Clean Technology Hub
Energy Innovation Centre

Mapping Nigeria's Critical Minerals: Foundations for an Energy Transition

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Introduction

The global race to achieve net-zero emissions is radically transforming the world's energy and industrial landscape. At the center of this transition is a surging demand for critical minerals, the essential raw materials used in clean energy technologies such as electric vehicles, battery storage systems, solar panels, wind turbines, and digital infrastructure. The International Energy Agency (IEA)[1] has projected a three-times increase in critical minerals demand globally by 2040, reaching an estimated 35 million tonnes annually, if countries fulfill their national energy and climate pledges.

Africa is home to approximately 30% of the world's critical mineral reserves[2], placing the continent at the heart of the global shift toward clean energy technologies. This has sparked renewed geopolitical and economic interest in Africa's mineral wealth and positioned the continent as a strategic supplier for the global energy transition.

Within this broader context, Nigeria's mineral wealth and strategic positioning within Africa offer economic development opportunities. The Federal Government of Nigeria (FGN), in its Mining Roadmap 2015, identified seven strategic minerals:[3] **coal, bitumen, limestone, iron ore, barites, gold, and lead/zinc** for focused development. These were selected based on the commerciality of their known reserves and their potential to stimulate broad-based economic growth through industrial linkages, including construction, cement production, steel development, and oil and gas applications. However, this list has remained static, and the country has yet to fully adapt its mineral strategy to the fast-evolving global priorities surrounding clean energy and digital technologies.

In light of the evolving global energy landscape, the need to revisit Nigeria's mineral prioritisation has become urgent. The Ministry of Solid Minerals Development (MSMD) is reportedly considering the addition of lithium and nickel[4] to the list of strategic minerals, in recognition of their centrality to the green economy and potential to enhance Nigeria's industrial resilience and climate response. While progress is underway, Nigeria is yet to establish a comprehensive framework for critical minerals to guide their effective management and development across the supply chain. In addition, there remains limited accessible data and technical documentation that assess the country's resource potential and associated beneficiation pathways.

Globally, critical minerals are defined by two main criteria: their economic importance in key technologies and the vulnerability of their supply chains to disruption. These criteria are dynamic and context-specific,

[1] A new frontier for global energy security frontier https://www.iea.org/topics/critical-minerals

[2] Chandler, B. (2022, October). Africa's critical minerals: Africa at the heart of a low-carbon future. Mo Ibrahim Foundation. https://mo.ibrahim.foundation/sites/default/files/2022-11/minerals-resource-governance.pdf

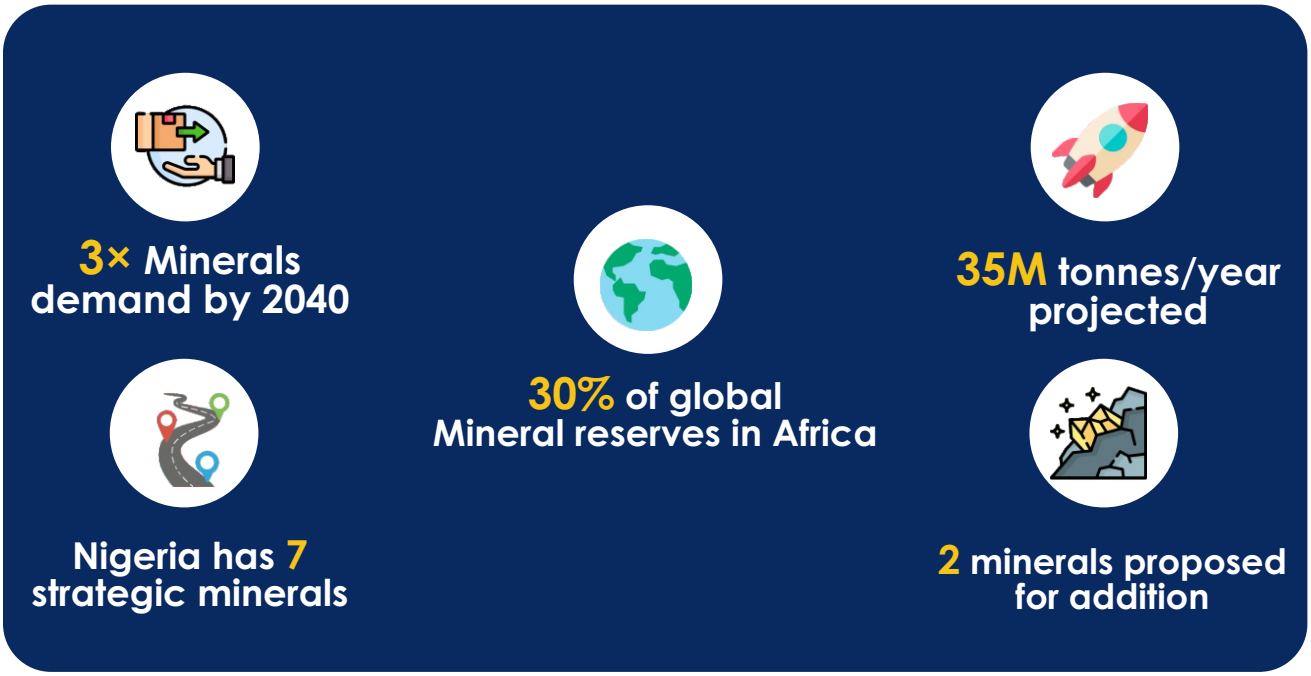
[3] PWC (2023, July). Nigerian mining – Progress, but still a long way to go s://www.pwc.com/ng/en/assets/pdf/nigerian-mining-progress-but-still-a-long-way-to-go1.pdf

[4] PWC (2023, July). Nigerian mining – Progress, but still a long way to go s://www.pwc.com/ng/en/assets/pdf/nigerian-mining-progress-but-still-a-long-way-to-go1.pdf

[5] Nigeria Economic Summit Group. (2023,). Nigeria's mining sector governance landscape and prospects: A diagnostic report.

shaped by evolving technological trends, policy priorities, market conditions, and geopolitical risks. As such, criticality assessments require regular updating and must consider both domestic development goals and international market trends.

This report presents a preliminary mapping of Nigeria's critical mineral potential, with a focus on those minerals most relevant to the energy transition. It highlights key occurrences and evaluates their strategic relevance. The aim is to inform future policy, stimulate targeted investment, and support the development of a national critical minerals strategy.



Methodology

This report adopts a desk-based approach to map Nigeria's critical minerals relevant to the global energy transition. It focuses on minerals essential for clean technologies such as lithium, nickel, cobalt, manganese, graphite, and rare earth elements, identified by global agencies like the IEA as crucial to decarbonisation efforts. Data was drawn from official publications by the Nigerian Geological Survey Agency (NGSA), national policy documents, academic literature, and credible media reports. Mineral occurrences were reviewed across several Nigerian states, with attention to their grade, concentration, and association with clean energy technologies. The locations were then categorised based on known viability, exploration status, and infrastructure capacity.

Due to limited access to real-time geological datasets, the mapping relies solely on available secondary data, gaps remain in areas where government or geological data is not publicly available. Nevertheless, this mapping offers a foundational understanding of Nigeria's critical mineral landscape and aims to support future research, policy development, and investment decisions that align with national goals for a sustainable energy transition.

Critical Minerals in Nigeria

Nigeria is emerging as a regional hub for critical minerals, driven by the increasing geological data revealing its extensive reserves. Its geological framework favours the conditions necessary for housing a wide range of critical minerals. A key feature is the occurrence of pegmatites within the Neo Proterozoic schist belts, which serve as host rocks for lithium and rare earth metals[6].

However, the exploitation of critical minerals in Nigeria has not reached its potential. In 2019 and 2020, the most mined minerals in the country were limestone, sand, granite, and laterite.[7] Yet Nigeria has significant potential to develop its critical mineral resources. For example, Recent estimates place its Lithium reserves at about $34 billion[8], with Nickel reserves at approximately 5 billion tonnes[9], and significant deposits of copper and cobalt.

Beyond raw mineral extraction, Nigeria holds potential across the entire critical minerals value chain, from exploration and mining to local beneficiation, refining, and export. Lithium beneficiation facilities are emerging in states like Nassarawa[10]. Scaling up local value addition would boost the country's revenue, create jobs, and contribute to the long-term sustainability goals.

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[6] Olade, M. (2024). Overview of the lithium geo-resources of Nigeria. Conference of the Nigerian Society of Economic Geologists, Ilorin, Nigeria.
[7] NBS (2021). Mineral Production Statistics 2019 - 2020. Abuja: National Bureau of Statistics. https://www.nigerianstat.gov.ng/elibrary/read/1241100.
[8] Oladehinde Oladipo. (2025). *Nigeria's $34bn lithium reserves in demand amid global rush*. BusinessDay. https://businessday.ng/news/article/nigerias-34bn-lithium-reserves-in-demand-amid-global-rush/
[9] https://www.sun.edu.ng/knowledgebase-articles/overview-of-the-occurrence-of-nickel-in-nigeria/
[10] Anyanwu, S. (2024) *President Bola Tinubu Commissioned First Largest Lithium Processing Plant in Nasarawa*. Federal Ministry of Information and National Orientation. https://fmino.gov.ng/president-bola-tinubu-commissioned-first-largest-lithium-processing-plant-in-nasarawa/

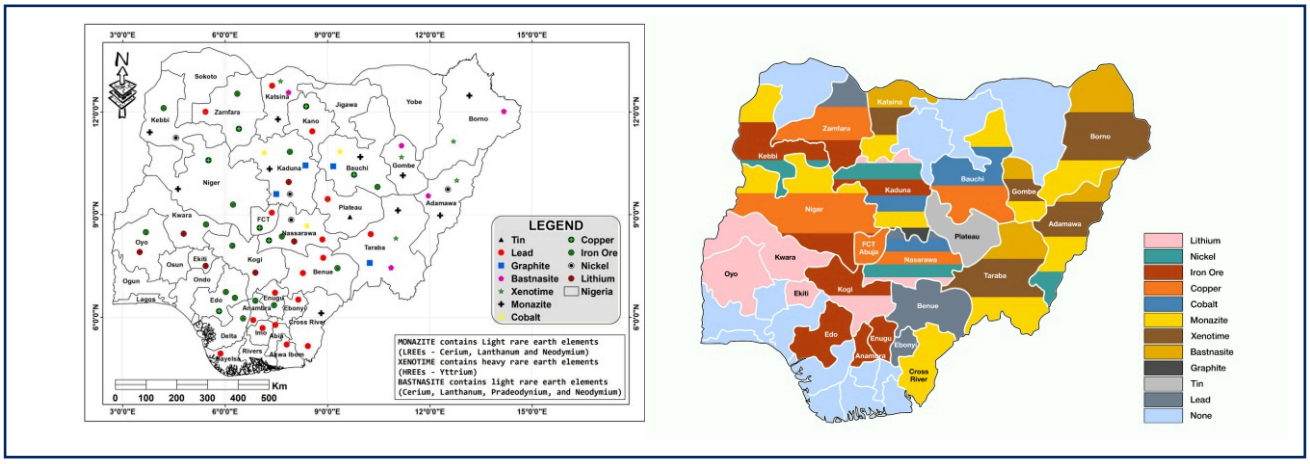

Fig. 1: Map of Nigeria showing the distribution of Critical Mineral Deposits

Lithium

Fig. 2: A piece of Lithium Ore

Recent discoveries have positioned Nigeria as a promising lithium source with vast reserves estimated to be worth over $34 billion[11]. Lithium's critical role in powering electric vehicles (EVs) and producing solar panels has made it one of the most sought-after minerals globally. The surge in electric vehicle (EV) battery production is the main driver behind the growing global demand for critical minerals like lithium. In 2023, lithium used in batteries reached approximately 140,000 tonnes, accounting for 85% of total lithium demand, marking a rise of over 30% from 2022[12].

This growing demand has spurred rapid industrial activity, including the establishment of multiple lithium processing factories across the country. Notably, a lithium factory was commissioned in Nassarawa State[13] in May 2024, operated by the Chinese-backed Avatar Energy, with a capacity to produce 4,000 metric tonnes of lithium daily and up to one million annually. Another factory is underway, set to be launched in Abuja, signalling continued investment in the sector.

[11] Oladehinde Oladipo. (2025). *Nigeria's $34bn lithium reserves in demand amid global rush*. BusinessDay. https://businessday.ng/news/article/nigerias-34bn-lithium-reserves-in-demand-amid-global-rush/

[12] International Energy Agency. (2024). *Trends in electric vehicle batteries*. In *Global EV Outlook 2024*. https://www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-vehicle-batteries

[13] Anyanwu, S. (2024) *President Bola Tinubu Commissioned First Largest Lithium Processing Plant in Nasarawa*. Federal Ministry of Information and National Orientation. https://fmino.gov.ng/president-bola-tinubu-commissioned-first-largest-lithium-processing-plant-in-nasarawa/

Surveys carried out by the Nigerian Geological Agency (NGSA) provided further insights into Nigeria's Lithium. The survey showed 2 high-grade varieties of lithium (spodumene and lepidolite)[14] ranging from 1% to as high as 13%, particularly in **Kwara and Oyo States.** These values exceed the global economic cut-off[15] of 0.4% Li_2O. This occurrence is in association with some rare earth metals such as cassiterite and columbite-tantalite, amongst others.

The locations[16] with this viable amount of Lithium include: ***Kwara, Nassarawa, Kogi, Ekiti, Kaduna, Oyo*** **Osun**. States with unknown economic viability are: ***Cross River, Bauchi, Niger, Edo and Taraba.***

Table 1: Key Lithium-Bearing Locations in Nigeria (Olade, 2023)

State	Pegmatite District	Local Govt Area	Dominant Mineralogy	Li_2O (%) Range
Oyo	Oke-Ogun	Komu	Spodumene >> Lepidolite	1.3 – 9.3% (Avg. 7%)
Oyo	Oke-Ogun	Iwajowa	Spodumene >> Lepidolite	Avg. 6%
Kwara	Kaiama/Bina	Kaiama/Bina	Spodumene	1.3 – 6.2%
Kwara	Gbu-Gbu/Lema	Gbu-Gbu	Spodumene >> Lepidolite	1 – 13% (Avg. 7%)
Kwara	Pategi-Share	Pategi	Spodumene	0.5 – 4%
Ekiti	Ijero-Ekiti	Ijero	Lepidolite	0.2 – 4.5%
Kogi	Egbe-Isanlu	Odo Eri	Lepidolite	2.70%
Nasarawa	Nasarawa	Nasarawa	Lepidolite, Spodumene	2.0 – 8.4%
Nasarawa	Keffi/Kokona	Keffi/Kokona	Lepidolite, Polylithionite	0.70%
Kaduna	Jema'a	Dangoma	Lepidolite, Spodumene	2 – 7% (Avg. 3.4%)

[14] Sakinat Damare Abubakar, The Role of Nigeria's Critical Minerals in the Global Energy Transition, VerivAfrica, published March 3, 2025. https://www.verivafrica.com/insights/the-role-of-nigerias-critical-minerals-in-the-global-energy-transition.
[15] Moses A. Olade, Lithium Geo-Resources in Pan-African Pegmatites of Nigeria – An Evaluation of Their Geological and Geochemical Characteristics and Implications for Mineral Exploration, Global Journal of Pure and Applied Sciences, vol. 31
[16] Moses A. Olade, Lithium Geo-Resources in Pan-African Pegmatites of Nigeria – An Evaluation of Their Geological and Geochemical Characteristics and Implications for Mineral Exploration, Global Journal of Pure and Applied Sciences, vol. 31

Nickel

Fig. 3: Pieces of Nickel Ore (The whistler 2016)

Nickel plays a vital role in energy storage technologies, especially as advancements in electric vehicle (EV) battery design continue to evolve. According to the International Energy Agency (IEA), demand for nickel is projected to rise by 65% this decade,[17] driven by its extensive use across clean energy technologies, including EVs, battery storage systems, geothermal, and hydrogen applications.

Surveys conducted by the Nigerian Geological Survey Agency (NGSA) indicate that Nigeria possesses high-grade nickel deposits in economically viable quantities. The country is estimated to have approximately 5 million metric tonnes of reserves[18], with an average nickel concentration ranging between 1% and 3%. Data from the UN Comtrade database below shows insights into Nigeria's nickel exports from 2000 to 2015 (Fig. 3).

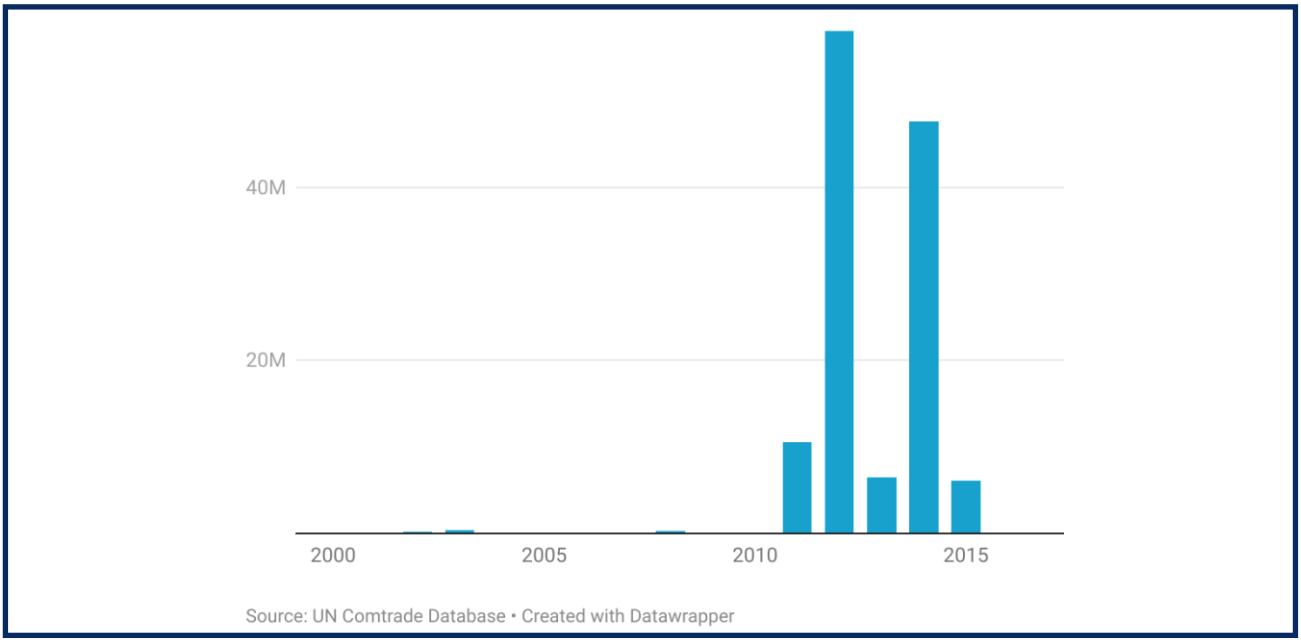

Fig. 3: Nigeria's Nickel Export between 2000 and 2015 (Author's illustration based on UN Comtrade Database)

[17] Aboli More, *Nickel Market Growth USD 55.7 Bn by 2033 at 5.5% CAGR*, Market.us News, September 2024 https://www.news.market.us/nickel-market-news/#:~:text=According%20to%20the%20International%20Energy,to%20218.9kt%20in%202023.

[18] https://www.sun.edu.ng/knowledgebase-articles/overview-of-the-occurrence-of-nickel-in-nigeria/

A significant discovery was made in August 2016 when Comet Minerals[19], an Australian mining company, identified a unique nickel deposit near ***Dangoma and Bakin Kogi villages in Kaduna State.*** Nicknamed the "Titan," this world-class deposit spans roughly 20 km², with the richest zone confined to 1 km². This unusual form of nickel occurrence distinguishes the Titan deposit on a global scale. Other states with economically viable deposits are: ***Nasarawa and Kebbi[20].***

Iron

High-quality iron ore is essential for manufacturing low-carbon steel, positioning it as a critical material in advancing global decarbonisation efforts[21]. Iron ore is among Nigeria's most abundant metallic resources, with over 1 billion tonnes in reserves, with 800 million proven and 500 million probable reserves spread across states such as ***Kogi, Enugu, Niger, Zamfara, Kaduna, Oyo, and Anambra[22].*** The most mineable deposits lie in Kogi's Okene-Lokoja-Kabba axis, known as the "Iron Triangle[23]."

Fig. 4: Pieces of Iron Ore (The Guardian, 2019)

Dominant ore minerals include hematite, magnetite, and goethite. Steel derived from iron ore is vital for renewable energy infrastructure, powering wind turbines, solar panel supports, and hydropower systems, and for producing magnets used in generators and electric motors, positioning iron as a key enabler of the clean energy transition[24].

The Itakpe Iron Ore Mine, operated by the National Iron Ore Mining Company (NIOMCO), remains Nigeria's flagship iron mining site. Efforts are ongoing to expand beneficiation and pelletizing capacity to support domestic steel production and reduce reliance on imports.

19 https://www.researchgate.net/publication/338711314_Perspectives_on_the_Recently-Discovered_Native_Nickel_Deposit_in_Dangoma_Kaduna_State_Nigeria

20 Sakinat Damare Abubakar, The Role of Nigeria's Critical Minerals in the Global Energy Transition, VerivAfrica, published March 3, 2025. https://www.verivafrica.com/insights/the-role-of-nigerias-critical-minerals-in-the-global-energy-transition.

21 Kolisnichenko, V. (2024, June 24). *Canada adds iron ore to the list of critical raw materials*. GMK Center. https://gmk.center/en/news/canada-adds-iron-ore-to-the-list-of-critical-raw-materials/

22 Moses Olade, 2019, *Geological Re-Evaluation of Nigeria's Iron Ore Deposits as Raw Materials for a Viable Iron and Steel Industry*, *Achievers Journal of Scientific Research*, vol. 2, no. 1, Open Access Publication of Achievers University, Owo

23 Moses Olade, *Geological Re-Evaluation of Nigeria's Iron Ore Deposits as Raw Materials for a Viable Iron and Steel Industry*, *Achievers Journal of Scientific Research*, vol. 2, no. 1, Open Access Publication of Achievers University, Owo

24 Sakinat Damare Abubakar, The Role of Nigeria's Critical Minerals in the Global Energy Transition, VerivAfrica, published March 3, 2025. https://www.verivafrica.com/insights/the-role-of-nigerias-critical-minerals-in-the-global-energy-transition

Table 2: Summary of Iron Ore Deposits in Nigeria by Location, State, and Iron Content (Fe wt. %), (*Olade, 2019*)

S/N	Deposit Location	State	Fe (wt. %)
1	Itakpe	Kogi	36
2	Ajabonoko	Kogi	37
3	Agbado-Okudu	Kogi	35
4	Ochokochoko	Kogi	34
5	Tajimi	Kogi	38
6	Ebiya	Kogi	34
7	Akoina	Kogi	41
8	Akunnu-Akoko	Ondo	–
9	Ogbomoso	Oyo	39
10	Gandafelan	Adamawa	38
11	Agbaja (Mt Patti)	Kogi	47
12	Kogi Iron	Kogi	41
13	Koton Karfe	Kogi	48
14	Bassa Nge	Kogi	46
15	Nsude	Enugu	47
16	Ameki-Ohafia	Abia	38
17	Nsugbe Hill	Anambra	–
18	Maru	Zamfara	35
19	Dakin Gari	Kebbi	29
20	Wonaka	Zamfara	29
21	Rishi	Bauchi	15
22	Dakin Gari	Kebbi	29
23	Muro-Toto	Nassarawa	31
24	Kagarko (Kubacha)	Kaduna	60
25	Birnin Gwari	Kaduna	34
26	Kazaure	Jigawa	32
27	Kakun	Kogi	62
28	Jawara	Kaduna	61
29	Gujeni	Kaduna	48
30	Iyuku	Edo	45
31	Agbaja Laterite	Kogi	46

Created with Datawrapper

Copper

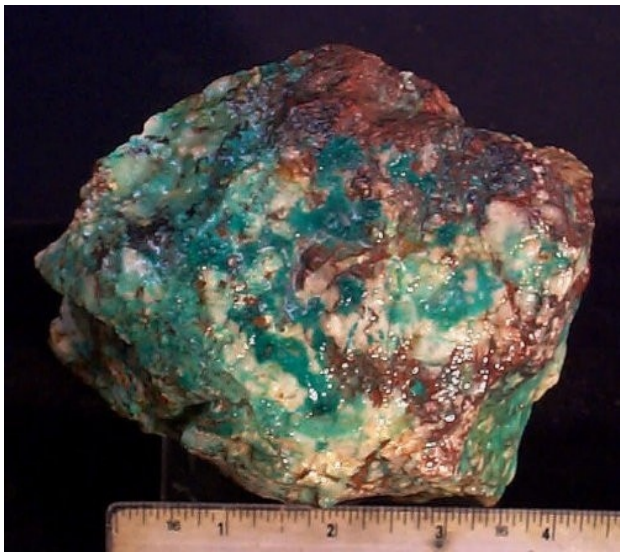

Fig. 5: A piece of copper ore (Nyahetok General Traders, 2012)

Copper plays an important role in energy technology, national defence, and consumer electronics. Demand for refined copper rose by 2.7% in 2023, up from 0.9% in 2022[25], driven by its essential use in electrical applications, renewable energy systems (wind, solar, geothermal), defence technologies, and power grid modernization.

In Nigeria, a 2019 NGSA assessment[26] identified significant copper resources in the Azara metallogenic province within the Middle Benue Trough, hosted mainly in Lower Cretaceous sandstones and shales.

The primary ore is chalcopyrite, with azurite and malachite associations. Mineralisation trends southwest–northeast, peaking at a 19.01% copper concentration in the Akiri area. Significant copper ore deposits are found in ***Azara and Akiri in Nasarawa State,*** along with occurrences in **Bauchi, Zamfara, Niger, and the Federal Capital Territory (FCT).** Nigeria's copper ore reserves are estimated to exceed 10 million tonnes**.**

Iron Reserves: Nigeria has over **1 billion tonnes of iron ore**, mainly in Kogi's "Iron Triangle"; key for low-carbon steel and clean energy infrastructure.

Copper Reserves: Nigeria holds over **10 million tonnes of copper**, with high-grade deposits (up to 19.01% concentration) in Azara and Akiri, Nasarawa State.

Strategic Uses: Both iron and copper are critical for renewable energy systems, power grids, electric motors, and national industrial growth.

[25] Sakinat Damare Abubakar, The Role of Nigeria's Critical Minerals in the Global Energy Transition, VerivAfrica, published March 3, 2025. https://www.verivafrica.com/insights/the-role-of-nigerias-critical-minerals-in-the-global-energy-transition.

[26] Nigeria Geological Survey Agency. (2021, March 22). *Geophysical investigation of copper deposit in Azara area, Nasarawa State.* https://ngsa.gov.ng/geophysical-investigation-of-copper-deposit-in-azara-area-nasarawa-state/

Cobalt

Fig. 6: A piece of cobalt ore

Cobalt, widely used in stabilising battery cathodes. It is mostly found in association with minerals like copper, nickel, gold, and iron. In Nigeria, Cobalt is mined as a by-product of Nickel and Copper. Known cobalt occurrences are reported in **Nasarawa, Kaduna, and Bauchi.**[27] Nigeria has cobalt occurrences yet to be fully evaluated, but they show potential in areas where copper and graphite coexist. More detailed exploration and economic assessment are required.

Monazite

Fig. 7: A piece of Monazite (Geiger Check)

Monazite is a phosphate mineral that serves as a significant source of light rare earth elements (LREEs) such as cerium (Ce), lanthanum (La), neodymium (Nd), praseodymium (Pr), and samarium (Sm). It also contains appreciable amounts of thorium (Th) and trace uranium (U) levels, contributing to its natural radioactivity[28]. Due to its high REE concentration, monazite is considered a critical mineral in high demand for clean energy, defence, and advanced electronics.

[27] Nigeria Economic Summit Group. (2023, February). Nigeria's mining sector governance landscape and prospects: A diagnostic report.
[28] https://geigercheck.com/product/monazite-ce-crystal-from-madagascar-uranium-ore-thorium-ore/

In Nigeria, monazite deposits are found across several states, including ***Bauchi (Rafin-Kayan, Toro, Alkaleri, Ningi, Tafawa Balewa), Adamawa, Gombe, Taraba, Borno, and Katsina***[29]. A research by Commodity 1 highlighted other possible locations such as: ***Cross River, Kaduna, Kebbi, and Niger States.***[30] These deposits are typically associated with alluvial and placer formations in riverbeds and coastal sands and are often found alongside minerals like ilmenite, zircon, rutile, quartz, feldspar, and mica. Monazite ore in Nigeria is a significant source of rare earth minerals, particularly ***Cerium, Lanthanum, and Neodymium***[31]. According to the United States Geological Survey, Nigeria holds an estimated 6 million tonnes[32] of monazite ore reserves, highlighting its potential as an important supplier of rare earth elements for global industries.

Xenotime

Fig. 8: A piece of Xenotime Ore (Dakota Matrix)

Xenotime is a ***yttrium*** phosphate mineral (YPO_4) and a primary source of heavy rare earth elements (HREEs) like ***yttrium***. Unlike monazite, xenotime is more valuable in applications like permanent magnets, nuclear technologies, and lasers, due to its HREE content.

In Nigeria, Xenotime is also found in ***Adamawa, Gombe, Taraba, Borno, and Katsina***[33].

Cobalt: Occurs as a by-product of nickel and copper in Nasarawa, Kaduna, and Bauchi; potential remains largely unexplored.

Monazite: Nigeria holds an estimated 6 million tonnes of monazite ore, rich in light rare earth elements, found in Bauchi, Adamawa, Gombe, and others.

Xenotime: A key heavy rare earth element source, found in Adamawa, Gombe, Taraba, Borno, and Katsina, used in magnets, lasers, and nuclear tech.

[29] Sakinat Damare Abubakar, The Role of Nigeria's Critical Minerals in the Global Energy Transition, VerivAfrica, published March 3, 2025. https://www.verivafrica.com/insights/the-role-of-nigerias-critical-minerals-in-the-global-energy-transition.
[30] https://commodity1.com/monozite-ore/
[31] https://commodity1.com/monozite-ore/
[32] https://commodity1.com/monozite-ore/
[33] Sakinat Damare Abubakar, The Role of Nigeria's Critical Minerals in the Global Energy Transition, VerivAfrica, published March 3, 2025. https://www.verivafrica.com/insights/the-role-of-nigerias-critical-minerals-in-the-global-energy-transition.

Bastnasite

Fig. 9: A piece of Bastanite Ore (Dakota Matrix)

Bastnasite is a fluorocarbonate mineral primarily composed of Light rare earth elements(LREEs) such as ***Cerium, lanthanum, Praseodymium, and Neodymium.*** In Nigeria, Bastnasite is also found in ***Adamawa, Gombe, Taraba, Borno, and Katsina***[34]***.*** It is used in various high-tech applications, including strong magnets used in smartphones, speakers, microphones, and vibration motors

Molybdenum

Fig. 10: A piece of Molybdenum Ore (International Molybdenum Association)

Molybdenum is a metal extracted from Molybdenite, used in various industries. Molybdenum is used in high-strength steel and as a catalyst in industrial processes.

NGSA reports the occurrence of Molybdenum rich in Aluminium in ***Plateau, Ondo, Ekiti, and Adamawa States.***[35]

Molybdenum Mines Nigeria Ltd operates a mining lease covering a 2.6 km² area in Kaura, Kaduna State. The lease is situated 30 km from Jos Dry Port, which provides rail access to Lagos for mineral exports.

[34] Sakinat Damare Abubakar, The Role of Nigeria's Critical Minerals in the Global Energy Transition, VerivAfrica, published March 3, 2025. https://www.verivafrica.com/insights/the-role-of-nigerias-critical-minerals-in-the-global-energy-transition.

[35] Nigeria Economic Summit Group. (2023, February). Nigeria's mining sector governance landscape and prospects: A diagnostic report.

The deposit consists of Molybdenite-bearing granitic rock outcrops, with a rich presence of lead, silver, palladium, and iridium as by-products.

Bauxite

Fig. 11: A piece of Bauxite Ore (Sandatlas)

Bauxite, the primary source of aluminium, is used to produce about 98% of aluminium globally. Africa plays host to around one-third of the world's bauxite, more than any other region[36]. In Nigeria, large bauxite deposits are found in ***Plateau, Ondo, Ekiti, and Adamawa States***.

Aluminium, derived from bauxite, plays a critical role in the transition to a low-carbon economy. It makes up more than 85% of most parts used in solar panels[37].

It is a lightweight, durable, and highly recyclable metal that is widely used in clean energy technologies such as solar panels, wind turbines, and electric vehicles.

Tin

Fig. 12: A piece of Tin Ore

Tin, one of humans' oldest metals, remains vital in modern technology and the global energy transition. The major application of tin is for soldering, where it serves as a key connector in electronics, including smartphones, laptops, solar panels, electric vehicles, and household appliances. Its softness and low melting point make it easy to process, while its conductivity supports applications in printed circuit boards, semiconductors, and renewable energy systems[38].

[36] Chandler, B. (2022,). *Africa's critical minerals: Africa at the heart of a low-carbon future*. Mo Ibrahim Foundation.
[37] Chandler, B. (2022,). *Africa's critical minerals: Africa at the heart of a low-carbon future*. Mo Ibrahim Foundation.
[38] Scotting, B. (2024). *First Tin: Tin – A Critical Metal for the Future*. Mining Outlook.
https://www.mining-outlook.com/commodities/tin-mining-sector/first-tin-tin-a-critical-metal-for-the-future

Tin is also gaining attention in advanced battery technology as a promising anode material in lithium-ion batteries, offering higher energy density and longer life than traditional graphite[39]. In Nigeria, tin primarily occurs as cassiterite, especially on the Jos Plateau, with historical evidence showing indigenous tin smelting in the Bauchi Plateau long before colonial involvement[40].

Graphite

Fig. 12: A piece of Graphite Ore

Graphite is essential for a range of high-value industrial uses beyond batteries, including nuclear reactors, steelmaking, electronics cooling, and flame-retardant construction materials. These overlapping applications are intensifying global demand and straining supply chains.[41]

In Nigeria, known graphite occurrences in states like ***Bauchi (Sama Barkono, Dutsen Haiyar), Kaduna (Saulawa, Birnin Gwari), Adamawa (Mayo Butale), and Taraba (Gayama)*** signal such an opportunity. Yet, these deposits remain largely underexplored, with available information mostly limited to artisanal mining activity. This underscores the urgent need for a coordinated approach to mapping, evaluating, and responsibly developing Nigeria's graphite resources.

[39] Casey, D. (2024). *The Growing Demand for Tin in Battery Technology*. Zimtu Capital Corp. https://www.zimtu.com/the-growing-demand-for-tin-in-battery-technology/

[40] *Hodder, B. W. (1959). Tin Mining on the Jos Plateau of Nigeria. Economic Geography, 35(2), 109-122*

[41] Adeh, J. (2025, May 1). *Securing Graphite Supply Chains: Critical Mineral Security Beyond China*. Discovery Alert. https://discoveryalert.com.au/news/graphite-global-security-2025/

Toward a Strategic Mineral Future

Nigeria stands at a crucial moment where the global shift toward clean energy presents a unique opportunity to become a key player in the emerging global critical minerals market. Despite its significant geological potential, the absence of a critical minerals framework poses a huge gap. Nigeria must act decisively, prioritising the development of a critical minerals framework is a foundational step. This should be complemented by policies that attract sustainable investments, embed Environmental, Social, and Governance (ESG) principles across the mining lifecycle, and foster Green Technology Manufacturing Partnerships (GTMPs) that support local beneficiation and technological innovation.

With coordinated action, Nigeria can potentially secure a competitive foothold in the global clean energy ecosystem in the long term, delivering developmental economic returns through environmental resilience and social inclusion.