

January 6, 2025

News and notes

Before going on to discuss the geology and geopolitics of [Guinea](#), here are some news items I thought were interesting.

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](#).
- Free Groundwater Modeling Course – [HydroGeoCenter](#).

Geopolitics

- [Guatemalan forces arrive in Haiti to fight gangs](#).
- I think that I [predicted this](#) last week: [Elon Musk demands King Charles orders new general election in latest attack on Labour](#).
- Stockpiling: [China's 2025 iron ore imports set to hit new high even as steel demand dwindles](#).
- From The Economist: [What will be the biggest stories in 2025?](#)
- Humour [The Babylon Bee's Predictions For 2025](#).
- [Beyond China: Which Countries Hold the Key to Future Rare Earth Supplies?](#)

Research and News

- [Depositional Environments and Soft Sediment Deformation in the Early Jurassic Ammonitico Rosso Formation of Western Greece](#).
- Plate tectonics and petrology: [Subducted Carbon From Mantle Plume in Mid-Ocean Ridge Basalts](#).
- The Common Descent Podcast: [Episode 208 – The Karoo Supergroup](#).
- Planetary geology: [Metal differentiation on asteroids recorded in Zn and Fe isotopic signatures of ureilites](#).
- [Preservation of organic carbon in marine sediments sustained by sorption and transformation processes](#); Phys.org summary [here](#).
- A piece of Gondwana: [Tristan da Cunha: The most remote inhabited island on Earth, forged from a supercontinent breakup](#).

- [The origin of island dolostones: Novel insights from in situ Mg isotope, major and minor elements analyses of Miocene dolostones on Shidao, the Xisha Islands.](#)
- [Petrogenesis and tectonic implications of Hongliutan Precambrian metamorphic rocks in the Tashikuergan-Tianshuihai Terrane, Northwest Tibet, China: insights from geochemical and geochronological studies.](#)
- [The progression of basaltic–rhyolitic melt storage at Yellowstone Caldera; Science Alert summary \[here\]\(#\).](#)
- [How Rocks And Minerals Give Fireworks Their Colors.](#)
- [Evolution of Modern and Ancient Orogenic Belts.](#)
- [US Geological Survey marks progress tracking nation’s supply critical minerals.](#)
- Lunar geology: [Tidally driven remelting around 4.35 billion years ago indicates the Moon is old; SciTechDaily summary \[here\]\(#\).](#)

Paleontology

- [A new *Archaeopteryx* from the lower Tithonian Mörnsheim Formation at Mühlheim \(Late Jurassic\).](#)
- [The first neuroanatomical study of a marine pleurodire \(the large Paleocene bothremydid *Azzabaremys moragjonesi*\) reveals convergences with other clades of pelagic turtles.](#)
- [Biggest trackway of dinosaur footprints found in Oxfordshire quarry.](#)
- Series on [The fish-to-tetrapod transition and the conquest of land by vertebrates](#) in the Fossil Record.
- [Concomitant formation of protocells and prebiotic compounds under a plausible early Earth atmosphere.](#)

Mining and Energy

- [US approves Idaho antimony mine a month after China blocked exports of vital mineral.](#)
- [This company helped build an Alaska mine without a tailings dump. Can it build two more?](#)
- [Goldman Sachs forecasts decline in Iranian oil supply by Q2.](#)
- Coalbed methane research: [Critical depth prediction based on in-situ stress and gas content model of deep coalbed methane in Liupanshui Coalfield in China.](#)
- Ore processing research: [Innovative study on chalcopyrite flotation efficiency with xanthate and ester collectors blend using response surface methodology \(B.B.D\): towards sustainability.](#)
- Behind a paywall, research on gold mineralization: [Arsenic in pyrite acts as a catalyst for dissolution-reprecipitation reaction and gold remobilization.](#)

- [Virginia Sets Date for Nuclear Fusion Electricity as Ground Is Broken on New Plant.](#)
- [Canada joins the hunt for rare earths to make chips — restrictions could delay a new mine by 10 to 15 years.](#)
- [Final iron ore train marks end of an era for Koolyanobbing with Yilgarn closure.](#)
- Zambia: [Mining start-up backed by Bill Gates and Jeff Bezos valued at \\$2.96bn.](#)

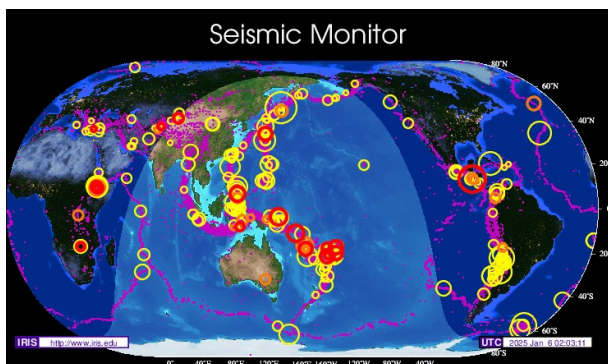
Environmental Geology and Hydrogeology

- Hydrogeology research: [A Laboratory-Validated, Graph-Based Flow and Transport Model for Naturally Fractured Media.](#)
- Investigation: [Feasibility of Radio Frequency Based Wireless Sensing of Lead Contamination in Soil](#); Phys.org summary [here](#).
- Remediation: [Yellowknife's Giant Mine underground sealed off.](#)
- [Improving Groundwater Security in the United States](#); Los Angeles Times summary [here](#).

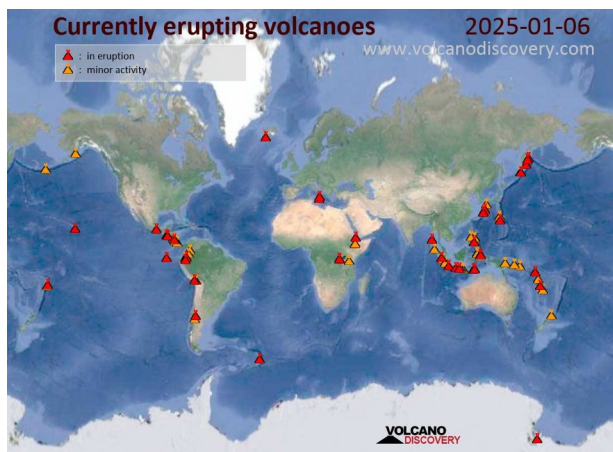
Glaciers and Climate Change

- [Rethinking the Lake History of Taylor Valley, Antarctica During the Ross Sea I Glaciation.](#)
- [Abrupt changes in biomass burning during the last glacial period](#); Phys.org summary [here](#).
- [Diversity and biogeography of the bacterial microbiome in glacier-fed streams.](#)
- Video: [80-Foot Glacier Collapses Before Ben Fogle's Eyes – BBC Earth Explore.](#)
- Opinion and review: [Clouds: do they Warm or Cool the Atmosphere?](#)

Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

Volcanoes

- United States Geological Survey (USGS) Volcano Watch: [Happy New Year, Hawaiian Style](#).
- USGS Yellowstone Volcano Observatory: [The explosive story of Excelsior Geyser](#).
- [Smithsonian / USGS Weekly Volcanic Activity Report](#).
- [Undersea volcano off Oregon coast could erupt this year, geologists predict](#).
- [The 1831 CE mystery eruption identified as Zavaritskii caldera, Simushir Island \(Kurils\)](#).
- Dormant volcanoes: [Seismic Reflection Imaging of Fluid-Filled Sills in the West Eifel Volcanic Field, Germany](#); Phys.org summary [here](#).

Earthquakes

- [Euro-Mediterranean Seismological Centre \(EMSC\)](#).
- [Earthquakes Monitoring Live Worldwide](#).
- [Seismic swarm rattles Ethiopia](#).
- Research: [Dynamically triggered seismicity in Japan following the 2024 Mw7.5 Noto earthquake](#).

Landslides

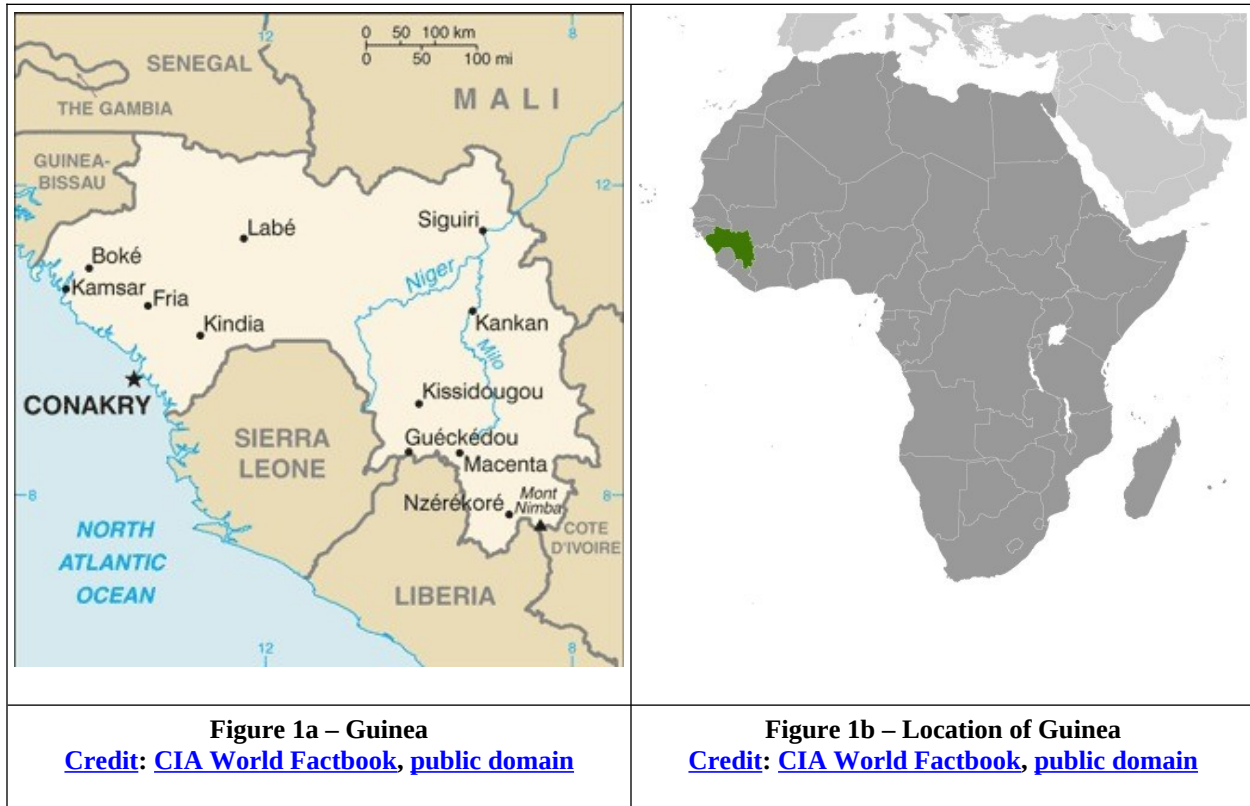
- [Passive radar breaks new ground in avalanche detection](#).

Upcoming Events

- The Geological Society: [Hybrid Conferences, January 16, 2025 – September 9, 2025, Climate and Ecology: Off the Rails](#).
- European Geosciences Union: [EGU General Assembly 2025, Vienna, Austria & Online 27 April–2 May 2025](#)
- [Sedimentary Geology and the Energy Transition Conference, June 2-5, 2025 – Salt Lake City, UT USA](#).
- [Geoscience Beyond Borders, GAC-MAC-IAH-CNC 2025 Ottawa, Ontario, May 11-14, 2025](#).
- [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](#).
- 2024-2025 [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](#).
- [List of events – The Geological Society](#).

January 6, 2025

Geology and the Fate of Societies – Guinea



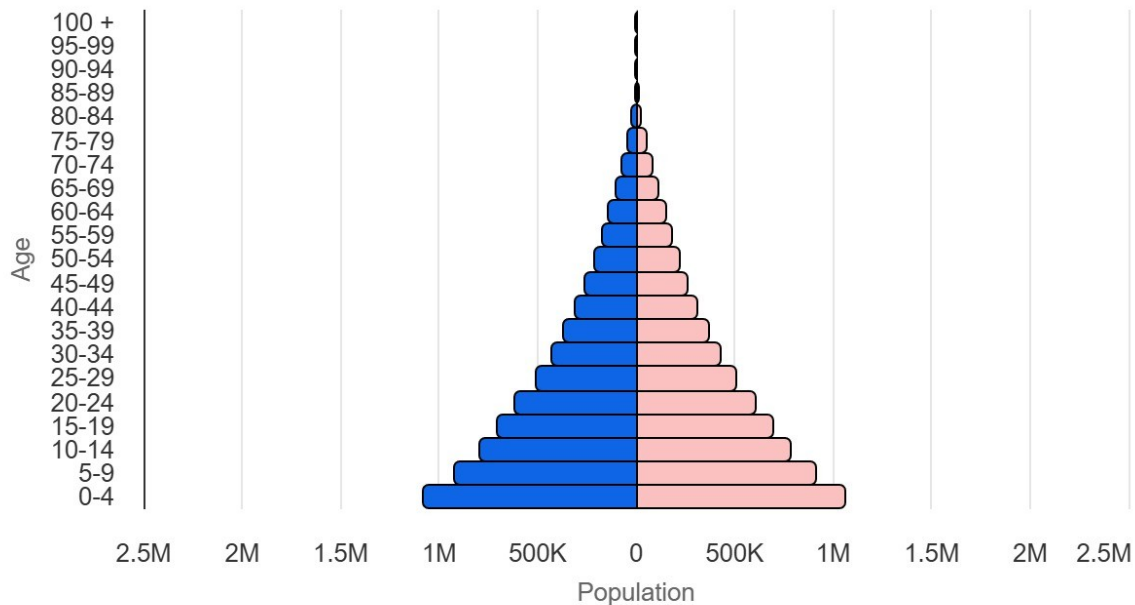
Once called [French Guinea](#), the Republic of [Guinea](#) (*République de Guinée*) is located in the bulge of [West Africa](#) bordering on the [Atlantic Ocean](#). Going clockwise, its land borders are: to the northwest is [Guinea-Bissau](#), to the north is [Senegal](#); to the northeast is [Mali](#); to the southeast is the [Côte d'Ivoire](#); and to the south are [Sierra Leone](#) and [Liberia](#).

Guinea is a [unitary presidential republic](#) currently ruled by a [military junta](#). The Interim President and Chairman of the [National Council of the Transition](#) (CNRD) is [Mamady Doumbouya](#); the Prime Minister is [Bah Oury](#). The CNRD currently fulfills the role of legislature. The Capital and largest city in Guinea is [Conakry](#) (pop. 1,660,973).

According to the [Central Intelligence Agency](#)'s (CIA) [World Factbook on Guinea](#), Guinea has a total area of 245,857 square kilometres (km²) of which 245,717 km² is land and 140 km² is water. Also according to the CIA World Factbook, 13,986,179 people live in Guinea, 38.1% of whom live in urban areas. Of the almost 14 million people in Guinea: 33.4% are from the [Fulani](#) tribe; 29.4% are [Malinke](#); 21.2% are [Susu](#); 7.8% are [Guerze](#); 6.2% are [Kissi](#); 1.6% are [Toma](#); and 0.4% are other and/or foreigners. Although [French](#) is the official language, some 40 other languages are spoken by and within the various ethnic groups.

About 85.2% of Guineans are [Muslim](#); of the remainder 13.4% are various [Christian](#) denominations; 1.2% have no religion; and 0.2% follow [traditional animist beliefs](#). In terms of education, 45.3% of the total population age 15 and over can read and write. Economically: the per capita [GDP](#) is \$3,241; the [Gini coefficient](#) is 33.7, indicating medium inequality; and the [Human Development Index](#) is low at 0.47.

Guinea (2023)



U.S. Census Bureau, International Database

Figure 2 – Demographic Profile of Guinea

Credit: U.S. Census Bureau, International Database, public domain

The [demographic profile](#) of Guinea shows a young population where approximately 41% of the population is under 15 years of age. The total fertility rate is 4.82 births per woman (more than the replacement rate of 2.1) resulting in an annual growth rate of 2.75%. Life expectancy at birth for both sexes is 64.3 years.

Geology

Guinea sits on the [West African Craton](#) and has an interesting, [complex geology](#) in terms of age and materials. The youngest formations are [unconsolidated Quaternary](#) aged sediments. In the river valleys these are [sands](#), [sandy loams](#), [silts](#) and [gravels](#). Along the coast, these Quaternary sediments are [marine loams](#), [clays](#), [clayey](#) sands and sands.

Next in age are the mostly unconsolidated outcrops of sedimentary rock in the northwest of the coastal zone [Upper Cretaceous](#) to [Neogene](#) in age including [limestones](#), [marls](#), silts and sands. Also, there are [Paleogene](#) to Neogene aged [lateritic crusts](#) resulting from the weathering of the basement rocks. These weathered materials include [laterite](#), [iron deposits](#), [kaolinitic](#) clays and [bauxite](#).

[Mesozoic](#) aged igneous intrusions ([sills](#) and [dykes](#)) in Guinea include [dolerite](#), [peridotite](#), [pyroxenite](#), [gabbro](#) and [syenite](#). As well, some [kimberlite](#) dykes and pipes in southern Guinea contain [diamonds](#).

[Palaeozoic](#) sedimentary deposits include:

- Various [Devonian](#) and [Silurian](#) aged [mudstone](#) and [siltstone](#) formations including the [Faro Suite](#), the [Sangui Sandstone](#), and the [Telimele – Bambaya Sandstone](#). Bauxite deposits were developed from weathering of [Silurian aged schists and slates in the Fria deposits](#).

- [Ordovician](#) aged [sandstones](#) including the [Pita Suite](#); these formations include some [quartzites](#) that contain diamonds.
- [Cambrian](#) aged sandstones and [conglomerates](#).

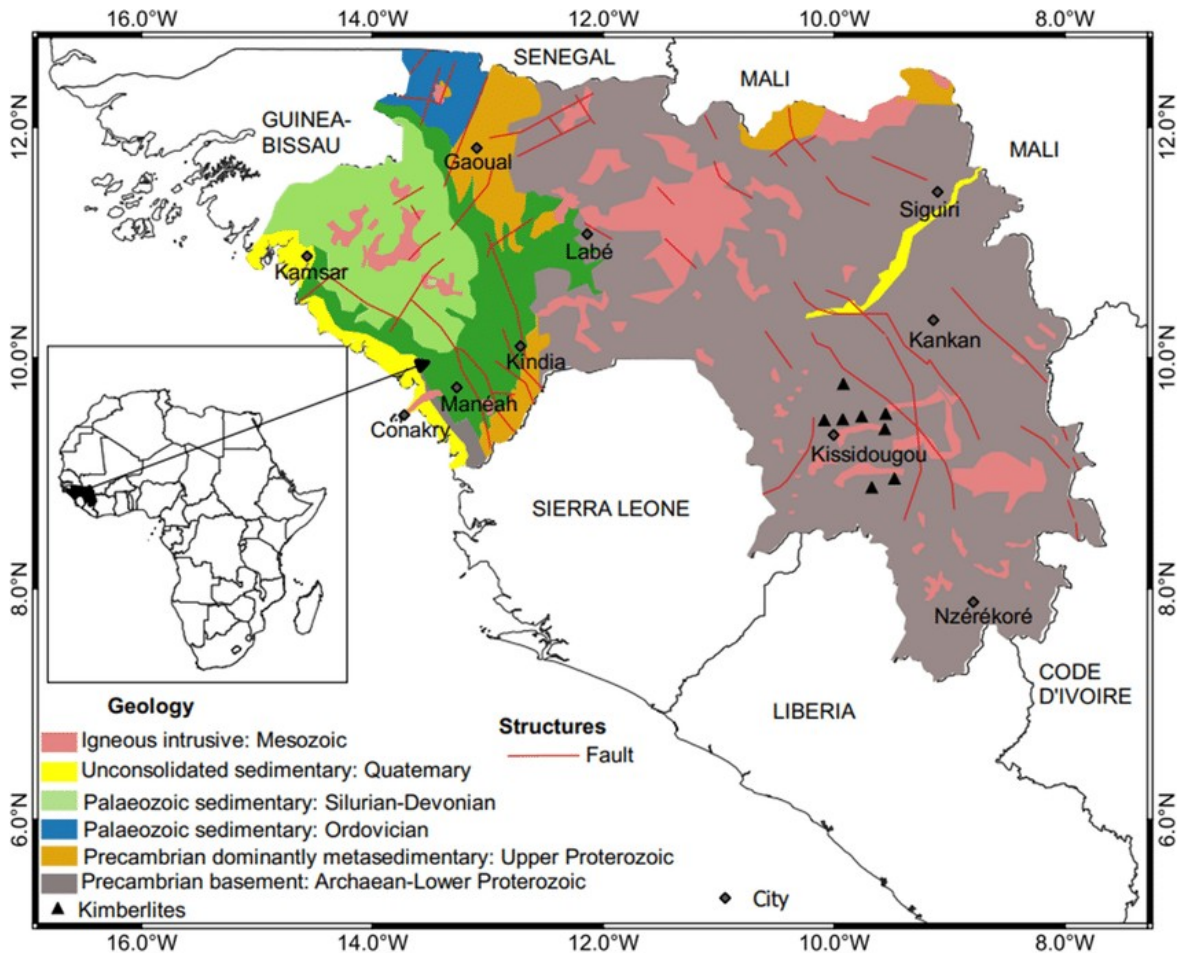


Figure 3 – Geology and Tectonic Map of Guinea
 Credit: Figure 1 in [Irinymi et al, 2022](#)

The [basement rocks](#) are divided into two main groups: an [Upper Proterozoic](#) sequence and another sequence dating between the [Archaean](#) and [Lower Proterozoic](#).

The Upper Proterozoic basement rocks are mostly metasedimentary but also has some [metavolcanic rocks](#). This group includes different sequences in different parts of the country such as: quartzites, [arkosic sandstones](#), [argillites](#), [alerolite](#), and metavolcanic rocks including [greenstone belts](#).

The Archaean to Lower Proterozoic group is mostly crystalline basement, including rocks of the [Kenema-Man](#) domain and the Lower Proterozoic [Birimian System](#). The Archean rocks in this group tend to be [strongly metamorphosed to amphibolite and granulite facies, and often greenschist](#); typical rocks include [gneiss](#), [schist](#), quartzite, [amphibolite](#), [granite](#) and [granodiorite](#). The Lower Proterozoic rocks tend to be [metasedimentary](#) and metavolcanic rocks (including greenstone belts) of lower metamorphic grade.

Resources

Agriculture



Figure 4 – Women Processing Palm Oil in Guinea

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

According to the CIA Factbook, 58.1% of the land in Guinea is used for agriculture (11.8% arable land, 2.8% permanent crops, 43.5% permanent pasture). Of the remaining, 26.5% is forest and 15.4% has other use.

About [84% of the workforce in Guinea](#) (this [includes children](#)) is employed in agriculture. Major crops include [cassava](#), [rice](#), [peanuts](#), [palm kernels](#), [maize](#), [fonio](#), [plantains](#), [potatoes](#), [sweet potatoes](#), and [yams](#). Much of the country engages in [subsistence agriculture](#). Commercial cash crops include [sugarcane](#), [citrus fruits](#), [bananas](#), [pineapples](#), peanuts, palm kernels, [coffee](#), [cocoa](#), and [coconuts](#). Some cocoa exported from Guinea [actually originates in the Côte d'Ivoire](#). Livestock raised in Guinea include goats, chickens (for meat and eggs) and cattle (for meat and dairy); it's a predominately Moslem country so don't expect to find much pork on the menu; although the [United Nations Food and Agriculture Organization](#) (FAO) statistics on agricultural production for Guinea ([site located here](#)) some pork products are produced. Last year, the [FAO indicated](#) that around 1 million people were projected to be acutely food insecure during the 2024 lean season.

With around 300 km of coastline, [Guinea](#) has both an artisanal (small scale subsistence) fishery and a larger commercial fishery. About 60,700 people are employed in the artisanal fishery as fishermen, boat owners, and processors. Species harvested in the artisanal fishery include [bonga](#), [sardines](#), [barracuda](#), [mullet](#), [bobo croaker](#), [guinea catfish](#), [threadfish](#), and [sharks](#).



Figure 5 – Fishing Pirogues on beach at Conakry
Credit: [Jeff Attaway, Creative Commons Attribution 2.0 Generic](#) license

About half the commercial fishery employs local fishermen, the rest are foreigners, especially [Chinese commercial fishermen](#). Some people accuse the commercial fishery of [illegal practices and collusion with corrupt Guinean officials](#). Species harvested in the commercial fishery include sardines, [chinchard](#), [mackerel](#), bonga, [carangides](#), [dorado](#), catfish, mullet, and [octopus](#).

Forestry



Figure 6 – Forests at Mount Nimba
Credit: [Yakoo1986, Creative Commons Attribution-Share Alike 4.0 International](#) license

As noted above, forests cover around 26.5% of Guinea's land area. These are tropical forests with a wide range of biodiversity. The two main forest regions in Guinea are:

- [Western Guinean lowland forests](#) (also found in Sierra Leone, Liberia, and the Côte d'Ivoire); and
- [Guinean montane forests](#) (also found in Sierra Leone and the Côte d'Ivoire).

Statistics on forestry production from the FAO can be found [here](#).

Mineral Resources



Figure 7 – Bauxite Specimen with Relict Stratification of the Parent Rock (slate), Fria, Guinea
Credit: [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

The mineral industry in Guinea ([USGS link](#)) consists largely of metallic mining – [bauxite](#), gold and potentially iron – as well as industrial minerals such as diamonds and cement.

Bauxite is the largest mineral resource exploited in Guinea, 67,000,000 tonnes were produced in 2019. Bauxite is the principal ore of aluminium and is [formed by the chemical weathering](#) of bedrock containing aluminum silicates, like the weathered slate in Figure 7. Bauxite mines in Guinea include: the [Bel Air bauxite mine](#), the [Sangaredi Mine](#), the [Dian-Dian Mine](#), the [Debele Mine](#), the [Friguia Mine](#), and the [Boke Mine](#).



Gold mining in Guinea is carried out by both industrial mines and artisanal producers. The two main industrial scale mines are the [Siguiro Mine](#), and the [Lefa Mine](#). Artisanal gold mining takes place at various locations throughout the country, including the town of [Kouremale on the border with Mali](#).

Figure 8 -Artisanal Gold Mining, Siguiro Prefecture, Guinea
Credit: Laura Lartigue of [USAID](#), [public domain](#)

[Diamonds](#) are mined at the [Aredor Mine](#) as well as by artisanal miners in the east of the country. Industrial [miners](#) are also exploring the diamond potential of this area. Also in the east part of Guinea is the [Simandou iron mine](#) that has not yet begun production because of problems with mining rights disputes and corruption.

There is no current oil production in Guinea, although the national petroleum company ([Société Nationale des Petroles](#)) is seeking [investments in offshore oil & gas exploration](#).

Figure 9 links to an interactive map of mineral occurrences in Guinea.

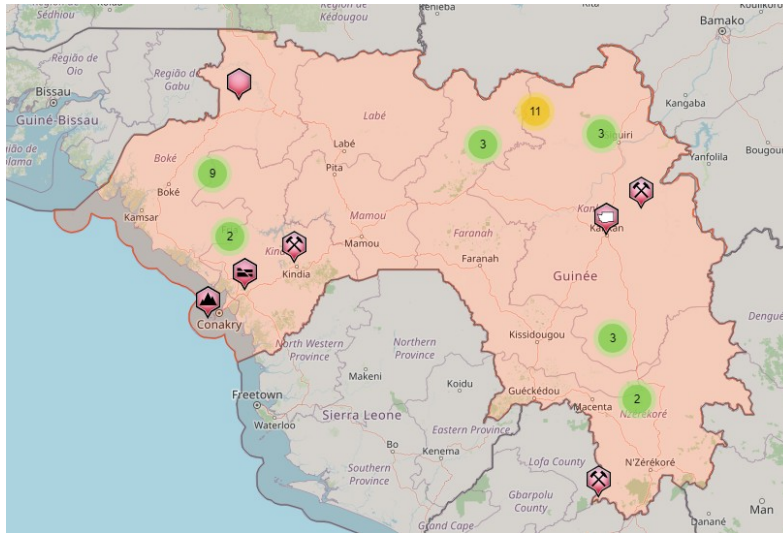
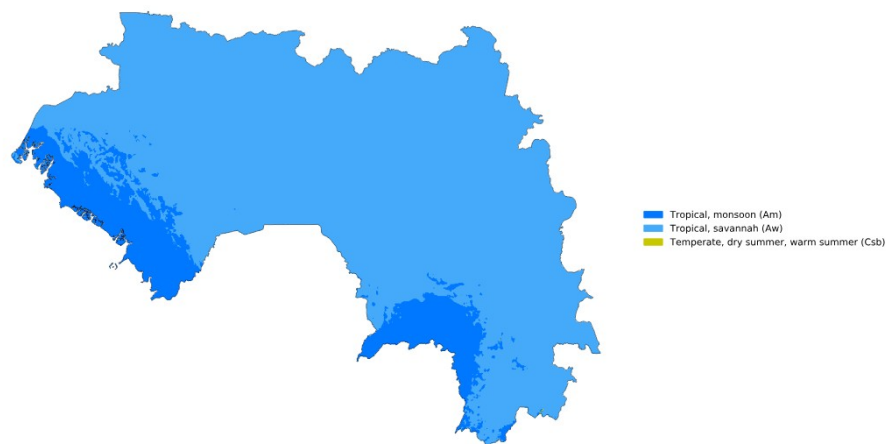


Figure 9 – Interactive Mineral Occurrences, Guinea
[Credit: ©mindat.org](#)

Climate

Köppen-Geiger climate classification map for Guinea (1991–2020)



Source: Beck et al. (2023): High-resolution (1 km) Köppen-Geiger maps for 1991–2099 based on constrained CMIP6 projections, Scientific Data 10:724. doi:10.1038/s41597-023-02549-6.

Figure 10 – Köppen-Geiger Climate Classification Map for Guinea
[Credit: Beck et al, 2023, Creative Commons Attribution-Share Alike 4.0 International license](#)

The climate in Guinea is generally hot and humid; monsoonal-type rainy season (June to November) with southwesterly winds; dry season (December to May) with northeasterly [harmattan winds](#). There are two main climate zones: tropical monsoon ([Am](#)) and tropical savannah ([Aw](#)).

Guinea looks like an interesting place to visit. However, travel advisories ([here](#) and [here](#)) recommend that you exercise a high degree of caution in Guinea due to political and social tensions stemming from the [military coup d'état in 2021](#). Crime, petty crime, violent crime, and outright banditry are not uncommon. Piracy in the seas offshore of the country has also been a problem. As a tropical country, there are lots of tropical diseases. Also, if you like to live on the wild side, sexual transmitted diseases are also common. 2SLGBTQI+ people are generally not welcome in the country, they have strict laws against homosexual behaviour.

Sounds inviting, eh? Still, if you want to go, check out [Climates to Travel](#) and [Lonely Planet](#). It could be exciting.

History and Geopolitics

History



Figure 11 – Imamate of Fouta Jallon, circa 1725-1912

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

While people have lived in West Africa since [Paleolithic times](#), the earliest records we have of the [history of Guinea](#) are from various state level polities, mostly associated with the spread of Islam into the region. These polities include: the [Songhai Empire](#), the [Imamate of Fouta Jallon](#), and the [Wassoulou Empire](#) (or Ouassoulou) founded by [Samori Ture](#). There is a really good podcast on the [rise and fall of the Songhai Empire](#) [here](#).

While European traders, such as the Portuguese, [were active along the Atlantic coast](#) beginning in the 15th Century, it wasn't until the [French](#) arrived in the 19th Century that serious colonial conquest began. Agreeing with other European powers to carve up Africa at the [Berlin Conference of 1884-85](#), the French proceeded to impose their rule on what became [French West Africa](#). Follow up on the links and decide for yourself if the French experience in West Africa was beneficial, or not.

In 1958, the French granted independence to their colonies in West Africa, including Guinea, with the Guineans choosing [full independence in a referendum](#).

Independence for Guinea has not been entirely peaceful and has included events such as:

- The rule of [Ahmed Sékou Touré](#) which included the detention of thousands of his opponents in the notorious [Camp Boiro](#); Touré's regime was [friendly with the Soviet Union](#);
- A failed invasion by [Portuguese](#) forces in 1970 seeking the overthrow of Ahmed Sékou Touré's government and the detention of independence advocates for the Portuguese colony of [Cabo Verde](#);
- A [coup d'état in 1984](#) that succeeded in overthrowing Ahmed Sékou Touré's government;
- The rule of the [Military Committee of National Restoration](#) led by [Lansana Conté](#);
- An [insurgency](#) by the [Rally of Democratic Forces of Guinea](#) (RFDG) operating out of neighbouring Liberia;
- The overthrow and death of Lansana Conté in the [2008 coup d'état](#);
- Rule by the [National Council for Democracy and Development](#) leading to the [2010 presidential election](#); and
- The [2021 coup d'état](#) leading to rule by the current government.

Overall, a fairly chaotic and unfortunate history since 1958.

Geopolitics



Figure 12 – Conakry, Guinea

Credit: Boubacar Bila Diao Balde, [Creative Commons Attribution-Share Alike 4.0 International](#) license

Sadly, for the people of Guinea, the history of the country could be used as a case study on how to keep people poor while systematically looting what wealth the country produces. That the French sought to maximize their return on investment when they ran the place should be obvious. However, the rule of subsequent governments following independence seemed to replace the economic exploitation by a colonial power with the economic exploitation by a home-grown elite. If anyone complained, there was the detention camps for political prisoners. Replacing one government with another through coup d'état further undermines any attempt to establish a fair and effective rule-of-law.

Of course, it's the ordinary people who suffer the most.

The low per capita GDP (3,241) and low human development index (0.47) is a direct consequence of the disorder, [corruption](#) (141 out of 180 in Transparency International [Corruption Perceptions Index](#)), and, ultimately, a failure to adequately invest in the most important "resource" a country has, its people. Surely, some of the money coming in from resource development could be used to educate children and improve the abysmal literacy rate of 45.3%.

The foreign relations of Guinea appear to be currently peaceful, although it hasn't always been that way and there are still unresolved problems. The most pressing problem is a border dispute with Sierra Leone over [the Yenga region](#), Sierra Leone has asked for international mediation. Following the 2021 coup d'état, Guinea's membership in the regional diplomatic/economic association ECOWAS [was suspended](#), although the sanctions against Guinea were lifted in 2024 and further [diplomatic mechanisms for security were put into place in November 2024](#). Since it is better to be diplomatic than kinetic, things are looking up for Guinea's relationship with their West African neighbours.

Further afield, the Chinese have a strong interest in [exploiting the fishery offshore of Guinea](#). Some accuse the Chinese of [looting the resource](#); realistically the Chinese have little incentive to conserve the resource. In recent years, the Chinese [have been seeking a greater presence in Africa](#), so this is something to watch.

Russia has been involved in Guinean affairs since Soviet times. Currently, Russian miners are operating two of the bauxite mines in the country, at Dian-Dian Mine and Friguia. It would be logical for the Russians to have an interest in having some sort of stable situation in Guinea, which might explain the [activities of the Wagner Group](#) in Guinea, if only to provide security for Russian assets there.

[The Americans also have an interest in seeing less disorder in Guinea](#); they too are looking for investment opportunities. More importantly, the Americans have an interest in preventing the Chinese and Russians from acquiring too much influence in the country.

It may be too early to be either optimistic or pessimistic with regards to the future of the people of Guinea. Some people in Guinea aren't waiting for things to get better, they are [leaving the country](#) for better prospects elsewhere. Of course, it is the most ambitious people who take this route, further impoverishing the home country by their absence. The best hope is for a stable government that takes human development seriously with spending on education, healthcare and infrastructure. Otherwise, the cycles of corruption, poverty and violence will continue to ruin the lives of Guineans.

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.