Location and Ranking of Exploration Targets in Nigeria

1 : 2,500,000

MINISTRY OF SOLID MINERALS DEVELOPMENT
FEDERAL REPUBLIC OF NIGERIA

Gold (Au) Targets

- Au 1: Located in Osun State, contains 17 known hydrothermal vein occurrences of Au and over 100 placer deposits, all hosted in Neoproterozoic meta-volcanics and volcano-sedimentary units. All mining activities are artisanal and active.
- Au 2: Located in Kebbi State, contains 101 active hard-rock occurrences of Au hosted in Neoproterozoic volcano-sedimentary units and Cambrian granites. All mining activities are artisanal and active.
- Au 3: Located in Niger State, is devoid of any documented hard-rock mineral occurrences and contains two placer deposits, all hosted in Neoproterozoic volcano-sedimentary units.
- Au 4: Located in Niger State, contains at least 27 active hard-rock occurrences of Au of hydrothermal genesis within Neoproterozoic volcano-sedimentary units and Cambrian granites. Presently, all mining activities are artisanal and active, and under a mining lease.
- Au 5: Located in Zamfara State, contains at least 21 active hard rock occurrences of Au hosted in Neoproterozoic volcano-sedimentary units. All mining activities are artisanal and active, and partially covered by a mining lease.
- Au 6: Located in Zamfara State, contains at least 15 active hard-rock occurrences of Au of hydrothermal genesis hosted in Neoproterozoic volcano-sedimentary units. All mining activities are artisanal and active following an N-S mineralization trend, covered by a mining lease.
- Au 7: Located between Kaduna and Niger States, contains at least two active hard rock occurrences of Au seemingly a stockwork deposit hosted in Neoproterozoic volcano-sedimentary units. All mining activities are artisanal and active following an N-S mineralization trend, covered by a mining lease.
- Au 8: Located in Kogi State, contains at least 99 active hard rock occurrences of Au suggesting a stockwork system hosted in Archean-Paleoproterozoic gneisses. All mining activities are artisanal and active following an NE-SW mineralization trend, covered by several mining licenses.
- Au 9: Located in Kebbi State, contains at least 67 mineral occurrences of Au suggesting a stockwork deposit hosted in Cambrian granites. All mining activities are artisanal and active following an NE-SW mineralization trend, partially covered by licenses.

Criteria	Points per Criterium	Au Targets and their scoring per criterium								
		Au 1	Au 2	Au 3	Au 4	Au 5	Au 6	Au 7	Au 8	Au 9
MPM Shape and intensity										
Compact pattern above 0.9	5	5							5	5
Compact pattern and above 0.8	4		4		4					
Compact pattern and above 0.7	3			3						
Diffuse pattern and above 0.9	2					2	2			
Diffuse pattern and above 0.8	1							1		
Within schist belt?										
Yes	5	5	5	5	5	5	5	5		
No	1								1	1
Within ultramafic complex?										
Yes	5	5					5			
No	1		1	1	1	1		1	1	1
Gold occurrences known?										
Yes	5	5	5		5	5	5	5	5	5
No	1			1						
Gold currently being mined?										
Yes	5	5	5			5	5	5	5	5
No	1			1	1					
Existence of placer deposits pinpointing to source?										
Yes	5	5				5			5	
Partially	3		3	3						
No	1				1		1	1		1
Contains cluster of deposits?										
Yes	5	5	5		5		5		5	5
No	1			1		1		1		
Number of veins in the target										
>15	5	5	5						5	5
15-10	4					4				
10-6	3				3		3			
6-3	2									
<3	1			1				1		
Length of major identified vein (m)										
>1000	5		5			5		5		
500-1000	4						4		4	4
250-500	3	3								
60-250	2									
<60	1			1	1					
NIMEP Data Available?										
Yes	5	5	5							
No	1			1	1	1	1	1	1	1
Total Score										
Score		48	43	18	27	34	36	26	37	33
Rank										
Rank Order		1	2	5	5	4	3	5	3	3

Lithum (Li)-Tantalum (Ta) Pegmatite Targets

- Li-Ta 1: Located around Keffi in Nasarawa State containing 17 pegmatitic veins hosted in gneisses and with a proven thickness of 20m. Mineralization trend of the bodies is NE-SW. Primary mining operations in the region are artisanal.
- Li-Ta 2: Located around Keffi in Nasarawa State containing 12 pegmatitic veins in gneisses. Mining in the region is artisanal and concentrates in 2 main areas with bodies of at least 20m thickness. Mineralization trend of the bodies is NE-SW.
- Li-Ta 3: Located close to Atabo town, Oyo State, containing 9 pegmatitic veins hosted mainly in gneisses. Mining in the region, on bodies with NNE-SSW trend, is artisanal and sites are mainly abandoned except one main pit.
- Li-Ta 4: Located around south-east of Ibadan, Oyo State, containing no known lithium or tantalum pegmatitic veins, but several aquamarine sites hosted in gneisses. Mining in the region is artisanal aided with excavator machinery on bodies with N-S trend.
- Li-Ta 5: Located around Saki East in Oyo State, containing two known mineralized pegmatitic veins hosted in gneisses. Mining in the region is solely artisanal on bodies with NE-SW trend.
- Li-Ta 6: Located around Beni Hill, Niger State, contains no known mineralized pegmatitic veins but has recent artisanal activities in an interpreted 2km body hosted in gneisses. Pegmatites seem to have a NNW-SSE trend.
- Li-Ta 7: Located around Irina town, Niger State, contains no known mineralized pegmatitic veins but has recent artisanal activities for gold related to pegmatites, having a N-S trend.
- Li-Ta 8: Located around Ijero area, Ekiti State, containing 13 known mineralized pegmatitic veins with proven thicknesses of 50m and hosted in gneisses and granites. Mining in the region is artisanal on bodies with NNE-SSW trend.
- Li-Ta 9: The target area situated around Danba Lema, Kwara State, containing 11 known mineralized pegmatitic veins with proven thicknesses of 40m and hosted in gneisses and granites. Mining is solely artisanal on bodies with NNE-SSW trend.
- Li-Ta 10: Located around Ila-Orangun, Kwara State, containing 3 known mineralized pegmatitic veins hosted in gneisses, of which two are recent and active and operated by artisanal miners, one is abandoned, and with an apparent NE-SW trend.
- Li-Ta 11: Located around Sepeteri Area, Oyo State, containing 12 known mineralized pegmatitic veins hosted in gneisses currently active and being exploited by artisanal miners with a NW-SE trend. Currently, there area is covered by several mining leases.

Criteria for Li-Ta Pegmatite Targets

Criterum	Points	Li-Ta 1	Li-Ta 2	Li-Ta 3	Li-Ta 4	Li-Ta 5	Li-Ta 6	Li-Ta 7	Li-Ta 8	Li-Ta 9	Li-Ta 10	Li-Ta 11
MPM Shape and intensity												
Compact pattern above 0.9	5	5									5	
Compact pattern and above 0.8	4								4			
Compact pattern and above 0.7	3					3	3			3		
Diffuse pattern and above 0.9	2		2	2	2			2				
Diffuse pattern and above 0.8	1											1
Close to young shear zone?												
Yes	5		5	5	5	5			5	5	5	5
No	1	1					1	1				
Li stream sediment anomalies												
>100	5											
100-80	4											
80-60	3				3							
60-40	2	2				2		2				
<40	1		1	1			1		1	1	1	1
Ta stream sediment anomalies												
>15	5											
15-10	4	4	4					4				
10-6	3				3	3						
6-3	2			2			2					
<3	1								1	1	1	1
Cs stream sediment anomalies												
>15	5											
15-10	4		4					4				
10-6	3			3	3	3						
6-3	2	2					2					
<3	1								1	1	1	1
Pegmatites occurrences known?												
Yes	5	5	5	5		5			5	5	5	5
No	1				1		1	1				
Number of pegmatite points												
>15	5	5										
15-13	4								4	4		4
13-10	3		3									
10-5	2			2								
<5	1				1	1	1	1			1	
Pegmatites being mined?												
Yes	5	5	5	5					5	5	5	5
No	1				1	1	1	1				
Proven thickness of pegmatites (m)												
>50	5								5			
50-30	4									4		
30-20	3	3										
20-10	2		2	2		2						
<10	1				1		1	1			1	1
Total Score												
Total Points		32	31	27	20	25	13	17	31	29	25	24
Total Score												
Rank order		1	1	2	3	3	5	4	1	2	2	3

Uranium (U) Targets

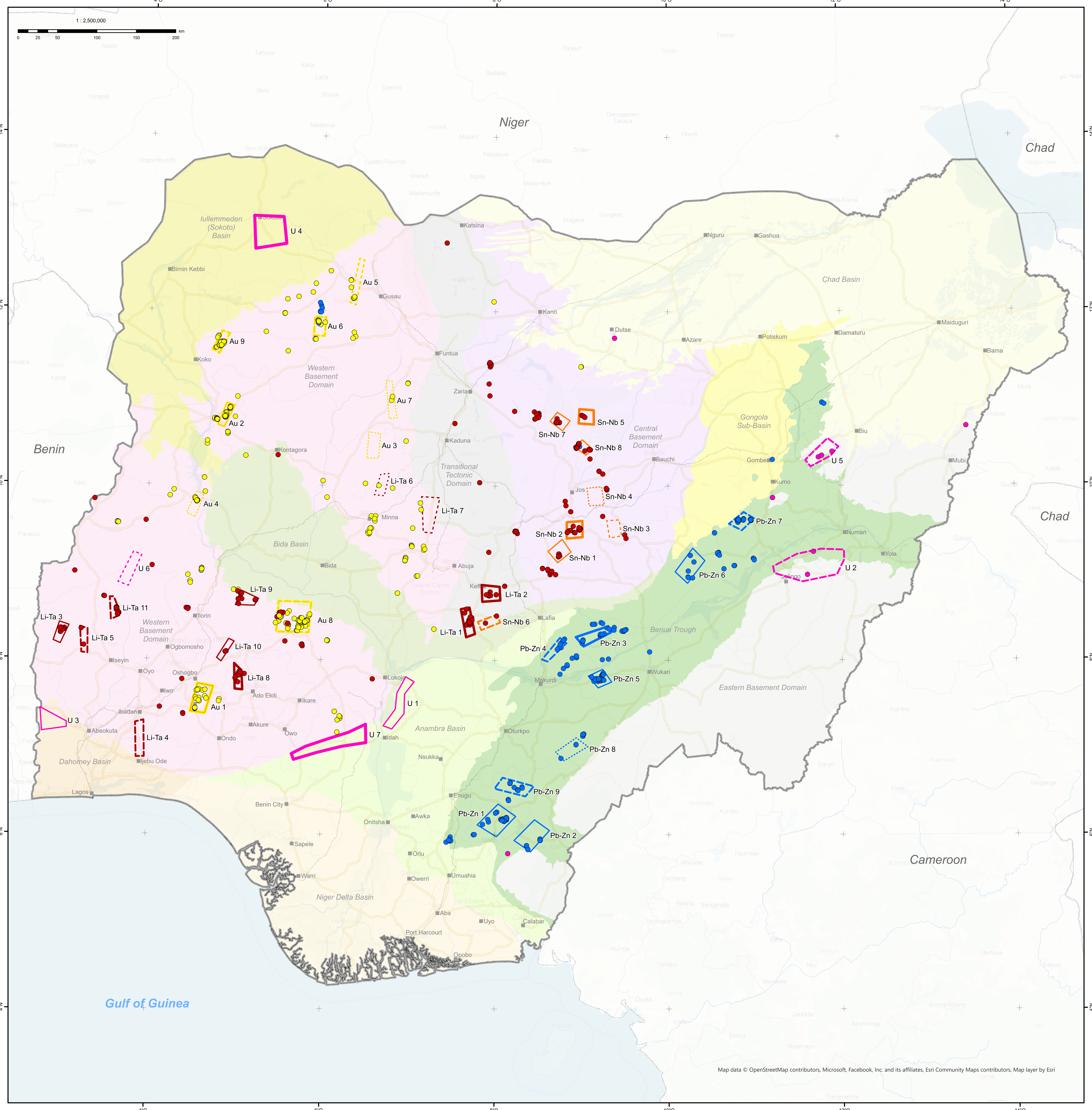
Uranium Mineral Occurrences after mineralization type:

1. Sandstone hosted ► diagenetic-epigenetic accumulations of uranium in sandstones from nearby leached uranium-rich basement complex granites. Uranium minerals, mainly pitchblende and coffinite, are disseminated or present as veinlets and found up to a depth of 200 meters, totaling 0.18 wt. % to 0.25 wt. % of U concentration

2. Phosphate related ► sedimentary marine origin mineral occurrences with apatite as the main host of uranium minerals within the Sokoto basin and Dahomey basin. Average uranium concentrations along the phosphate nodules and pellets range from 29-65 ppm.

3. Hydrothermal (vein) ► endogranitic and perigranitic hydrothermal-related accumulations of uranium in fractures, stockworks and shear zones concentrated in the Adamawa Massif, which hosts the Mika prospect. Estimated uranium resources at the Mika Prospect total 52 tons at 0.63wt. % U with a vertical extent of 130 meters, while at Ghumchi, 100 tons at 0.90wt. % U with a vertical extent of 200 meters.

4. Accessory minerals ► uranium occurring as accessory phases, mainly as pyrochlore, within granitic intrusions (e.g., Older and Younger Granites) formed through anatectic and anorogenic processes. Uranium minerals contain concentrations from 190 ppm of up to 3.5 wt. % UO2 and average ThO2 values of 4.3 wt. % ThO2.



Legend

Mineral Occurences (without Placers)

- Gold (Au)
- Base Metals (Pb, Zn, ba)
- Rare Metals (Ta, Li, Sn, Nb)
- Nuclear Fuel (U)

Gold (Au) Targets

Rank	Score
1	>= 45
2	>= 40-44
3	>= 35-39
4	>= 34-30
5	< 30

Tin (Sn) Targets

Rank	Score
1	>= 31
2	>= 25-30
3	>= 20-24
4	>= 15-19
5	< 15

Lithium (Li)-Tantalum (Ta)-Pegmatites Targets

Rank	Score
1	>= 30
2	>= 25 -29
3	>= 20-24
4	>= 15-19
5	< 15

Lead (Pb)-Zinc (Zn) Targets

Rank	Score
1	>= 35
2	>= 30-34
3	>= 25-29
4	>= 20-24
5	< 20

Uranium (U) Targets

Genetic types

1. Sandstone hosted
2. Phosphate related
3. Granite related/hydrothermal
4. Accessory minerals

Geological & Tectonic Units

- Chad Basin
- Niger Delta Basin
- Gongola Sub-Basin
- Iullemmeden (Sokoto) Basin
- Dahomey Basin
- Anambra Basin
- Bida Basin
- Benue Trough
- Western Basement Domain
- Transitional Tectonic Domain
- Central Basement Domain
- Eastern Basement Domain

Topography

- Nigeria Border
- International Borders
- River
- Lake
- Settlements
- Railway
- Road

REFERENCES:
Topographic Map: OpenStreetMap (and) contributors, CC-CY-SA
Administrative Boundaries - downloaded from https://www.naturalearthdata.com/downloads/
Important data sources:
Geological map of Nigeria - NGSA (2006)
Litho-structural Map of Nigeria – NGSA (2023)
Mineral Occurrence database of Nigeria – NGSA (2022)
Low-res Geophysical Datasets (Magnetics, Radiometry) – NGSA (2013)
High-res Geophysical Datasets (Magnetics, Radiometry) – NGSA (2024)
Geochemical datasets – NGSA 2022
NMRDSS NIGERIA - https://miningdecision.minesandsteel.gov.ng/nmrdss/

Tin (Sn) and Niobium (Nb) Targets

- Sn-Nb 1: Located in Plateau State, boasts six Pneumatolytic veins of Sn-Nb within supergene-enriched sediments, aligned with east-west structures in late Jurassic intrusives/volcanics. All mining activities in the region are artisanal, with no active licenses reported as of 2023.
- Sn-Nb 2: Located in Plateau State, contains 11 Pneumatolytic veins of Sn-Nb within supergene-enriched sediments, aligned along east-west structures in late Jurassic intrusives/volcanics. All mining operations are artisanal, with no active licenses reported as of 2023.
- Sn-Nb 3: Located in Plateau State, lacks any known hard-rock occurrences but some placer deposits of Sn-Nb, all hosted in late Jurassic intrusives/volcanics. Mining activities in the region are artisanal, albeit all active licenses are exploratory in nature.
- Sn-Nb 4: Located in Plateau State, hosts just one known Pneumatolytic vein occurrence, aligning with a north-south trend within late Jurassic intrusives/volcanics. All mining operations in the vicinity are artisanal and covered by a license.
- Sn-Nb 5: Located in Bauchi State, boasts four known hard-rock occurrences along with several placer deposits of Sn-Nb. Pneumatolytic veins within late Jurassic intrusives/volcanics follow an NNW-SSE trend. All mining activities in the region are artisanal without a valid license.
- Sn-Nb 6: Located in Nasarawa State, contains one known hard-rock occurrence and one massive placer deposit. Structures follow an NE-SW trend within late Jurassic intrusives/volcanics. All mining activities are artisanal.
- Sn-Nb 7: Located in Kano State, contains four Pneumatolytic veins of Sn-Nb along with nine diagenetic placer deposits hosted mainly in late Jurassic intrusives/volcanics. Primary mining operations are industrial, with some additional artisanal sites.
- Sn-Nb 8: Located in Bauchi State, contains six Pneumatolytic veins and eight diagenetic placer deposits all within late Jurassic intrusives/volcanics. Primary mining operations in the region are artisanal without any valid license.

Criteria	Points per Criterium	Sn Targets and their scoring per criterium							
		Sn-Nb 1	Sn-Nb 2	Sn-Nb 3	Sn-Nb 4	Sn-Nb 5	Sn-Nb 6	Sn-Nb 7	Sn-Nb 8
MPM Shape and intensity									
Compact pattern above 0.9	5		5	5		5			
Compact pattern and above 0.8	4	4					4		
Compact pattern and above 0.7	3				3				3
Diffuse pattern and above 0.9	2							2	
Diffuse pattern and above 0.8	1								
Tin occurrences known?									
Yes	5	5				5		5	5
No	1		1	1	1		1		
Tin deposits being mined?									
Yes	5	5	5			5	5	5	5
No	1			1	1				
Niobium within the mineral suite?									
Yes	5	5	5				5	5	5
No	1			1	1	1			
Undocumented deposits found?									
Yes	5	5		5	5	5	5		5
No	1		1					1	
Potential for old placers?									
Yes	5		5			5			
No	1	1		1	1		1	1	1
Existence of placer deposits pinpointing to source?									
Yes	5		5					5	
Partially	3			3		3			3
No	1	1			1		1		
Number of hard rock occurrences									
>15	5								
15-10	4		4						
10-6	3	3							3
6-3	2					2		2	
<3	1			1	1		1		
Total Score									
Score	40	29	31	18	14	31	23	26	30
Rank									
Rank order	7	2	1	4	5	1	3	2	2

Lead (Pb) and Zinc (Zn) Targets

- Pb-Zn 1: Located in Lower Benue Trough, conatins15 occurrences of Pb-Zn, two of which are undergoing advanced activities and production. Extensive N-S trending veins are prevalent, hosted within interbedded argillaceous and sandstone beds.
- Pb-Zn 2: Located in Lower Benue Trough, comprises 13 occurrences of Pb-Zn exploited by artisanal operations. The general vein trend follows an NW-SE orientation hosted within early Cretaceous interbedded argillaceous and sandstone beds.
- Pb-Zn 3: Located in Middle Benue Trough, encompasses 10 occurrences of Pb-Zn, one site with active underground mining operations. Extensive N-S trending veins are prevalent and hosted within late Cretaceous sandstones and limestones.
- Pb-Zn 4: Located in Middle Benue Trough, comprises 10 occurrences of Pb-Zn, one site with underground mining operations. Extensive N-S trending veins are prevalent and hosted within late Cretaceous syn-rift sandstones and limestones.
- Pb-Zn 5: Located in Middle Benue Trough, contains 30 occurrences of Pb-Zn exploited by artisanal miners. The predominant trend of the mineralized bodies extends E-W hosted within late Cretaceous carbonaceous shales, mudstones, shaly limestones, and coal seams.
- Pb-Zn 6: Located in Upper Benue Trough, contains five occurrences of Pb-Zn featuring recent small-scale mining operations. The mineralized veins exhibit a predominant N-S trend hosted within late Cretaceous syn-rift sediments.
- Pb-Zn 7: Located in Upper Benue Trough, contains 47 occurrences of Pb-Zn, with one site currently undergoing recent industrial-scale mining operations. The mineralized veins exhibit a predominant NNW-SSE trend hosted within early and late Cretaceous sandstones and siltstones.
- Pb-Zn 8: Located in Lower Benue Trough features no reported occurrences of Pb-Zn. Mining operations within the area are entirely artisanal with no license claim. The mineralized veins predominantly trend NE-SW hosted within late Cretaceous syn-rift sandstones and siltstones.
- Pb-Zn 9: The target within the Upper Benue Trough boasts 47 occurrences of Pb-Zn, with one site currently undergoing recent industrial-scale mining operations. The mineralized veins predominantly trend NNW-SSE hosted within early and late Cretaceous syn-rift sandstones and siltstones.

Criteria	Points per Criterium	Pb-Zn Targets and their scoring per criterium								
		Pb Zn 1	Pb Zn 2	Pb Zn 3	Pb Zn 4	Pb Zn 5	Pb Zn 6	Pb Zn 7	Pb Zn 8	Pb Zn 9
MPM favourability map pattern										
Compact pattern above 0.9	5	5		5	5				5	
Compact pattern and above 0.8	4						4	4		
Compact pattern and above 0.7	3		3							
Diffuse pattern and above 0.9	2					2				2
Diffuse pattern and above 0.8	1									
Within visible anticlinal structure? (see Tilt of the RTP and lithostructural map)										
Yes	5	5	5	5	5	5	5		5	
No	1							1		1
Proximity to volcanic rocks (indicated by the 1st Vertical Derivative of RTP magnetic signal)										
Yes	5		5	5		5				5
No	1	1			1		1	1	1	
Pb-Zn occurrences known?										
Yes	5	5	5	5	5	5	5	5		5
No	1								1	
Number of veins/pits										
>15	5					5		5		
15-10	4	4								
10-6	3		3							3
6-3	2			2	2		2			
<3	1								1	
Pb-Zn active open pit?										
Yes, big pit	5	5		5		5	5	5		
Yes, small pit	3		3							3
No mining	1				1				1	
Length of the existing pits (m)										
>2000	5	5				5				
2000-1400	4			4				4		
1400-1000	3						3			
1000-500	2		2							2
<500	1				1				1	
NIMEP exploration in the area?										
Yes	5		5	5	5		5			5
No	1	1				1		1	1	
Total Score										
Score		31	31	36	25	33	30	26	16	26
Rank										
Rank order		2	2	1	3	2	2	3	5	3

Location and Ranking of Exploration Targets in Nigeria

1 : 2,500,000

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Map projection
Transverse mercator
(UTM Zone 32N)

Reference system
Spheroid: WGS_1984
Datum: D_WGS_1984

Project Name
Mineral Sector Support for Economic Diversification Project (MinDiver)

Project Coordinator
Dr. Salim Salaam

Project Financing
The World Bank

THE WORLD BANK IBRD • IDA

MINISTRY OF SOLID MINERALS DEVELOPMENT
FEDERAL REPUBLIC OF NIGERIA

beak CONSULTANTS

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