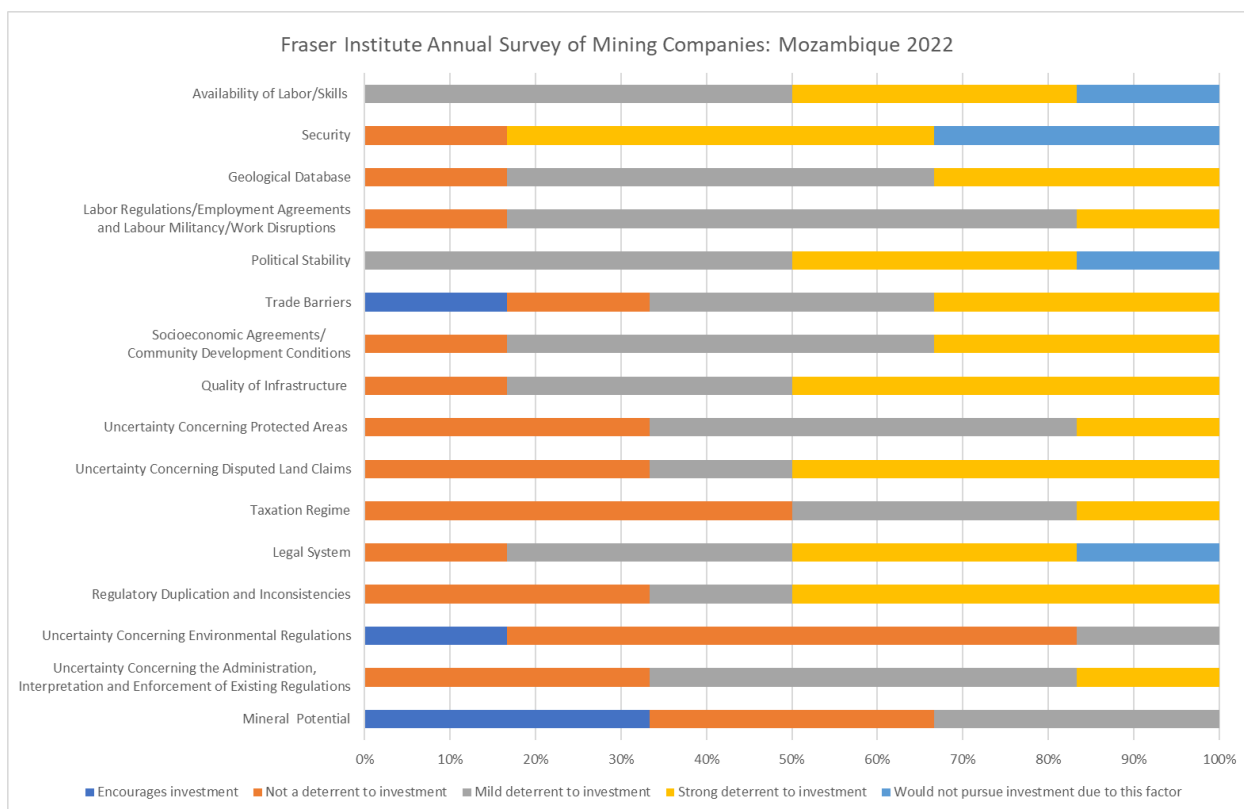


Figure 5: Mozambique results from the 2022 Fraser Institute Annual Survey of Mining Companies

The 2022 Fraser Institute Annual Survey of Mining Companies revealed Mozambique's limited capacity to attract investments. Among the 16 issues evaluated, only three—environmental regulations, mineral potential, and the taxation regime—garnered more than 50% in favor of investment. However, the

predominant concerns revolve around security, closely trailed by political instability and a scarcity of skilled labor. Labor regulations and infrastructure quality were also highlighted as significantly impeding investment, with more than 50% of respondents identifying these as deterrents.

The country's abundance of critical raw materials presents opportunities for industrialization and improving living standards. Partnerships with entities like the EU highlight the potential for clean energy production, utilizing Mozambique's graphite in the production of essential components for lithium-ion batteries. Despite having vast hydropower potential and plans for diverse energy sources, challenges like an underdeveloped power grid hinder rapid progress. The government aims for complete electrification by 2030 and has launched initiatives like PRONAI to modernize and boost competitiveness in various industries, emphasizing import substitution and public-private partnerships in industry-specific zones.

3. Investment/financing prospects for ECRM projects in the Mozambique

3.1. Fiscal, legislative and regulatory context for in-country financings

In Mozambique, the exercise of a commercial activity presupposes the incorporation of a company or the registration of a branch. As we will see later, in Mozambican law the consortium is not an autonomous entity, but only a contract.

The Commercial Code in Mozambique outlines specific business entity types, including limited liability general partnerships, private limited companies (Lda.), public limited companies (S.A.), and simplified joint stock companies. Moreover, Mozambique is not currently part of OHADA (Organization for the Harmonization of Business Law in Africa), which includes 17 member countries, and there is no indications suggesting Mozambique's imminent adherence to it.

Specific Tax on Mining Activity

In Mozambique, individuals and corporate entities involved in mining activities are subject to various specific taxes alongside the general taxes under the country's tax system. These specific taxes include the Mineral Production Tax (IPM), Surface Tax (ISS), and Mineral Resource Rent Tax (IRRM).

Mineral Production Tax (IPM): applies irrespective of legal authorization for mining operations. Triggered upon mineral extraction, this tax is exempt for minerals used in geological research. Its taxable base relies on the value of extracted minerals after treatment or, for untreated products, their initial value. Determining this value depends on recent sale prices or, in their absence, international market reference rates. Transport costs are deductible when calculating the taxable base. The IPM rates vary by mineral type, ranging from 1.5% for sand and stone to 8% for diamonds. Payment must be made by the 10th of the month following production or before export to gain export clearance.

Surface Tax (ISS): is an annual levy based on the area of mining activity. The rates differ according to the mining license type and duration. This tax exempts the mining area from other land usage and exploitation fees. Payment is due annually by January 31st or upon obtaining or renewing mining licenses, with specific deadlines based on license issuance.



Mineral Resource Rent Tax (IRRM): applies as an additional tax on companies when cash flows exceed 18%. This tax is based on positive net cash gains and is set at a fixed rate of 20% on annual gains above the threshold. Tax estimation is required by May 31st and must be paid in two equal instalments in August and November, each equivalent to 50% of the estimated tax amount.

These specific taxes shape the taxation framework for the mining sector in Mozambique, with distinct payment timelines, taxable bases, and rates tailored to different aspects of mining operations.

Transfer of Mining Rights

In Mozambique, the transfer of mining rights requires government approval, involving a formal request and various documents submitted for authorization. The process can take up to 180 days, and certain conditions must be met, including the transfer between resident entities and disclosure of company details. Additionally, changes in company ownership, such as mergers, demergers, or transfers of shares, demand authorization and follow similar formalities as mining title transfers.

These operations involving changes in ownership or shareholder structures require authorization; otherwise, they hold no legal effect in Mozambique. The authorization process typically involves scrutiny by tax authorities to determine potential taxable capital gains arising from the transaction.

Regarding tax implications, gains from the direct or indirect transfer of shares or participation rights involving assets in Mozambique are considered taxable, regardless of the entities being residents or non-residents. The gains are autonomously taxed at a 32% rate, applicable to both residents and non-residents. The tax is due within 30 days of the sale date and is calculated based on the difference between the transfer and acquisition prices of the shares.

The determination of the sales price lacks specific regulations, leaving room for potential disagreement between the taxpayer and tax authorities. Hence, having a comprehensive market study supporting the transaction price is crucial. Despite the liability for settling the tax falling on the non-resident entity without a permanent establishment in Mozambique as per law, joint and several liability is imposed on the acquiring entity or the mining rights holder.

Foreign Assignees Employment

In Mozambique, entities can employ foreign workers subject to specified limits based on the company's size, currently being revised for implementation in March 2024. The employment of foreign workers requires compliance with regulations concerning work permits, which are undergoing changes.

Work Permit

For entities hiring foreign employees within set quotas, the employment must be reported to the Labor Authorities within 15 days from admission.

Work permits can be granted for a maximum of 2 years and may require an academic equivalence certificate from the Ministry of Education. The process can be expedited in the mining and Oil & Gas sectors, although actual processing can take up to 15 working days. Work permits above the quota need

special approval by the Ministry of Labor and may take 3 to 6 months due to bureaucracy. Short-term permits (up to 120 or 180 days) don't necessitate a formal employment contract.

Immigration

Mozambique offers various visas like transit, student, tourist, business, and residence/work visas, obtainable from consular missions, border posts, or online.

Work visas for foreign citizens intending to work in Mozambique require documents such as a valid passport, work permit, medical certificate, and proof of accommodation and must be extended within 30 days. Visa extension entails submission of employer-related documents, work permit, and others for a maximum of one year, renewable based on the work permit's validity.

For workers in the extractive industries, additional approval from the Minister of Mineral Resources is required. Termination of work permits and visas must be formally communicated to labour authorities and the immigration department, respectively.

Import and export

In Mozambique, import and export processes involve strict customs controls and exchange formalities. Both importers and exporters need licenses, and customs clearance agents are currently mandatory. The system "Janela Única Electrónica" (JUE) manages import/export declarations and incurs processing fees based on the declared value.

A new requirement, the Conformity Assessment Programme (CAP), supervised by INNOQ, IP, ensures goods comply with standards. A Certificate of Conformity (CoC) is necessary for consignments, issued before shipment by a government-contracted agent.

Import procedures include obtaining licenses, submitting documents via the JUE, paying duties and fees, and confirming payments through a commercial bank. Exports require licenses, detailed invoices, certificates, and authorization, with similar steps to the import process. Mining products have additional requirements like the Kimberley Process Certificate and prepayment of mining production tax for rough diamonds, precious metals, and gems.

As a member of the Southern African Development Community (SADC), Mozambique adheres to protocols for trade, gradually reducing customs barriers among member states with proper documentation like the SADC Certificate of Origin, affirming adherence to specific Rules of Origin. The customs department requires various documents for approval, including the SADC Certificate of Origin, customs declarations, export invoices, costing for value added requirements, and any other necessary documents.

African Continental Free Trade Area (AfCFTA)

The African Continental Free Trade Area (AfCFTA), the world's largest free trade area, includes 55 African Union countries, including Mozambique, and eight Regional Economic Communities. It aims to create a unified and liberalized market for trade and services. Implementation occurs in phases, supported by



various initiatives targeting trade facilitation, investment, digital trade, inclusive trade, and environmentally sustainable practices.

Mozambique, although a signatory state, hasn't ratified the treaty yet, despite public support for ratification. There are concerns about the potential impact on public expenditure due to Mozambique's heavy reliance on imports and exports of raw materials, which might limit its ability to benefit from the market opportunities created by AfCFTA. The implementation of AfCFTA objectives will likely involve establishing rules of origin criteria, even though formal integration steps haven't been ratified within Mozambique's national jurisdiction. This necessity aligns with the objectives endorsed by the signatory countries.

3.2 Macroeconomic context for in-country financings

Gross domestic product (GDP) analysis

Mozambique's GDP showcases a promising trajectory, poised for growth despite recent challenges. With an estimated GDP growth of 3.8% in 2022 and projections indicating a potential rise to 4.8% in 2023 and 8.3% in 2024, the economy demonstrates resilience. Key drivers include the robust performance of extractive industries and agriculture. Anticipated faster GDP per capita growth, from 2.0% to 5.5% in 2023 and 2024 respectively, signifies a positive outlook, albeit contingent on managing risks like climate shocks and the insurgency in the North.

Historical GDP growth (The World Bank, 2022)

Mozambique's GDP trajectory has seen notable shifts in the past decades. Between 2003-2013, robust growth averaged 7.4%, fostering economic development. However, the subsequent decade showed a slowdown, averaging 3.9%, influenced by diverse challenges. In 2022, GDP rebounded to 3.8%, signifying a recovering economy.

Distinct sectors presented divergent performances. Agriculture, health, and transport surged with growth rates of 3.4%, 4.7%, and 3.5%, propelled by amplified inputs and public spending. Conversely, the tourism sector faced a setback, contracting by -1.7% due to pandemic and climate-related issues.

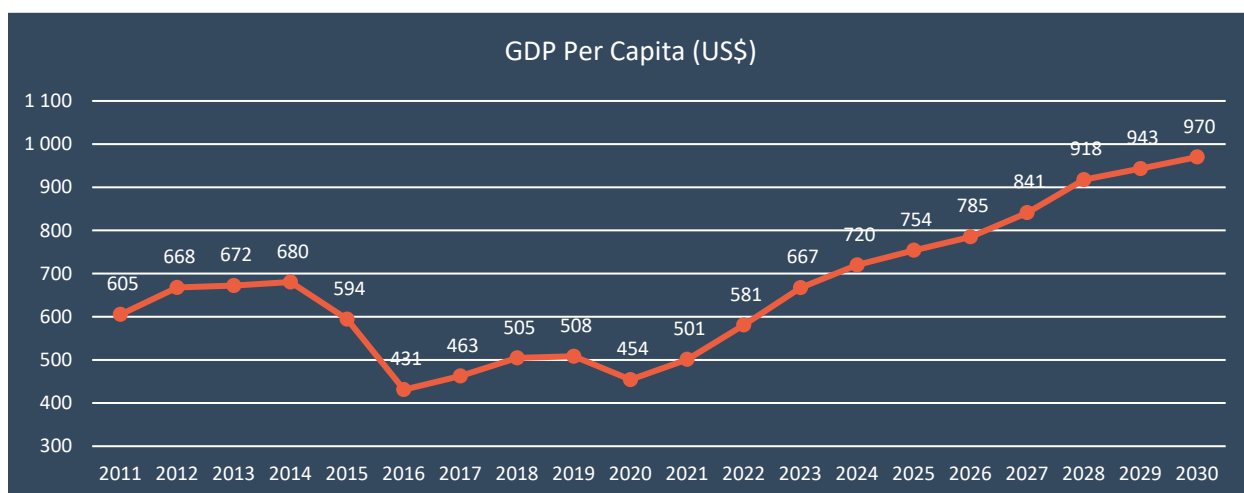


Figure 6: Mozambique - Historical GDP per capita from 2011 to 2021 & projected estimations from 2022 to 2030 (Sources: World Data Bank, S&P)

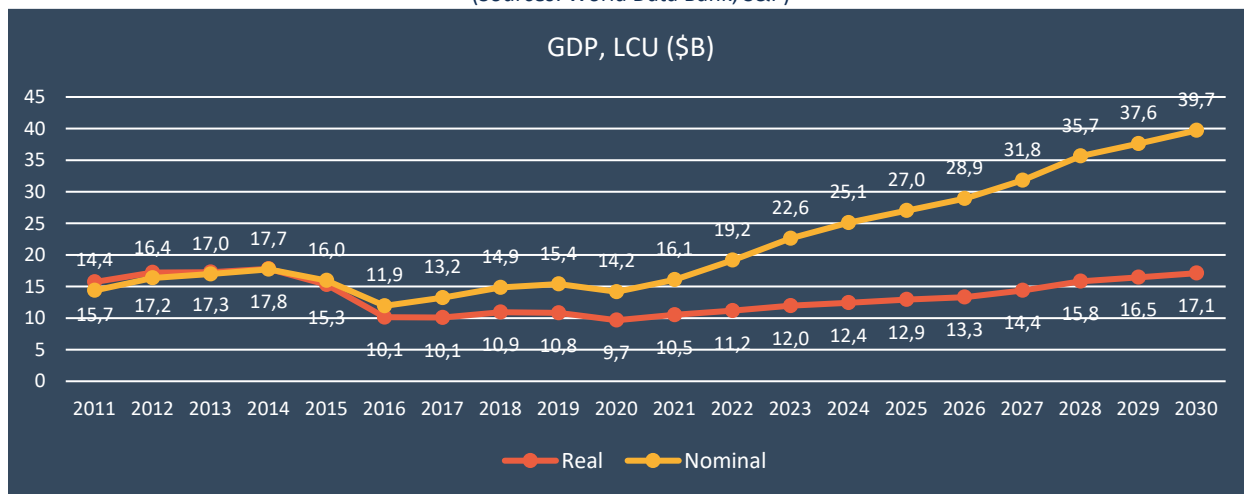


Figure 7: Mozambique - Historical and projected nominal GDP and real GDP (Sources: S&P)

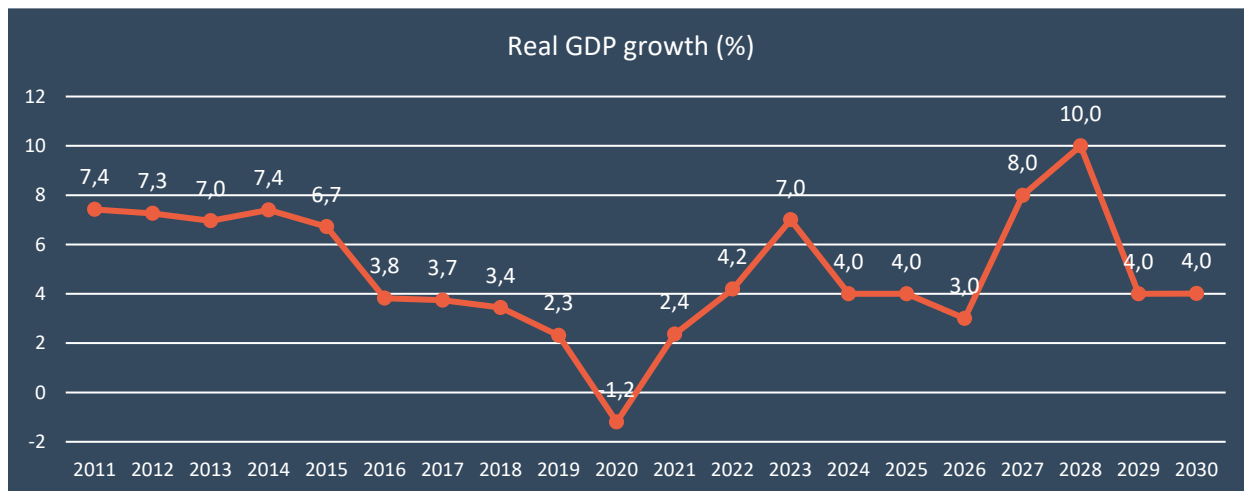


Figure 8: Mozambique - Historical and projected real GDP growth (Sources: S&P)

Private consumption, constituting 65% of GDP in 2021, remained pivotal, while gross capital formation rose to 58%, predominantly driven by extractive industries. However, negative net exports linked to mega-project imports countered this growth.

The country's GDP history illustrates a resilient economy adapting to challenges, showcasing potential for sustained growth. Despite hurdles, Mozambique displays resilience, fostering optimism for future economic stability and progress. Economic diversification and prudent fiscal measures remain crucial for navigating potential hurdles and sustaining growth momentum.

Economic drivers and sector breakdown (The World Bank, 2022)

Historically, Mozambique's GDP evolution has been shaped by diverse sectoral contributions. In the 1980s, agriculture was a primary economic pillar, constituting nearly 30% of the economy. However, the civil war disrupted agricultural activities and infrastructure, hindering growth. Post-war recovery

witnessed a surge in the services sector, expanding to around 50% of GDP by the early 2000s, signaling a shift in the economy's composition.

From 2010 onwards, the extractive sector, notably natural gas and coal, began gaining prominence, accounting for nearly 40% of the country's exports. This shift was pivotal, altering the economic landscape significantly. By 2022, services maintained a dominant position, representing 45% of GDP, while the burgeoning extractive industries drove industrial growth.

Agriculture, historically vital, now contributes around 23% of GDP, indicating a substantial transformation in sectoral contributions over time. This evolution highlights the transformative influence of extractive industries on Mozambique's economic structure. However, it underscores the imperative for strategic diversification and resilience across sectors to ensure sustainable and balanced growth, mitigating over-reliance on any single industry.

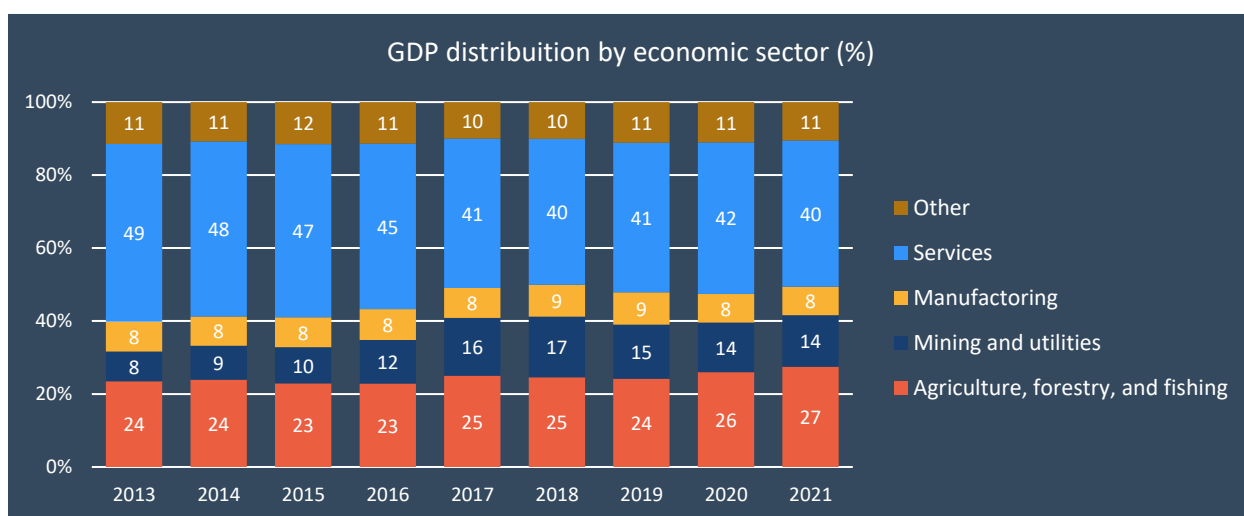


Figure 9: Mozambique - Distribution of GDP across economic sectors from 2011 to 2021 [%]¹

Foreign Direct Investment (FDI) Landscape

Mozambique's FDI inflows surged, reaching 7.2% of GDP in 2020, largely attributed to investments in natural resource projects. The country attracted \$3 billion in FDI in 2020, showcasing resilience amid global economic turbulence. Initiatives under Mozambique's development plans have played a pivotal role in attracting foreign investments, especially in energy and infrastructure.

Foreign Direct Investment (FDI) Trends

Mozambique has witnessed a surge in foreign direct investment (FDI) in recent years, propelled by its natural resource endowments and strategic location. The country's vast reserves of natural gas and coal have attracted substantial FDI, particularly in the extractive industries. Additionally, renewable energy projects, such as solar and wind power, have garnered interest from international investors seeking to capitalize on Mozambique's renewable energy potential.

¹ Source: World Data Bank

The United Nations Conference on Trade and Development (UNCTAD) reported an increase in FDI inflows, indicating growing investor confidence in Mozambique's economic prospects. However, challenges related to regulatory frameworks, infrastructure limitations, and socio-political stability pose potential risks that investors carefully consider.

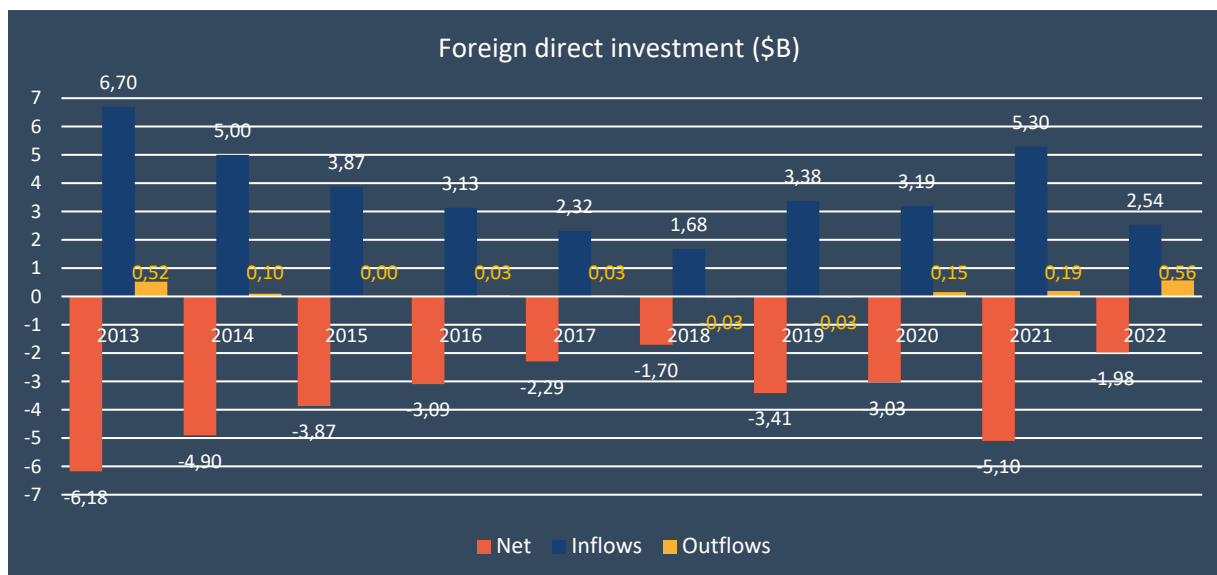


Figure 10: Mozambique - Foreign direct investment net, net inflows, net outflows from 2013 to 2022²

Currency and Inflation Dynamics

Mozambique's currency, the Mozambican Metical (MZN), operates within a framework of fixed parities, ensuring stability in exchange rates and free transferability. Influenced by its Southern African Development Community (SADC) membership, the Metical is subject to market forces, regulated by the central bank to stabilize its value.

Inflation trends in Mozambique have been subject to various internal and external factors. High inflation rates in recent years have been attributed to external shocks, including fluctuations in global commodity prices and climatic hazards affecting agricultural production. For instance, disruptions in global commodity markets and extreme weather events have contributed to the volatility observed.

Inflationary pressures have surged to 9.8% by August 2022, primarily attributed to rising food prices. These inflation trends, linked to global commodity price fluctuations and climatic hazards affecting agriculture, have significant repercussions, particularly for households reliant on imported goods and energy. This underlines the need for comprehensive measures to address inflationary pressures and enhance economic stability.

Looking ahead, stakeholders are closely monitoring inflationary trends, and the government, in collaboration with the central bank, is taking proactive measures to mitigate these pressures. Future policies and interventions are expected to play a crucial role in stabilizing prices and fostering a conducive economic environment for both businesses and households.

² Source: World Data Bank

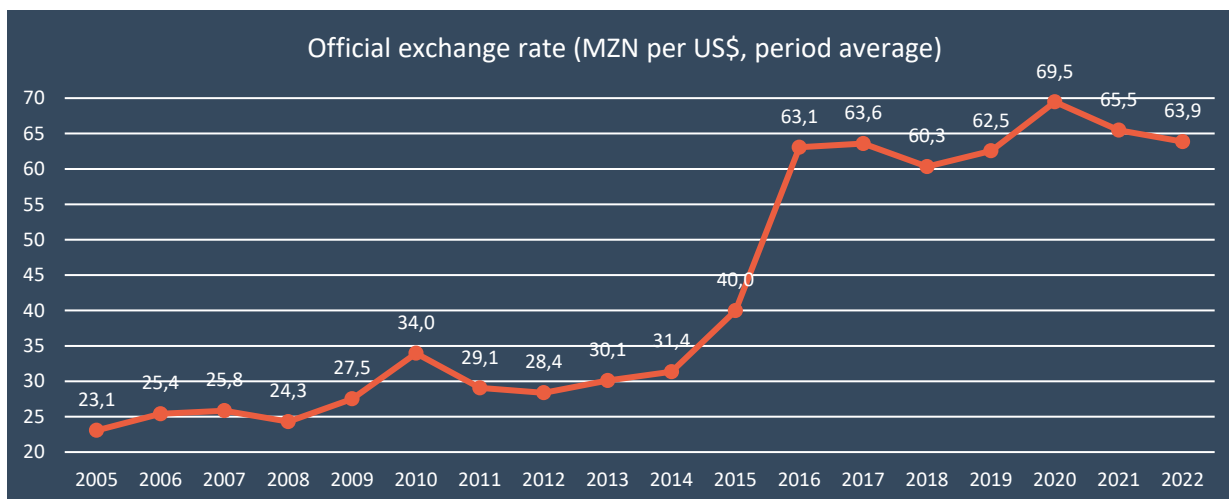


Figure 11: Mozambique - Historical official exchange rate (Metical per US\$, period average) (Source: World Data Bank)

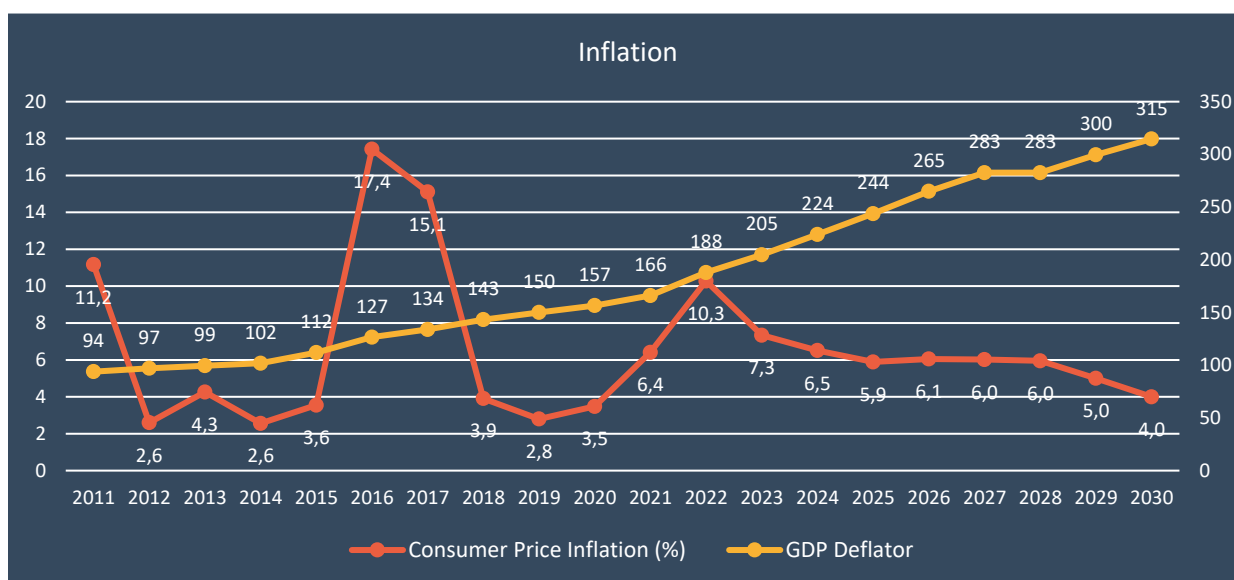


Figure 12: Mozambique - Historical and projected data on inflation indicators (S&P Global, 2022)

Sovereign Debt and Fiscal Sustainability

Mozambique's sovereign debt situation has undergone fluctuations due to economic challenges and external factors. The country has witnessed an increase in public debt in recent years, raising concerns about fiscal sustainability. This rise in debt levels, particularly in the wake of the COVID-19 pandemic and its economic repercussions, has prompted a need for prudent fiscal management and debt restructuring measures. Mozambique's public debt surged to \$14.3 billion in 2021, representing 80% of the country's GDP. Despite the anticipated relief from natural resource exploitation, challenges persist due to external factors affecting key sectors such as energy and agriculture. The successful utilization of resources is crucial to mitigate the current deficit.

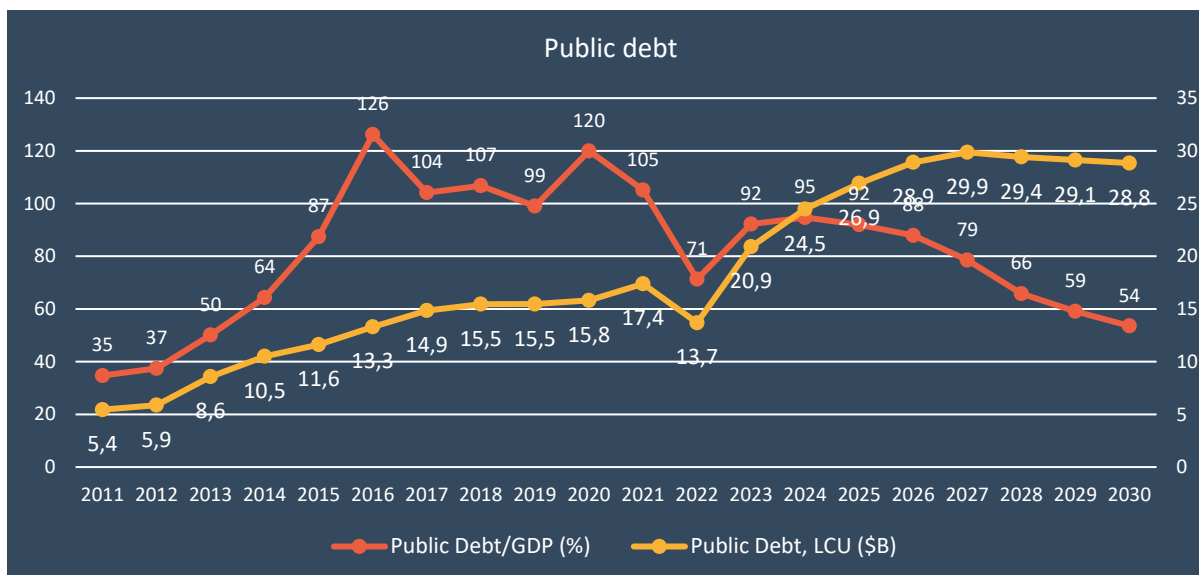


Figure 13: Mozambique - Historical and projected data public debt and debt/GDP (S&P Global, 2022)

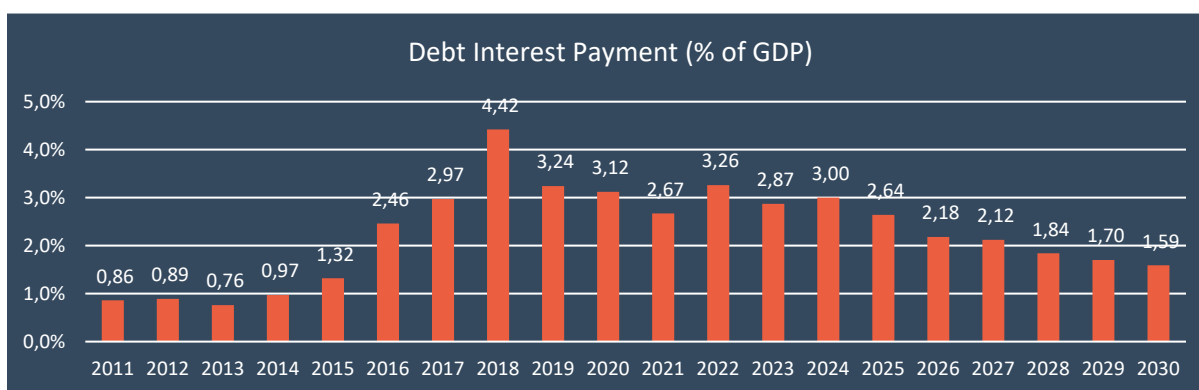


Figure 14: Mozambique - Historical and projected data on public debt interest payment (S&P Global, 2022)

The government is exploring strategies to manage public debt and enhance fiscal resilience. Efforts to diversify revenue sources, improve tax collection systems, and engage in responsible borrowing practices are underway to ensure long-term fiscal sustainability. The fiscal stimulus plan (Pacote de Aceleração Económica, PAE) implemented by the government over the period 2023-2024 will also support economic activity. This post-Covid economic support programme should improve the business environment by simplifying administrative procedures and improving the quality of infrastructure (roads, health and education, energy, access to water and telecommunications).

The country's tariff regime applies varying rates based on the nature of imported goods. Customs duties range from 0% to 20%, while additional charges like the Community solidarity levy and the Economic Community of West African States (ECOWAS) levy may also be applicable. Similarly, export duties, particularly on non-monetary gold, are fixed at 4% of the customs value and are payable upon exit from the national territory.

Regional Economic Alliances and Business Environment

Mozambique actively participates in regional and global economic alliances, significantly impacting its economic landscape. As a member of the Southern African Development Community (SADC) and the African Continental Free Trade Area (AfCFTA), Mozambique gains access to expansive markets. SADC, with 16 member states and a combined GDP exceeding \$600 billion, offers a substantial regional market for trade and investment. AfCFTA, covering 1.3 billion people and a GDP surpassing \$3.4 trillion, provides Mozambique with opportunities to expand market access and foster investments across Africa.

The country pursues bilateral and multilateral agreements, focusing on trade facilitation, investment protection, and technical cooperation. These agreements, particularly with key partners, have significantly boosted trade volumes, with exports reaching approximately \$5 billion in recent years. Mozambique collaborates with global entities like the United Nations (UN), International Monetary Fund (IMF), and World Bank, securing substantial aid and investment for infrastructure development and economic growth.

Mozambique's commitment to regional integration and broader economic opportunities through these partnerships shapes its economic policies, attracts investments, and drives sustainable development. This active engagement has been instrumental in maintaining an average GDP growth of around 3-4% annually over the last decade."

3.3 Political context for in-country financings

President Filipe Nyusi, since taking office in 2015, has aimed to attract foreign investment, focusing on mining and energy sectors. Mozambique's National Development Strategy (2015-35) underscores plans to become a leading global mineral resource hub. However, political and operational challenges, particularly the insurgency by al-Sunnah militants in Cabo Delgado, pose significant obstacles to investment.

Total Energies halted its LNG project due to the insurgency, impacting the region's security and investment climate. Despite ongoing security threats, efforts by regional and international bodies like the Southern Africa Development Community Mission in Mozambique (SAMIM) aim to combat al-Sunnah. To address economic challenges, the Nyusi government removed legislative barriers and engaged the private sector in drafting new investment-friendly laws.

Political environment

Background: Mozambique has experienced relative stability as a multiparty democracy post its civil war (1977-92). The main opposition, Renamo, weakened due to internal conflicts post-2019 elections, signing a peace agreement in August 2019, officially ending their insurgency. The disarmament of Renamo fighters reduced the threat of further conflict. The closure of Renamo's last military base in June marked the end of the disarmament process and set focus on decentralization measures outlined in the peace agreement. Renamo gears up for future elections.

President Nyusi faces internal divisions within the ruling Frelimo party ahead of the 2024 elections, aiming to position himself or an ally for the presidency, while the constitution limits a president to two terms.



These divisions intensify due to legal proceedings linked to the "hidden loans scandal," involving misappropriation of \$2bn during the tenure of former President Armando Guebuza (2005-15).

Current dynamics: President Nyusi has consolidated control over state institutions and within the Frelimo party ahead of Mozambique's 2024 general elections. The uncertainty surrounding a potential third term for Nyusi persists as he delays selecting a successor, solidifying his authority by positioning allies for key roles and potential successors. His focus remains on Frelimo's success in the upcoming municipal polls, considered crucial for the 2024 elections. Despite Nyusi's re-election as party president, internal disputes within Frelimo persist, particularly from factions supporting past presidents Chissano and Guebuza. Nyusi has minimized the influence of the Guebuza faction through strategic cabinet changes and addressing the "hidden loans scandal." However, his attempts to change the constitution for a third term are unlikely to succeed due to internal opposition. Nyusi aims to influence the succession process by supporting allies like Celso Correia, Adriano Maleiane, and Max Tonela for potential presidential candidates in 2024. Restarting LNG projects in Cabo Delgado remains a priority for Nyusi's economic recovery plans, crucial for both political and economic stability. His policies focus on reducing the state's role in the economy, attracting foreign investment, and continuing infrastructure development through public-private partnerships. While uncertainty remains about Nyusi's succession and potential third term, his influence over the process suggests continuity in policy direction, prioritizing economic recovery and reducing state involvement in the economy.

Civil unrest, stability and terrorism: The upcoming municipal elections in Mozambique are likely to favor Frelimo, positioning them well for the 2024 general elections due to their strong influence on social spending and patronage networks. This dominance might lead to sporadic protests, especially in urban areas, fueled by voter registration irregularities and preparation delays. However, internal divisions within the opposition may limit widespread protests, confining unrest to specific areas.

Civil unrest and climate disasters have significantly impacted Mozambique's economic stability. Ongoing armed conflicts and cyclones have disrupted economic activities, hampered infrastructure projects, and discouraged investments. The aftermath of such disasters diverts resources from developmental projects, impacting sectors like agriculture and tourism. To counter these challenges, Mozambique has initiated resilience measures focusing on disaster preparedness, early warning systems, and community programs. Investments in climate-resilient infrastructure, sustainable agriculture, and innovative technologies aim to mitigate climate change effects and bolster economic sustainability.

Terrorism threats persist in Cabo Delgado, with groups like Al-Sunnah disrupting economic activities like LNG and mining. Despite recent security operations weakening key leaders, the group still poses a significant threat, requiring ongoing vigilance in central and northern districts against terrorism.

Attitudes towards foreign investment and the mining sector: Nyusi's administration actively encourages foreign investment in the mining sector, prioritizing it within national development policies. This commitment to fostering foreign direct investment aligns with long-term development strategies and current government plans. Nyusi is expected to maintain a pro-business approach, aiming to expedite mining and natural gas activities by 2024. Despite uncertainties about succession, a probable Frelimo victory in the 2024 elections would likely sustain a business-friendly environment, considering ongoing

economic challenges. However, local concerns persist regarding perceived exclusion of communities by foreign investors and government officials in resource exploitation, potentially fueling demands for more local involvement policies and increased civil society activism against mining operators in the future.

Civil society activism: Civil society in Mozambique actively monitors foreign investments in mining and natural resources, highlighting concerns about human rights issues such as poor working conditions, wage law violations, excessive use of private security, and instances of forced and child labor. NGOs have criticized the state for inadequate regulation enforcement, particularly in large-scale mining projects leading to people's displacement. Reports by organizations like Human Rights Watch have documented forced evictions by coal-mining operations and monitor militant attacks in gem-rich areas of Cabo Delgado province. Recently, HRW urged Mozambican authorities to enhance security and provide support for those displaced by the ongoing insurgency. Under Nyusi's leadership, activists advocating transparency and anti-corruption have faced increased harassment, especially concerning reporting on the insurgency in Cabo Delgado. Amendments to the anti-terror law in May 2022 sparked criticism from civil society groups as potentially criminalizing insurgency reporting, despite the government's adoption of the law in June 2022. Additionally, the government's actions against critical journalists, like canceling public advertising contracts, have drawn international scrutiny from organizations like Freedom House.

Regulatory environment: The mining sector in Mozambique is regulated by multiple bodies, including the Council of Ministers, Ministry of Mineral Resources and Energy (MIREME), and the National Institute of Mines (INAMI). MIREME oversees mining licenses and supervises INAMI, responsible for regulating mining activities and public-private sector involvement in mining products. The National Directorate of Geology and Mines (DNGM) manages administrative procedures and mining information, while the Inspectorate-General of Mineral Resources and Energy monitors and inspects mining activities.

Carlos Zacarias, appointed as Minister of Mineral Resources and Energy in March 2022, brings substantial experience in the energy and mining sector, aiming to expedite LNG production restart and attract foreign investment. National laws, such as the Mining Law and Regulations, Taxation Law for Mining Operations, Mega-Projects Law, Health and Safety Regulations, and Environmental Regulations, provide the legal framework for mining activities. These laws detail licensing procedures, investment regimes, tax exemptions, safety measures, and environmental impact management in the mining sector.

Local content and ownership requirements: Regulatory risks in Mozambique's mining sector often revolve around issues concerning local content. The government aims to tackle public concerns that large mining projects primarily focused on exports don't adequately benefit the wider population. While the 2014 mining and petroleum codes outline local content requirements, some aspects lack implementing regulations. Stricter regulations on permits for foreign workers reflect the government's push for local employment. The 2014 Mining Law emphasizes local content, urging preference for Mozambican suppliers and services, even if they're pricier than imports. Mining operators must offer job opportunities and technical training to locals, prioritizing those residing near mining operations. Foreign ownership in mining adheres to the Mega-Projects Law, mandating a percentage of the project's capital to be reserved for local participants, ranging from 5% to 20%.



Implementation: Regulatory implementation in Mozambique faces challenges due to capacity limitations. Civil service constraints lead to officials not staying updated on regulations, sometimes requesting unnecessary documents. Local government structures, lacking resources, struggle to oversee companies' compliance with land use and community consultation obligations, causing issues in later project phases. State-owned companies' dual roles as commercial players and regulators create potential conflict of interest concerns. In the mining sector, decentralization laws introduced provincial governors in May 2019, causing confusion regarding license awards. Provincial governments can grant mining licenses without central government approval, but regulations remain unclear for operations spanning multiple provinces.

Contract risk and expropriation: Mozambique's government maintains a pro-investment stance to prevent expropriation and safeguard foreign investors' assets, particularly in mining and natural gas sectors, aiming to address socioeconomic challenges. Despite concerns regarding potential discriminatory actions by influential government figures, past incidents of asset seizures and license suspensions have occurred. While the judicial system, though imperfect, offers redress for affected companies, instances of government actions like unilateral license suspensions have been recorded in response to situations like the "coal rush" in Tete province.

External environment

International relations: The Mozambican government has made efforts to rebuild ties with traditional Western donors, aiming to attract more foreign investment and international funding. President Nyusi's diplomatic approach has focused on strengthening relations with Western partners and investors, especially after budgetary support was suspended due to a debt scandal implicating high-ranking officials in 2016. Despite this, the IMF adjusted its stance in March 2022 due to concerns about potential economic collapse and the government's anti-corruption efforts, approving a \$470 million Extended Credit Facility (ECF) to aid fiscal improvement.

Western interests, notably in extractive industries and infrastructure, are increasingly active in the country. Maintaining strong ties with regional peers and the Southern African Development Community (SADC) remains a priority for Mozambique. The SADC's support in counterinsurgency operations in Cabo Delgado is crucial. President Nyusi aims to assure mining industry investors about the government's capability to handle security concerns in the northern regions, particularly in Cabo Delgado province, as they seek to resume LNG and mining operations.

International regulations: Mozambique's government is actively aligning with international standards and recommendations to enhance the appeal of its mining sector for foreign investors. Efforts include adopting regulations suggested by global institutions and complying with the Extractive Industries Transparency Initiative (EITI) standards. The EITI's recent validation report commended the government's engagement in addressing governance challenges in the extractive sector but highlighted the need for more transparency, particularly in beneficial ownership in mining to tackle corruption risks. However, challenges persist, as Mozambique was placed on the Financial Action Task Force (FATF) "grey list" due to deficiencies in anti-money laundering and counterterrorism financing regulations. To rectify this and improve international standing, the government established a committee to oversee measures



recommended by the FATF. While Mozambique has been an International Labour Organization (ILO) member since 1976 and ratified numerous human rights conventions, it's yet to ratify two fundamental ILO conventions related to occupational safety and health hazards, essential for ensuring safe workplace conditions.



4. Assessment of social, environmental, and governance challenges³

Mozambique's mining industry plays a substantial role in the economy, contributing 7% to GDP and 6% to government revenues in 2019. Abundant reserves in coal, gold, graphite, tantalum, and other minerals offer significant potential. Coal mining, with vast deposits, and promising gold reserves stand out, alongside valuable minerals like graphite, precious stones, and heavy sands. The sector's potential is highlighted by TotalEnergies' 3.5 billion euros LNG project restart. Mozambique aims to attract investments, especially in graphite, leveraging incentives and profit repatriation. However, despite its importance, the sector's revitalization is slow due to inadequate supervision and regulation enforcement, particularly in smaller mines. The industry employs about 139,000 workers across large-scale and artisanal operations, constituting around 3% of formal employment. Mining drives growth in Mozambique's Special Economic Zones (SEZs) like Nacala and Maputo. Investments here create jobs, support infrastructure, and amplify trade prospects. The SEZs also foster value-added services for mining-related businesses, while the Nacala Logistics Platform facilitates global market access. Overall, this integrated approach is fuelling economic development and positively impacting Mozambique's population.

4.1. Country-level assessment and context

4.1.1. Context

The Ministry of Mineral Resources and Energy (MIREME) is in charge of enforcing the Mining Law, whilst events and incidents are simultaneously monitored by the Ministry of Lands, Environment and Rural Development (MTERD). The other key stakeholder in the Mozambican mining sector are: National Institute of Mines (INAMI), National Directorate of Geology and Mines (DNGM), Ministry of Land and Environment (MTA), Tax Authority of Mozambique, Bank of Mozambique and the High Authority of Extractive Industry (established by the Mining Law in 2014, this regulatory authority is not operational yet).

Mozambique is a member of the Extractive Industries Transparency Initiative (EITI) since 2009, a global standard for the good governance of oil, gas and mineral resources. The aim of the initiative is to promote better governance, transparency and accountability within resource-rich countries.

The EITI provides a platform to ensure that this potential for the extractive industry is ethically achieved, as a lack of transparency in the extractive sector can have serious implications for both the environment and local communities. The process is encouraging a range of organisations, such as companies, government and civil society, to work together to drive the necessary governance reforms and increase effective engagement with key stakeholders.

³ Most of this section is from AfricaMaVal deliverable 4.1 by AWIMA

4.1.2. Mineral and Mining Policies

Mozambique's mining sector is governed mainly by nationwide laws and implementing regulations. Some of the specific laws and regulations governing the country's mining sector include:

- Mining Law (Law 18/2014, of 19 August 2014): This law provides for the definition, rights and duties of holders of mining titles, concession and licences, as well as the legal framework for the exploitation, production and transport of minerals in Mozambique.
- Environmental Law (Law 7/2018, of 22 August 2018): This law seeks to ensure the protection of the environment and the balanced and sustainable use of natural resources, as well as the safety and health of people.
- Customs Clearance Regulations (Decree 9/2017, of 6 April 2017): This law regulates the import and export of goods, provides for customs exemptions and establishes a preferential customs regime for the import of goods intended for use in the mining operations.
- Council of Ministers Decree 23/2018, of 3 May: This decree aims to support and promote green projects, programmes and activities in order to contribute to the control and reduction of greenhouse gas emissions.
- Regulations on the Hiring of Expatriates for the Petroleum and Mining Sectors (Decree 63/2011, of 7 December 2011): This decree regulates the employment of foreign personnel in Mozambique, as well as the procedures for the notification and authorisation of the hiring of foreigners.
- Regulations on Marketing of Mineral Products (Decree 22/2009, of 6 April 2009): This decree sets the ground-rules for the marketing of mineral products in Mozambique for entities that do not hold mineral titles.
- Regulations on Marketing of Diamonds, Precious Metals and Gems (Decree 39/2007, of 11 December 2007): This decree establishes the specific rules for the marketing of diamonds, precious metals and gems.
- Resettlement Regulations (Decree 31/2012, of 8 August 2012): This decree sets out the measures to be taken in order to ensure the protection of the rights of all persons affected by a project or an activity.
- Environmental Regulations for Mining Activities (Decree 11/2006, of 31 March 2006): This decree establishes the requirements to ensure the compliance with environmental regulations in the mining sector.
- Law on the Taxation and Fiscal Benefits of Mining Operations (Law 28/2014, of 23 September 2014): This law regulates the taxation system applied to mining operations.

4.1.3. Mining Regulations

Mozambique's mining regulations are governed by national laws, overseen by the Ministry of Mineral Resources and Energy (MIREME). Mining rights are awarded based on competence, technical, and financial capabilities, granted through mining titles by the State on a first-come, first-served basis to eligible legal entities registered in Mozambique. Recently, MIREME engaged Spatial Dimension, a Trimble Company, to upgrade the mining cadastre system, managed by the National Institute of Mines (INAMI). This upgrade aims to transition to an e-government-based system, streamlining licensing processes, enhancing efficiency, and improving revenue collection. The upgraded system facilitates online applications, license management, payments, reporting, and renewals, significantly enhancing revenue collection in Mozambique's mining sector. This digital transformation simplifies exploration and licensing



processes, making it more accessible for investors and positively impacting the industry's growth and the country's economic development.

The exploration and the mining concession are most usually mining titles and are summarised in Table 3.

Table 4: The various license types available for the mining sector of Mozambique

Licence Type	Description	Duration	Renewable	Restriction
Exploration Licence	This grants the rights to undertake exploration and prospecting to assess whether there are mineral resources; it may not exceed 19998 ha.	5 years	Renewable for an additional 3 year period.	
Mining Concession	This grants concessionaires the right to undertake mining operations and the right to dispose of minerals found;	25 years	Mining concessions are granted for 25 years and may be extended once, for another 25-year period. Extensions must be requested within 365 days prior to its due date.	The area of the concession must exceed that which is reasonably necessary for the mining operation.

For significant mining projects, the State and the concessionaire can establish a mining contract, though it is not mandatory unless the project's value surpasses USD 500 million. Such contracts serve as frameworks for additional rights, but their contents cannot conflict with Mozambican mining laws. Mining contracts cover various aspects, including the State's involvement, dispute resolution methods, and plans for benefiting local communities.

When finalizing the contract, considerations include the project's scale, invested capital, and the significance of minerals involved.

Requirements for Mining Rights Holders:

Mining rights holders in Mozambique bear several obligations related to environmental protection and community engagement. These obligations vary based on the scale and complexity of mining operations. Regardless of their specific title, they are required to furnish a financial guarantee aligning with their work programs or projected investments to ensure compliance. This performance bond can be withdrawn under specific conditions or invoked by the State for breaches leading to title revocation.

Mining concession holders must conduct impact assessments, prioritize local development, engage with communities, pay royalties, adhere to safety standards, and report activities regularly to the government. They must also operate within legal frameworks and maintain social and environmental standards mandated by law. Responsibilities encompass respecting local communities, preserving their cultural heritage, compensating landowners for damages, rehabilitating mined areas, reporting discoveries to the government before public announcements, and ensuring adequate insurance coverage for site-related risks.

Additionally, they're mandated to sell mineral products within Mozambique for industrial development and list their mining company on the Mozambique Stock Exchange.

Renewal and Transfer of Mining Titles

Under Mozambique's Mining Law, transferring mining titles or shares within the title-holding company requires government approval through MIREME. While leasing mining rights is prohibited, titleholders can delegate operational duties to a third party. Mining operators must register with MIREME for each specific mining title. For extensions of prospecting and exploration licenses, applicants must submit a request at least 60 days prior, accompanied by necessary documentation and fees. Approval depends on compliance with obligations and is subject to evaluation by the Ministry of Mineral Resources and Energy. Transfer of these licenses or shares requires prior government approval. A Mining Permit is necessary for various activities like extracting minerals for public works, geological research, or fossil removal.

Each mining title requires specific documentation:

- Processing and Mineral Treatment Licence necessitates land use rights, feasibility studies, and environmental impact assessments.
- Mining Certificate mandates applications, criminal records, and feasibility studies.
- Mining Pass requires applications, liability statements for employed workers.
- Trading Licence demands marketing plans, operator identification, and liability statements for employed operators.

4.1.4. Taxation and Royalties

Mozambique's Mining Law dictates that mineral processing must occur in-country when resource availability and viability permit it. Taxation and royalties for mining companies encompass a special value-added tax regime, production taxes, and surface taxes. Mining contracts may include exemptions and administrative adjustments. Foreign applicants should note that mining certificates, passes, and concessions are exclusively awarded to Mozambicans or Mozambican companies. Mineral rights are protected through an independent judicial system, allowing for international arbitration if needed. Environmental liabilities require financial bonds or insurance coverage.

Specific taxes applied to mining activities include royalties based on mineral types and varying rates, alongside surface taxes categorized by mining title. Mineral Resource Rent Tax is levied at 20% on net cash flow for projects achieving a minimum return rate. Additional general taxes, such as corporate income tax, value-added tax, customs duties, windfall profits tax, and capital gains tax on equity transfers, are also applicable. These regulations aim to attract both foreign and local investment while ensuring Mozambique's government actively participates in the country's economic growth.

4.1.5. Environment

Mozambique emphasizes environmental sustainability in mining, seeking a balance between economic gains and resource conservation. The Environmental Regulations for Mining Activity (2006) delineate requirements for assessments, permits, and audits, classifying mining operations into three levels based on scope and equipment sophistication. These levels determine the environmental guidelines and management plans.



Projects categorized as Level I must adhere to basic environmental rules, mitigating air, soil, and water pollution and preserving flora, fauna, and human health. Level II and III activities require specific plans and programs under the Environmental Regulations, mandating environmental management and risk control measures. To prevent over-mining, mining ventures with a pre-tax net return of 18% or more face windfall profits tax assessments. Financial bonds are compulsory for Level II and III operations, ensuring accountability for potential decommissioning costs and environmental damages.

Preserving Mozambique's **cultural heritage**, rich in tangible and intangible aspects, is crucial. Mining fosters economic growth and sustains traditions, necessitating a deeper understanding and respect for this heritage. Initiatives to safeguard culturally sensitive sites and support local cultural activities are vital in preserving this legacy.

The legal framework for **mine closure** and relinquishment, governed by the Mining Law of 2014, outlines procedures to protect the environment, compensate affected communities, and restore mined areas. Closure plans, environmental studies, and financial security declarations are required for legal compliance, ensuring post-operation land rehabilitation and environmental preservation.

Mozambique has implemented **water** resource management regulations within its mining framework. The Mining Law and its regulations oblige mining operators to protect water quality and quantity. Environmental impact studies and water resource management programs require approval from competent authorities before commencing mining activities. The National Legal Framework for Integrated Water Resources Management emphasizes sustainable water resource management, public access to safe water, and pollution prevention.

4.1.6. Social

Land-use and Mineral Rights: Governed by the Mining Law, land rates and mining rights are determined individually. Surface tax and corporate income tax apply alongside royalties, aiming to protect local communities and the environment. Holders of mining rights must create resettlement plans and compensate affected populations.

Artisanal and Small-Scale Mining (ASM): Mozambique boasts a robust ASM sector contributing significantly to the economy through gold production. The government formalizes ASM operations, creating designated areas and associations. Despite its importance, ASM faces challenges like environmental degradation. Mozambique addresses these issues by supporting initiatives like The Mining Development Fund and establishing the Gemmological Institute to promote value addition to ASM-origin gemstones.

Operational Health and Safety (OHS) and Labour Regulations: Mozambique prioritizes health and safety in mining operations. The Mining Law establishes guidelines for health and safety measures, requiring mining concession holders to submit comprehensive plans, conduct regular site inspections, and produce environmental management reports. The policy also emphasizes public health and safety regulations, covering various aspects, from worker authorization to compensation for long-term health impacts.



Labour Practices: The Labour Constitution and Code affirm employees' rights to form trade unions and advocate for workers' interests. Trade unions have significant roles in protecting workers' rights, including engaging in collective bargaining and representing workers' interests.

Societal and Community Aspects: Mozambique's policies emphasize community rights and environmental protection. Regulations mandate public consultations before mining operations commence and focus on sustainable development. The government promotes foreign investment and local economic development by offering customs exemptions and competitive tax rates for the mining industry.

4.2. Assessment of the Mozambican Mining Regime with Respect to ESG objectives

Mozambique has integrated the ESG framework into its mining sector, emphasizing sustainability principles. Environmental regulations categorize operations into three levels based on potential impact, requiring assessments or management plans. Socially, resettlement plans aim to restore affected communities' conditions, and there's encouragement for agreements addressing environmental, social, and cultural aspects. Despite challenges, Artisanal Small-scale Mining (ASM) remains vital, contributing to employment and rural income, yet needing better policy support for sustainable growth.

Governance-wise, the legal framework is strong, but practical implementation needs improvement. Licensing procedures are stringent, aided by a robust cadastre system and transparent practices. The government plans to review stock market registration for mining firms and revise laws governing mining projects. These efforts indicate a structured ESG policy in Mozambique's mining sector, though implementation and revisions are pending in certain areas.

5. Business network between the European Union and Mozambique

5.1. Assessment of the upstream and downstream business ecosystem

The relationship between the EU and Mozambique is characterized by multifaceted partnerships spanning bilateral, regional, and global domains. The EU assumes an active role in advocating peace, security, trade, investment, development cooperation, and humanitarian aid, thriving across political, trade, economic, and cooperative sectors. The EU plays a pivotal role in fostering dialogue for peace between Mozambique's Government and its primary opposition party, Renamo. This diplomatic engagement culminated in the signing of the Peace Agreement in August 2019. Additionally, the EU commits substantial support, amounting to €60 million, towards the implementation of this important agreement.

An Economic Partnership Agreement (EPA) sealed between the EU and Mozambique seeks to alleviate poverty, stimulate economic diversification, and foster employment opportunities. This pact aims at encouraging intra-regional integration while cautiously embracing global economic openness.

Moreover, the extensive links between the EU and Mozambique align with key priorities outlined in the EU Strategy for Africa. These priorities encompass trade facilitation, initiatives for a sustainable green transition, advancements in digital transformation, fostering sustainable growth, and generating employment opportunities.

5.1.1. Context, formal and informal players

The mining industry in Mozambique is regulated by the Ministry of Mineral Resources and Energy and the National Institute of Mines. The Ministry of Mineral Resources and Energy is responsible for awarding mining rights, while the National Institute of Mines oversees mining activities.

5.1.2. Relationships at local or regional levels

Overall, the EU-Mozambique relationship at local or regional levels involves tailored interventions and partnerships aimed at addressing specific challenges, fostering development, and enhancing the well-being of communities within Mozambique.

Southern African Development Community (SADC): Mozambique has been a member of SADC since its creation. In 1993, through Resolution 3/93, dated 1st June, the country ratified the SADC community treaty. Since then, Mozambique has ratified several other agreements and treaties of SADC, most notably the Resolution no. 44/99, dated 28th December, related to the protocol on trade in the SADC region. One of the main objectives of this protocol is the gradual reduction/elimination of customs barriers in trade between member states, provided that the rules of origin are observed. Thus, to apply such exemption/reduction of duties, a Certificate of Origin is required.

African Continental Free Trade Area (AfCFTA): The AfCFTA is the world's largest free trade area (signed in 2018 and officially launched in 2021) in which the 55 countries (being Mozambique part of it) of the African Union (AU) and eight Regional Economic Communities (RECs) have form part of it. The AfCFTA is



to be implemented in phases as illustrated below, with the main goal of the creation of a single and liberalised market for trade and services.

Phase	Supporting initiatives ⁴
Facilitating trade in goods	The Global Alliance for Trade Facilitation: a public-private partnership led by the World Economic Forum, International Chamber of Commerce (ICC), Center for International Private Enterprise (CIPE) and the German Agency for International Cooperation (GIZ) to implement trade-facilitation projects. These projects cover aspects such as trade facilitation such as digitalizing border processes, digitizing phytosanitary and rules of origin certificates, modernizing customs broker arrangements etc
Facilitating services and investment	Enabling Action on Sustainable Investment (EASI) initiative: EASI projects will bring a public-private approach to implementing investment measures that will facilitate the flow of sustainable investment and grow a larger continental market, thereby attracting greater FDI from outside Africa. EASI projects can also help support the implementation of the WTO Investment Facilitation for Development Agreement.
Facilitating digital trade	TradeTech: a concept that reflects different Fourth Industrial Revolution technologies in the trade space. - Digital Economy Agreements Leadership Group: this provides an impartial space for information exchanges and debate concerning digital economy agreements. - Trade Finance Frontiers: a multistakeholder group to explore and analyze where public-private cooperation can help the growing trade finance gap. - Digital Economy Agreements Leadership Group: this provides an impartial space for information exchanges and debate concerning digital economy agreements
Facilitating inclusive trade	Labour Programme and Trade and Indigenous Peoples Programme aim to identify how trade tools and mechanisms can better serve workers and increase access to trade benefits for Indigenous businesses and communities.
Facilitation environmentally sustainable trade	A guidebook of investment facilitation measures for developing countries to attract FDI aligned with climate action.

Although Mozambique is a signatory state, it has not ratified the treaty to date. Public pronouncements have been made in favour of ratification, but there are no indications that this will happen any time soon.

Development Cooperation: The EU engages in localized development projects aimed at specific regions within Mozambique. These projects often focus on areas such as infrastructure development, education, healthcare, agriculture, and community empowerment. They aim to address local challenges and improve living conditions.

Humanitarian Aid: At the regional level, the EU often provides humanitarian aid in response to natural disasters, conflicts, or other emergencies affecting specific areas within Mozambique. This aid includes assistance in the form of food, shelter, healthcare, and other essential services to affected communities.

Trade and Economic Partnerships: Regional trade and economic partnerships between the EU and Mozambique can have localized impacts, especially in areas where specific industries or sectors thrive. For instance, certain regions might specialize in agricultural production or mining, and EU trade agreements may influence the dynamics and development of these sectors at a local level.

⁴ Source: Adapted from World Economic Forum. (n.d.). (rep.). AfCFTA: A New Era for Global Business and Investment in Africa. Retrieved from https://www3.weforum.org/docs/WEF_Friends_of_the_Africa_Continental_Free_Trade_Area_2023.pdf

Cultural and Educational Exchanges: The EU might engage in cultural and educational exchanges at regional levels within Mozambique. This could involve initiatives promoting cultural understanding, student exchanges, or support for local educational institutions to enhance skills and knowledge.

Local Governance and Capacity Building: The EU often collaborates with local governments and institutions to strengthen governance structures, promote good governance practices, and build the capacity of local authorities. This support aims to empower local leadership and improve service delivery to communities.

Environmental and Sustainability Initiatives: The EU supports localized environmental and sustainability initiatives in Mozambique, focusing on regions dealing with environmental challenges such as deforestation, climate change impacts, or biodiversity conservation. These efforts aim to promote sustainable development practices at the regional level.

5.2. Building new B2B relations

The EU and Mozambique have signed an Economic Partnership Agreement (EPA), which aims to reduce poverty, diversify economies, and create employment through enhanced intra-regional integration and a carefully managed opening towards the world economy.

The EU-Mozambique Global Gateway Investment Forum was held on November 2023, in Maputo. The forum aims to enhance and mobilize European private sector investments and partnerships in Mozambique, with a focus on digital transition, renewable energy, agriculture, blue economy, transport, and tourism. The forum will bring together public and private sector stakeholders to explore new business horizons.

5.3. Promoting local content and enabling mining cluster actors

5.3.1. Relevant institutions for the development of a Mozambique-focused critical minerals network

State institutions:

Ministry of Mineral Resources and Energy: ensures the implementation of the Government's policy in geological research, exploitation of mineral and energy resources, as well as in the development and expansion of infrastructure for supplying electricity, natural gas, and petroleum products."

National Institute of Mines: is the regulatory entity for mining activities in Mozambique

Private or consular institutions:

Chamber of Mines of Mozambique (CMM): a formal private sector organization that aims to represent the entire mining sector in Mozambique

Associação Geológico-Mineira de Moçambique (AGMM): a private association that aims to reinforce the interventionism of the associative, subsidizing the emergence of sustainable solutions for the challenges and opportunities in the geological and mining sector of the country.



5.3.2. Academic institutions and other training establishments in the field of geosciences and mining

Mozambique's mining industry is rapidly expanding, demanding a skilled workforce. Educational institutions like Eduardo Mondlane University are adapting, offering specialized courses in geosciences and mining engineering. Collaborations with international partners enhance knowledge exchange. Government support for vocational programs aims to equip individuals with practical skills. Mozambique education system struggles to meet industry demands due to resource constraints. Despite a variety of courses, alignment with the evolving needs of the mining sector remains a challenge.

Courses available in public institutions

Institution	Faculty	Course	Contact
Universidade Eduardo Mondlane	Faculdade de Ciências	Degree in Applied Geology	Av. Julius Nyerere - Campus Universitário 3453; Maputo Tel. +258 21 493 376 www.ciencias.uem.mz/
		Masters in Mineral Resources Management	
Universidade de Licungo	Faculdade de Ciências	Degree in Geology	Estrada Regional nº 642, Campus de Murrópuè, Quelimane Tel. +258 84 340 3960 www.unilicungo.ac.mz
Universidade Púnguè	Faculdade de Geociências e Ambiente	Degree in Geology	Bairro Heróis Moçambicanos, Cidade Chimoio, Provincia de Manica Tel. +258 25 125 700 www.unipungue.ac.mz
		Masters in Mining and Sustainability	
	Faculdade de Engenharia	Degree in Mining Engineering	
		Degree in Mineral Processing Engineering	
Universidade de Rovuma	Faculdade de Geociências	Degree in Geology	Av. Josina Machel nº 256 Tel. +258 84 073 1777 www.unirovuma.ac.mz
Universidade Lúrio	Faculdade de Engenharias	Degree in Geological Engineering	Bairro de Marrere, R. nr. 4250, Km 2,3 - Nampula Tel. +258 26 218 250
Universidade Wutivi		Degree in Mining Engineering	Av. Da Namaacha, nº118, Belo-Horizonte, Boane, Maputo Tel. (+258) 85 777 1613 www.unitiva.ac.mz
		Degree in Applied Geology	
Instituto Superior Politécnico de Tete		Degree in Mining Engineering	Estrada Nacional nº 7, Km 1, Bairro Matundo, Cidade Tete Tel. (+258) 252 20454 www.ispt.ac.mz
Instituto Superior de Ciências e Tecnologia de Moçambique		Degree in Geological and Mining Engineering	Rua 1,194 n ° 332, Bairro Central, Maputo, Maputo 1100 Tel. +258 84 093 1000 www.isctem.ac.mz

Courses available in private institutions

Institution	Faculty	Course	Contact
Universidade Católica de Moçambique	Faculdade de Gestão de Recursos Naturais e Mineralogia	Degree in Mining Engeneering	Av. da Liberdade, Bairro Josina Machel, Tete Phone: (+258) 25 224 066 www.ucm.ac.mz
		Degree in Mineral Processing Engeneering	
Universidade Jean Piaget de Moçambique		Degree in Geological and Mining Engeneering	Campus Universitário de Inhamizua, Beira, Moçambique Telefone: +258 23 346 6200 www.unipiaget.ac.mz

6. Energy and digital transition: develop a strategy for the EU and Africa Partnership

Existing partnerships/projects dealing with responsible sourcing, CRM, with synergies to the AfricaMaVal objectives

i. Strategy for responsible sourcing:

The concept of responsibility remains undefined. However, the 2014 mining code delineates several actions that must be incorporated into each mining contract, forming a segment of negotiations between the company and the government. These include, among others:

Minimum local content: The law requires that mining companies operating in Mozambique must have a minimum percentage of local content in their operations.

Local employment and training requirements: The law requires that mining companies must employ Mozambican citizens and provide them with adequate training.

Incentives in relation to increasing the value of the minerals to be extracted (downstream processing): The law provides incentives for mining companies to increase the value of the minerals extracted through downstream processing.

Corporate social responsibility requirements: The law requires mining companies to undertake corporate social responsibility activities to benefit the communities in which they operate.

Memorandum of understanding between the firm, the State and the community establishing dialogue with local communities: The law requires mining companies to establish a memorandum of understanding with the state and local communities to ensure that the communities are involved in and benefit from the mining activity.

Disputes resolution mechanisms, including provisions relating to the settlement of disputes by way of arbitration: The law provides for dispute resolution mechanisms, including arbitration, to settle disputes between mining companies and the state or local communities.

The way that the communities in the area will be involved in and benefit from the mining activity: The law requires mining companies to ensure that the communities in the area are involved in and benefit from the mining activity.

ii. Mining sector development policies, targets and goals

Based on the Mineral Resources Policy and Strategy from 2013, but also on the 2014 mining law. The policy provides guidance towards turning the mineral resources into drivers of industrialization, diversification and broader economic transformation. Local content is at the center of this policy, improving and promoting the participation of local stakeholders and to maximize benefits for the local

economy. Several priority areas have been identified where mining firms are required to make special efforts to increase local participation.

According to the mining law, a prominent mechanism through which LC is to be promoted is through public tender processes, which are mandatory above a certain threshold. In these tenders, priority is to be given to local offers. This 'priority' however is not closer defined. Closely related to this is the requirement of foreign firms that provide services to mining operations to "associate with" Mozambican entities. Here too, this association is not closer defined.

Similar, the GoM tries to promote local employment, at least when competencies are available. The companies also have to provide professional training of national workers.



7. Opportunities for responsible investments

7.1. Identification of individual exploration, mining and refining projects

The projects presented on Table 4 were identified as fulfilling the following requisites:

- Credible ECRM resource estimate available.
- Sufficient availability of credible project-specific information on economics and ESG features.
- The project operator is seeking investment or financing.
- Part of the project's current or anticipated future ECRM production is potentially available to the EU industry.

Four projects were selected within the framework of this study. Balama Central started production in November 2021 and is expected to produce up to 50,000 tpa of graphite concentrate over an estimated mine life of 27 years.

Monte Muambe Rare Earths Project is a world-class carbonatite-hosted rare earth element (REE) exploration and development project located in Tete Province. Altona Rare Earths Plc. is strongly focused on the high-grade parts of the deposit to rapidly move towards development.

Triton Minerals Ltd.'s Balama North Project is the world's largest known combined graphite-vanadium resource, located in northern Mozambique. The project consists of two significant areas of interest that are currently being evaluated: Nicanda Hill and Cobra Plains. The Nicanda Hill Resource of 1.4 billion tn at 11.1% TGC is the world's largest graphite-vanadium deposit. Triton is actively seeking a JV Partner and Finance to complete Feasibility Studies and advance development.

Inhambane Mineral Sands Project is a key opportunity for Heavy Minerals Ltd and is considered a large, commercially viable mineral sands deposit. The project is located in the Southern part of the Inhambane Province, Mozambique. Heavy Minerals intends to continue exploring for ilmenite, zircon and rutile while awaiting the granting of its Mining Licence applicatio. The project has an installed processing capacity of 120 tons per hour, valued at ten million. The heavy sands processing plant, operated by Mutamba Mineral Sands, will have the capacity to process 120 tons per hour and has an investment of ten million US dollars.

Table 5: Projects selected to be presented as fact sheets in WP7

Project	Owners	Commodities	Total in situ Value	Possible benefits from EU partnership
Balama	Triton Minerals Ltd.	Graphite Vanadium	183,224.8	Complete feasibility studies and advance development
Monte Muambe	Altona Rare Earths Plc Unnamed Owner	Lanthanides Cerium Praseodymium Neodymium Terbium Dysprosium Niobium	16,718.9	Drive exploration

Balama Central	Tirupati Graphite plc	Graphite Vanadium	3,692.7	Consolidate production
Inhambane	Heavy Minerals Ltd., Private Interest	Ilmenite Rutile Zircon Leucoxene Heavy Mineral Sands	1,375.0	Drive exploration

7.2. ASM sector country profiles

Country profiles on ASM sector developments and investment

One of the core objectives of the AfricaMaVal is to identify investment opportunities in a number of commodities considered critical by the European Union, and there is a clear interest to include the ASM sector in the identification of such opportunities. The emphasis should be on identifying responsible investment opportunities that strengthen the artisanal sector's supply potential and address ESG impacts while also contributing to higher value addition and economic development.

To ease identification of opportunities, the following categories should be considered.

1. Governance: focusing on the needs of the sector to strengthen its governance to ensure it contributes to socio-economic development. This could include support to government, knowledge sharing programmes, extension services to the ASM sector, etc.
2. Support to existing initiatives: existing initiatives which focus on supporting the ASM sector to improve its social and economic impacts, and that could benefit from stronger / continued financing.
3. Value chain projects (processing, trading, etc.): opportunities to support value addition projects which directly support and benefit the ASM sector.
4. Small-scale mining projects: specific small-scale mining projects which might benefit from financing opportunities and investment (e.g., to improve mining techniques, production, environmental and social impact management.).

Conclusion

Mozambique serves as a compelling example for mining investments, presenting a complex interplay of both opportunities and challenges. Abounding in rich and varied mineral resources, including critical raw materials (CRMs), Mozambique captivates mining investors seeking promising ventures. This wealth of valuable resources, combined with the proactive governmental approach, enhances the country's attractiveness in the eyes of potential investors.

From a positive perspective, Mozambique's mineral abundance acts as a magnet, attracting global mining investors. The extensive reserves of valuable minerals, especially CRMs, offer an attractive prospect for individuals seeking profitable ventures within a highly competitive global market. This inherent potential elevates Mozambique's profile, garnering interest and focus from mining stakeholders on an international scale.

Moreover, the collective endeavours of the Mozambican government highlight its commitment to fostering an inviting investment climate. Through strategic policies and initiatives, the government acts to create an environment conducive to foreign capital inflow into the mining sector. These policies are thoughtfully designed to attract and facilitate foreign investments, positioning mining as a corner stone for driving economic growth and fostering comprehensive national development.

However, within these encouraging opportunities, Mozambique faces inherent complexities that present challenges for potential investors. The country struggles with significant difficulties such as infrastructural limitations, civil unrest, and regulatory intricacies, demanding thorough assessment and strategic navigation. Successfully overcoming these challenges mandates a meticulous approach, calling for potential investors to navigate the elaborate operational landscape through comprehensive due diligence and planning.

Investors assessing Mozambique's mining sector must prioritize thorough risk management and forward-thinking strategies. Successfully crossing the interplay between promising prospects and intricate challenges requires careful assessment and comprehensive planning. Collaborative alliances with the government and local stakeholders emerge as crucial elements in harnessing Mozambique's vast mining potential, fostering mutual growth, and nurturing sustainable development.

Essentially, Mozambique emerges as a compelling yet multifaceted scene for mining investments. Balancing the pull of abundant opportunities with the complexities of operational details calls for astute engagement, diligent planning, and collaborative alliances. As Mozambique strides forward, investors equipped with a comprehensive understanding of these dynamics hold the potential to leverage the country's vast mining resources while contributing to its socio-economic growth trajectory.



References

AWIMA (2023). AfricaMaVal Deliverable 4.1 Report on mining regimes with respect to ESG objectives

Bingen, B., Bjerkgård, T., Boyd, R., Dehls, J., Engvik, A., T. Grenne, T. I. Henderson, I.O. Lutro, V. Melezhik, G. Motuza, Ø. Nordgulen, M. Often, J.S. Sandstad, M. Smelror, A. Solli, H. Stein, O.M. Sæther, T. Thorsnes, E. Tveten, G. Viola (Geological Survey of Norway), W. Bauer, P. Dunkley, E. Gonzalez, L. Hollick, J. Jacobs, R. M. Key, R. Smith, R.J. Thomas (British Geological Survey), D. Jamal (University Eduardo Mondlane), F. Catuane, S. de Azavedo, P. Feitio, P. Fumo, V. Manhica, S. Manuel, A. Moniz, F. Njange, D. Rossi, I. de S. Saranga, H. de S. Soares, D. Tembe, B. Uachave e/and E. Zandamela (National Directorate of Geology) (2007) Mineral resources management capacity of Mozambique. Component 2: Geological Infrastructure Development Project. Direcção Nacional de Geologia

Callaghan, C. (compiler) 2002 Mineral scan of the Zambezi River and Beira Corridor Spatial Development Initiatives. 247p

Lächelt, S., (2004) Geology and mineral resources of Mozambique Mineral Resources Management Capacity Building Project. Direcção Nacional de Geologia. ISBN 1-919908-52-8

Lehto, T., Gonçalves, R. (2008) Mineral Resources Potencial in Mozambique in GTK Consortium Geological Surveys in Mozambique 2002–2007, edited by Yrjö Pekkala, Tapio Lehto & Hannu Mäkitie Geological Survey of Finland, Special Paper 48, 307–321

Marques, J.M., (1989) O Campo Pegmatítico do Alto Ligonha: Estado actual e sua importância a curto prazo. Tese de Licenciatura, Departamento de Geologia, Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal, pp. 291.

Marques, J.M., Ferrara, M. & Mäkitie, H., (2011) O Novo Campo Pegmatítico da Região de Marirongoè, Província de Tete, Moçambique, 6o. Congresso Luso-Moçambicano de Engenharia/3o. Congresso de Engenharia de Moçambique, Maputo, Moçambique, 769- 770.

Marques, J. M., (2017) Distribuição dos campos pegmatíticos em Moçambique: sua localização, caracterização e mineralizações. Proceedings CLME2017/VCEM 8º Congresso Luso- Moçambicano de Engenharia / V Congresso de Engenharia de Moçambique. Maputo, 4-8 Setembro 2017; Ed: J.F. Silva Gomes *et al.*; Publ: INEGI/FEUP

Plaza-Toledo, M. (2018) The Mineral Industry of Mozambique. USGS 2017-2018 Minerals Yearbook, Vol. III, Mozambique Country Chapter

Vasconcelos, L. (2014) Breve apresentação sobre os recursos geológicos de Moçambique. Comunicações Geológicas (2014) 101, Especial II, 869-874. ISSN: 0873-948X; e-ISSN: 1647-581X



Vella, A. (2022) Highlighting mineralized geological environments through a new data-driven predictive mapping approach. PhD Thesis, Institut des Sciences de la Terre d'Orléans, Université d'Orléans

Koistinen, T., Lehtonen, M., Fernando, S., Matola, R. (2008) Contribution to the structure at the eastern margin of the Archaean Zimbabwe craton, Mozambique in GTK Consortium Geological Surveys in Mozambique 2002–2007, edited by Yrjö Pekkala, Tapio Lehto & Hannu Mäkitie Geological Survey of Finland, Special Paper 48, 121–144

Pekkala, Y., Lehto, T., Lehtonen, M. (2008) Introduction to GTK projects in Mozambique 2002–2007 in Geological Survey of Finland, Special Paper 48 Yrjö Pekkala, Tapio Lehto & Matti I. Lehtonen

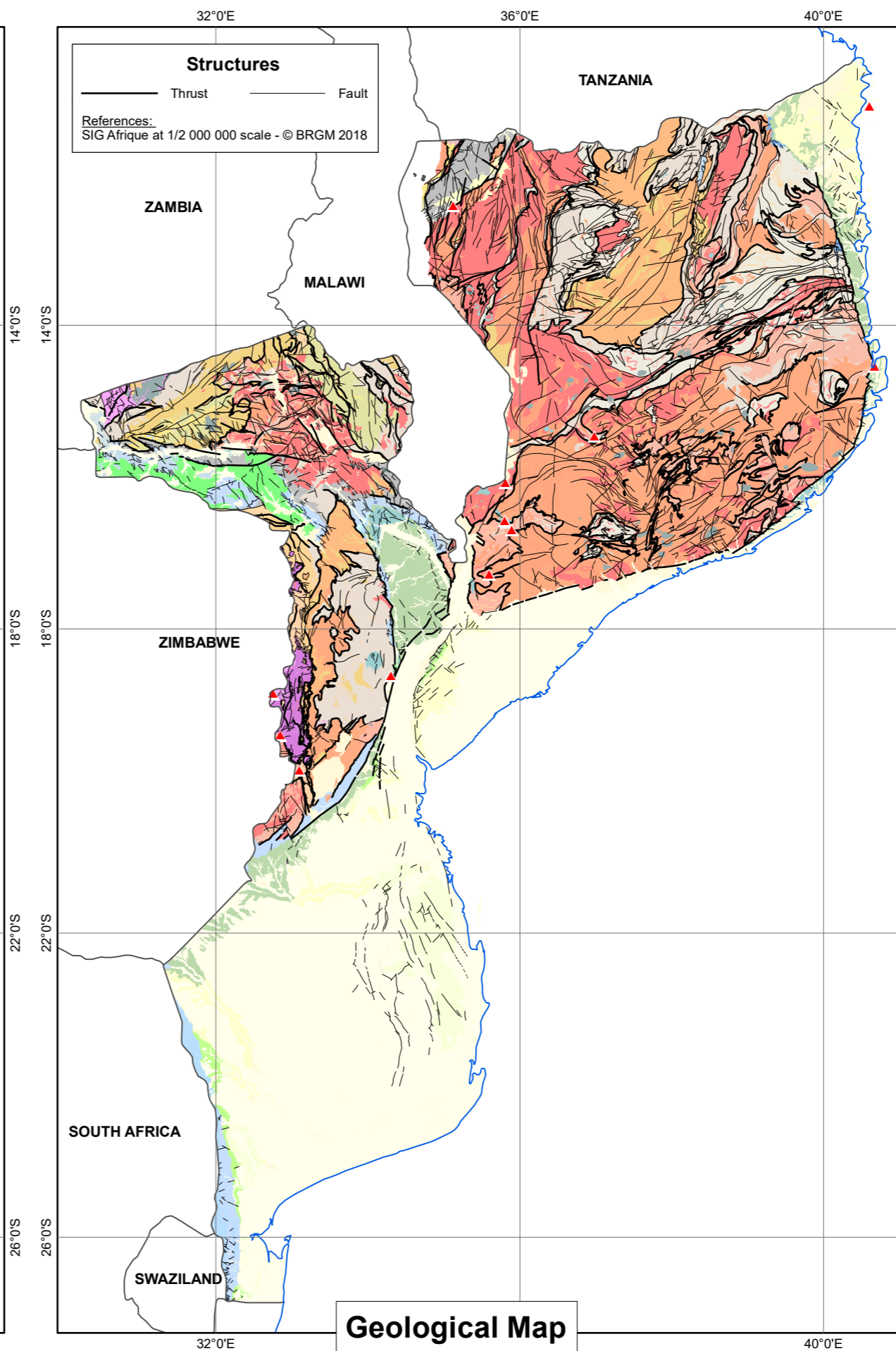
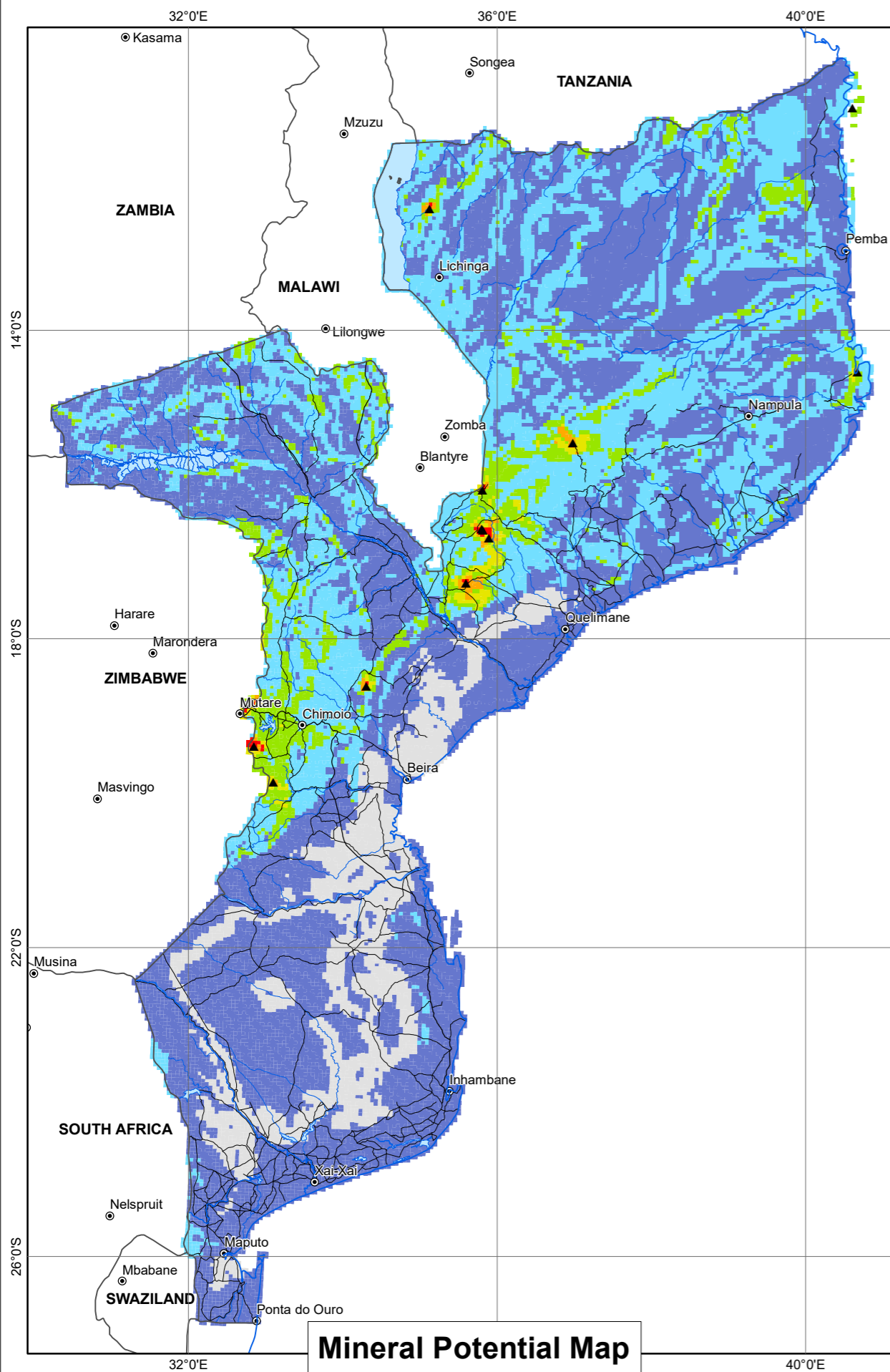


APPENDICES



Country: MOZAMBIQUE

MINERAL POTENTIAL MAP - BAUXITE (Al)



Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

Known occurrences

- ▲ Bauxite (Al)
- ▲ SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 32398 99.38% Non-occurrence in database Non-occurrence predicted	False positive Cells: 167 0.51% Non-occurrence in database Occurrence predicted
False negative Cells: 1 0.00% Occurrence in database Non-occurrence predicted	True positive Cells: 35 0.11% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.53
Cell size: 5000 m

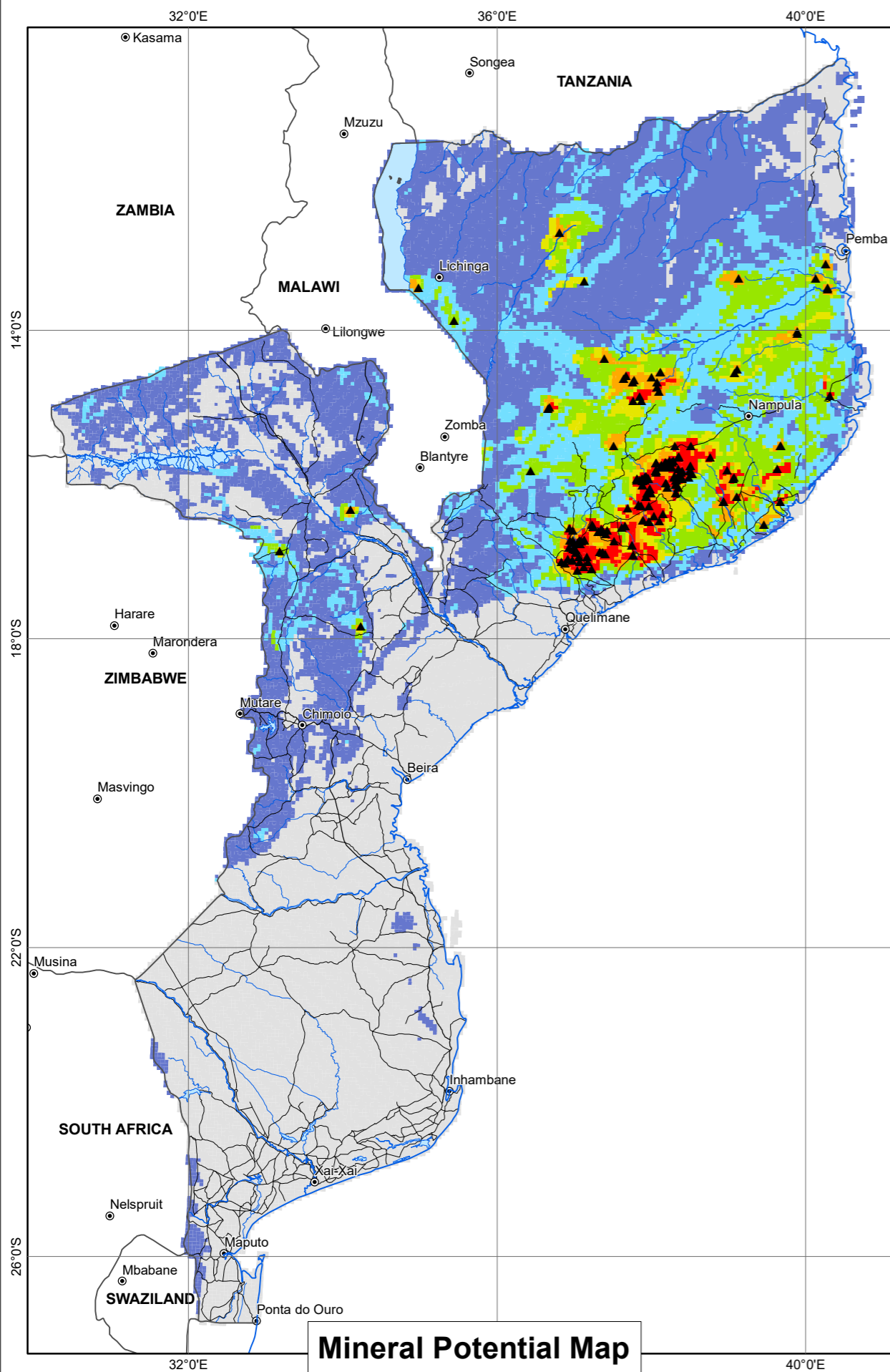
0 75 150 300 Km

Datum : WGS84 (World Geodetic System 1984)

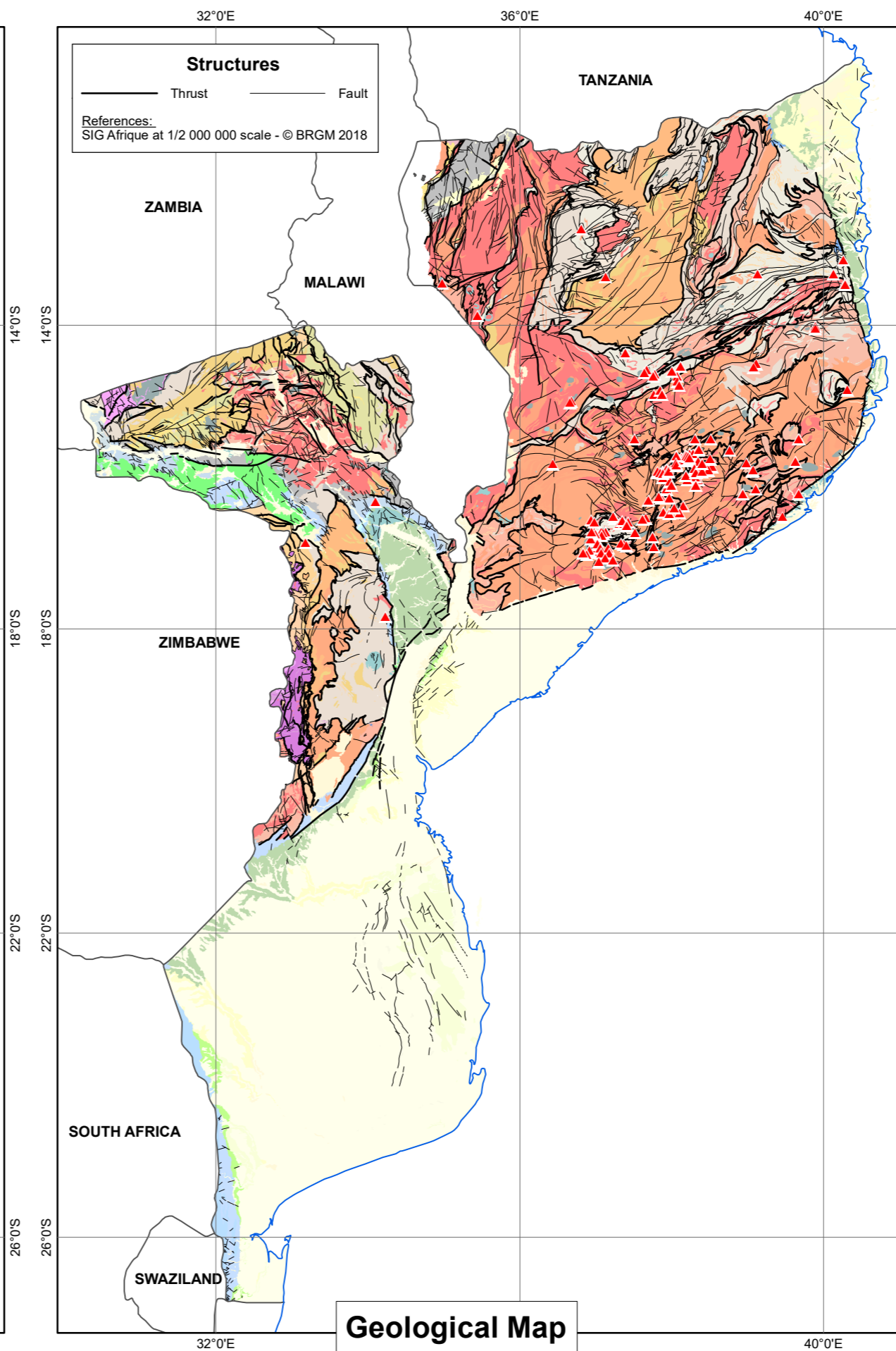
January 2024

Country: MOZAMBIQUE

MINERAL POTENTIAL MAP - BERYLLIUM (Be)



Mineral Potential Map



Geological Map

Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

Known occurrences

- ▲ Beryllium (Be)
- ▲ SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 30915 94.82% Non-occurrence in database Non-occurrence predicted	False positive Cells: 1349 4.14% Non-occurrence in database Occurrence predicted
False negative Cells: 5 0.02% Occurrence in database Non-occurrence predicted	True positive Cells: 332 1.02% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.44
Cell size: 5000 m

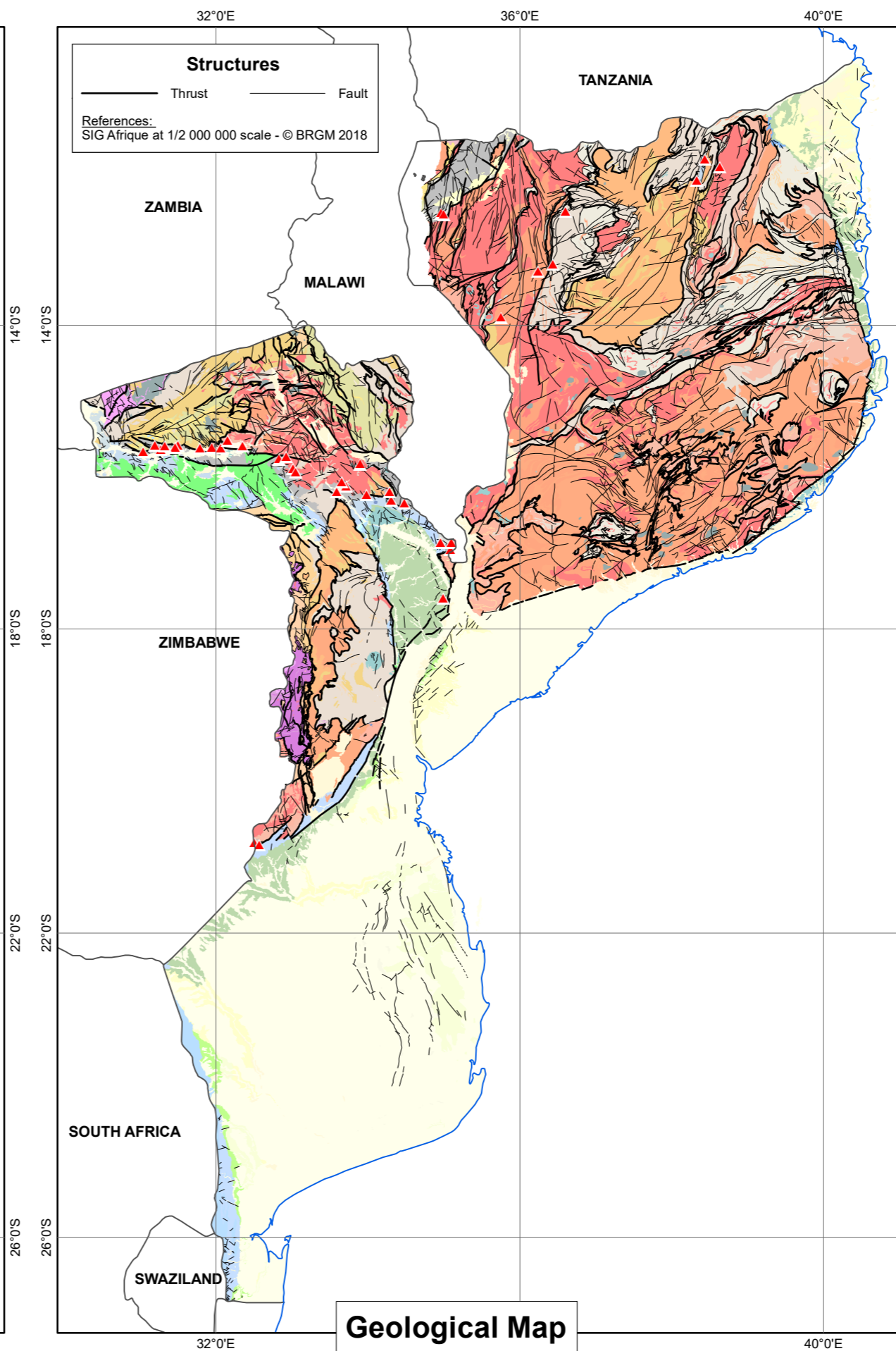
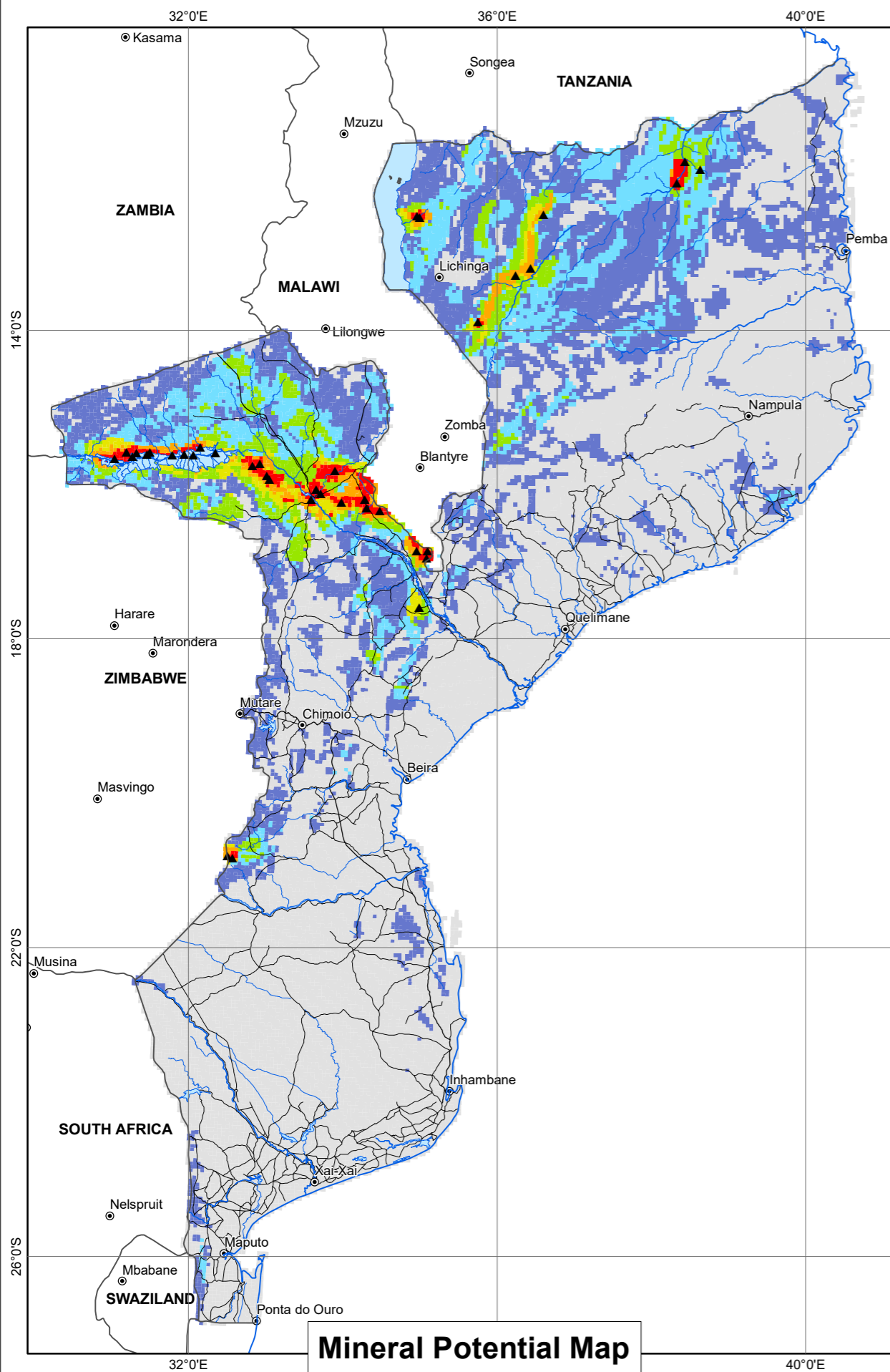
0 75 150 300 Km

Datum : WGS84 (World Geodetic System 1984)

January 2024

Country: MOZAMBIQUE

MINERAL POTENTIAL MAP - COKING COAL (Coal)



Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

Known occurrences

- ▲ Coking coal (Coal)

SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 31376 96.24% Non-occurrence in database Non-occurrence predicted	False positive Cells: 1108 3.40% Non-occurrence in database Occurrence predicted
False negative Cells: 1 0.00% Occurrence in database Non-occurrence predicted	True positive Cells: 116 0.36% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.40
Cell size: 5000 m

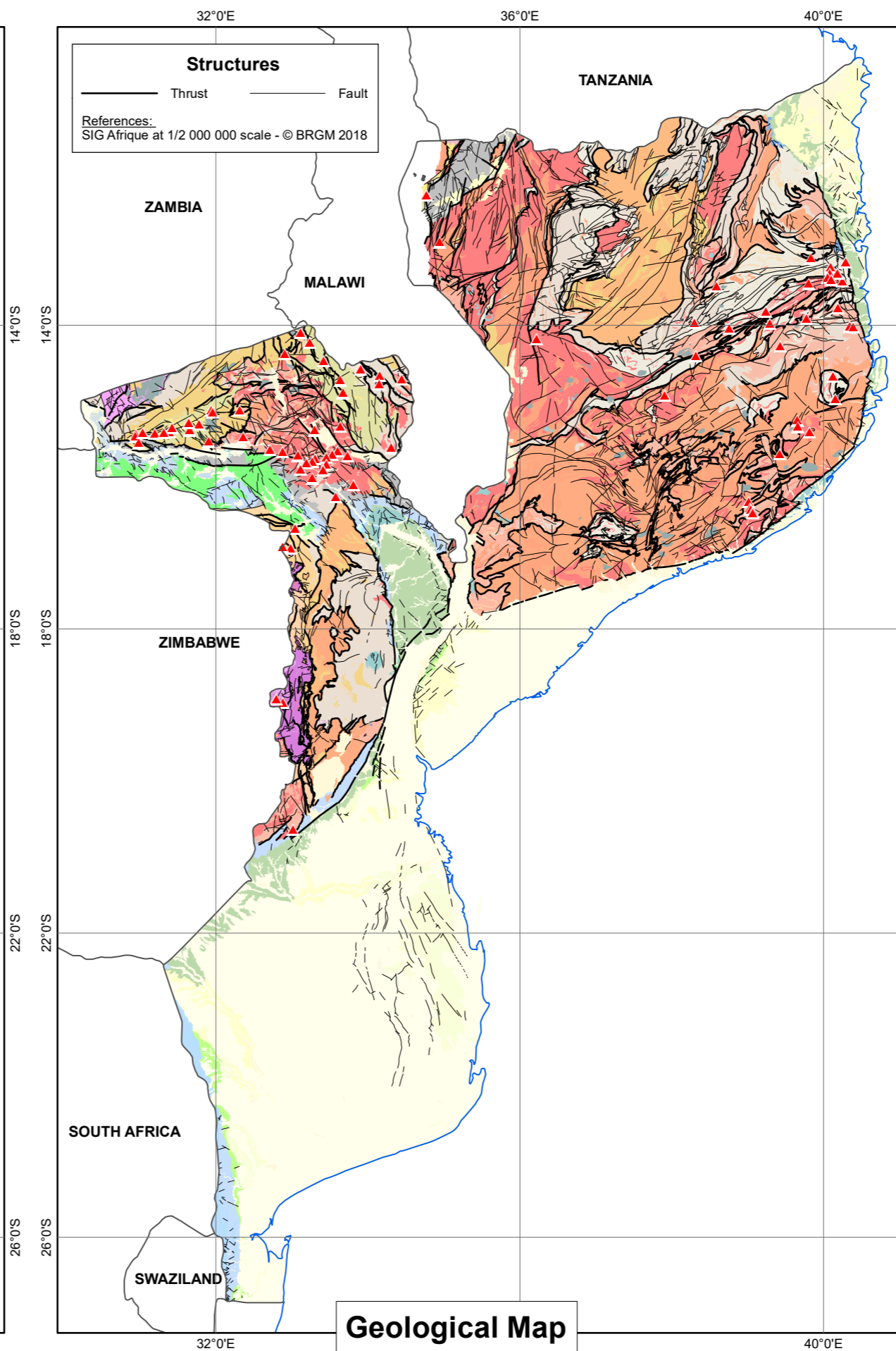
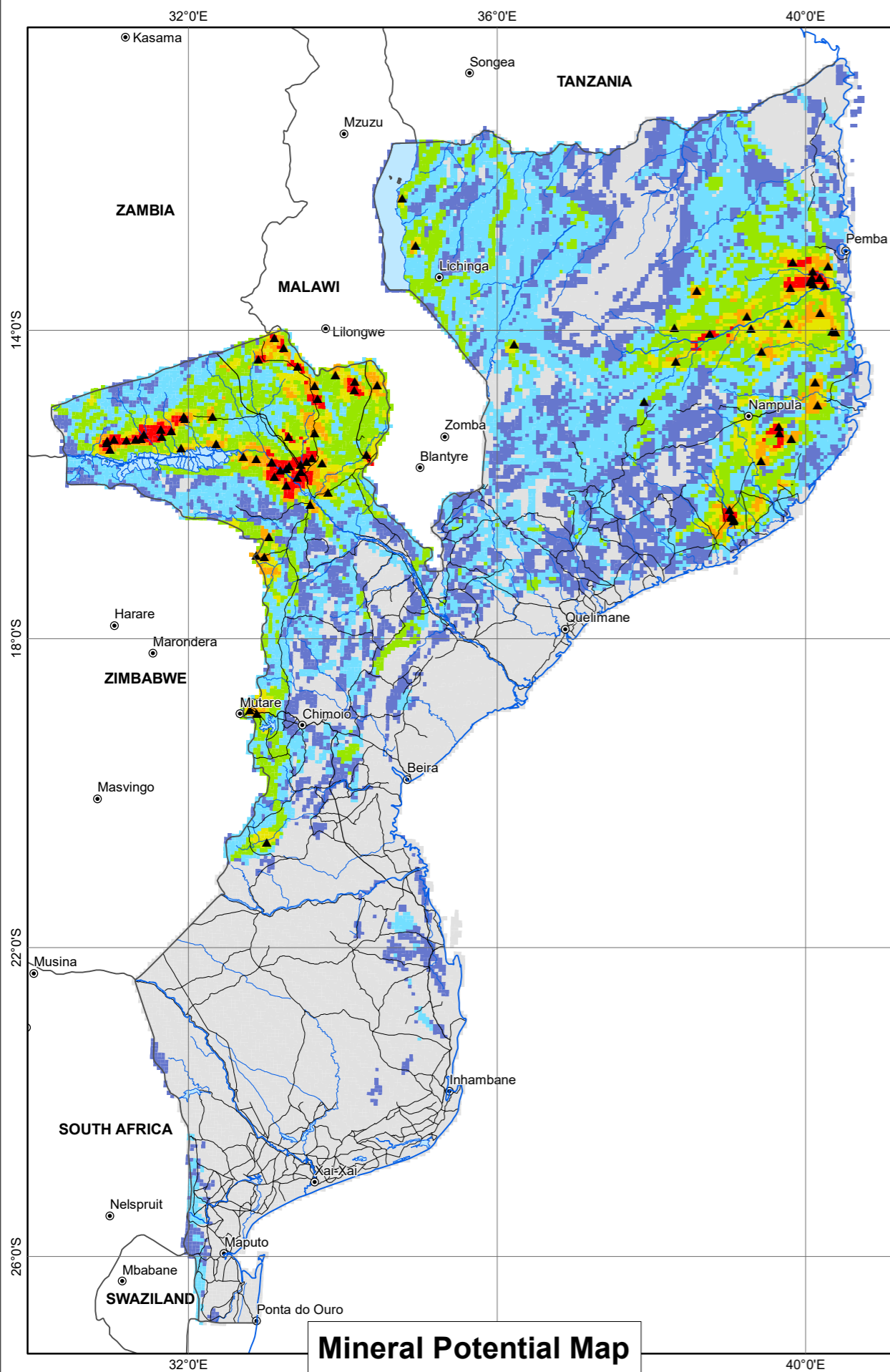
0 75 150 300 Km

Datum : WGS84 (World Geodetic System 1984)

January 2024

Country: MOZAMBIQUE

MINERAL POTENTIAL MAP - COPPER (Cu)



Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

Known occurrences

- ▲ Copper (Cu)
- ▲ SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 30799 94.47% Non-occurrence in database Non-occurrence predicted	False positive Cells: 1545 4.74% Non-occurrence in database Occurrence predicted
False negative Cells: 4 0.01% Occurrence in database Non-occurrence predicted	True positive Cells: 253 0.78% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.48
Cell size: 5000 m

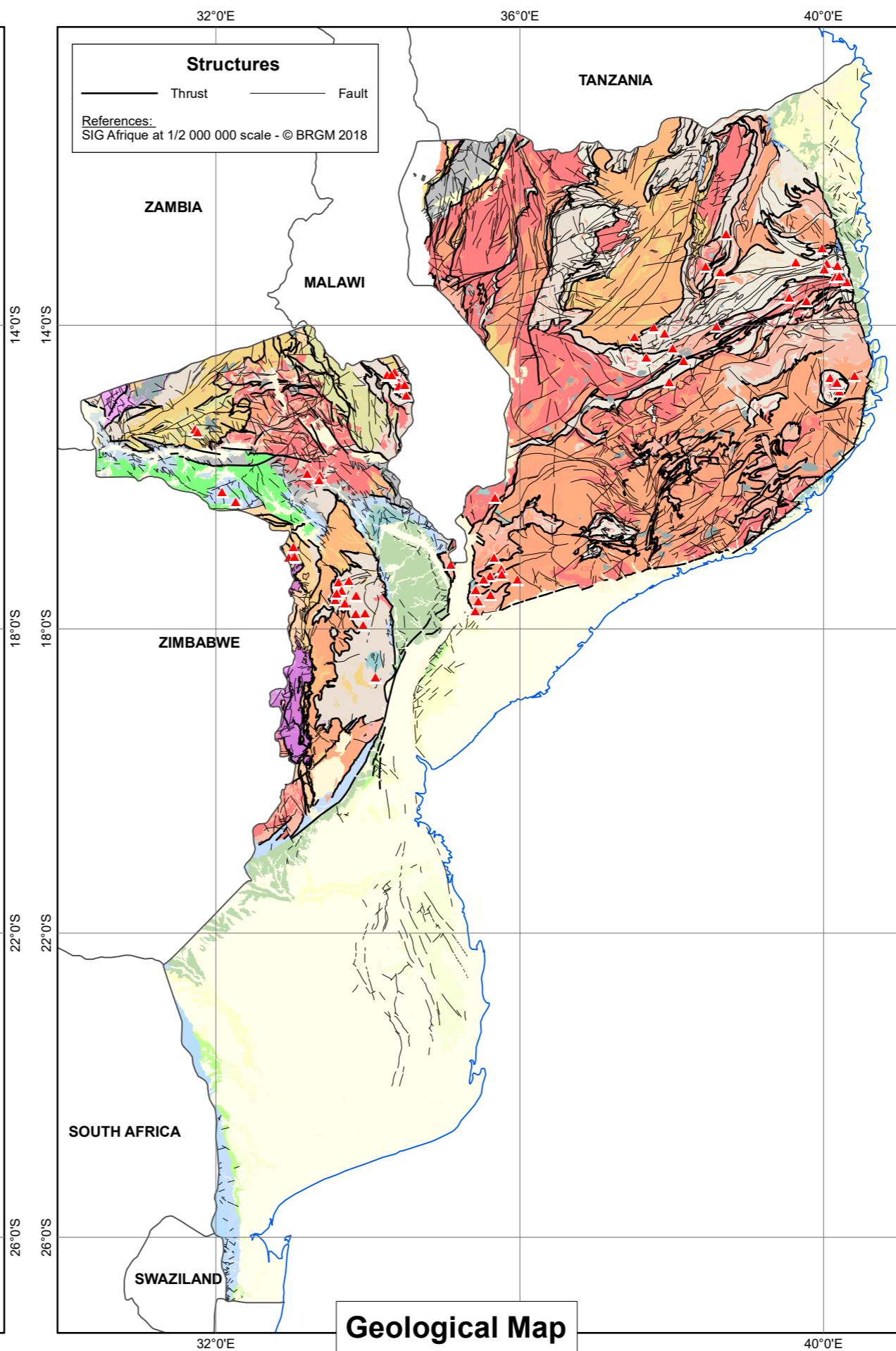
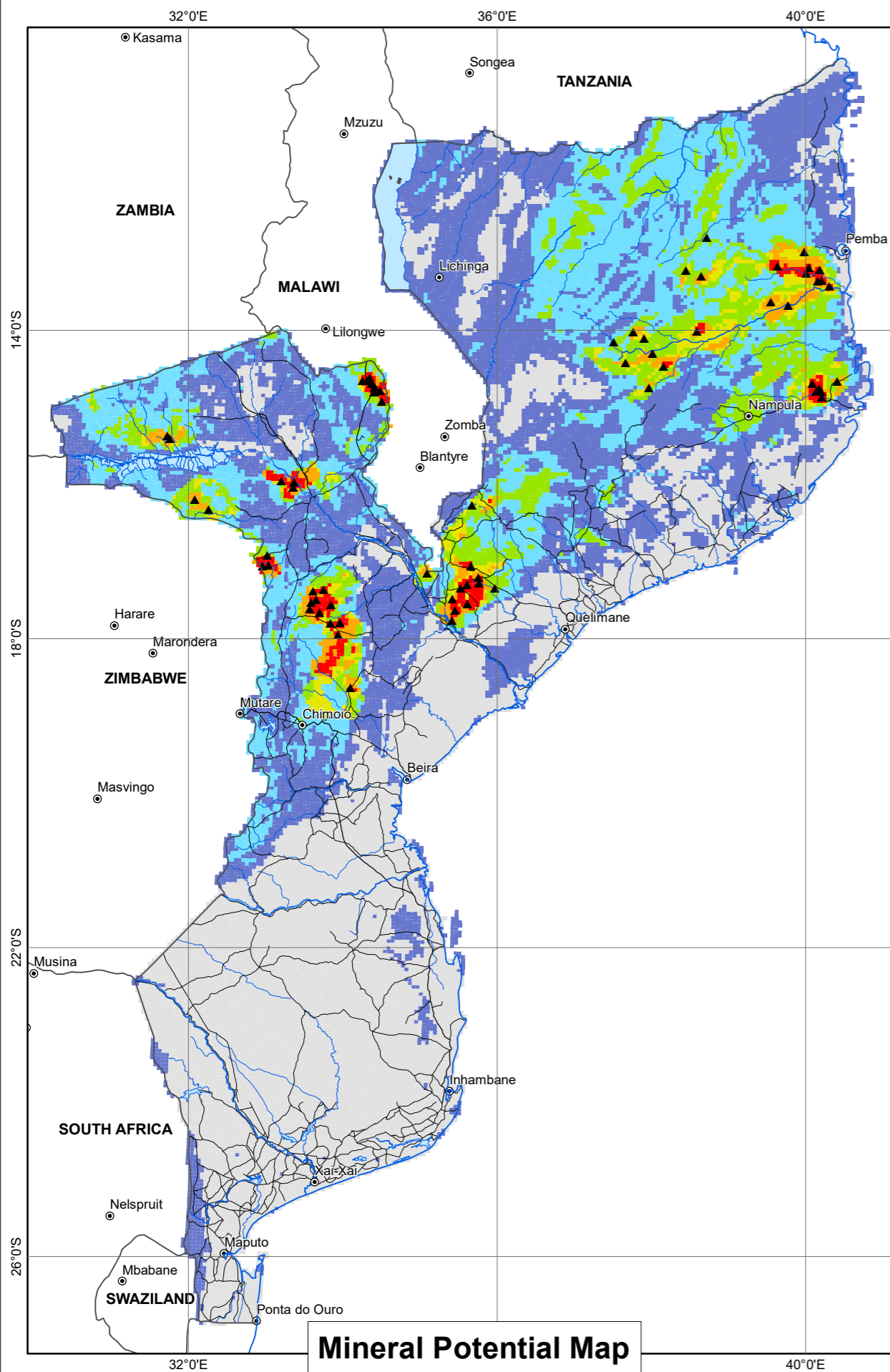
0 75 150 300 Km

Datum : WGS84 (World Geodetic System 1984)

January 2024

Country: MOZAMBIQUE

MINERAL POTENTIAL MAP - NATURAL GRAPHITE (Gr)



Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

Known occurrences

- ▲ Natural Graphite (Gr)
- ▲ SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 30975 95.02% Non-occurrence in database Non-occurrence predicted	False positive Cells: 1429 4.38% Non-occurrence in database Occurrence predicted
False negative Cells: 7 0.02% Occurrence in database Non-occurrence predicted	True positive Cells: 190 0.58% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.43
Cell size: 5000 m

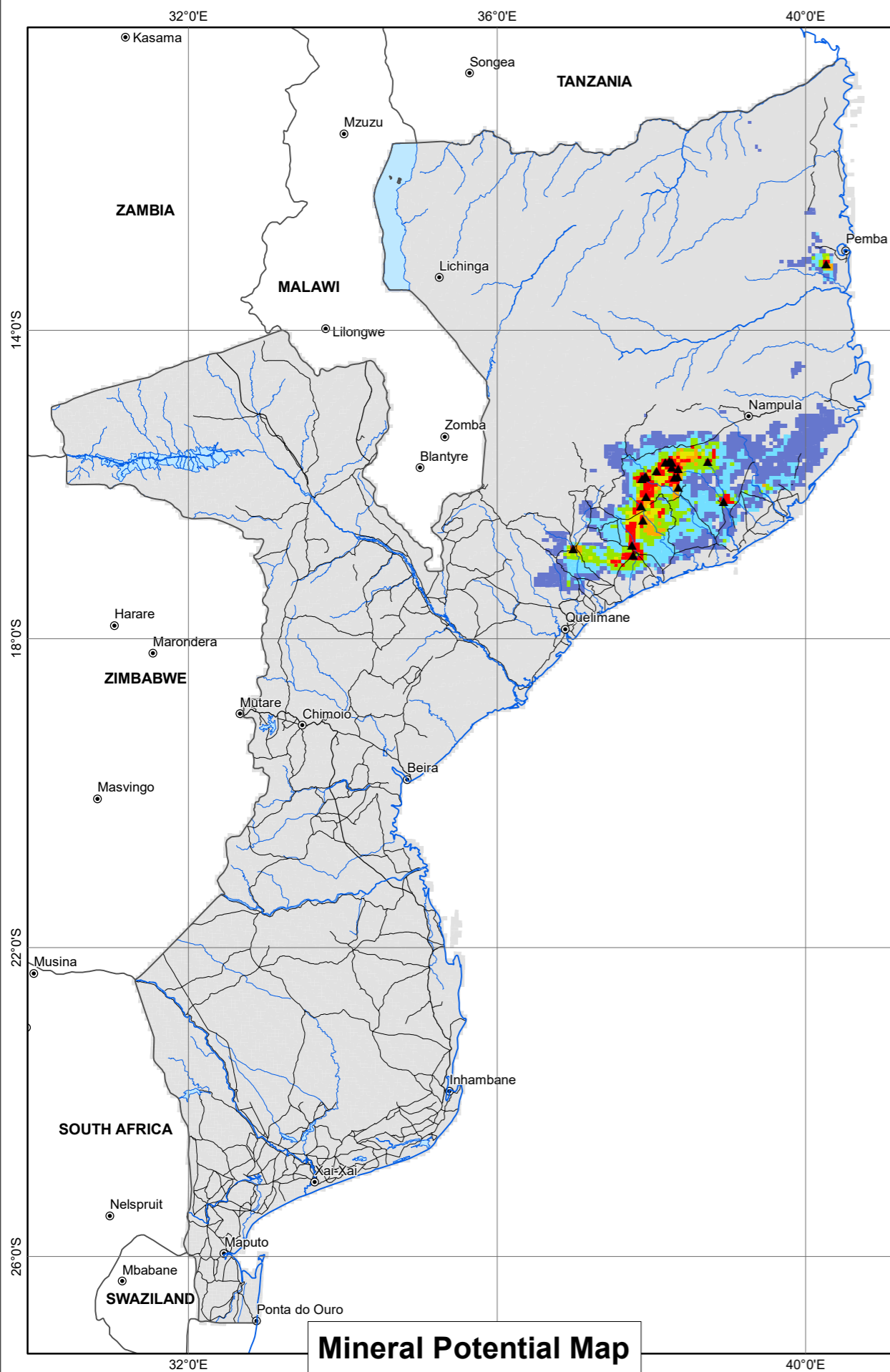
0 75 150 300 Km

Datum : WGS84 (World Geodetic System 1984)

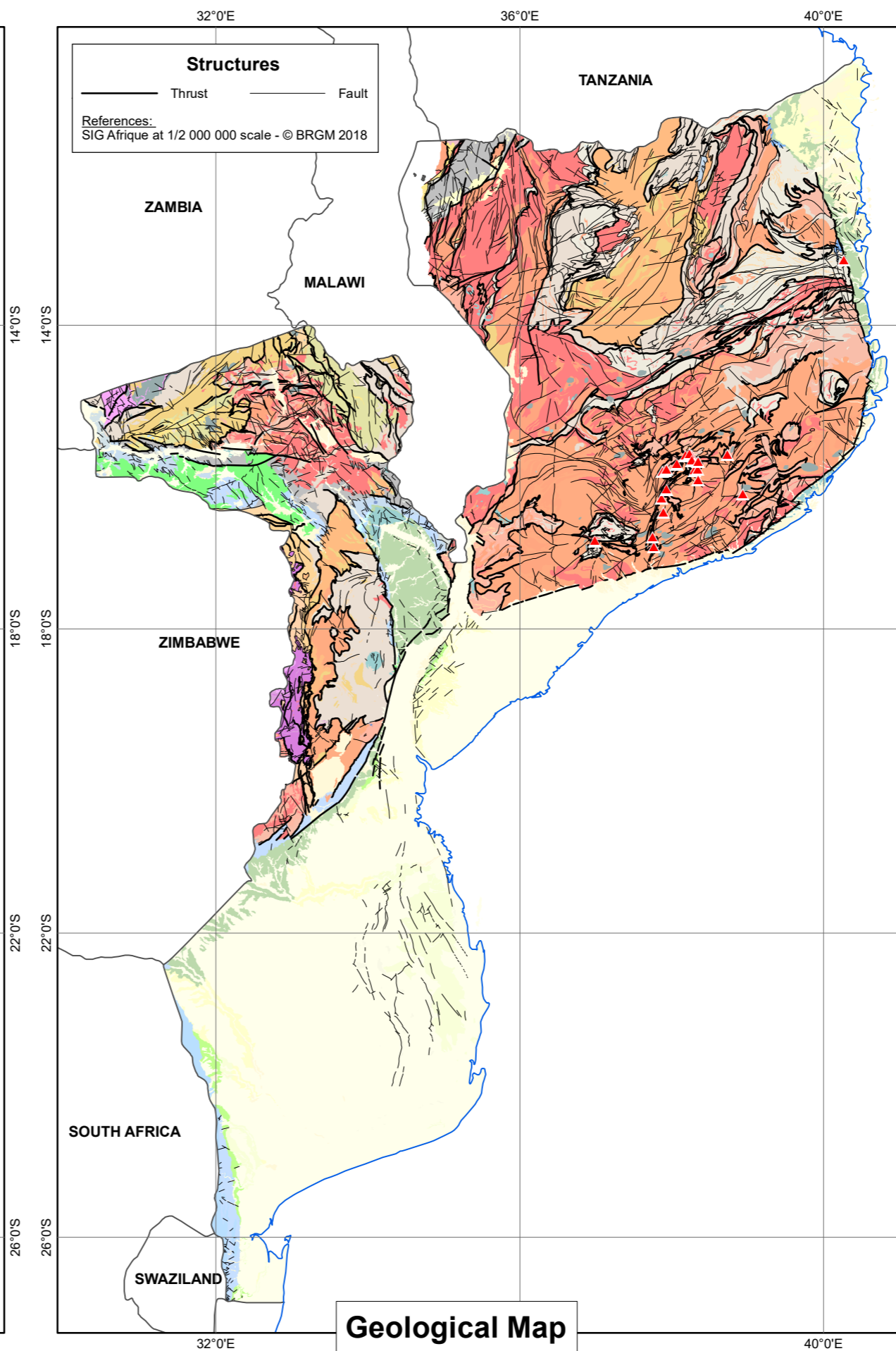
January 2024

Country: MOZAMBIQUE

MINERAL POTENTIAL MAP - LITHIUM (Li)



Mineral Potential Map



Geological Map

Legend

Score

- <math>< 0.05</math>
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

Known occurrences

- ▲ Lithium (Li)
- ▲ SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 32403 99.39% Non-occurrence in database Non-occurrence predicted	False positive Cells: 140 0.43% Non-occurrence in database Occurrence predicted
False negative Cells: 0 0.00% Occurrence in database Non-occurrence predicted	True positive Cells: 58 0.18% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.69
Cell size: 5000 m

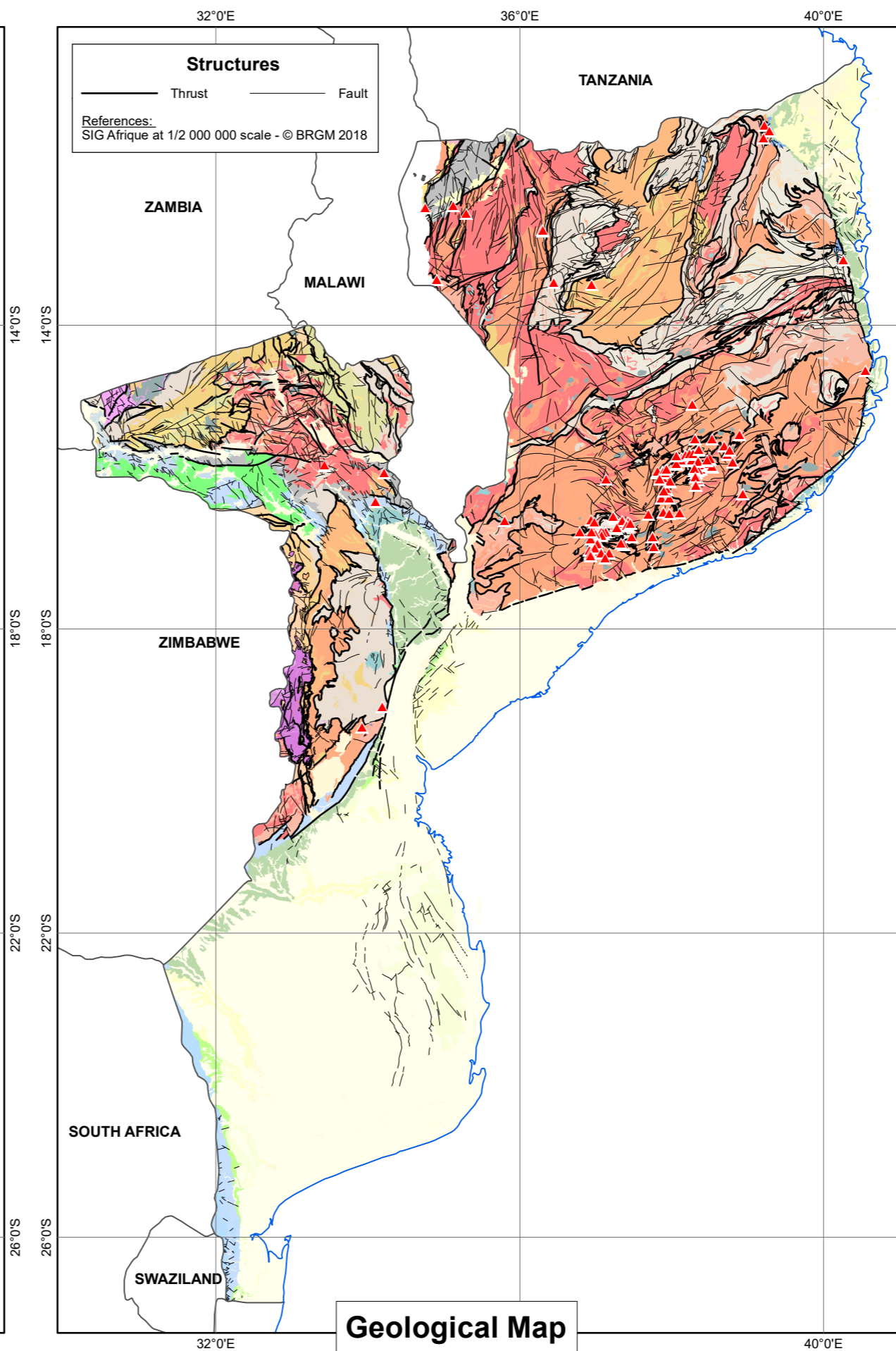
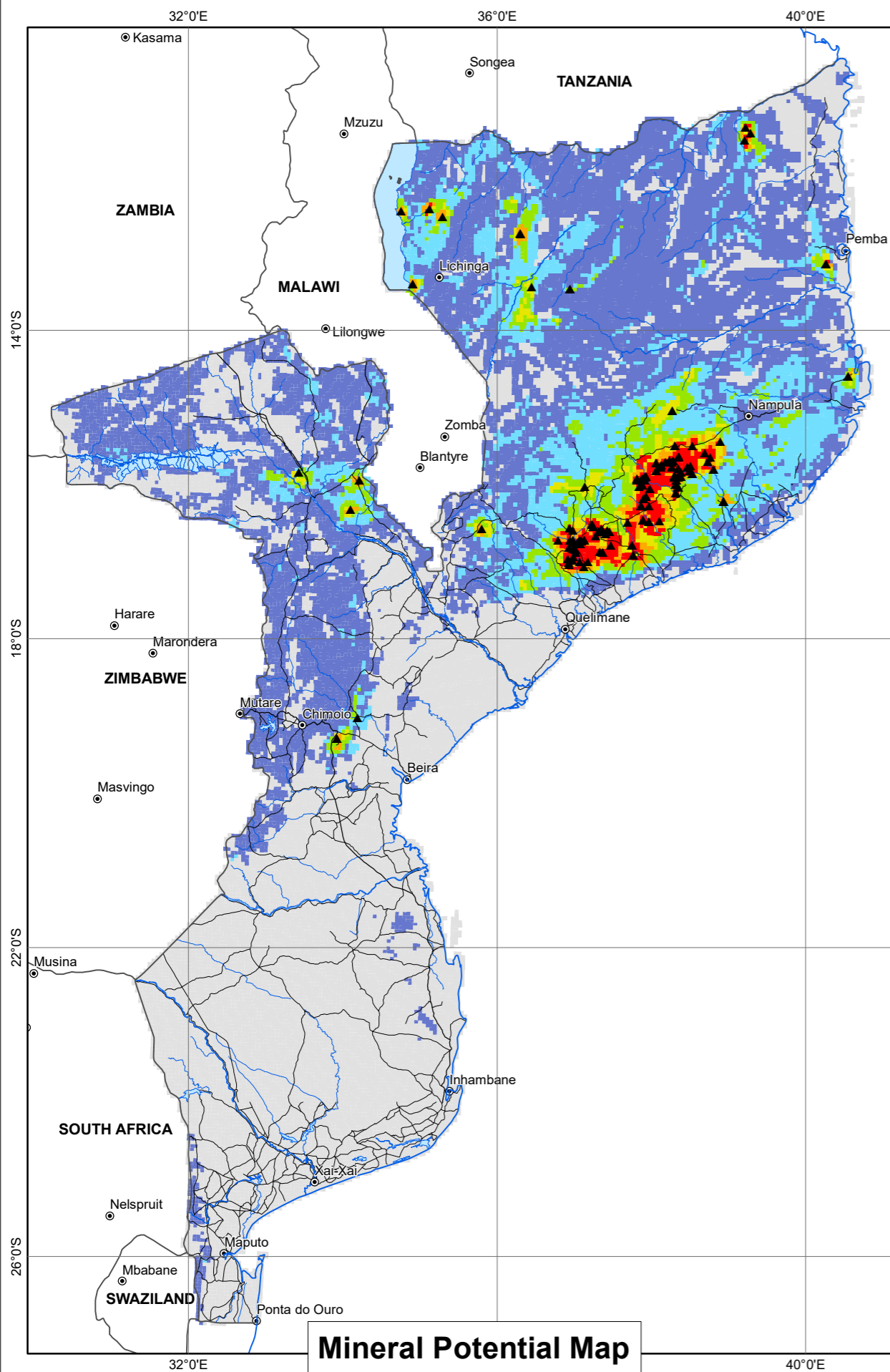
0 75 150 300 Km

Datum : WGS84 (World Geodetic System 1984)

January 2024

Country: MOZAMBIQUE

MINERAL POTENTIAL MAP - LITHIUM-NIOBIUM-TANTALUM (Li-Nb-Ta)



Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

Known occurrences

- ▲ Lithium-Niobium-Tantalum (Li-Nb-Ta)
- SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 31338 96.12% Non-occurrence in database Non-occurrence predicted	False positive Cells: 1006 3.09% Non-occurrence in database Occurrence predicted
False negative Cells: 2 0.01% Occurrence in database Non-occurrence predicted	True positive Cells: 255 0.78% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.38
 Cell size: 5000 m

0 75 150 300 Km

Datum : WGS84 (World Geodetic System 1984)

January 2024