

August 4, 2025

News and notes



Poppies (*Oreomecon nudicaulis*) on my backyard fence

Starting this week, I am changing the name of this weblog to **Raymond's Geology Blog** and concentrating on geological matters rather than discuss a lot of geopolitics. This week, before going on to discuss the geology and mineral resources of Liberia, we will first look at some news items I thought were interesting.

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

- [Exposing China's Military & Media Push In Africa.](#)
- [Secret Transfers: China's 'Dark Fleet' Helps Iran Sneak Oil Past U.S. Sanctions.](#)
- [The battle for Ukraine's geological wealth.](#)
- Competing theories of geopolitics: [Building Eurasia's New Fortress.](#)
- Cambodia/Thailand War:
 - [Lethal Cambodia-Thailand border clash linked to cyber-scram slave camps.](#)
 - [Why Cambodia and Thailand were involved in a decades-long, deadly dispute.](#)

Research and News

- Geophysics: [Seismic characterization of lava flow facies in the critical zone of the Deccan Traps using shear wave velocity models.](#)

- [Late Holocene Human Impact on Tropical Soil Erosion in the Maritime Continent.](#)
- Mineralogy: [Formation of nano-CdS solid solution: A mechanism for Cd enrichment in sphalerite.](#)
- Geochemistry: [Oxygen isotopic re-equilibration during transformation of ikaite to calcite via amorphous calcium carbonate.](#)
- [Misunderstandings about the Tunguska airburst event, clarifying the physical record based on new evidence.](#)
- [Neoichnology and sediment distribution in tidal flats of the mud-dominated mesotidal Mira River estuary \(Portugal\).](#)
- [Tracking bioturbation through time: The evolution of the marine sedimentary mixed and transition layers.](#)
- [Abiotic chemically oscillating reactions make patterns in deep-sea ferromanganese nodules and crusts.](#)
- [A robust quantification of H₂O in silicate glasses through micro-Raman spectroscopy: insights on the compositional effect.](#)

Plate Tectonics

- [Probabilistic Assessment of the Causes of Active Deformation in Greece, Western Anatolia, and the Balkans Using Finite Element Models.](#)
- [Ductile to Brittle Progression During Exhumation Controlled the Architecture of the Naukluft Nappe Complex, Namibia.](#)
- [Fluid-mediated deformation leads to weakening, strengthening, and block-in-matrix structures during prograde subduction mélange formation.](#)
- [A Gravity Study of the Crustal Structure Beneath the Young Amagmatic Rukwa-Tanganyika Rift Zone.](#)
- [A ~700-km-Long Fossil Tonian Magmatic Arc Belt Hidden Within the Yangtze Block's Interior, South China;](#) behind a paywall; Live Science summary [here](#).
- [A viable Labrador Sea rifting origin of the Northern Appalachian and related seismic anomalies;](#) Phys.org summary [here](#).
- [Impacts of Pre-Existing Structural Fabrics on Fault Growth and Evolution During Multi-Phase Rifting: Case Study From the Central Browse Basin, North West Shelf of Australia.](#)

Paleontology

- [Standing giants: a digital biomechanical model for bipedal postures in sauropod dinosaurs.](#)
- Ammonites: [Site visit: Unearthing buffalo spirit stones in Alberta's Bearpaw Formation.](#)

- [On the occurrence of the ammonite genus *Blaschkeiceras* Zeiss, 2001, from the Upper Jurassic \(Tithonian\) of the Jaisalmer Basin, western India.](#)
- [New evidence for the co-occurrence of two genera of Paleoparadoxiidae \(Mammalia, Desmostylia\) from the Middle Miocene of Japan: insights into taxonomic status and paleodiversity in Desmostylia.](#)
- [A new fossil kangaroo species of the genus *Dorcopsoides* \(Marsupialia, Macropodinae\) from the late Miocene Ongeva Local Fauna, central Australia.](#)
- [The first fossil loggerhead sea turtle \(Cheloniidae: *Caretta*\) from the North Pacific and its nannofossil biostratigraphy.](#)
- [The paleoecology and taphonomy of a Santonian-Campanian \(Upper Cretaceous\) dinosaur-bearing vertebrate locality from Bulgaria: a window into an underexplored part of the Late Cretaceous European Archipelago.](#)
- [The Pliensbachian at the Peniche Global Stratotype Section and Point \(GSSP, Portugal\) – a section full of remarkably preserved worms.](#)
- [Negative ontogenetic allometry of cardinal spines in the early Cambrian arthropod *Isoxys volucris* indicates their defensive function.](#)
- [Fossil samples archive functional diversity in marine ecosystems: An empirical test from a present-day coastal environment.](#)

Mining and Energy

- [Codelco confirms death of four trapped workers at El Teniente mine.](#)
- Reservoir geology: [Research on quantitative prediction method of structural fractures in metamorphic rock reservoirs.](#)
- Gold geology: [Gold geochemical anomalies delineated by the stratigraphic zoning anomaly lower limit contrast method: a case study of panjiaba, Shaanxi province, China.](#)
- [OPEC+ seen further raising oil production on Sunday, sources say.](#)
- [Record Permian Output Boosts Exxon's Q2 Results.](#)
- [Chevron Tops Profit Estimates on Record-High Oil and Gas Output.](#)
- [Who Could Have Guessed that the Nantucket Wind Farm Would Be a Disaster?](#)
- [Copper and gold deposit found near Canada's Golden Triangle just 59 feet below the surface.](#)
- USEIA: [We expect rapid electricity demand growth in Texas and the mid-Atlantic.](#)
- ["China Is Playing with Fire" as CFR-1000 Gigawatt Fast Neutron Reactor Sparks Global Panic and Divides Scientists Over Nuclear Future.](#)

- Behind a paywall: [Overview of Brine-Hosted Lithium Mineral Resources, Distribution, and Genesis in the Western Canada Sedimentary Basin.](#)
- [Genesis and Resource of Lithium Brines in the Qaidam Basin of North Qinghai-Xizang Plateau: An Overview.](#)
- [AI in Wyoming may soon use more electricity than state's human residents.](#)
- [Timeline: Inside Mali's high-stakes gold dispute with Barrick.](#)

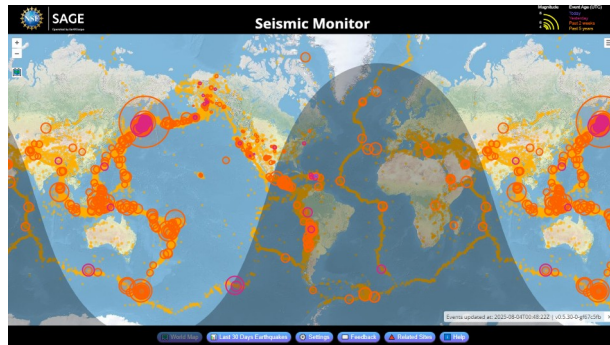
Environmental Geology and Hydrogeology

- [NOAA says Gulf of Mexico dead zone is smaller this year.](#)
- [160-year-old N.S. gold mine to undergo \\$33M remediation.](#)
- [Radioactive wasp nest found at site where US once made nuclear bombs.](#)
- Whiskey's for drinking, water's for fighting: [East Texans condemn Dallas millionaire's plan to pump 16 billion gallons of their groundwater to other parts of the state – every year.](#)
- [Changes in Permeability and Pore Structure Induced by CO₂-Water-Basalt Interaction: Insights From Flow-Through Experiments at 200°C.](#)
- Sweden: [Poison in the water: the town with the world's worst case of forever chemicals contamination – podcast.](#)
- [Nevada's data center boom is a power, water conundrum.](#)
- [A bill to prohibit weather modification within the United States, and for other purposes.](#)

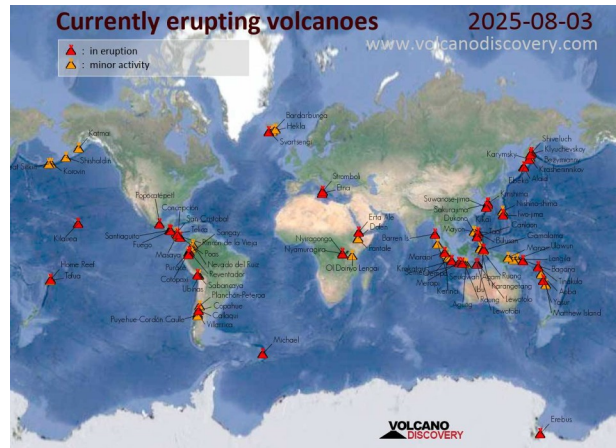
Glaciers and Climate Change

- Computer modelling: [Deforestation Could Push Amazonia Close to a Tipping Point Under Future Climate Change.](#)
- [Outburst of a subglacial flood from the surface of the Greenland Ice Sheet.](#)

Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

Volcanoes

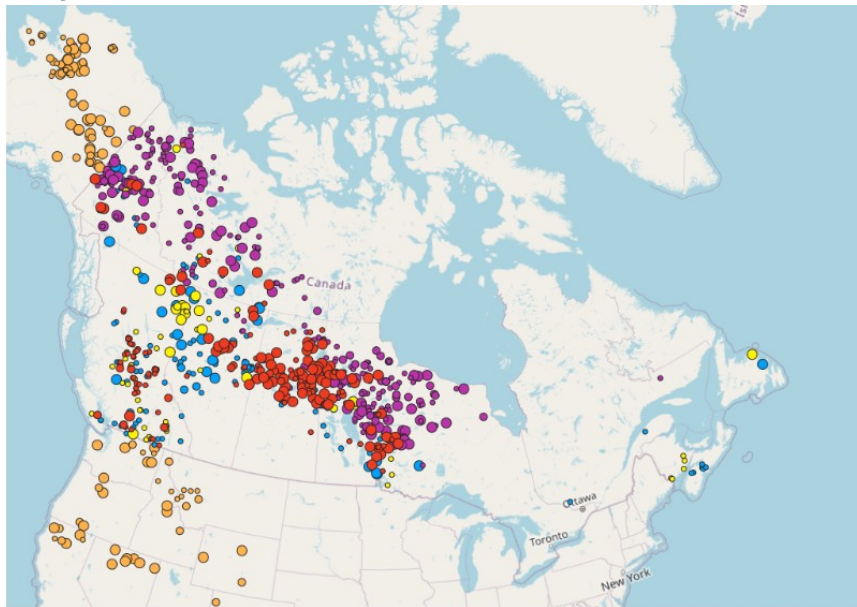
- [Smithsonian / USGS Weekly Volcanic Activity Report.](#)
- United States Geological Survey (USGS) Volcano Observatories:
 - [Cascades Volcano Observatory Weekly Update.](#)
 - Volcano Watch – [Distant versus local earthquakes and tsunami response times in Hawaii.](#)
 - [No, animals are not leaving Yellowstone National Park.](#)
- [Relation Between Volcanic Tremor and Geodetic Strain Signals During Basaltic Explosive Eruptions at Etna.](#)
- [Klyuchevskoy volcano in Russia's far east starts erupting after earthquake.](#)
- [Understanding Attachment to Place in the context of the 2021 Tajogaite eruption crisis and recovery, La Palma.](#)

Earthquakes

- [Euro-Mediterranean Seismological Centre \(EMSC\).](#)
- [Earthquakes Monitoring Live Worldwide.](#)
- Research in fluids and aftershocks: [The Role of Co-Seismic Devolatilization in Driving Aftershock Sequences in Greece.](#)
- [Coupled earthquakes and resonance processes during the uplift of Campi Flegrei caldera.](#)
- [Why some underwater earthquakes cause tsunamis – and others, just little ripples.](#)
- Kamchatka earthquake:

- [Kamchatka earthquake is among top 10 strongest ever recorded. Here's what they have in common.](#)
- [M8.8 earthquake strikes offshore Kamchatka.](#)
- [A first look at the Mw8.8 Kamchatka earthquake](#), USGS summary [here](#).
- [Video of tsunami.](#)
- NOAA [simulation of tsunami propagation.](#)
- [M 6.9 – Macquarie Island region.](#)

Wildfires and Other Geohazards



Interactive Wildfire Map August 3, 2025

Credit: ©Canadian Wildland Fire Information System

- [Wildfires Spread Out West as Canada Fire Smoke Covers Midwest.](#)
- [Identification and classification method of landslide pattern in the soil water index-based early warning system.](#)
- Landslides: [Forecast, Monitor, Adapt: A Multi-Agency Effort to Protect People during Postfire Debris Flows.](#)

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; also they now have a [Free Online Learning Module: Pumping Test Analysis](#).
- Free Groundwater Modeling Course – [HydroGeoCenter](#).
- From Western Australia: [Carbonatite, lamprophyre and host rocks in the northern Aileron Province](#).
- Two volumes of Geology of Indonesia now can be accessed for [FREE/GRATIS](#). The books can be accessed from: vol 1 <https://lnkd.in/eH6Gcka4>; vol 2 <https://lnkd.in/egTYmpjk>.
- Brett Davis' book on veins in a deforming rock mass: "[The Veining Bible](#)"; also at [this site](#).

Upcoming Events

- [Society for Sedimentary Geology conference, Mountjoy IV – August 10-13, 2025, in Montreal, Canada](#).
- [Copper to the World Conference, Tuesday 26 – Wednesday 27 August 2025](#), in Adelaide, Australia; report on 2024 conference [here](#).
- [The 52nd Congress of the International Association of Hydrogeologists, 15-19 September 2025, Melbourne Australia](#).
- [GeoManitoba 2025 78th Annual Canadian Geotechnical Society Conference & 9th Canadian Permafrost Conference, RBC Convention Centre, Winnipeg, Manitoba, September 21 – 24, 2025](#).
- [29 September – 1 October 2025, Stuttgart, Germany, Nature Conference on Advancing Perovskite-Based Photovoltaics](#).
- Australia: [12–18 October 2025, Earth Science Week](#).
- [November 3 – 4, 2025 Central Canada Mineral Exploration Convention 2025 Victoria Inn Hotel & Convention Centre, 1808 Wellington Avenue, Winnipeg, Manitoba R3H 0G3, Canada](#).
- [5th International Professional Geology Conference \(IPGC\), November 5 to 7, 2025, Zaragoza, Spain](#).
- [Saskatchewan Geological Open House, December 1 to 3, 2025, Delta Bessborough Hotel, Saskatoon](#); Registration for the 2025 Conference will be opening on August 6.
- 2025 [Society of Petroleum Engineers Distinguished Lecturer Schedule](#).
- [List of geoscience events in 2025 from the International Union of Geological Sciences](#).
- [American Geophysical Union List of Upcoming Meetings](#).
- The Geological Society: [Events & Courses](#).
- [“Geology Hour” Online](#), evenings on the 3rd Monday of the Month from the Geological Society of the Oregon Country.

August 4, 2025

Geology and Mineral Resources – Liberia

Introduction



Figure 1a – Liberia

Credit: [CIA World Factbook](#), [public domain](#)



Figure 1b – Location of Liberia

Credit: [CIA World Factbook](#), [public domain](#)

[Liberia](#) is a country of [5,437,249 people](#) on the [Atlantic](#) coast of [West Africa](#). The country has an area of 111,369 square kilometres and borders on: [Sierra Leone](#) to the northwest; [Guinea](#) to the north; and [Côte d'Ivoire](#) to the east. For more details on the country, check out the [CIA World Factbook on Liberia](#) as well as the [Wikipedia article](#).

Geology

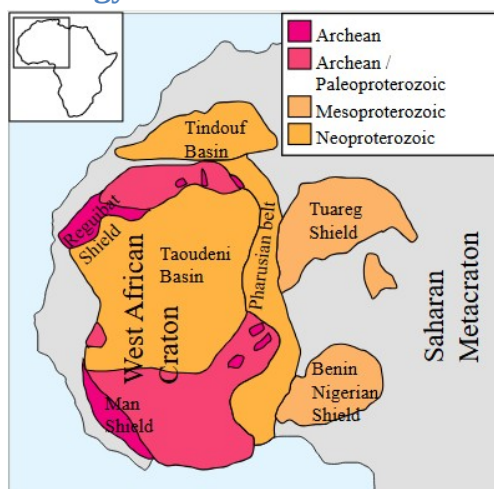


Figure 2 – West African Craton

Credit: [Aymatth2](#), [public domain](#)

Liberia sits on the [Man Shield](#) portion of the [West African Craton](#) of the [African Plate](#). The West African Craton is made up of [Archean](#) and [Paleoproterozoic](#) aged rocks brought together during the [Eburnean orogeny](#).

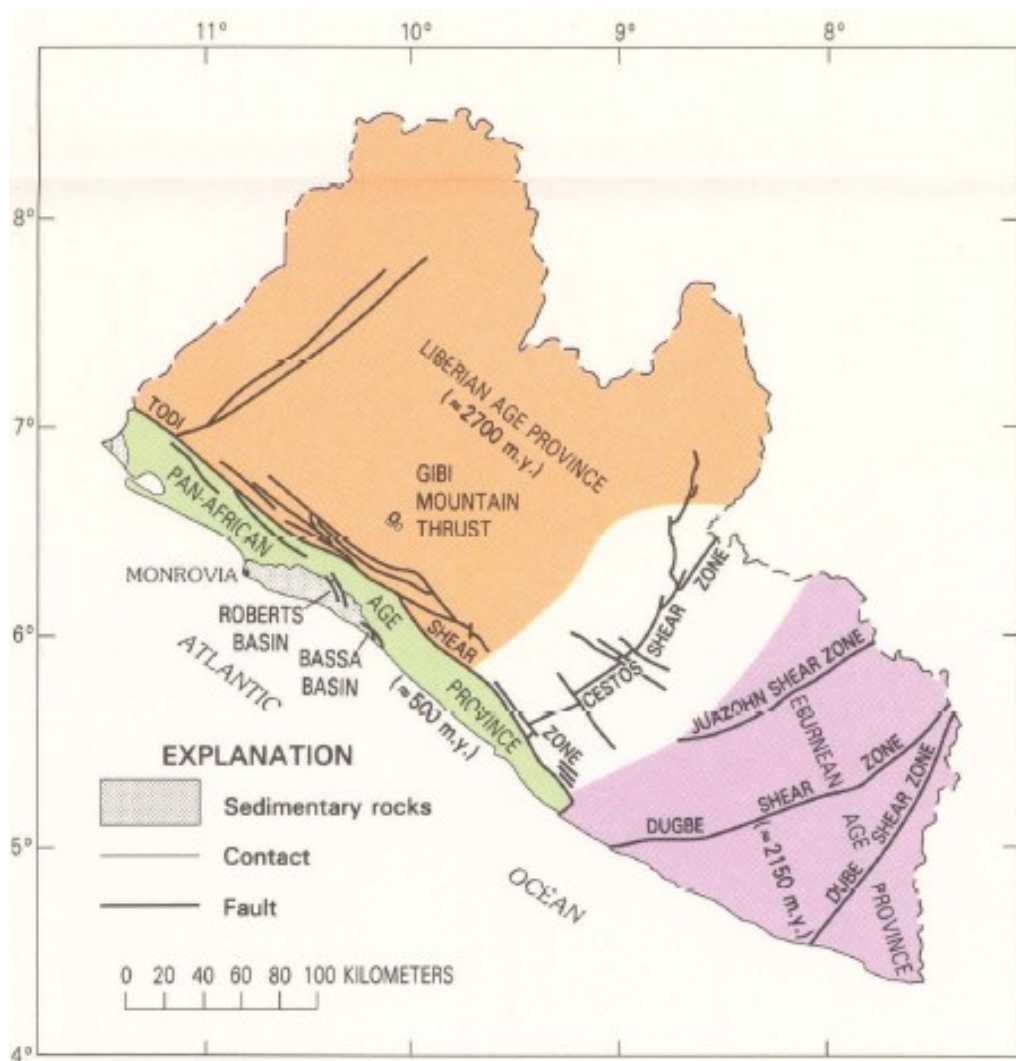


Figure 3 – Geological Provinces of Liberia
 Credit: Tydsal & Thorman 1983, USGS IMAP 1480, public domain

The major geological provinces in Liberia are:

- The [Liberian Age Province](#), approximately 2700 million years old, [Paleoproterozoic](#);
- The [Eburnean Age Province](#), approximately 2,150 million years old, also Paleoproterozoic;
- The [Pan-African Age Province](#), Lower [Paleozoic](#);
- The [Roberts and Bassa Basins](#); and
- The offshore [Liberia Basin](#).

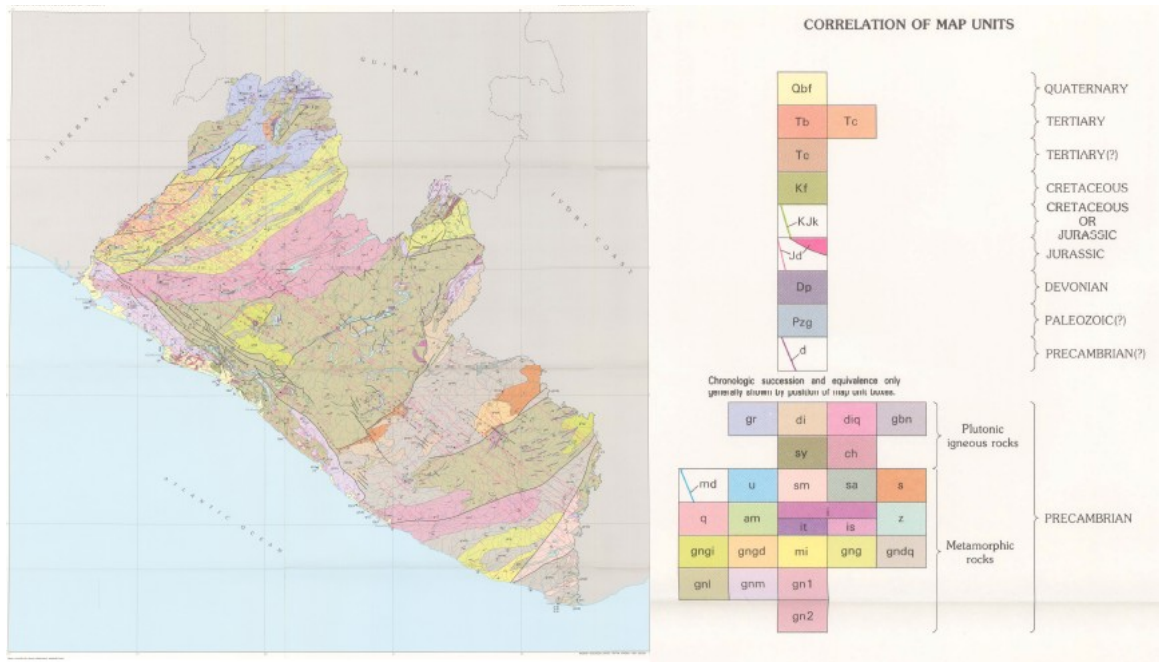


Figure 4 – Geologic Map of Liberia

Credit: Tydsal & Thorman 1983, USGS IMAP 1480, public domain

The youngest deposits in Liberia are [Quaternary](#) aged beach and [fluvial](#) deposits including modern beach deposits, older beach deposits made up of nearly pure [quartz](#) sand about 1 metre thick, and yet older silt and sand beach and fluvial deposits.

The next older units are [Neogene](#) to [Paleogene](#) ([Tertiary](#)) deposits of [bauxite](#) and [canga](#). Both the bauxite and canga were formed by tropical weathering of underlying bedrock. Bauxite is rich in aluminum whereas canga is rich in iron oxides. The next older Tertiary deposit is the [Edina Sandstone](#), a medium to coarse grained sandstone sometimes forming a [conglomerate](#).

The thick marine sediments of the offshore [Liberian Basin](#) are [Cretaceous](#) aged and younger. On shore Cretaceous aged deposits in Liberia include the [Farmington River Formation](#), a dark dirty [sandstone](#) sometimes called a [wacke](#). There are also [kimberlite](#) intrusions ranging in age from Cretaceous to [Jurassic](#) in age and Jurassic aged [diabase](#) dykes, including the [Monrovia Diabase](#).

The oldest sedimentary deposits in Liberia are:

- The [Devonian](#) aged [Paynesville Sandstone](#), a lightly coloured quartz sandstone; and
- The [Neoproterozoic](#) aged [Gibi Mountain Formation](#) made up of [tillite](#), [laminite](#) with [ice rafted](#) grains, [arkose](#) and [shale](#); this collection of rocks suggests a [Cryogenian](#) age.

[Precambrian](#) igneous deposits in Liberia include: diabase intrusions, [granitic](#) rocks, [diorite](#), [quartz diorite](#), [norite](#), [syenite](#), and [charnockite](#). The oldest deposits in Liberia are metamorphic rocks including: metamorphosed diabase intrusions, [ultramafic](#) rocks, [mica schist](#), [amphibolite schist](#), generalized [schist](#), [quartzite](#), [amphibolite](#), [banded iron formations](#), [migmatite](#), together with various kinds of [gneiss](#) such as [granitic gneiss](#), [granodiorite gneiss](#), quartz diorite gneiss, [leucocratic](#) and [melanocratic](#) gneiss.

For further reading on the geology of Liberia you can read:

- R. W. White, 1969, Sedimentary rocks of the coast of Liberia, USGS Open-File Report 69-318, <https://doi.org/10.3133/ofr69318>
- P. M Hurley, G. W Leo, R. W White, H. W Fairbairn, 1971, *Liberian Age Province (about 2,700 m.y.) and Adjacent Provinces in Liberia and Sierra Leone*, GSA Bulletin, Volume 82, Number 12, [https://doi.org/10.1130/0016-7606\(1971\)82\[3483:LAPAMA\]2.0.CO;2](https://doi.org/10.1130/0016-7606(1971)82[3483:LAPAMA]2.0.CO;2)
- J.C. Behrendt, C. Woterson, 1972, *Tectonic Map of Liberia Based Upon Geophysical and Geological Surveys*, USGS Open File Project Report IL-LI-60, <https://pubs.usgs.gov/of/1972/0032/report.pdf>
- J. C. Behrendt; J. Schlee; J. M. Robb; M. K. Silverstein, 1974, *Structure of the Continental Margin of Liberia, West Africa*, GSA Bulletin Volume 85, Number 7, [https://doi.org/10.1130/0016-7606\(1974\)85%3C1143:SOTCMO%3E2.0.CO;2](https://doi.org/10.1130/0016-7606(1974)85%3C1143:SOTCMO%3E2.0.CO;2)
- C. E. Hedge, R. F. Marvin, and C. W. Naeser, 1975, *Age provinces in the basement rocks of Liberia*, Journal of Research of the U.S. Geological Survey, <https://pubs.usgs.gov/publication/70232613>
- R. G. Tydsal & C. H. Thorman, 1983, *USGS IMAP 1480*, scale 1:1,000,000, <https://doi.org/10.3133/i1480>
- A. W. Magee, 1985, *Depositional Environments of Late Precambrian Sediments from Liberia, Sierra Leone, and Senegal, West Africa*, Master of Science (MS), Thesis, Ocean & Earth Sciences, Old Dominion University, DOI: 10.25777/90h6-vh74 https://digitalcommons.odu.edu/oeas_etds/253

Mineral Resources



Figure 5 – Iron Ore Mine at Yekepa, Nimba County, Liberia

Credit: [Fred van der Kraaij](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license

According to the [USGS Minerals Yearbook, the Mineral Industry of Liberia](#), the country produces metallic and industrial minerals:

- Barite is mined from deposits along Mount Gibi district, Margibi County by [Steinbock Liberia Barite Mining](#), according to the Steinbock website, 100,000 tonnes of barite was produced in 2024;
- Cement is produced in Monrovia by the [Liberia Cement Corp. Ltd.](#) 474,187 tonnes [produced](#) in 2022;
- Diamonds are produced by small artisanal operations at various counties in Liberia, 52,165 carats [produced](#) in 2022;
- Gold is produced by various small artisanal operations in Grand Cape Mount County (8,700 kg were produced in 2022) as well as at the [New Liberty Gold Mine](#), 90 km northwest of Monrovia in Grand Cape Mount County (3,000 kg [produced](#) in 2022);
- Iron ore is mined at one location in Liberia: the [Mount Gangra Mine](#) operated by [ArcelorMittal Liberia](#) at Yekepa, Nimba County; iron ore was formerly mined at the [Bong Mine](#) in the Fuamah District, Bong County, but it was shut down last year due to environmental violations. In 2022 5,000,000 tonnes of iron ore [were mined](#) in Liberia;
- 200,000 tonnes of sand and gravel together with 9,700 tonnes of crushed stone for construction were [produced](#) in 2022.

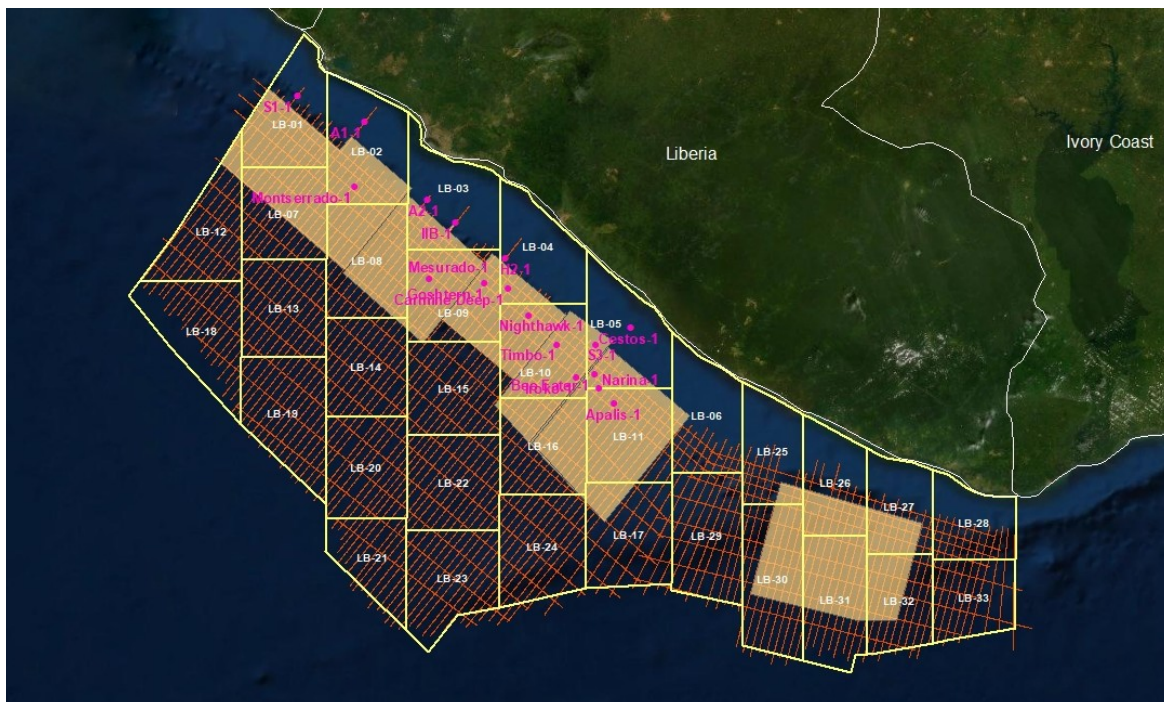


Figure 6 – Liberian Offshore Exploration Blocks

Credit: ©TGS

Liberia does not have any current petroleum production. Beginning in 2021, the [Liberia Petroleum Regulatory Authority](#) began offering of [ffshore exploration leases](#). However, the process has been delayed and there are concerns that the process [has been corrupted](#).

Figure 7 links to an interactive mineral occurrence map for Liberia.



Figure 7 – Interactive Mineral Occurrence Map of Liberia

[Credit: ©mindat.org](#)

Summary

That wraps up this quick look at the geology and mineral industry of Liberia. The biggest potential for future work appears to be potential for offshore oil production, if they can get the permitting sorted out. Also. The Bong Mine has huge iron ore reserves yet to be mined, so the environmental concerns with that property need to be ironed out.

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.