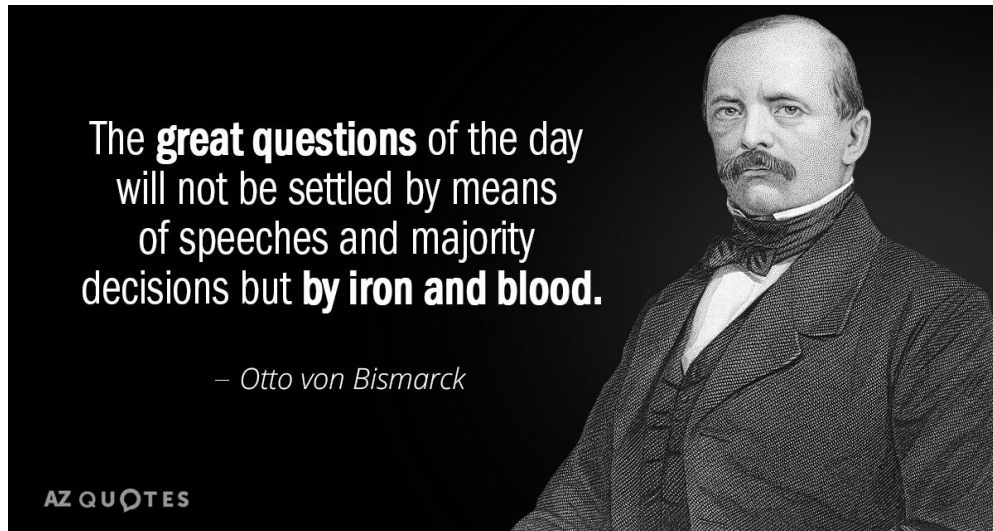


July 22, 2024

News and notes

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

Geopolitics



Credit: A-Z Quotes

- Related to a [previous post](#), video: [How El Salvador Destroyed Their Brutal Gangs Changes Everything!](#)
- Resource grab: [Japan expands continental shelf eastward for rare metals research.](#)
- [Casus belli](#): [Ethiopia begins 5th filling of Renaissance Dam without agreement.](#)
- Video: [Bolivia Just Survived a Really Weird Coup. Here's What Happened.](#)
- Disorder in Africa: [As Rwanda votes, tensions with neighbouring DR Congo deepen over M23.](#)
- China and the metals market: [Copper market's biggest whale fuels speculation of a major shift.](#)
- Dividing the spoils: [Seabed mining regulator meets amid mounting pressure for code.](#)
- Supply chain risk assessment from the United States Geological Survey: [USGS releases first study to assess global earthquake risk to mineral supplies.](#)

Research and News

- The August 2024 Edition of *Sedimentology* is [here](#).
- [A study of the effects of early diagenesis on the geotechnical properties of carbonate sediments \(North West Shelf, Australia\).](#)

- [The preservation of storm events in the geologic record of New Jersey, USA](#); Phys.org summary [here](#).
- [On the delayed expression of mantle inheritance–controlled strain localization during rifting](#).
- [Slab steepening and rapid mantle wedge replacement during back-arc rifting in the New Hebrides](#).
- Carbon cycle research: [Mixotrophic growth of a ubiquitous marine diatom](#); Phys.org summary [here](#).
- [Unraveling iron oxides as abiotic catalysts of organic phosphorus recycling in soil and sediment matrices](#); Phys.org summary [here](#).
- [An electron backscatter diffraction study of monazite: Linking the time-deformation path](#).
- [Melting at the base of a terrestrial magma ocean controlled by oxygen fugacity](#).
- Geomorphology: [Unveiling the Geological Wonders of Lake Powell From Space](#).

Paleontology

- Evolution: [Biologist Rosemary Grant: ‘Evolution happens much quicker than Darwin thought’](#).
- [Unique functional diversity during early Cenozoic mammal radiation of North America](#); behind a paywall, Phys.org summary [here](#).
- [Brazilian researchers discover dinosaur fossil after heavy rains in Rio Grande do Sul](#).
- [‘Incredibly unusual’ dinosaur unearthed in Mississippi](#); no paper published as of yet.
- Stromatolites: [Exploring electron backscatter diffraction analysis as a tool for understanding stromatolite: Quantitative description of Cretaceous lacustrine stromatolite reveals formative processes and high-resolution climatic cycles](#).

Mining and Energy

- Ore deposit geology: [Geological controls of mineralization occurrences in the Egyptian Eastern Desert using advanced integration of remote sensing and magnetic data](#).
- [Congo’s South Kivu governor suspends mining operations in province](#); watch for a new licensing regime that enriches the governor.
- [Canada Nickel outlines new million-tonne nickel resource near Timmins](#).
- [Hearst-area graphite deposit holder gets excited about mining](#).
- [Tectonic Metals gets funding for gold exploration in Alaska](#).
- There’s gold in those hills: [Goliath Resources makes discovery in British Columbia’s Golden Triangle](#).

- [Firm says production may never resume at Yukon gold mine after ore-slide disaster.](#)
- [US oil major to start producing 'gold hydrogen' in disused oil well by end of this year.](#)
- [Kuwait Announces 'Huge' Oil and Gas Discovery in Offshore Field.](#)
- [What Australia can learn from Canada's nuclear power industry.](#)

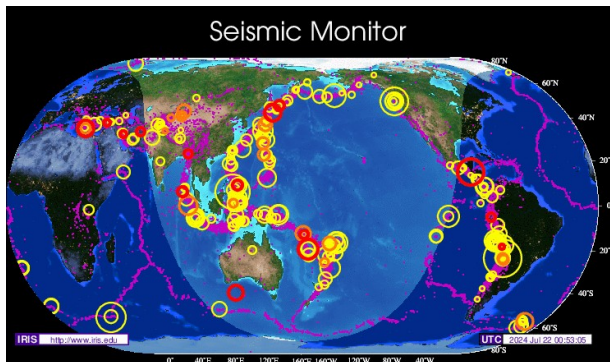
Environmental Geology and Hydrogeology

- [Dragonflies Reveal Surprising Insights into Mercury Pollution.](#)
- [Shell quietly backs away from pledge to increase 'advanced recycling' of plastics.](#)
- PFAS: [NC farmer losing crop because of unsafe levels of chemicals in water.](#)
- Le Monde, PFAS in European drinking water: [Drinking water in Paris and other European cities contaminated with an unmonitored 'forever chemical'.](#)
- [Groundwater-dependent ecosystem map exposes global dryland protection needs;](#) Phys.org summary [here.](#)
- Free books from the Groundwater Project: [Guidance on Natural Source Zone Depletion](#) and [The Hyporheic Handbook: A handbook on the groundwater-surface water interface and hyporheic zone for environment managers.](#)

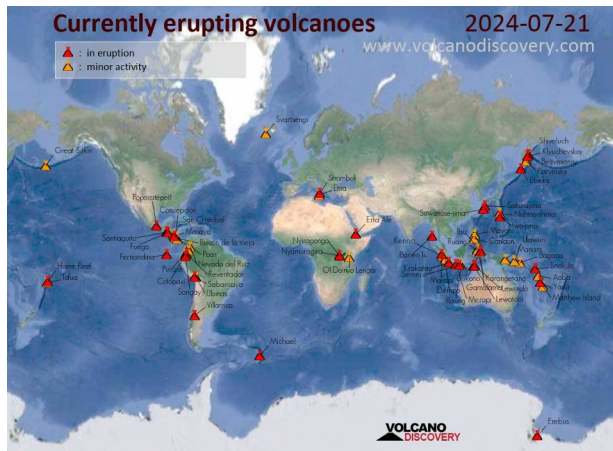
Glaciers and Climate Change

- [As alpine glaciers melt, the corpses of long-lost climbers are being discovered in the ice.](#)
- Statistical analysis: [Apples, Oranges, and Normalized Hurricane Damage.](#)
- [Canada's Climate Policies Criticized by Oil Sector and Environmentalists Alike.](#)

Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

- United States Geological Survey (USGS) Volcano Watch: [Measuring Volcanic Gases: The Answer is Blowin' in the Wind](#).
- USGS Yellowstone Volcano Observatory: [Yellowstone GPS stations help to monitor solar storms that cause widespread auroras](#).
- [Smithsonian / USGS Weekly Volcanic Activity Report](#).
- Video: [Magma Pressurizing Beneath Hawaii's Kilauea Volcano Causes Quakes and Inflation: Geologist Analysis](#).
- I missed this one last week, video: [Mass Evacuation in Italy! Stromboli volcano eruption in Sicily, ash and lava everywhere](#).
- Also in Italy: [Lava and ash spew from Italy's Mount Etna volcano](#).
- Ancient Italy: [A novel view of the destruction of Pompeii during the 79 CE eruption of Vesuvius \(Italy\): syn-eruptive earthquakes as an additional cause of building collapse and deaths](#); Phys.org summary [here](#).
- [New Zealand: Seismic characteristics of the 2022-2023 unrest episode at Taupō volcano, Aotearoa New Zealand](#).
- [Euro-Mediterranean Seismological Centre](#)
- [Earthquakes Monitoring Live Worldwide](#).
- From the British Geological Survey: [Seismicity in the Irish Sea](#).
- [M7.4 earthquake shakes Chile](#); USGS summary [here](#).
- Synthetic earthquakes: [Induced seismicity and surface deformation associated with long-term and abrupt geothermal operations in Blue Mountain, Nevada](#).
- Landslides: [Regional-Scale Evaluation of Landslide Distribution and Its Relation to Climate in Southern Alberta, Canada](#).
- Flash flood geology: [Experimental Investigation on the Effect of Sequences of Unsteady Flows on Bedload Sediment Transport](#).

Upcoming Events

- [Goldschmidt 2024, August 18-24, Chicago IL](#), organized by the Geochemical Society and the European Association of Geochemistry.
- [Lloydminster Heavy Oil Show September 11-12](#); Pipeline Online summary [here](#).
- [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](#).

July 22, 2024

Geology and the Fate of Societies – Equatorial Guinea



Figure 1a – Equatorial Guinea

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



Figure 1b – Location Map

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

A former [Spanish colony](#), the [Republic of Equatorial Guinea](#) is on the west coast of [Africa](#) on the [Gulf of Guinea](#). It includes a mainland portion, bordered by [Cameroon](#) to the north and [Gabon](#) the south and east, together with the offshore islands of [Bioko](#) (formerly called Fernando Po) and [Annobón](#). Between Bioko and Annobón is the island nation of [São Tomé and Príncipe](#). The government of Equatorial Guinea is officially a [presidential republic](#) but is actually a [dictatorship](#). The president/dictator of Equatorial Guinea is [Teodoro Obiang Nguema Mbasogo](#) (Teodoro Obiang). The Capital City is currently [Malabo](#) (pop. 297,000) although a new Capital is being built at [Ciudad de la Paz](#) (pop. 2,000). The largest city in Equatorial Guinea is [Bata](#) (pop. 250,770).

According to the [Central Intelligence Agency](#) (CIA) [World Factbook on Equatorial Guinea](#) has a total area of 28,051 square kilometres. Also according to the World Factbook, 1,795,834 live in Equatorial Guinea, 74.4% of whom live in urban areas. Of the approximately 1.8 million people in Equatorial Guinea, 85.7% of the population are ethnic [Fang](#). Of the remainder 6.5% are [Bubi](#); 3.6% are [Ndowe](#) (a.k.a. Benga), 1.6% are Annobón (mixed race inhabitants of Annobón Island); 1.1% are [Bujeba](#) (a.k.a. Kwasio); and the remaining 1.1% are others. The official languages of Equatorial Guinea are [Spanish](#), [French](#), and [Portuguese](#) together with the languages of the major ethnic groups. 88% of the population identify as [Roman Catholic](#). Among the others, 5% are [Protestant Christians](#), 2% are [Muslim](#), and the remaining 5% are something other. In education, the [literacy rate](#) in Equatorial Guinea is 92.1% for men and 76.4% for women.

Equatorial Guinea (2023)

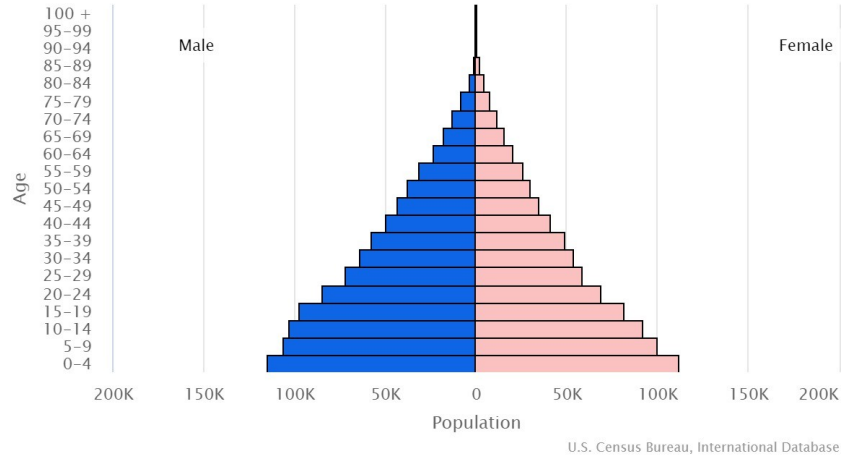
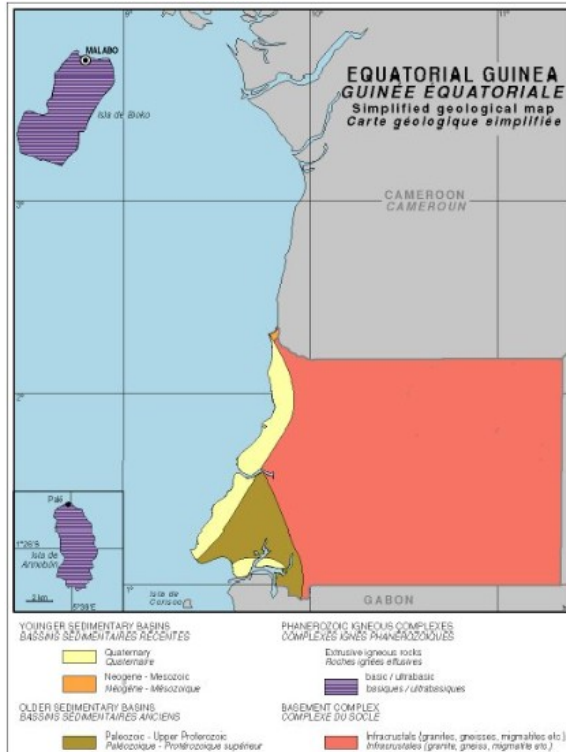


Figure 2 – Demographic Profile of Equatorial Guinea
Credit: U.S. Census Bureau, International Database, public domain

The demographic profile shows a young country where 60% of the population is under the age of 25 years. The total fertility rate is 4.19 births per woman, more than the replacement rate of 2.1, and the annual growth rate is 3.4%. Life expectancy at birth for both sexes is 63.8 years (shorter if you get on the [wrong side](#) of President Teodoro Obiang).

Geology



From youngest to oldest, the [geology of Equatorial Guinea](#) consists of:

- Sedimentary rocks of the [Rio Muni Basin](#) that overlie [basement rocks](#) ranging in age from [Mesozoic](#) to [Neogene](#) to [Quaternary](#) along the west coast of mainland Equatorial Guinea;
- [Cretaceous](#) to Neogene aged volcanics of the [Cameroon Volcanic Line](#) making up the offshore islands of Bioko and Annobón; and
- [Archaean](#) aged basement rocks of the [Congo Craton](#) under most of the mainland of Equatorial Guinea.

Figure 3 – Geological Map of Equatorial Guinea
Credit: © Mindat.org

The [Rio Muni Basin](#) sedimentary rocks extend westward under the Gulf of Guinea and contain significant petroleum resources. Figure 4 shows the generalized stratigraphic column, showing ages of units, major geologic events, lithology and probable source rocks, and tectonic stages of the Rio Muni Basin.

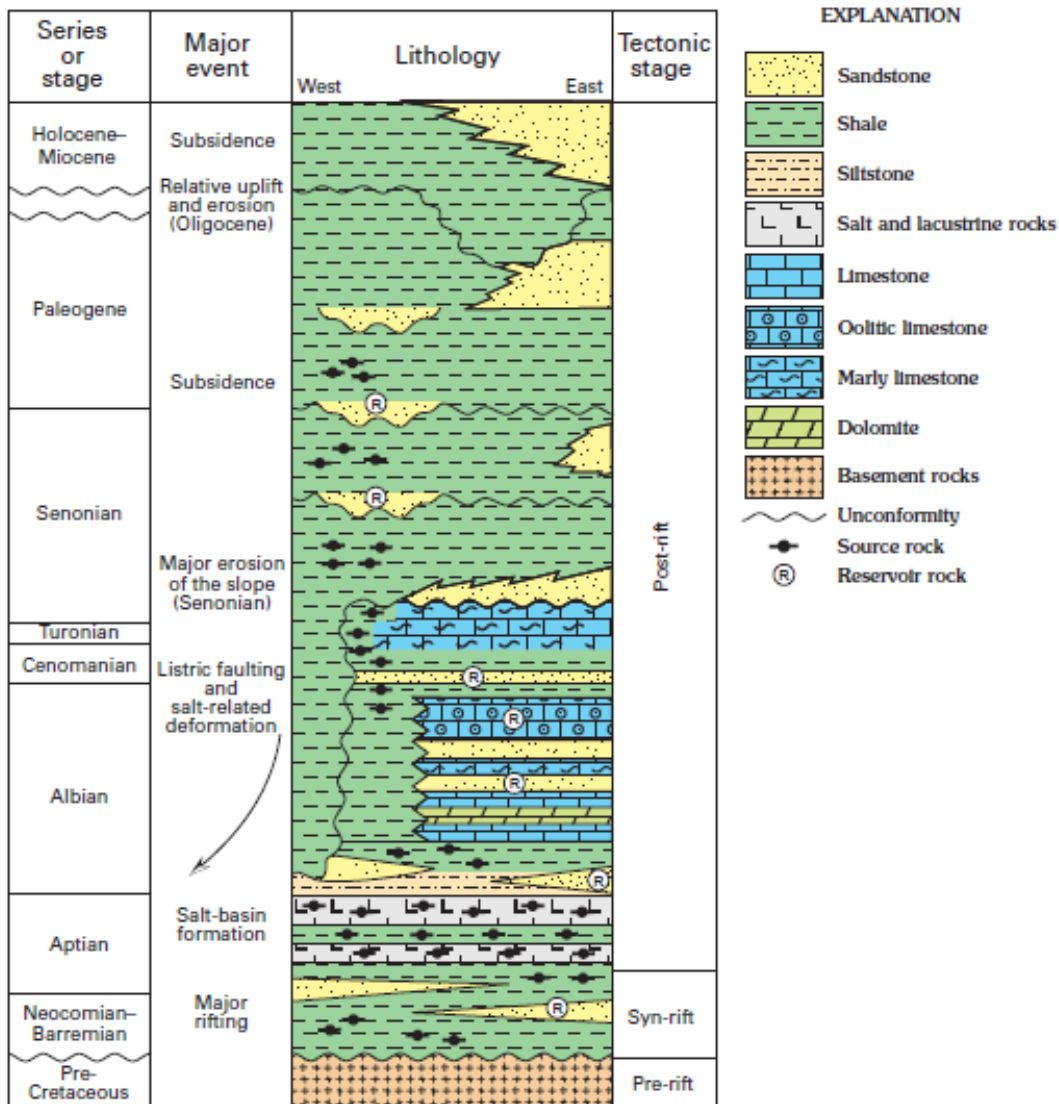


Figure 4 – Generalized Stratigraphic Column, Rio Muni Basin
 Credit: Figure 7 in [USGS Bulletin 2207-B](#), public domain

The volcanic rocks of the offshore islands of [Bioko](#) and [Annobón](#), also called the [Insular Province](#), consist of a variety volcanic rocks including [alkali basalt](#), [basalt](#), [basanite](#), [benmoreite](#), [hawaiiite](#), [mugearite](#), [peridotite](#), [trachyte](#), and [tristanite](#).

The Archean aged rocks of the Congo Craton consist of crystalline rocks, these include [gneiss](#), [greenstone](#), [amphibole schist](#) and [granitoid](#) rocks.

Resources

Agriculture Resources



Figure 5 – A Farm in Equatorial Guinea

Credit: [Miguel Obono Ekieme](#), [Creative Commons Attribution 2.0 Generic](#) license

According to the CIA World Factbook, 10.1% of Equatorial Guinea is agricultural land (4.3% [arable land](#), 2.1% [permanent crops](#), 3.7% permanent [pasture](#)). Equatorial Guinea has limited agricultural resources and [imports about 70%](#) of their food requirements. Major agricultural products grown in the country include [sweet potatoes](#), [cassava](#), [plantains](#) and [bananas](#), [oil palm fruit](#), [coconuts](#), [coffee](#), and [cocoa beans](#). Livestock raised in Equatorial Guinea include [chickens](#), [cattle](#), [pigs](#) and [goats](#). Statistics on agricultural production in Equatorial Guinea from the [United Nations Food and Agriculture Organization](#) (FAO) can be found [here](#). Information on [food insecurity in Equatorial Guinea](#) from the FAO is not available. According to other sources such as the [Borgen Project](#), malnutrition is common in the country.



Figure 6 – Fishermen in Kogo, Equatorial Guinea

Credit: [Miguel Obono Ekieme](#), [Creative Commons Attribution 2.0 Generic](#) license

As a coastal country, Equatorial Guinea has a fishing industry. [Studies](#) into the industry indicate that it is a mixture of small-scale fisheries, industrial large-scale fisheries, domestic fisheries together with legal and illegal foreign fisheries. One recent article indicates that [West Africa's coast was a haven for piracy and illegal fishing](#), but that modern technology has allowed for better regulation of the fishery. [Equatorial Guinea's fisheries](#) have an estimated annual production potential of around 75,000 tons.

Forestry



Figure 7 – River Sendje Equatorial Guinea

Credit: [Blitz1980](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license

Although the CIA World Factbook indicates that forest covers 57.5% of Equatorial Guinea, this does not include protected areas. In fact, the [country is almost entirely forested](#), except for the offshore island of Annobón. The forest itself is a rich equatorial forest that is exploited for local uses and [timber exports to China](#). Statistics on the forest industry in Equatorial Guinea from the FAO can be found [here](#). Figure 8 shows the Forest Atlas of Equatorial Guinea.

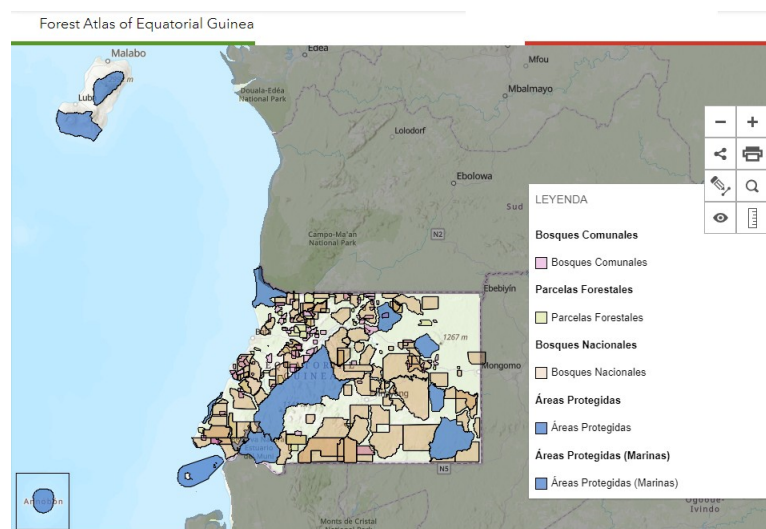
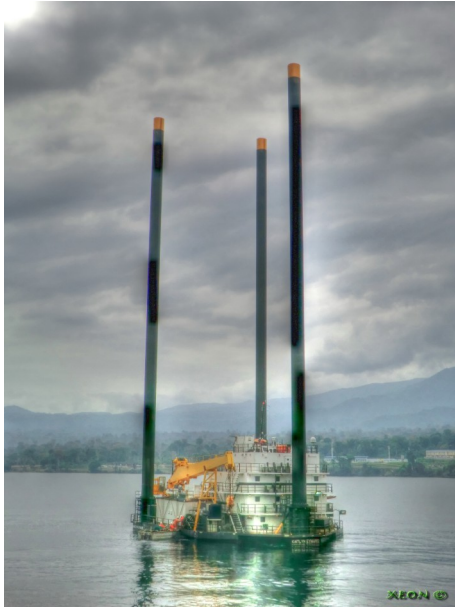


Figure 8 – Forest Atlas of Equatorial Guinea

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

Mineral Resources



The most significant mineral resources in Equatorial Guinea are its [offshore petroleum deposits](#). Onshore, mineral resource extraction appears to be limited to [artisanal gold](#) production. Statistics on mineral production in Equatorial Guinea from the USGS can be found [here](#).

The main oil and gas fields offshore Equatorial Guinea are the:

- [Alba Field](#) (conventional [gas](#));
- [Alen Field](#) (gas and [condensate](#));
- [Aseng Field](#) (conventional [oil](#) and gas);
- [Ceiba Field](#) (conventional oil);
- [Okume Complex](#) (conventional oil); and
- [Zafiro Field](#) (conventional oil).

Figure 9 – Jack-up Drilling Rig at Luba
Credit: ---=XEON=---, [Creative Commons Attribution 3.0 Unported license](#)

Although there is only limited onshore mineral production, the Government of Equatorial Guinea is [encouraging exploration](#), especially for [gold](#). Figure 10 leads to an interactive map of mineral occurrences in Equatorial Guinea

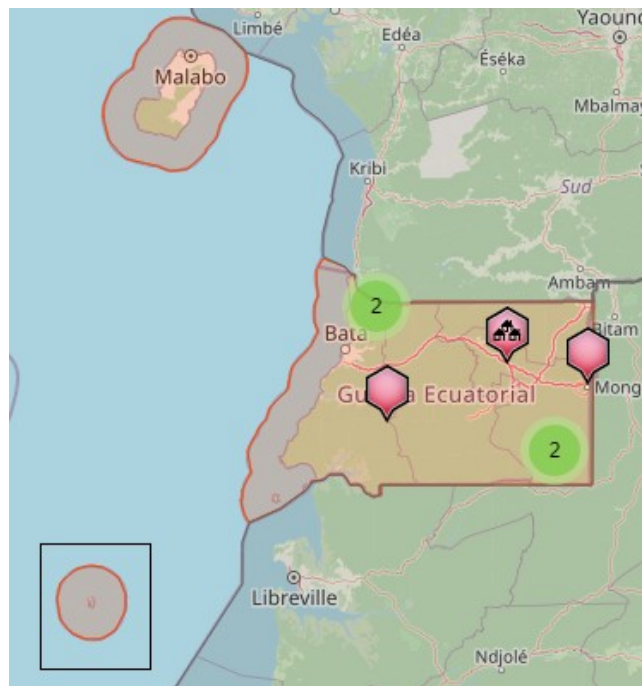
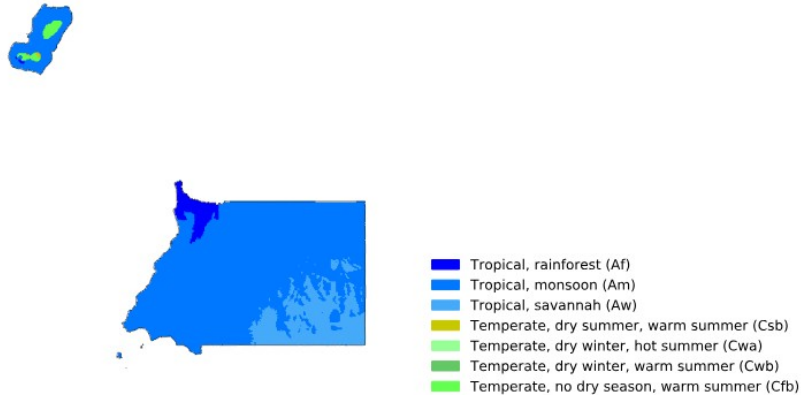


Figure 10 – Interactive Mineral Occurrence Map
Credit: ©Mindat.org

Climate

Köppen–Geiger climate classification map for Equatorial Guinea (1980–2016)



Source: Beck et al.: Present and future Köppen-Geiger climate classification maps at 1-km resolution, Scientific Data 5:180214, doi:10.1038/sdata.2018.214 (2018)

Figure 11 – Köppen-Geiger Climate Classification Map for Equatorial Guinea
Credit: Beck et al, 2018, Creative Commons Attribution-Share Alike 4.0 International license

The climate of mainland Equatorial Guinea is entirely tropical and includes the following zones:

- tropical rainforest ([Af](#));
- tropical monsoon ([Am](#)); and
- tropical savannah ([Aw](#)).

On the offshore island of Bioko, the lowland areas are tropical rainforest but the upland areas are a mixture of temperate climates: [Csb](#), [Cwa](#), [Cwb](#), and [Cfb](#). Annobón Island has a tropical savannah climate.

If you want to visit Equatorial Guinea, you might want to first check out the travel advisories [here](#) and [here](#). The main dangers appear to be petty crime (it is not so petty if you are the one robbed), offshore piracy, and tropical disease.

If you still want to go (some parts could be a pleasant place to visit), check out these two travel sites:

- [Climate to Travel](#);
- [Lonely Planet](#).
- [Wildtrips](#).

History and Geopolitics

A Largely Unwritten History

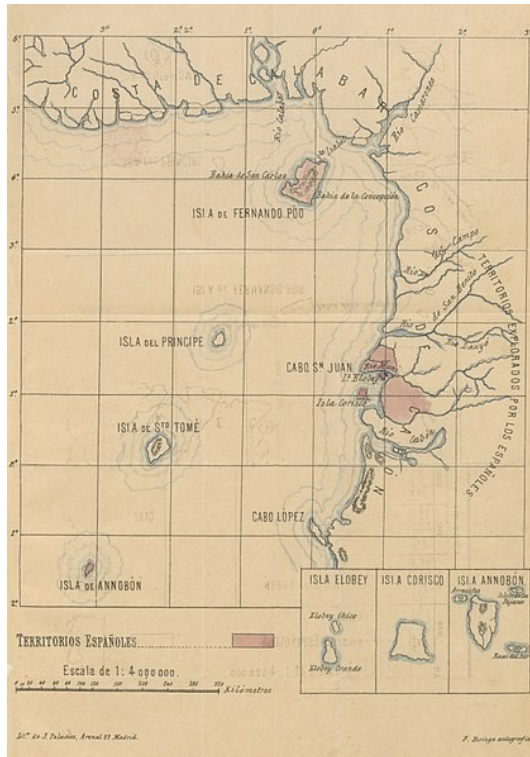


Figure 12 – Gulf of Guinea, 1897

Credit: [British Library HMNTS 10164.i.12.](#), public domain

The earliest inhabitants of Equatorial Guinea were [Pygmies](#), who have lived there since time immemorial. Within historical times, here are the following [major events](#):

- Sometimes between the 17th and 19th centuries, [Bantu](#) peoples, ancestors of the Fang and many others in Equatorial Guinea, arrived in the country.
- [Igbo](#) people, from modern [Nigeria](#), expanded the [Aro Confederacy](#) into mainland Equatorial Guinea during the 18th and 19th centuries.
- [Portuguese](#) explorer [Fernando Po](#) arrived in 1472, establishing a trading colony on Bioko in 1474; the Portuguese also settled Annobón with people from [Angola](#) during this time.

- In 1778, the lands making up Equatorial Guinea were ceded to [Spain](#) in the [Treaty of El Pardo](#). The Spaniards ruled the country as [Spanish Guinea](#).
- From 1827 to 1843, the [United Kingdom](#) established a base on Bioko to suppress the [transatlantic slave trade](#).
- In 1968, the [Spanish](#) granted independence to Equatorial Guinea.
- [Francisco Macías Nguema](#), was elected the first president of an independent Equatorial Guinea in 1968; beginning in 1970 Francisco Nguema ruled the country as leader of a single party state.
- Teodoro Obiang, the current President, led a [coup d'état](#) in against Francisco Nguema 1979 and has ruled Equatorial Guinea as dictator to this day.
- [Major oil discoveries in 1995 and 1999](#) made Equatorial Guinea a significant oil producer.
- In 2004, Teodoro Obiang survived an [unsuccessful coup attempt](#) led by by European and [South African](#) mercenaries.

- [Maritime border disputes](#) with Gabon were settled in 2022 in a [ruling by the International Court of Justice](#); potential petroleum deposits were the main issue in the dispute.

Geopolitics – A Poor Country



Figure 13 – Meeting of [Sergei Shoigu](#) with a colleague from Equatorial Guinea, January 23, 2020

Credit: [Вадим Савицкий](#) (Vadim Savitsky), [Creative Commons Attribution-Share Alike 4.0 International](#) license

Despite the large revenues taken in from oil production, Equatorial Guinea remains an [impoverished country](#). The leadership class in the country, led by dictator Teodoro Obiang, must take primary responsibility for this [sorry state of affairs](#). There has been little investment in the people of Equatorial Guinea, [schooling is only free to age 14](#) and few students can afford further education. Investment in health care has also been [less than adequate](#) when compared to the country's income.

On the other hand, those with access to the oil wealth have made [themselves very wealthy](#). This situation can be best summarized in [Transparency International's](#) rating of [Equatorial Guinea at 172 out of 180](#) countries on their list – near but not quite at the bottom in terms of corruption.

As if the failure to invest its oil revenues in its own people is not bad enough, Equatorial Guinea has also distinguished itself in terms of [human rights abuses](#). This is not unusual in a dictatorship and in his long reign as President, Teodoro Obiang has [made a name for himself](#) in abusing his fellow human beings. The target of Teodoro Obiang harsh reign are not criminal malefactors, for whom some harshness might be justified, but rather his political opponents. Political crimes are consequently dealt with more efficiently than the kinds of crimes that make everyday life difficult for ordinary citizens. I guess that it is a matter of priorities.

In terms of [relations with their neighbours](#), 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. In other relations, Equatorial Guinea and Cameroon have peaceful relations with [recent talks between the countries' leaderships](#). The [European Union](#), as representative of the former colonial powers, has taken a role in [fostering good relations](#) between Equatorial Guinea and Cameroon.

Finally, we have the interest in Equatorial Guinea by other powers. Russia has an ongoing relationship with Equatorial Guinea including high level meetings as recent as [November 2023](#). Russian economic involvement in the country may be [an outcome](#) of these talks. [Chinese officials have also been talking](#) with Equatorial Guinea. One outcome of these talks may be a [Chinese naval base](#) in the country. Needless to say, the [United States has concerns](#) with this plan. Hosting a Chinese naval base may make Equatorial Guinea a target in any future great power conflict, as if they people of that country don't have enough trouble.

That kind of wraps up this short look at Equatorial Guinea. If any of this interests you, follow up on the links.

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.