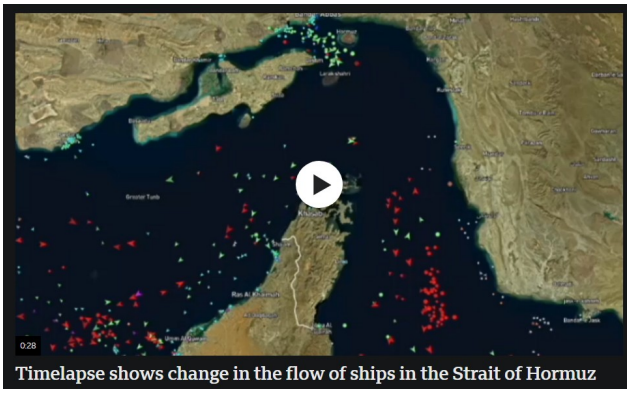
March 9, 2026

News and notes



Credit: BBC

This week, before going on to discuss the geology and mineral resources of Niger, we will first look at some news items I thought were interesting. The picture above is from the BBC and links to a timelapse video of ships travelling the Strait of Hormuz.

If you enjoy my blogs, bookmark the site and check on Mondays rather than relying on social media postings which can get lost in the shuffle. For my news items, I try to stick to open access papers.

Comments

If anyone has comments on any of my postings, please leave a comment on the Linkedin page for the posting or email me at raymondreichelt@gmail.com.

Geopolitics

- U.S. Opens Military Action in Ecuador Against 'Terrorist Organizations'.
- Video: Canada's commodity comeback, energy superpower ambitions & the arctic challenge: Heather Exner-Pirot on Power Struggle.
- Iran War & Energy Geopolitics
  - Iran war threatens a prolonged hit to global energy markets.
  - UAE and Kuwait Start Oil Output Cuts After Hormuz Blockage.
  - Oil Prices Hit $90 as Middle East Tensions Escalate.
  - Mapped: The World's Oil Chokepoints.
  - How one massive gas field shapes the global stakes of conflict in the Middle East.
  - Aluminum price surges to 4-year high on Bahrain force majeure.

Research and News

- The Effects of Carbonate Precipitation on the Physical Properties of Basalt.

- Broadband Dielectric Analysis of Clays: Impact of Cation Exchange Capacity, Water Content, and Porosity.
- For jigsaw puzzle lovers: Puzzle: the geological map of France in a thousand pieces!
- Generation of inner core anisotropy by anisotropic thermal conductivity of iron crystals.
- Playing with dirt for science: Comparing Paleointensity Recording Efficiencies of Detrital and Biogenic Magnetite by Deposition Experiments With Synthetic Sediments.
- Experimental crystallization of analcime zeolite from clay and feldspar precursors.
- The Central Gneiss Belt revisited: Forensic analysis of the metamorphic core complex hypothesis and an alternative explanation.
- Geological history: Refined chronologies of magnetochron M0r reveal asynchronous terrestrial and marine carbon isotope responses to Oceanic Anoxic Event 1a.
- More geological history: Environmental changes during the middle to late Norian: An integrated record from the Southern Tethys, Ras Al-Khaimah, United Arab Emirates.
- Topography influences megadune distribution and morphology.
- Tonalite-trondhjemite-granodiorite suites (TTGs): Silicified seafloor contribution to TTG formation: insights from zircon O and Si isotopes.

Plate Tectonics

- Tectonic differentiation and thermal history of the eastern Ordos Basin (central-western China) since the Mesozoic.
- Subduction Zone Magnetism: The Influence of Metamorphism and Serpentinization in the Mantle Wedge.
- The Western Alps: 3-D Modeling of Differential Exhumation of Ultrahigh-Pressure Metamorphic Rocks Driven by Increasing Plate Divergence.
- Stratigraphic and geochronological constraints on the supracrustal succession of the South West Terrane of the Yilgarn Craton of Western Australia: Insight into Archean terrane amalgamation.
- Pacing supercontinent rhythms from the metallogenic record.

Paleontology

- Reevaluating the nutrient timeline: Francevillian basin geochemistry reveals early permissive conditions for eukaryotic life.
- Revision of the extinct shark *Synechodus prorogatus* Kriwet, 2003 (Chondrichthyes, Elasmobranchii) and its galeomorph affiliation.
- Arborea elegans: a novel arboreomorph species from the late Ediacaran of Newfoundland.

- High-resolution Annotated Dataset of Girvanella Boundstone Microfacies from the Xiannüdong Formation, China.
- A Giant Halisaurine from the Late Maastrichtian of Morocco.
- Largest Silurian fish illuminates the origin of osteichthyan characters.
- An aberrant stem tetrapod from the early Permian of Brazil.
- Southernmost occurrence of *Purgatorius* sheds light on the biogeographic history and diversification of the earliest primate relatives; Phys.org summary here.
- Triceratops skeleton 'Trey' to hit auction block as dinosaur prices soar; put in your bids online March 17 to 31 on Joopiter.
- Earliest direct evidence of trophic interactions between terrestrial apex predators and large herbivores; Phys.org summary here.

Mining and Energy

- How Canada's biggest iron project is almost unknown.
- Venezuela's Gas Potential Could Overshadow Its Famous Oil Reserves.
- Methane: Subsurface gas hydrate plugs.
- US Antimony receives $27M Defense Production Act funding.
- USA Rare Earth to buy remaining Round Top stake for $73M.
- An oil company quietly dug a surprisingly deep geothermal well.
- Ore mineralogy: Tungsten Mineralization in the Eastern Alps (Austria): Implications of Scheelite Trace Element Composition for Exploration Potential Evaluation.
- Japan has just lowered its drill to 19,685 feet below the ocean with the Chikyu, and the message to China is clear: we are going after rare earths even if they are 1,180 miles from Tokyo.
- New Zealand: How supercritical geothermal energy could change our future.
- Uranium in Saskatchewan:
  - NexGen eyes summer 2026 build for huge Rook I uranium mine.
  - Uranium exploration ramps up across Athabasca Basin.
- N. Ontario:
  - Gold project's environmental assessment up for public comment.
  - Feds decide against impact assessment on Ring of Fire mine.

Environmental Geology and Hydrogeology

- Observations of Tidal Induced Responses in Self-Potential Data in a UK Beach Sand Aquifer: Implications for Monitoring Seawater Intrusion.
- Numerical modeling of the Cauê Aquifer in the ferruginous geosystems of the Moeda Syncline (Iron Quadrangle, Brazil): Assessing regional impacts of groundwater pumping and predicting future drawdown trends.
- Environmental evidence of surface manifestations of regional groundwater flows in the lower Colorado River Basin: the case Mexicali Valley, Mexico.

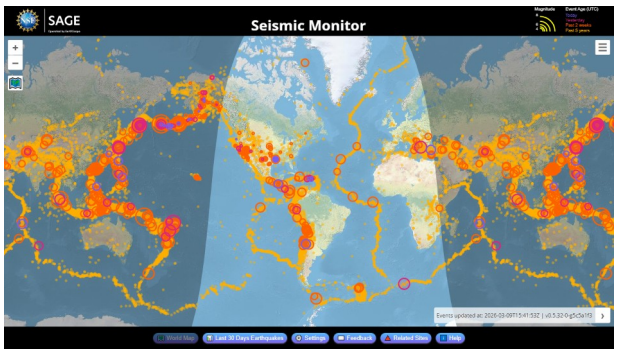
Glaciers and Climate Change

- Ancient climate change: High productivity and multilayered circulation in the Late Cretaceous Arctic Ocean.
- Greenland Monthly Accumulation Maps (1960–2022): A Statistical Semi-Empirical Bias-Adjustment Model.
- Mechanisms of Surface Meltwater Ponding and Drainage on the Greenland Ice Sheet Revealed Using SkySat Imagery and Deep Learning.

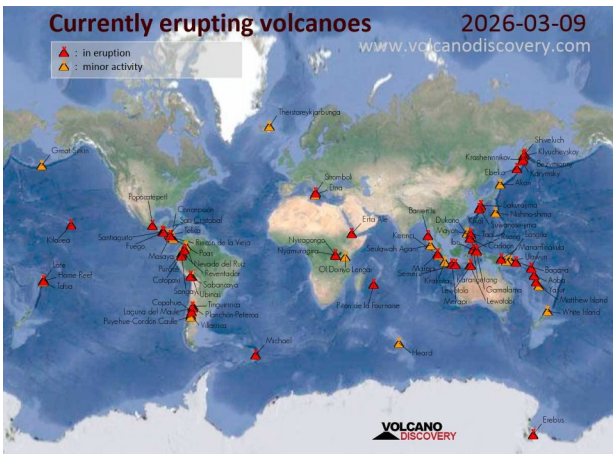
Bad Science

- Opinion: Scientific Publishing: One of the Greatest Scams of our Times.
- Controversial comet theory struck by two new retractions.
- A medical journal says the case reports it has published for 25 years are, in fact, fiction.
- Jurassic Park palaeontologist parts ways with university after Epstein emails.

Volcanoes, Earthquakes and Geohazards



Seismic Monitor



Active Volcano Map

Volcanoes

- Smithsonian / USGS Weekly Volcanic Activity Report.
- United States Geological Survey (USGS) Volcano Observatories:
  - Yellowstone Caldera Chronicles:Mushroom Pool: The subtle spring with the spectacular story.
  - Cascades Volcano Observatory Weekly Update.
  - Volcano Watch – USGS updates "Volcano Observatory Notice to Aviation" alerts.
- A review of the supercritical state of eruption-fed volcanic density currents in subaerial and subaqueous settings.
- Stress and Strain in Magma-Mush Reservoirs: Implications for Reservoir Failure and Magma Propagation.
- Experimental and thermodynamic constraints on the magmatic variables governing pre-eruptive conditions at Hunga volcano: Development of a new equilibrium orthopyroxene-clinopyroxene thermometer.

Earthquakes

- Euro-Mediterranean Seismological Centre (EMSC).
- Earthquakes Monitoring Live Worldwide.
- Tourmaline fault mirrors record seismic slip on N-S normal faults in the Himalayan orogen.
- Poroelastic Bulk Controls on Shear Localization in Fault Gouge During Earthquake Rupture: Insights From a Hybrid Numerical Framework.
- Fault Kinematics of the 2019–2026 Puerto Rico Earthquake Sequence: Conjugate Faulting Within a Zone of Oblique Subduction.
- Seismicity and Seismotectonics in the Cantabrian-Pyrenean Zone (N Spain) Using a Dense Temporary Network of Broadband Seismic Stations.
- Can we tell if an earthquake is going to be a foreshock?
- Activating a Natural Fault Zone in the Swiss Alps.

Geohazards

- Ancient geohazards: Archeological data with AI- and physics-based modeling explain typhoon-induced disasters in inland China around 3000 yr B.P.

Free Geology Books and Other Stuff

Free geology books can be downloaded from these sites:

- OreZone Readers and Experts Telegram Channel; the Ore Zone channel also shows employment opportunities for geologists.
- The Groundwater Project has many groundwater geology books for free download together with free online courses, listed here.
- Free Groundwater Modeling Courses from the HydroGeoCenter.
- From Western Australia: Carbonatite, lamprophyre and host rocks in the northern Aileron Province.
- The Geology of Indonesia: Volume 1 and Volume 2.
- Brett Davis' book on veins in a deforming rock mass: "The Veining Bible"; also at this site.
- From the Mineralogical Society of America: Handbook of Mineralogy.
- Systematic geochemical classification of felsic igneous rocks of the Yilgarn Craton.
- From the Arizona Geological Survey: Geochemistry Diagram Generator v 1.0.

Upcoming Events

- It's Groundwater Awareness Week (March 8–14).
- March 15-21, 2026, Provincial Engineering and Geoscience Week, Manitoba.
- AGS Annual Conference 2026, 19th Mar 2026, One Great George Street, London, U.K.
- ISMPP U: Restoring Trust in Science: Storytelling, AI, and Integrity in Scholarly Publishing (Mar. 26, 2026, 10:00 am ET).
- 14-15 April 2026: 2026 IAH Ireland Conference – Groundwater 2035, Tullamore, Ireland
- GAC-MAC 2026 St. John's NL, St. John's Convention Center, May 25-28, 2026.
- PEG2026: 11th International Symposium on Granitic Pegmatites; 16th–19th August 2026, in Perth, Western Australia.
- 14-18 September 2026 , IAH 2026, 53rd Congress of the International Association of Hydrogeologists; Budapest Congress Center.
- September 30 - October 3, 2026 SEG 2026 Conference Salt Lake City, United States.
- Paleoamerican Odyssey 2026, October 14-17, 2026, Santa Fe Convention Center, Santa Fe, New Mexico.
- Society of Petroleum Engineers Distinguished Lecturer Schedule.
- American Geophysical Union List of Upcoming Meetings.
- The Geological Society: Events & Courses.
- Upcoming Distinguished Geoscience Australia Lectures (DGALs).

March 9, 2026

Geology and Mineral Resources – Niger

Introduction

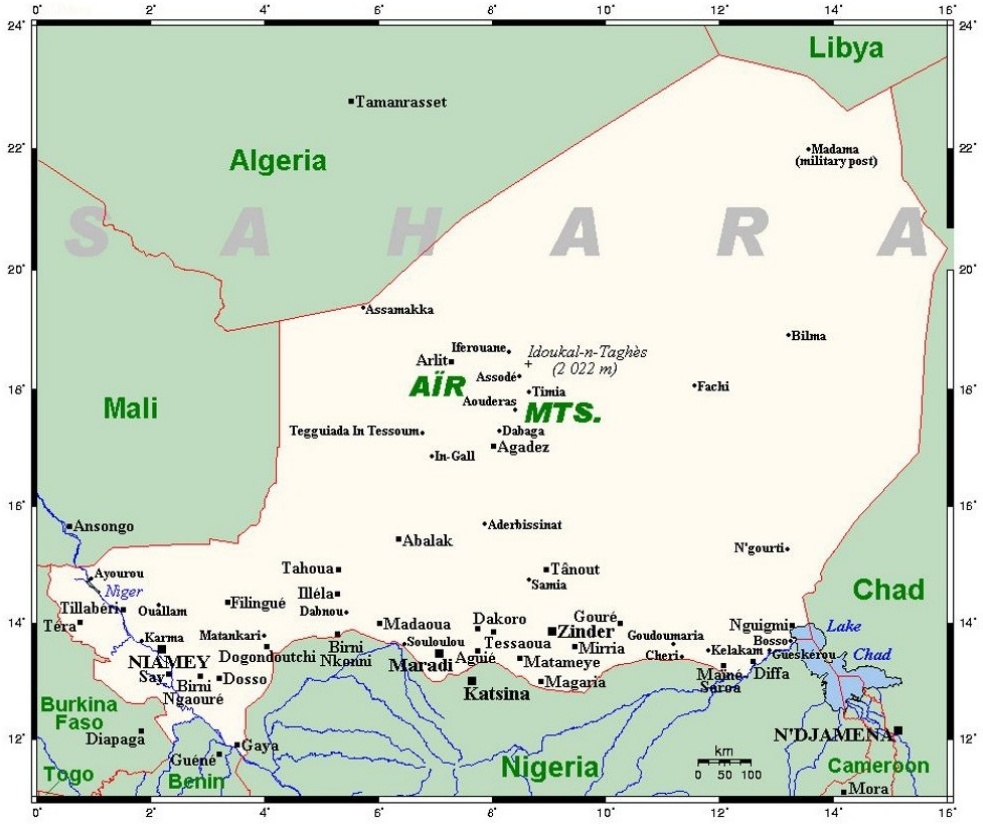


Figure 1 – Niger
Credit: Mapsland.com, Creative Commons Attribution-Share Alike 3.0 Licence

A former French colony, the Republic of the Niger is a landlocked country of 25,396,840 people in West Africa. The country has an area of 1,267,000 square kilometres and borders on Libya to the northeast, Chad to the east, Nigeria to the south, Benin and Burkina Faso to the southwest, Mali to the west, and Algeria to the northwest.

Niger is a relatively poor country with a per capita GDP (PPP) of $2,100 and a low Human Development Index of 0.419. The economy of Niger centers on subsistence agriculture, livestock raising, natural resource exploitation, uranium mining and oil production. In 2024, the top exports of Niger were oil seeds, crude petroleum, radioactive chemicals (uranium concentrate), refined petroleum, and soybeans. The top destinations for exports were China, France, India, Togo, and Chad. In 2024, the top imports of Niger were rice, packaged medications, refined petroleum, palm oil, and fabrics. The top origins for imports were China, India, Nigeria, Turkey, and Togo.

For more details on Niger, check out the Wikipedia and Grokipedia articles on the country.

Geology

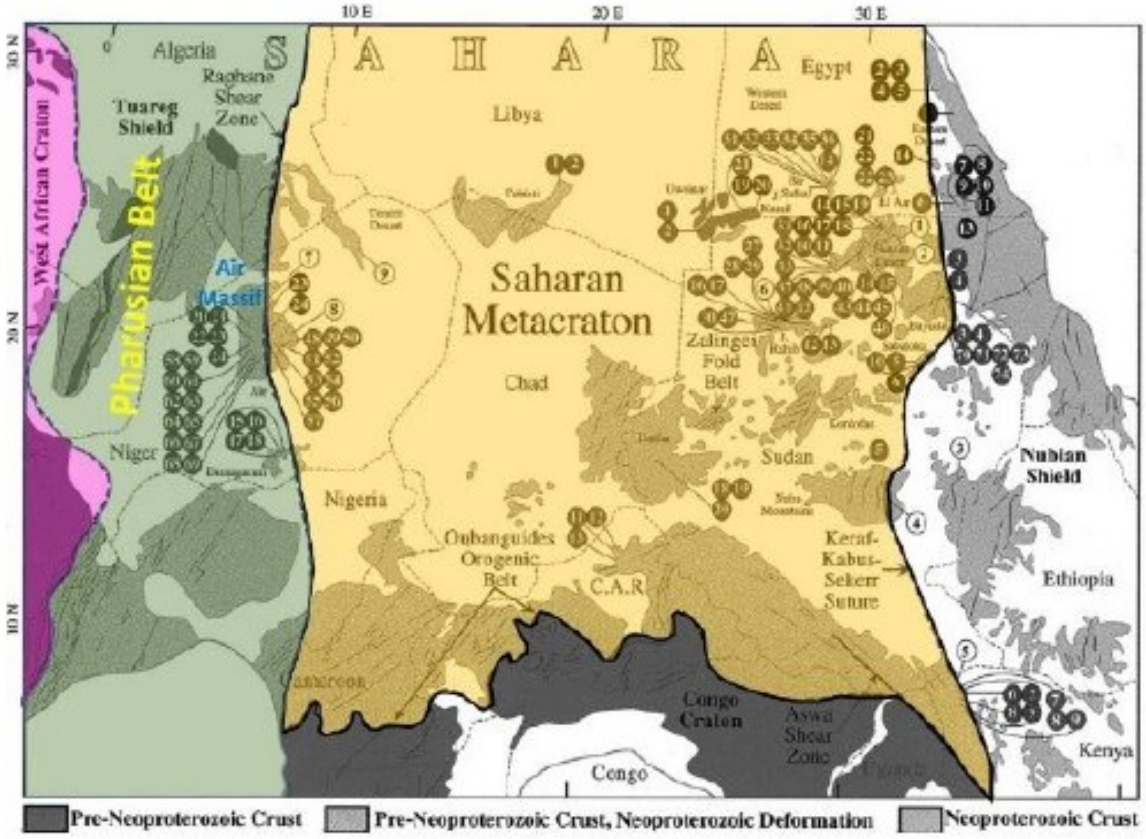


Figure 2 - Location of the Saharan Metacraton (yellow), Pharusian Belt (pale-green) and West African Craton (purple), Credit: Figure 3-2 in Leblanc, 2022

Tectonically, the geology of Niger sits within the African Tectonic Plate. This was part of the ancient supercontinent of Gondwana and the formation of Gondwana is important to the tectonic geology of the country.

Within Niger, there are three main divisions of the African Plate, running east to west these are the:

- The Saharan Metacraton, consisting of continental crustal rocks, such as granitoids and greenstone belts, ranging in age from Archean to Proterozoic and re-mobilized during the Neoproterozoic;
- The Pharusian Belt, formed by the closure of the Pharusian ocean during the Neoproterozoic approximately 800 to 600 million years ago (Mya) and is made up of mafic to ultramafic rocks along with suite of rocks associated with the former subduction zone.
- The West African Craton, formed from the collision of Archean aged centres next to multiple Paleoproterozoic domains made up of greenstone belts, sedimentary basins, regional plutons, and large shear zones.

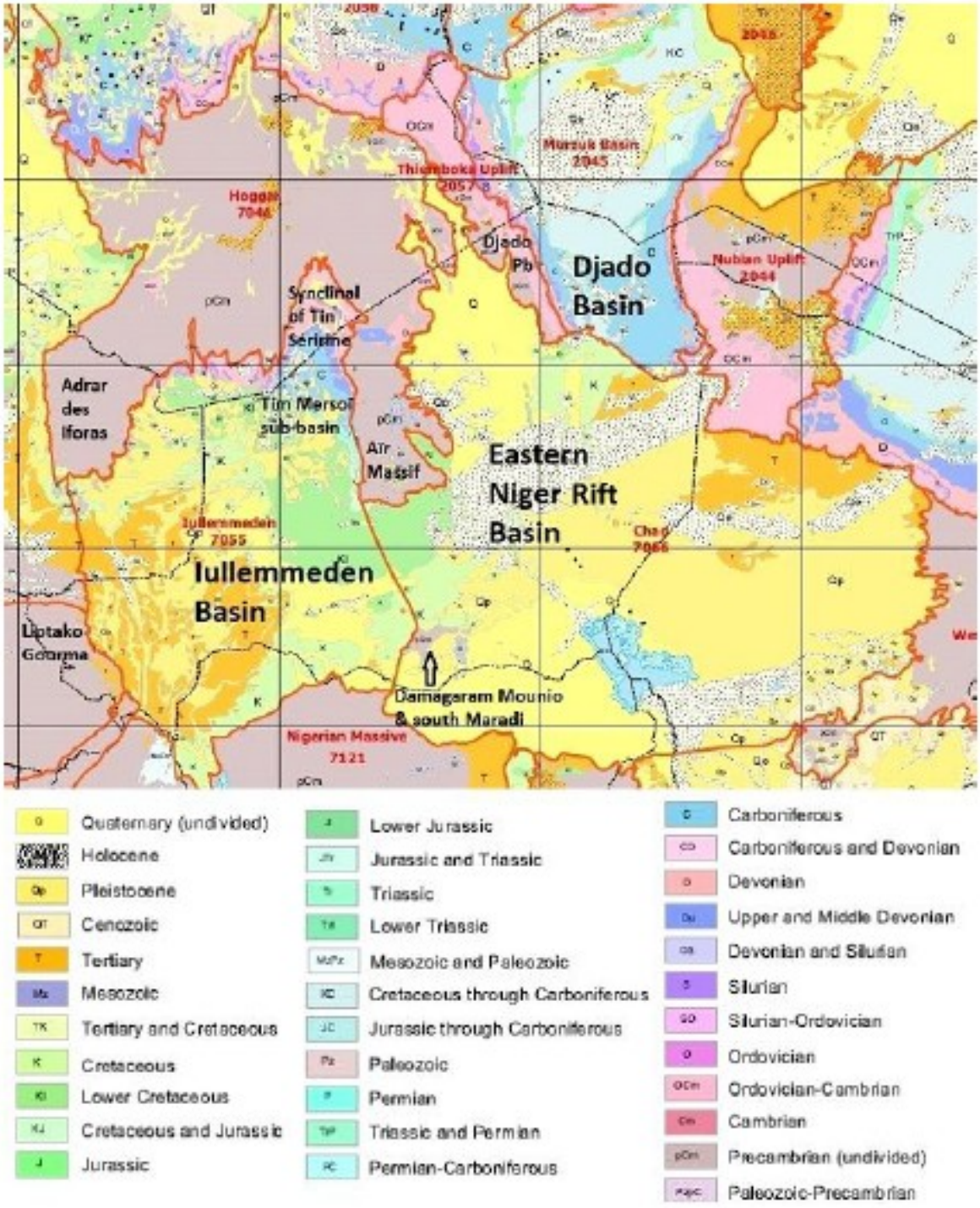


Figure 3 Geological map of Niger with the location of its basement areas and sedimentary basins
Credit: Figure 4-6 in Leblanc, 2022

Overlying the cratonic rocks are a three of sedimentary basins, these include:

- The Iullemmeden Basin, covering much of western Niger, the Iullemmeden Basin is made of of sediments ranging in age from Cambrian to Pleistocene;

- The Eastern Niger Rift Basin, in the eastern part of Niger is made up of Mesozoic to Cenozoic aged sediments overlying a crystalline basement ranging in age from Archean to Jurassic.
- The Djado Basin, in the northeast of Niger, containing sediments ranging in age from Paleozoic to Mesozoic and including rocks from the Ordovician aged Hirnantian glaciation.

Figure 4, below shows a general geological map of Niger.

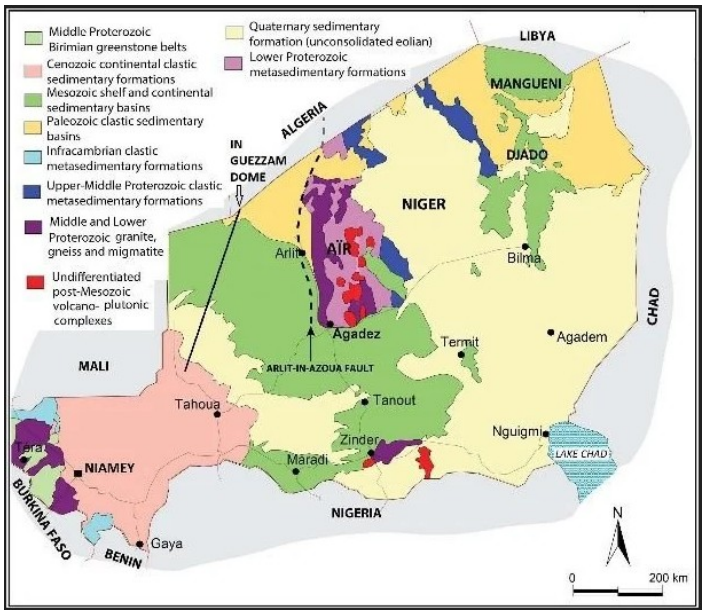


Figure 4 - General Geological Map of Niger
Credit: Figure 5-9 in Leblanc, 2022

Paleontology

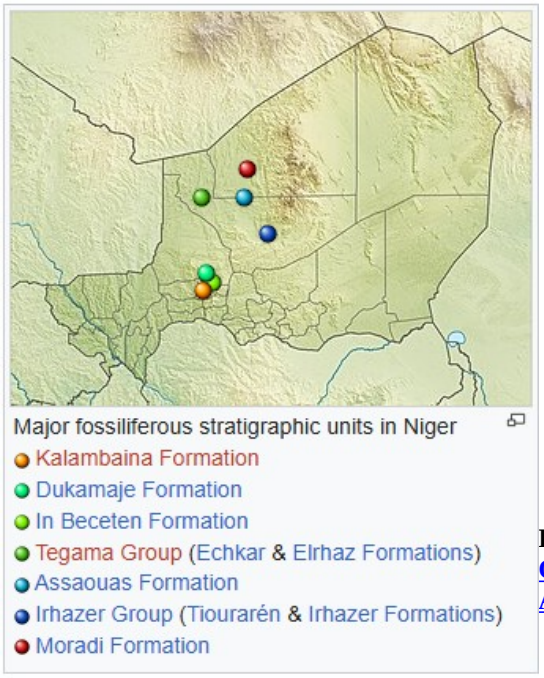


Figure 5 – Major Fossiliferous Stratigraphic Units in Niger
Credit: Wikipedia, Creative Commons Attribution-Share Alike 4.0 License

Major fossiliferous stratigraphic units in Niger range in age from the Paleozoic to the Cenozoic and include:

- Kalambaina Formation – Paleogene;
- Dukamaje Formation – Late Cretaceous, Maastrichtian;
- In Beceten Formation – Late Cretaceous, Coniacian to Santonian;
- Tegama Group (Echkar & Elrhaz Formations) – Cretaceous, Aptian to Albian;
- Assaouas Formation – Middle Jurassic;
- Irhazer Group (Tiourarén & Irhazer Formations) – Middle to Late Jurassic;
- Moradi Formation - Late Permian.

Lets look at a few fossils from these formations:

Endothyra

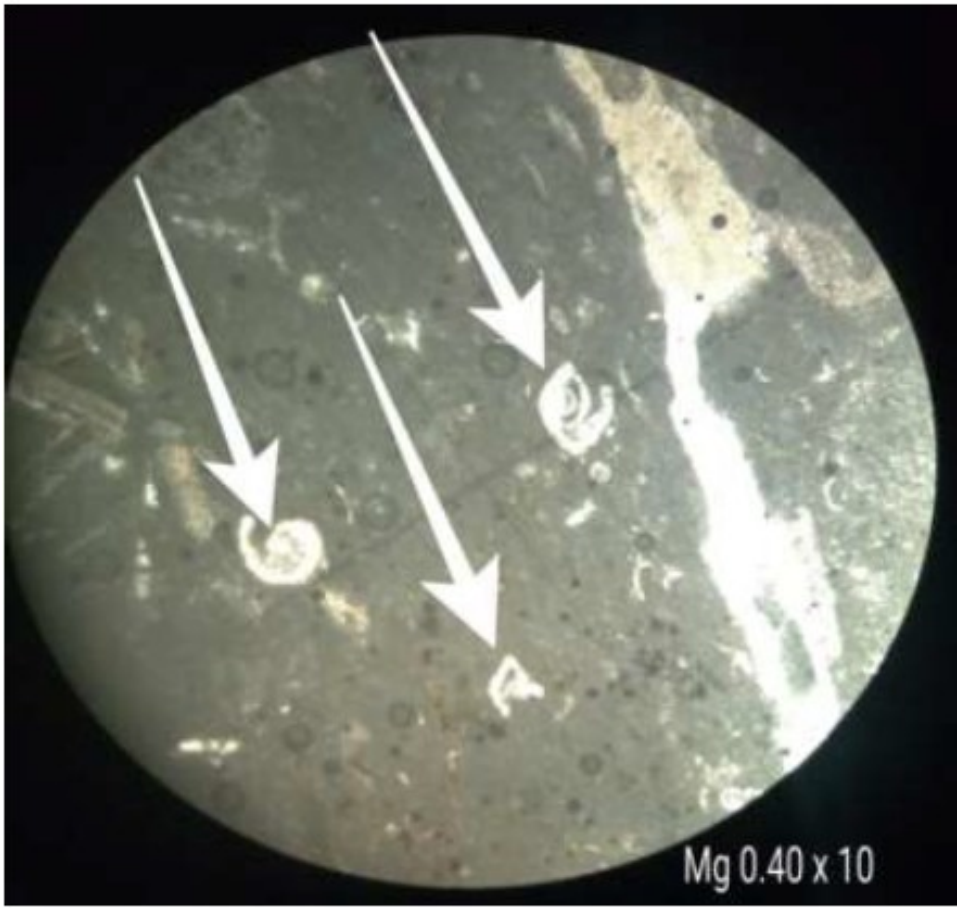


Figure 6 – *Endothyra* Fossil in the Kalambaina Formation
Credit: Figure 9 in Yelwa *et al*, 2025

Endothyra was a fusilinad Foraminifera, is single cell amoeba that made a hard exoskeleton. In Niger, they are found in the Paleogene Kalambaina Formation.

Igdamanosaurus

Figure 7 – Life Restoration of *Igdamanosaurus*
Credit: FunkMonk, Creative Commons Attribution-Share Alike 3.0 Unported license

Igdamanosaurus was a mosasaur that lived during the Maastrichtian age of the Late Cretaceous. In Niger, fossils of *Igdamanosaurus* were found in the Dukamaje Formation.

Libycosuchus brevirostris

Figure 8 - *Libycosuchus brevirostris*
Credit: Ghedo, Creative Commons Attribution-Share Alike 4.0 International license

Libycosuchus brevirostris was a crocodyliform reptile that lived during the Late Cretaceous. Fossils of *L. brevirostris* were found in the In Beceten Formation.

Aegyptosaurus

Figure 9 – Speculative restoration of *Aegyptosaurus*
Credit: Levi Martinez-Reza, Creative Commons Attribution-Share Alike 3.0 Unported license

Aegyptosaurus was a dinosaur that lived during the Late Cretaceous Period. Fragmentary fossils, believed to be Aegyptosaurus, were found in the Echkar Formation of the Tegama Group.

Mineral Resources

Figure 10 – Arlit Open Pit Uranium Mine
Credit: David FRANCOIS, Creative Commons Attribution-Share Alike 3.0 Unported license

According to the most recent (2019) USGS Minerals Yearbook on Niger, the mineral industry in Niger produces: industrial minerals, Cement and Salt; metallic minerals, Gold, Silver, and Uranium; and fuel minerals, Coal and Petroleum. The most recent (2021) production statistics on mineral production in Niger from the USGS are here. Not covered in the USGS report, but critical to life in a desert country like Niger, are the groundwater resources.

Industrial minerals

- Cement is produced at a plant in Malbaza Uzine, in southwestern Niger;
- Salt is produced by artisianal miners at the Bilma salt pans in the Tenere Desert of northern Niger.

Metallic minerals

- Gold and silver are produced by artisianal miners at various places in Niger as well as at the Samira Hill Mine Niger's military government announced on March 6, the revocation of gold mining concessions.
- Uranium is produced at the Arlit open pit mine and the Azelik Mine. The Akouta underground mine closed in 2021. The uranium deposit at Imouraren is under development.

A few more words on of uranium in Niger. The geology of the deposits are interesting. The main uranium deposits (Arlit, Akouta, and Imouraren) are located in continental siliciclastic formations. These appear to have been deposited during a prolonged process that began with the Atlantic rifting during Lower Cretaceous. Hydrothermal fluids moved along Arlit fault and formed uranium ores in aquifers. under reducing conditions. Uraninites and other secondary uranium minerals then formed when the minerals were exposed by exhumation during the Cenozoic creating supergene deposits.

The politics of uranium production in Niger have also been contentious. For years, the uranium production in Niger was controlled by a French mining company and the profits from the mining primarily benefited that company. France also became dependent on Nigerien uranium for their domestic nuclear program. In 2024, Niger nationalized the uranium mines and, in 2025, opened bidding for new operators. As well, Niger seized some 1,500 tonnes of uranium and the disposition of the uranium is still in dispute. Keep an eye of this story, it could be interesting.

Fuel minerals

- Coal is mined at the Anou Araren mine in the central Agadez Region, the coal is used to power a thermal electric generation plant.
- Petroleum is produced at the Agadem oilfields in the Diffa region.

Groundwater Resources

Groundwater in Niger is sourced from:

- Unconsolidated aquifers in alluvial and aeolian sediments and from the Chad Formation;
- Sandstones and limestones in the Chad Basin and the Iullemeden Basin as well as from the Farazekat sandstone; and
- From aquifers in igneous and metamorphic weathered/fractured basement rocks.

There are no statisitics on groundwater production in Niger. Groundwater is recovered from hand dug wells and drilled boreholes.

Figure 11 links to an interactive mineral occurrence map of Niger from Mindat.org.

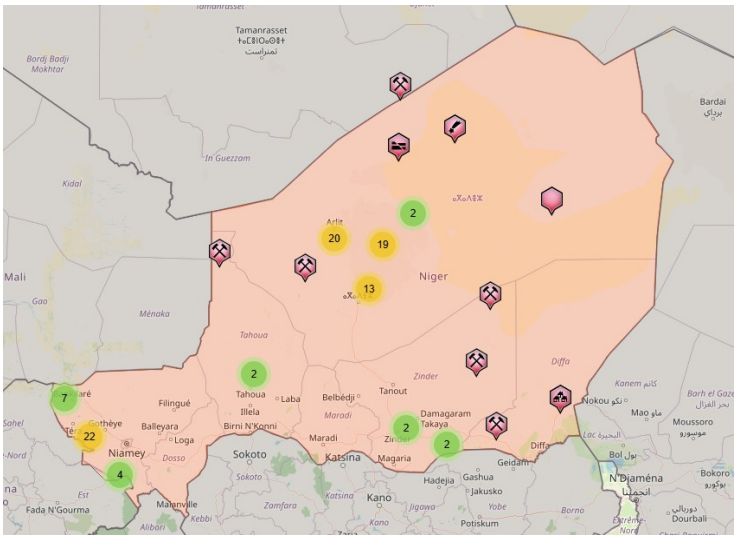


Figure 11 – Interactive Mineral Occurrence Map of Niger
Credit: Mindat.org

Summary

Figure 12 - Rural village, northern Tillabéri
Credit: Lars Rosendahl Appelquist, Creative Commons Attribution-Share Alike 4.0 International license

Niger could be a promising place for mineral development. However, the current military junta is still formulating the rules under which they will allow development and this may take a while to be sorted out. This situation is worth keeping an eye on.

Standard Caveat

J. Robert Oppenheimer on freedom and scientific inquiry

The purpose of my weblog postings is to spark people's curiosity in geology. Don't entirely believe me until you've done your own research and checked the evidence. If I have sparked your curiosity in the subject of this posting, follow up with some of the links provided here. If you want to, go out into the field and examine some rocks on your own with the help of a good field guide. Follow the evidence and make up your own mind.

In science, the only authority is the evidence.