

September 23, 2024

News and notes

Before going on to discuss the geology and geopolitics of Gabon, here are some news items I thought were interesting.

Free Geology Books

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](#).
- [Lithium in Nevada-origins, extent, role in the energy transition, and implications for economic development and national security](#).

Geopolitics

- [US Navy Directed to Prepare for War With China by 2027](#).
- 72 minutes before the complete extinction of the planet, Scott Ritter [interview](#).
- [Indian state oil refiners seeking long-term deals with Russia](#); related: [Russia's Fuel Exports Rise by 10% in September](#).
- [Switzerland Dumps Neutrality as Senate Rejects Ban on Joining NATO Drills](#).
- [Ukrainian drone attack triggers earthquake-sized blast at arsenal in Russia's Tver region](#).
- [Russian nuclear test chief says Moscow is ready to resume testing 'at any moment'](#).
- [Russia's Shadow Fleet is a Ticking Geopolitical Timebomb](#).
- Result of drone attacks: [Russian Oil Refining Capacity Plummets 14.5%](#).
- Video: [Russian Geopolitics: An eschatological perspective – Aleksandr Dugin](#).

Research and News

- Geological history: [Titanite petrochronology, phase equilibria modelling and the role of amphibole during decompression: Insights from the Shabogamo Domain, central Grenville Province](#).
- More geological history: [First High-Precision U–Pb CA–ID–TIMS Age of the Chuanlinggou Formation, North China Craton: Implications for Global Correlations of Black Shales and the Statherian/Calymmian Boundary](#).
- [End of an Era: Historic Landsat 7 Mission Takes Its Final Images of Earth](#).

- [A common precursor for global hotspot lavas](#); Phys.org summary [here](#).
- [Ancient Muriwai lava megapillows gain global recognition](#).
- [Evidence suggesting that earth had a ring in the Ordovician](#); Phys.org summary [here](#).
- Mineralogy research: [Relating Quartz Crystallographic Preferred Orientation Intensity to Finite Strain Magnitude in the Northern Snake Range Metamorphic Core Complex, Nevada: A New Tool for Characterizing Strain Patterns in Ductilely Sheared Rocks](#).
- [Dehydration melting at the top of the lower mantle](#); Northwestern University press release [here](#).

Coastal Geology

- [Numerical Modeling of Extreme Sea Levels on the Laptev Sea Coast](#).
- [Stunning drone footage shows oceanfront houses on the brink of collapse in the Outer Banks](#).
- [First assessment of coastal subsidence on a European scale](#).

Sedimentology

- [Organic matter binding detrital grains contributing to ooid formation and small shelly fossil preservation, a case from the middle Cambrian, southern North China](#).
- [Hydrothermal activity near the Permian–Triassic transition in the south-western Ordos Basin, China: Evidence from carbonate cementation in Upper Permian sandstones](#).
- [October 2024 Edition of Sedimentology](#).

Plate Tectonics

- Geophysics and Plate tectonics: [Seismic Evidence of Basin Development in NE Tibetan Plateau in Response to Deep Crustal Dynamics From Joint Inversion of Rayleigh Wave Ellipticity and Phase Velocity](#).
- [Structures and Magmatism Associated With a Failed Triple Junction in Traill Ø, East Greenland](#).
- [One Billion Years of Stability in the North American Midcontinent Following Two-Stage Grenvillian Structural Inversion](#).
- [Bringing the Submarine Mariana Arc and Backarc Basin to Life for Undergraduates and the Public](#).
- [Multistage lithospheric drips control active basin formation within an uplifting orogenic plateau](#); Phys.org summary [here](#).
- [Earth's tectonic and plate boundary evolution over 1.8 billion years](#); IFL Science summary [here](#).
- [Plate tectonic surprise: Utrecht geologist unexpectedly finds remnants of a lost mega-plate](#).

Paleontology

- [Body-size reductions in dacryoconarid tentaculitoids during Late Devonian warming.](#)
- [Using pollen in turbidites for vegetation reconstructions.](#)
- Dingo evolution: [Phenotypic diversity in early Australian dingoes revealed by traditional and 3D geometric morphometric analysis](#); Yahoo News summary [here](#).
- British Columbia: [Dinosaur fossil finds in northern B.C. could include new species](#); hat tip to Rob M.
- [Exploring the macroevolutionary impact of ecosystem engineers using an individual-based eco-evolutionary simulation.](#)
- [An unusual Cretaceous beetle with affinity to Anamorphidae \(Coleoptera: Coccinelloidea\).](#)
- Newfoundland: [Fossils Discovered on Bonavista Peninsula Brought to Life by Paleoartist.](#)
- Everything is bigger in Texas: [New remains of the mosasaur *Globidens alabamaensis* from the North Sulphur River of Texas](#); Live Science summary [here](#).
- Published September 14: [Neues Jahrbuch für Geologie und Paläontologie – Abhandlungen Band 312 Heft 2](#); five new paleontology papers.
- [Discriminating conodont recording bias: a case study from the Nanzhang-Yuan'an Lagerstätte.](#)

Ore Deposit Geology

- [Metallogenic model of the Lykling ophiolite-hosted lode Au deposit, Scandinavian Caledonides: Insight from fluid inclusions, mineral chemistry and stable isotope geochemistry.](#)
- [Geological Controlling Factors on Mississippi Valley-Type Pb-Zn Mineralization in Western Semnan, Iran.](#)

Mining and Energy

- [TotalEnergies Set to Develop \\$9 Billion Suriname Oil Resources](#); also: [TotalEnergies Starts Natural Gas Production from Argentinian Offshore Field.](#)
- Peter Thiel [comments on nuclear power.](#)
- AI is an energy hog: [Three Mile Island nuclear plant to restart for Microsoft.](#)
- [Gold price breaks \\$2,600 barrier as Fed cut bets prolong historic run.](#)
- [Vanadium is the new battery cathode chemistry, says Pure Lithium CEO.](#)
- [Saskatchewan processing plant first to produce rare earth metals in North America.](#)
- Mineral processing research: [Chelator-Assisted Precipitation-Based Separation of the Rare Earth Elements Neodymium and Dysprosium from Aqueous Solutions](#); Phys.org summary [here](#).

Ooh, Shiny

- [Kimberlite pre-conditioning of the lithospheric mantle and implications for diamond survival: a case study of olivine and mantle xenocrysts from the Koidu mine \(Sierra Leone\).](#)
- [Canadian miner unearths 1,094-carat diamond weeks after finding another mammoth gem; from mine in Botswana.](#)

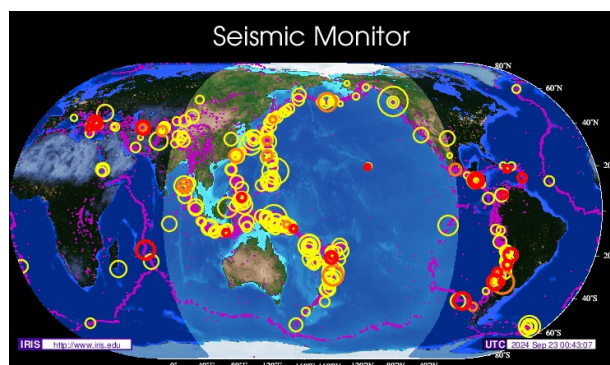
Environmental Geology and Hydrogeology

- Plastics pollution: [How Does Plastic Litter Accumulate in Submarine Canyons?](#)
- Remediation news: [Former Victoria Gold engineer blasts Yukon gov't for 'passive' response to mine failure.](#)
- More remediation news: [Atlantic Mining to pay Nova Scotia gold mine clean-up bond as it appeals conditions.](#)
- Heavy metals and corals: [Incorporation of Dissolved Heavy Metals Into the Skeleton of *Porites* Corals Based on Multi-Element Culturing Experiments.](#)
- [Nuclear energy race: Japan to launch world's first steady-state fusion reactor.](#)

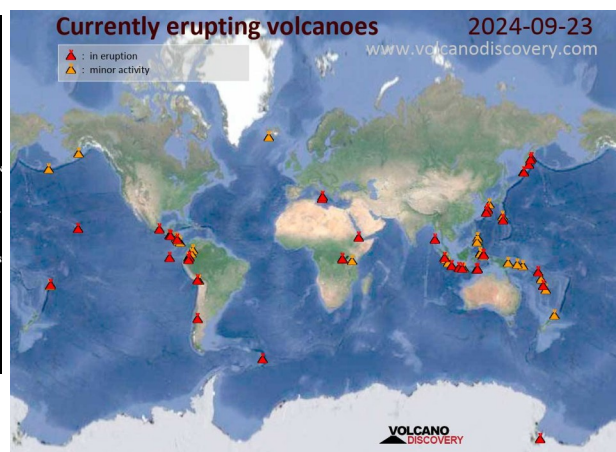
Glaciers and Climate Change

- [Atmospheric blocking slows ocean-driven melting of Greenland's largest glacier tongue.](#)
- [Scientists have captured Earth's climate over the last 485 million years. Here's the surprising place we stand now;](#) Zero Hedge summary [here.](#)
- ['Disappeared completely': melting glaciers worry Central Asia.](#)
- [A Virtual Expedition to the Juneau Icefield.](#)

Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

Volcanoes



- United States Geological Survey (USGS) Volcano Watch: [A New Kīlauea Eruption](#);
 - [September 19, 2024 —Kīlauea middle East Rift Zone eruption overflight](#);
 - [September 18, 2024 – lava oozes during the active Kīlauea eruption](#);
 - [Lava flow erupted west of Nāpau Crater on the middle East Rift Zone of Kīlauea, observed September 16, 2024](#).

Nāpau Crater, East Rift Zone of Kīlauea, September 18, 2024

Credit: USGS photo by H. Winslow, [public domain](#)

- USGS Yellowstone Volcano Observatory: [The mountain that roared](#).
- [Smithsonian / USGS Weekly Volcanic Activity Report](#).
- Volcano research: [The rheology of rhyolite magma from the IDDP-1 borehole and Hrafninnuhryggur \(Krafla, Iceland\) with implications for geothermal drilling](#).

Earthquakes

- [Euro-Mediterranean Seismological Centre](#)
- [Earthquakes Monitoring Live Worldwide](#).
- Earthquake research: [Rupture Model of the 5 April 2024 Tewksbury, New Jersey, Earthquake Based on Regional Lg-Wave Data](#).
- [Shallow M5.0 earthquake shakes West Java, Indonesia](#); USGS summary [here](#).
- [Magnitude-5.1 earthquake strikes near Midland, Texas, as thousands report shaking](#); USGS summary [here](#).
- [M6.5 earthquake strikes offshore western Canada](#); USGS summary [here](#).
- AI & earthquake research: [AI-Driven Innovations in Earthquake Risk Mitigation: A Future-Focused Perspective](#).

Upcoming Events

- [39th General Assembly of the European Seismological Commission](#) to be held in Corfu (Greece) from 22 to 27 September.
- [GeoFutures: Planetary Geoscience Conference](#), 14-15 November 2024, hybrid meeting.
- [Groundwater Week 2024](#), December 10-12 in Las Vegas, Nevada.
- [Copper to the World Conference, Tuesday 26 – Wednesday 27 August 2025](#), in Adelaide, Australia; report on 2024 conference [here](#).
- [List of geoscience events in 2025 from the International Union of Geological Sciences](#).
- [Society of Petroleum Engineers Distinguished Lecturer Schedule](#).

September 23, 2024

Geology and the Fate of Societies – Gabon



Figure 1a – Gabon

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

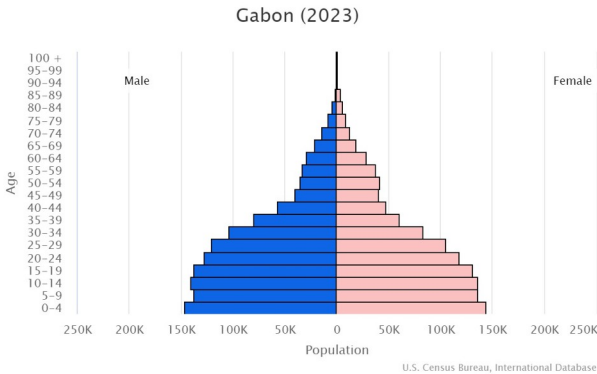
Figure 1b – Gabon Location

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

Located on the [Atlantic](#) coast of [Central Africa](#), the [Gabonese Republic](#), is bordered by [Equatorial Guinea](#) to the northwest, [Cameroon](#) to the north and the [Republic of the Congo](#) on the east and south. To the west, is the [Gulf of Guinea](#). The Gabonese Republic is officially a [unitary presidential republic](#) but is currently ruled by a [military junta](#). The Transitional President is [Brice Oligui Nguema](#) who also chairs the [Committee for the Transition and Restoration of Institutions](#) (CTRI), the official name of the ruling junta. The Transitional Vice President is [Joseph Owondault Berre](#) and the Interim Prime Minister is [Raymond Ndong Sima](#). The Capital and largest city in Gabon is [Libreville](#) (pop. 703,904).

According to the [Central Intelligence Agency](#) (CIA) [World Factbook on Gabon](#), the country has a total area of 267,667 square kilometres (km²) of which 257,667 km² is land and 10,000 km² is water. Also according to the CIA, 2,455,105 people live in Gabon, most of whom live in urban areas. The country is ethnically diverse, divided among [Fang](#) 23.5%; [Shira-Punu'Vii](#) 20.6%; [Nzabi-Duma](#) 11.2%; [Mbede-Teke](#) 5.6%; [Myene](#) 4.4%; [Kota-Kele](#) 4.3%; [Okande-Tsogho](#) 1.6%; other ethnicities, including [Baka](#), 12.6%; and foreigner 16.2% (as of 2021). The official language of Gabon is [French](#); a wide variety of other languages are spoken including [English](#), [Spanish](#), [Portuguese](#), [Fang](#), [Mbeté](#), [Myene](#), [Nzebi](#), [Punu](#), [Teke](#), and [Vili](#).

In terms of common religions, 80.2% of Gabonese are Christian, split between [Protestants](#) and [Catholics](#). Of the remaining, 10.8% are [Muslim](#), 1.1% follow [traditional/animist beliefs](#), other 0.9%, 7% have no religion, and 0.9% are something other. As far as education goes, 85.5% of the population aged 15 and over can read and write. Economically, the per capita [GDP](#) is \$19,165, the [Human Development Index](#) is a medium ranking of 0.693, and the [Gini coefficient](#) is 38, indicating medium inequality. Unemployment is high at ~20%.



The [demographic profile of Gabon](#) shows a young population, about 35% of the population is under 15 and the median age is 22 years of age. The total fertility rate is 3.26 births per woman and the annual growth rate is 2.4%. Life expectancy at birth for both sexes is 70 years.

Figure 2 – Gabon Demographic Profile
Credit: U.S. Census Bureau, International Database, public domain

Geology



Figure 3 – Gondwana during the Mesoproterozoic
Credit: Woudloper, Creative Commons Attribution-Share Alike 3.0 Unported, 2.5 Generic, 2.0 Generic, and 1.0 Generic license

The tectonic background for the [geology of Gabon](#) is shown above in Figure 3. Gabon sits within the [Congo Craton](#). The Congo Craton split off from the [Gondwana Supercontinent](#) with the widening of the South Atlantic that began in the [Early Cretaceous](#) about [138 Mya](#).

The oldest rocks in Gabon are [Archean](#) aged basement rocks of the [Chaillu Massif](#) and North Gabon Massif. Both massifs are composed of predominately granitoid rocks: [granite](#), [monzonite](#), [syenite](#) and [diorite-tonalite-granodiorite](#). The North Gabon Massif also contains [a greenstone belt called the Bélinga Group](#) that includes [itabirites \(banded iron formations\)](#), [ultramafic](#) assemblages, and [amphibolites](#).

The next older group of rocks include [Proterozoic](#) aged rocks including:

- The [Paleoproterozoic Franceville Supergroup](#) made up of a sedimentary sequence that includes [shale](#) and [carbonate rocks](#); The Franceville Supergroup includes Oklo, a [high grade uranium](#)

[deposit that at one time formed a natural fission reactor](#), the International Atomic Energy Agency has a good discussion on the deposit, and the reactor, [here](#).

- The [Ogooue Orogenic Belt](#) in west-central Gabon also dates from the Paleoproterozoic and consists of [metasedimentary](#) and [metavolcanic rocks](#) in a [fold and thrust belt](#).
- In the southwest of Gabon is the Mayombe-Nyanga terrane consisting of Paleoproterozoic and [Mesoproterozoic](#) aged rocks; the terrane includes the Lambarene [migmatite](#) belt, the Doussa Supergroup, and the granites of the Mesoproterozoic [Mayombe Supergroup](#), Mesoproterozoic [dolerite](#) dykes also cut the Mayombe-Nyanga terrane.
- Deformed volcanic and sedimentary sequences make of the [Neoproterozoic](#) aged [West Congolian Supergroup](#).

More recent [Cretaceous](#) to [Quaternary](#) aged deposits are found immediately offshore in the [Gabon Coastal Basin](#). Deposits in this basin include mostly clastic ([mudstones](#) and [sandstones](#)) but also an [evaporite](#) sequence during the [Aptian Age](#) of the Early Cretaceous coinciding with the opening up of the South Atlantic and a carbonate sequence in the following [Albian](#) and [Cenomanian](#) ages. [Deformation in the evaporite layer](#) has caused [structural traps for petroleum](#) to form in the basin.

For further information on the geology of Gabon, check out the detailed geological map in Figure 4

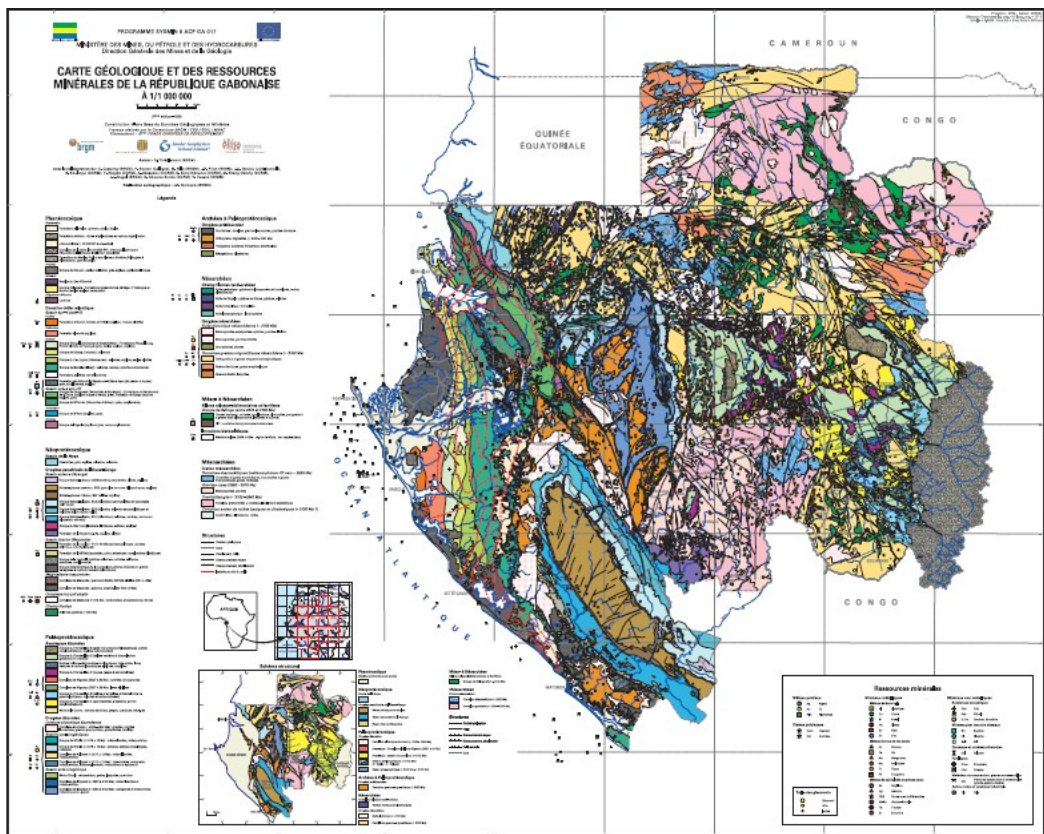


Figure 4 – Geological Map of Gabon

Credit: [Bureau de Recherches Géologiques et Minières \(brgm\)](#), [public domain](#)

Resources

Agriculture and Fisheries



Figure 5 – Cropland in Gabon

Credit: VIGNA christian, [Creative Commons Attribution-Share Alike 4.0 International](#) license

According to the CIA World Factbook, 19% of Gabon is agricultural land (1.2% [arable land](#), 0.6% [permanent crops](#), and 17.2% permanent [pasture](#)). Forest covers the remaining 81% of the land.

[Agriculture contributes](#) 5.7% to Gabon's GDP and employs 60% of the labour force. Much of the farming in Gabon is [subsistence agriculture](#). The major crops grown are [plantains](#), [cassava](#), [sugarcane](#), [yams](#), [taro](#), [vegetables](#), [maize](#), [peanuts](#), and [natural rubber](#) from the [rubber tree](#). Gabon is [not self sufficient in cereal grain](#) production and relies on imports for 90% of their cereal grain needs. Livestock raised in Gabon include [cattle](#), [sheep](#), [goats](#), [pigs](#), and [poultry](#). [Meat from wild game](#) (so called bush meat) is also sold in the food markets. Statistics from the United Nations Food and Agriculture Organization (FAO) can be found [here](#). Statistics on food insecurity in Gabon are not easily available, [USAID statistics indicate](#) that 23% of the population are undernourished.



Figure 6 – Fishing Village in Gabon

Credit: David Stanley, [Creative Commons Attribution 2.0 Generic](#) license

Much of the fishing industry in Gabon is artisanal, i.e. local fishing for local consumption although there is also a [commercial fishery](#), a [sports fishery](#), and [aquaculture](#). The fishery remains an undeveloped resource and many of the fishermen are recent immigrants from [Nigeria and Benin](#). [Total fish production](#) in Gabon was 31,097 tonnes for 2021.

Forestry



Figure 7 – Tropical Rainforest in Gabon

Credit: Nik06, [mongabay.com](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

As noted above, 81% of Gabon is tropical rainforest and is part of the larger [Congolian Rainforest](#). The main kinds of forest in Gabon include:

- [Northwestern Congolian lowland forests](#);
- [Atlantic Equatorial Coastal Forests](#);
- [Western Congolian forest-savanna mosaic](#); and
- [Central African mangroves](#).

[Forestry accounts](#) for about 4% of Gabon’s GDP and employs 20,000 people. Production is mostly tropical hardwoods for both local use and export. Interestingly, [Gabon has been paid to preserve their forests](#) as a hedge against climate change. Statistics on forest production in Gabon can be found [here](#).

Mineral Production



Figure 8 – Offshore Drilling Rigs, Port Gentil, Gabon

Credit: [Barada-nikto, Creative Commons Attribution-Share Alike 4.0 International](#) license

The mineral industry in Gabon produces petroleum, natural gas, manganese and gold. The USGS summary of the Gabon mineral industry is [here](#) and the most recent production statistics (2020-21) are [here](#).

Among metallic mineral production, gold [was mined](#) at the [Bakoudou](#) until 2017. [Artisanal gold mining](#) continues in the [Eteke region](#) and an [exploration project](#) in the area [may or may not continue](#). The largest metallic mineral production [in Gabon is for manganese](#), the largest of which is the [Moanda mine](#). Manganese production at the [M’Bembele mine](#) was suspended but has resumed [under China’s CICM Huangzhou company](#).

Petroleum and natural gas production is from both onshore and offshore fields, including the:

- [Tchatamba complex conventional oil field](#),
- [Remboue oilfield](#),
- [Obangue oilfield](#),
- [Tsiengui oilfield](#),
- [Etame oilfield](#) including North and South Tchibala,
- [Brème, Oguendjo and East Orovinzare \(EOV\) fields](#),
- [Toucan oilfield](#),
- [Anguille oilfield](#), and others.

Figure 9 links to an interactive mineral occurrence map from [Mindat](#) for Gabon.

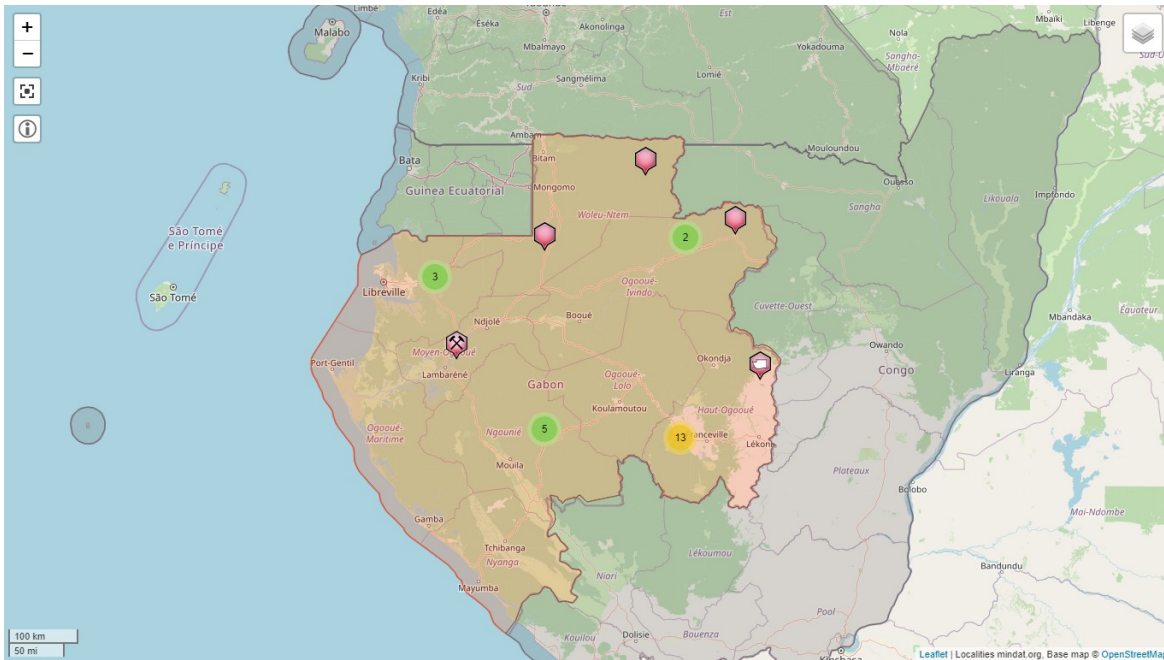


Figure 9 – Mineral Occurrence Map of Gabon
 Credit: ©Mindat.org

Climate

Gabon map of Köppen climate classification



Gabon has a tropical climate with two main zones:

- Monsoon climate ([Am](#)), and
- Tropical savanna climate ([Aw](#)).

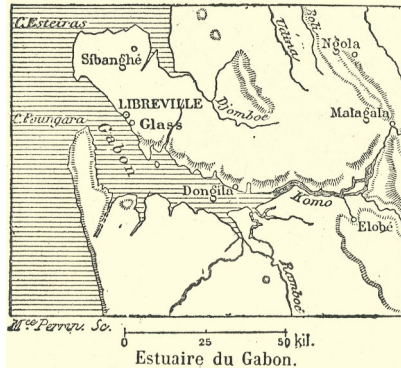
You may want to travel to Gabon, for any of a number of reasons. The weather is pleasant, if you like it hot, and you may have work to do there, such as mineral exploration. Gabon is also an excellent destination for [ecotourism](#).

Before you go, see the news to see if there has been a recent coup d'etat, and check out the travel advisories [here](#) and [here](#). You can also check out [Climates to Travel](#) and [Lonely Planet](#).

Figure 10 – Köppen Climate Classification, Gabon
 Credit: [Ali Zifan](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license

History and Geopolitics

History



The [history of Gabon](#) has three main divisions:

- The precolonial period, which is the longest and about which the least is known;
- The colonial period as part of the [French Equatorial Africa](#);
- The period since independence in 1960.

For a detailed chronology of events, check out this [site](#).

Figure 11 – Gabon Estuary, 1894
Credit: Frantz Schrader (1844-1924)
public domain

The earliest known inhabitants of the forests around the [Gabon Estuary](#) were the ancestors of the [Baka](#) people, formerly called [Pygmies](#). Beginning around 3,500 years ago, [Bantu speaking people](#) moved into the area bringing an [effective tropical agriculture, iron tools and weapons](#). Few records exist, but beginning in the 14th Century AD, native kingdoms such as the Kingdoms of [Loango](#) and [Orungu](#) ruled the area.

The French arrived in 1838 and established a protectorate over the local chiefdoms. The [French ruled Gabon](#) until 1960, when the country was granted independence. With independence came the challenges of self rule, which the Gabonese have struggled with. One party rule and fixed elections have been the norm in the country. [Human right abuses](#), while not severe by African standards, have occurred. In 2023, the current government came power following [a coup d'etat](#).

Geopolitics

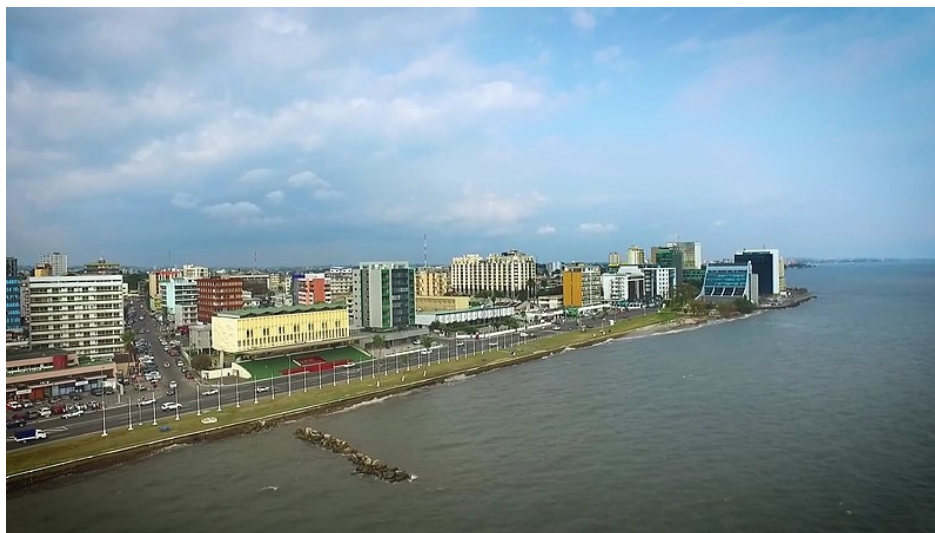


Figure 12 – Boulevard de l'indépendance Libreville
Credit: Delrick Trevor, Creative Commons Attribution-Share Alike 4.0 International license

Internally, Gabon is a resource rich country with great potential for further development. Unfortunately, the development of their people is probably their biggest deficit. Political disorder, human right abuses, and corruption ([Gabon ranks 136 out of 180](#) on Transparency International's List) have hindered the people's development. The lure of easy gains from oil revenues has tempted many public officials to engage in corrupt self-dealing, [with some having to face the consequences](#). Clearly, the military junta ruling Gabon [has many challenges](#) in dealing with this predicament.

Gabon's [relationship with its neighbours](#) also has challenges. Following the 2023 coup d'etat, Gabon was [suspended](#) from the African Union and the Economic Community of Central Africa States (ECCAS). However, in March 2024, [those sanctions were lifted](#), in part because of [diplomacy with Republic of Congo](#). The current government has also [reached out diplomatically to their neighbours in Cameroon](#). So far, things seem peaceful on those fronts.

Elsewhere, as I noted in my blog entry of [July 22, 2024](#), Equatorial Guinea and Gabon have only [recently settled](#) their maritime border dispute. It is [uncertain if this agreement will hold](#) or if there will be further trouble.

Going further afield, Gabon has kept [close relations with its former colonial master](#), France. However, those [relations are evolving](#) as France takes a more hands-off approach and Gabon seeks closer ties with other powers. One of those attempts to diversify their diplomatic ties was when Gabon joined the [British Commonwealth in 2022](#). Gabon also maintains friendly [relations with the United States](#) and [Russia](#).

An interesting development in foreign affairs for Gabon has been their relationship with [China](#). Following the 2023 coup, there was some concern that Chinese investments [would be at risk](#). However, China has not lost out and is [pursuing further investments in Gabon](#). This is one to watch, if only as part of [China's increasing involvement with Africa](#).

That kind of winds up this short look at Gabon. I don't know if Gabon will reform itself and make progress to developing their country and especially their people. The current junta [seems to working towards](#) a more stable government. If they succeed, the country could have a great future. Otherwise, they risk becoming yet another [failed state](#).

Standard Caveat

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.