

May 20, 2024

News and notes

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

Geopolitics



A car burns on the Normandie provincial road, outside Noumea in the overseas French territory of New Caledonia, on May 16, 2024.

[DELPHINE MAYEUR—AFP/GETTY IMAGES](#)

- [France admits it's lost control of parts of New Caledonia, the world's third-largest producer of critical EV metal nickel](#), sorry, behind a paywall; Related: [Nickel price jumps as unrest cuts output in No. 3 miner New Caledonia](#).
- [Why One of Russia's Top Economists is Being Appointed as Minister of Defense](#); tactics win battles, logistics win wars.
- War makes the nation and nation make war: [Dmitry Trenin: A massive transformation is taking place in Russia, and the West is blind to it](#).
- [Slovakia faces 'civil war' – interior minister](#).
- ['Big blunder' to let China and Russia get close – US strategist](#).
- [Congo demands international embargo on Rwandan mineral exports](#).

Research and News

- Bad Science, weekend reads: [Rector in Spain faces more scrutiny](#); [Wiley to shut down 19 more journals](#); [chemistry journal folds after outcry](#).
- Mineralogy and geochemistry: [An improved methodology for high-resolution LA-ICP-MS trace-element fingerprinting of tephra layers: Insights from the Upper and Lower Nariokotome Tuffs, Turkana Basin, Kenya](#).
- Petrology: [Genesis of Rare Metal Granites in the Nubian Shield: Tectonic Control and Magmatic and Metasomatic Processes](#).

- Geotechnical engineering: [Mechanism of vertical displacement beneath shallow compression zone in coastal area.](#)
- More geotech: [Study on the fracture propagation of ground fissures with syn-depositional structure in Fenwei Basin, China.](#)
- Geological history: [Eoarchean low \$\delta^{18}\text{O}\$ zircon indicates emergent land at 3.73 Ga.](#)

Plate Tectonics

- [Morpho-Tectonic Evolution of the Southern Apennines and Calabrian Arc: Insights From Pollino Range and Surrounding Extensional Intermontane Basins.](#)
- [Thick slab crust with rough basement weakens interplate coupling in the western Nankai Trough.](#)
- [Evidence for Ultra-Low Velocity Zone Genesis in Downwelling Subducted Slabs at the Core–Mantle Boundary.](#)
- [Early Earth “subduction”: short-lived, off-craton, shuffle tectonics, and no plate boundaries.](#)
- [Potassium isotopic evidence for recycling of surface water into the mantle transition zone.](#)
- [The affinity of microcontinents in northern East Gondwana in the Silurian: Hainan Island response to the closure of the Proto-Tethys Ocean.](#)
- [A HIMU-like component in Mariana Convergent Margin magma sources during initial arc rifting revealed by melt inclusions.](#)

Geophysics

- Geophysics and dendrochronology: [Mysteries of the Carrington Event, the largest solar superstorm in modern times, unraveled by tree rings.](#)
- [Exploration technique: Airborne Sounding Radar for Desert Subsurface Exploration of Aquifers: Desert-SEA: Mission concept study \[Space Agencies\]; Phys.org summary \[here\]\(#\).](#)
- [Shear-wave attenuation anisotropy: a new constraint on mantle melt near the Main Ethiopian Rift.](#)

Sedimentology

- [Stacking pattern transition caused by submarine channel inception and internal levée development.](#)
- Sediments and Milankovitch cycles: [Helium-isotope constraints on palaeoceanographic change and sedimentation rates during precession cycles \(Cenomanian Scaglia Bianca Formation, central Italy\).](#)
- The [June 2024 of Sedimentology](#) is here.

Paleontology

- If you are in Alberta, Canada this summer: [New exhibit at Royal Tyrrell Museum features fossils from beginning of life on Earth.](#)

- [Fossils Being Formed Today Will Show How Humans Disrupted Life On Earth.](#)
- Examining fossils with a synchrotron: [The Mona Lisa of fossils secretly visits Diamond](#); Phys.org summary [here](#).
- [Early Jurassic origin of avian endothermy and thermophysiological diversity in dinosaurs](#); Phys.org summary [here](#).
- [A new ornithopod from the Upper Cretaceous \(Huincul Formation\) of northwestern Patagonia, Argentina: Implications on elasmarian postcranial anatomy](#); behind a paywall, Sci News summary [here](#).
- [Boy and grandad find dinosaur footprint in Irchester.](#)
- [Pseudoscorpion in Indian amber A new genus and species of fossil pseudoscorpion \(Arachnida: Pseudoscorpiones\) from the Eocene amber of Western India.](#)
- Discovery of the first ancestors of scorpions, spiders and horseshoe crabs: [Lower Ordovician synziphosurine reveals early euchelicerate diversity and evolution](#); Eureka Alert summary [here](#).
- [A remarkable spiny arachnid from the Pennsylvanian Mazon Creek Lagerstätte, Illinois](#); Phys.org summary [here](#).
- [Caridoid crustaceans from the Ballagan Formation \(Tournaisian, Lower Carboniferous\) of Willie's Hole, Chirnside, Scottish Borders, UK](#); Phys.org summary [here](#).
- Reproduction by cloning and ancient echinoderms with 6 legs instead of 5: [Fossil evidence for the ancient link between clonal fragmentation, six-fold symmetry and an epizoic lifestyle in asterozoan echinoderms](#); Science Alert summary [here](#).
- Video: [How Sponges Beat The First Mass Extinction](#); by being simple and resilient.
- [Ediacaran marine animal forests and the ventilation of the oceans](#); Phys.org summary [here](#).

Mining and Energy

- Geology of the Red Lake gold deposit: [Gold Mineralization, Hydrothermal Alteration, and Li Isotope Fractionation at Cochenour Orogenic Gold Deposit, Red Lake, Canada](#); sorry, behind a paywall.
- Geology of another gold deposit: [Genesis of the Baiyun Gold Deposit in Northeast Hubei Province, China: Insights from In Situ Trace Elements and S-Fe Isotopes of Sulfide.](#)
- [Spot silver tops \\$30 an ounce to hit highest since 2013.](#)
- [Copper and gold prices close in on records as metals mayhem continues.](#)
- [Red Pine plans new resource, downplays alleged assay fraud at Ontario gold project.](#)
- [U.S. to end new coal leasing in nation's largest coal-producing region.](#)

- [Russia Discovers Massive Oil and Gas Reserves in British Antarctic Territory.](#)

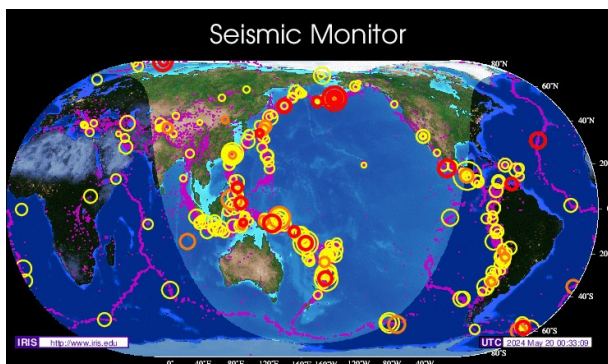
Environmental Geology and Hydrogeology

- Recycling: [Sequential Selective Dissolution of Coinage Metals in Recyclable Ionic Media](#); Phys.org summary [here](#).
- PFAS: [The Ins and Outs of Per- and Polyfluoroalkyl Substances in the Great Lakes: The Role of Atmospheric Deposition](#); summary from The Guardian [here](#).
- Australia: [NSW's Cadia goldmine confirms groundwater affected by potentially toxic mining waste.](#)
- Whiskey's for drinking, water's for fighting: [Nevada neighbors fear for water as mining claims circle town.](#)
- [The Groundwater Project is pleased to announce the publication of its 50th book.](#)

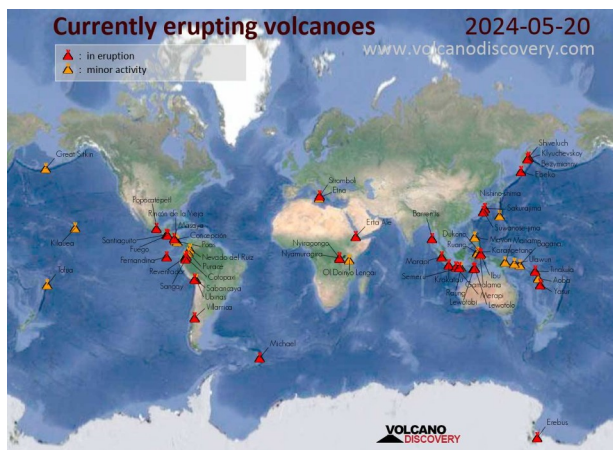
Glaciers and Climate Change

- [Characteristics of glacier ice melt runoff in three sub-basins in Urumqi River basin, eastern Tien Shan](#); Phys.org summary [here](#).
- [GNET Derived Mass Balance and Glacial Isostatic Adjustment Constraints for Greenland](#); Phys.org summary [here](#).
- [A diminished North Atlantic nutrient stream during Younger Dryas climate reversal](#); Phys.org summary [here](#).
- Fossil record of climate change during the [Late Pliocene: Amplified seasonality in western Europe in a warmer world](#); Phys.org summary [here](#).

Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

- United States Geological Survey (USGS) Volcano Watch: [A fresh look at Kīlauea's 1924 explosive deposits.](#)

- USGS Yellowstone Volcano Observatory: [Gas emissions and temperatures measured at the new Tern Lake thermal area.](#)
- [Smithsonian / USGS Weekly Volcanic Activity Report.](#)
- Research: [The spatial distribution and evolution of volcanic vents in monogenetic fields in active extensional tectonic setting: Examples from the northern Main Ethiopian Rift \(Ethiopia\).](#)
- [NZ-led team of scientists hope to understand why 2022 Tongan volcano was so violent.](#)
- [How to get front-row seats to an active volcano in Guatemala.](#)
- [Euro-Mediterranean Seismological Centre](#)
- [Earthquakes Monitoring Live Worldwide.](#)
- [M4.9 earthquake at the Cierro Prieto geothermal field, Baja California, Mexico; USGS summary \[here\]\(#\).](#)
- [M5.1 earthquake shakes Indonesian islands of Bali and Lombok; USGS summary \[here\]\(#\).](#)
- Earthquake research: [Examination of shallow and deep S-wave velocity structures from microtremor array measurements and receiver function analysis at strong-motion stations in Kathmandu basin, Nepal.](#)
- Earthquake research: [Uncertainty in Ground-Motion-to-Intensity Conversions Significantly Affects Earthquake Early Warning Alert Regions.](#)
- Earthquake research: [Correction Factors to Account for Seismic Directionality Effects: Case Study of the Costa Rican Strong Motion Database.](#)
- Geohazards in Kenya: [Geologists investigate huge cracks and earth movements in Nakuru.](#)
- Geohazards in Texas, landslides: [Kinematics and Controlling Factors of Slow-Moving Landslides in Central Texas: A Multisource Data Fusion Approach.](#)

Upcoming Events

- **On now:** [GAC-MAC, Brandon MB, May 19-22, 2024.](#)
- [5th Iceland Geothermal Conference, May 28-30, Reykjavik, Iceland.](#)
- [Bootleggin' Breakfast 2024, Calgary, AB, July 9 & 11, 2024.](#)
- [Goldschmidt 2024, August 18-24, Chicago IL,](#) organized by the Geochemical Society and the European Association of Geochemistry.
- [Groundwater Week 2024,](#) December 10-12 in Las Vegas, Nevada.

May 20, 2024

Geology and the Fate of Societies – Djibouti



Figure 1a – Djibouti

**Credit: [CIA World Factbook – Djibouti](#)
public domain**



Figure 1b – Location Map, Djibouti

**Credit: [CIA World Factbook – Djibouti](#)
public domain**

The [Republic of Djibouti](#) ([government website here](#)) is a small country in the [Horn of Africa](#). To the south of Djibouti is [Somalia](#); to the southwest is [Ethiopia](#); and to the north is [Eritrea](#). East of Djibouti is the [Red Sea](#) and the [Gulf of Aden](#). Across the Gulf of Aden is [Yemen](#). The government is a unitary [presidential republic](#) under the [dictatorship](#) of President [Ismail Omar Guelleh](#). The Djibouti Prime Minister is [Abdoulkader Kamil Mohamed](#) and there is a [National Assembly](#) legislature.

According to the [Central Intelligence Agency](#) (CIA) [World Factbook on Djibouti](#), the country has an area of 23,200 square kilometres (km²) of which 23,180 km² is land and 20 km² is water.

Also according to the CIA World Factbook, Djibouti has a population of 994,974; of that nearly 1 million people, 60% are ethnic [Somali](#), 35% [Afar](#), and the other 5% are mostly Yemeni [Arab](#), also some [French](#), [Ethiopians](#), and [Italians](#). The official languages of Djibouti are [Arabic](#) and [French](#); [Somali](#) and [Afar](#) are also commonly spoken. Nearly all people in Djibouti, 94%, are [Sunni Muslim](#). The remaining 6% are mostly foreign-born residents and include [Shia Muslims](#), [Christians](#), [Hindus](#), [Jews](#), [Baha'i](#), and [Atheists](#).

“[Demographics is destiny](#)” ([Auguste Comte](#) 1798 – 1857). The [demographic profile for Djibouti](#) shows a young society where birthrates have been declining and population stabilizing. The median age is 26.3 years; the life expectancy for both sexes is 65.6; total fertility rate is 2.13 births per woman (just above the replacement rate of 2.1) and the annual growth rate of the population is 1.9%. Djibouti is also a [largely urban society](#) with 78.2% of the population living in urban areas.

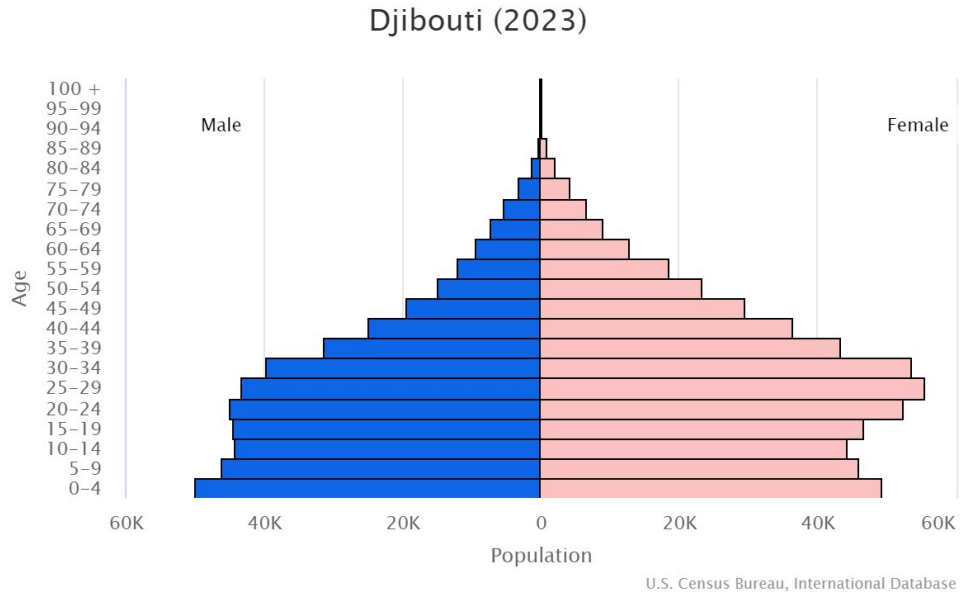
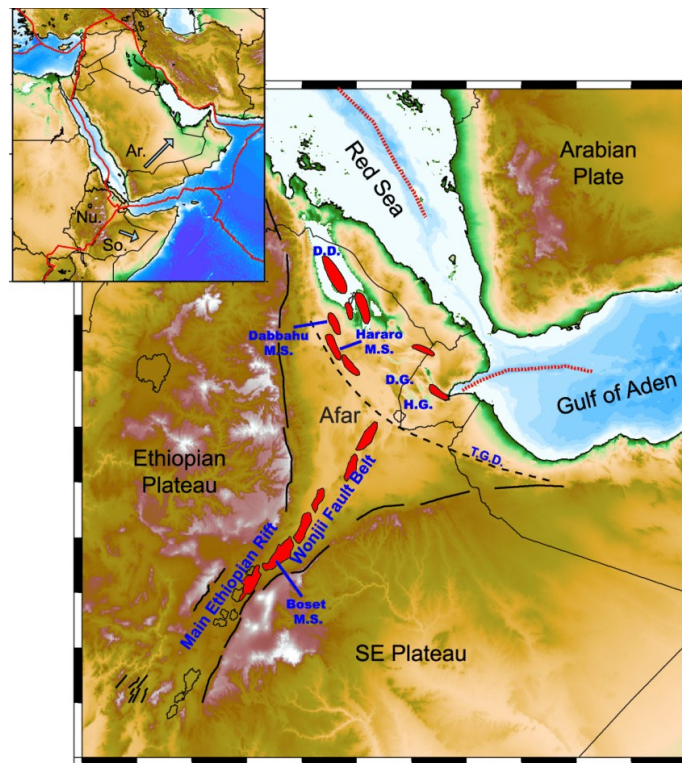


Figure 3 – Demographic Profile of Djibouti
 Credit – U.S. Census Bureau, International Database, Djibouti, public domain

Geology



Tectonic setting of the East African rift system in the Horn of Africa. Solid black lines show Oligocene-Miocene border faults of the Red Sea, Gulf of Aden and East African rifts. Red segments show the Quaternary-Recent sub-aerial rift axes. DD: Danakil Depression. TGD: Tendaho-Goba'ad Discontinuity. MS: magmatic segments. DG: Dobi Graben. HG: Hanil Graben. Dashed red lines are sea-floor spreading centres in the Red Sea and Gulf of Aden. Top left Inset: topography of NE Africa and Arabia. Arrows show plate motions relative to a fixed Nubian plate. Red lines are plate boundaries.

Figure 3 – Tectonic Setting for Djibouti
 Credit: Figure 1 in Daniels *et al*, 2014

Located at the [Afar Depression](#), Djibouti, and the Horn of Africa, sit on a [rift](#) system on the [divergent boundary](#) between three [tectonic plates](#). To the northwest is the [Nubian Plate](#); to the southeast is the [Somali Plate](#); and to the northeast is the [Arabian Plate](#).

The [geology of Djibouti](#) consists largely of [volcanic rocks](#) that range in age from the [Miocene](#) to the [Holocene](#) epochs. These volcanic deposits include: [basalts](#); [rhyolites](#); intrusive [dykes](#) of various volcanic rocks; [silicic](#) massifs and domes; and [ignimbrites](#), lithified volcanic ash.

[Sedimentary deposits](#) in [Djibouti](#) include: [Cenozoic](#) aged [alluvial deposits](#); [carbonate deposits](#) from [coral reefs](#), on the coast; Cenozoic [clay](#) and alluvium deposits [intercalated](#) with the volcanic rocks; and [Jurassic – Cretaceous](#) aged [sandstones](#) of the [Amba Aradam Formation](#). Figure 4 shows a geological map of Djibouti.

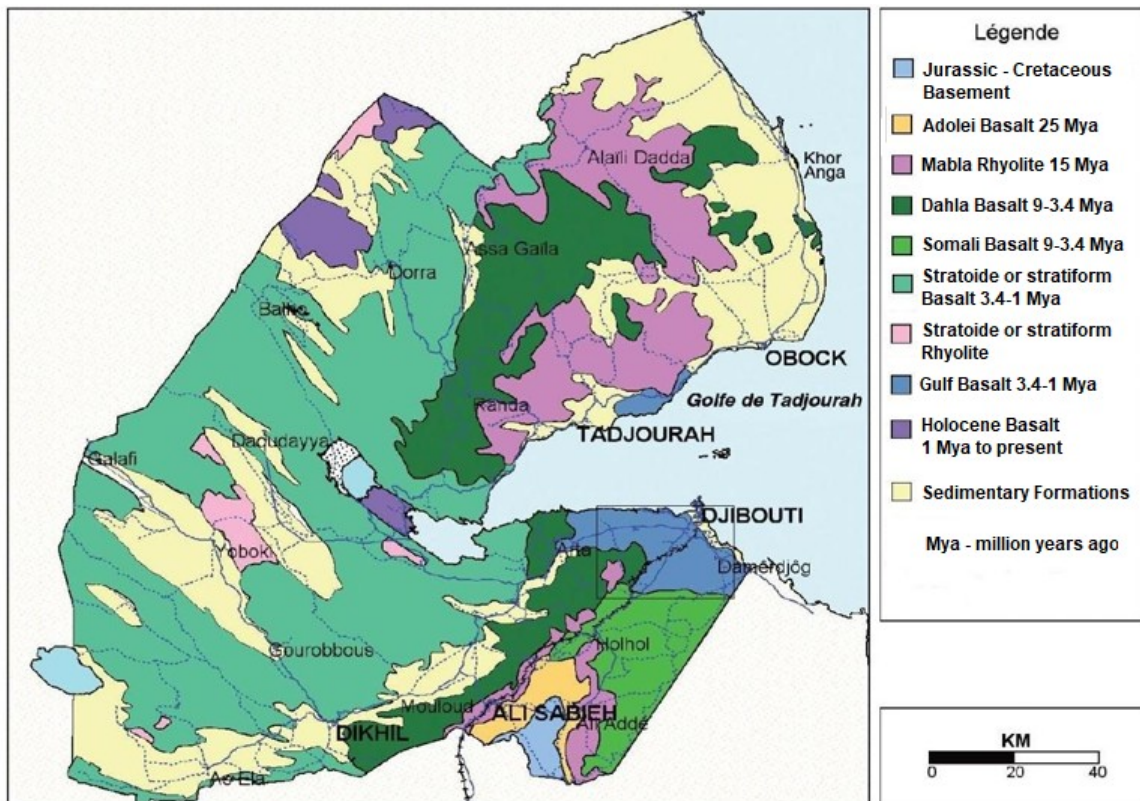


Figure 4 – Geological Map of Djibouti
Credit: Figure 1 in Suge et al, 2018

Formations referred to in Figure 4 include:

- The [Adolei Rhyolite, Mabla Rhyolite and Dahla Basalt](#);
- The [Somali Basalt](#),
- The [stratoide or stratiform basalts and rhyolites](#); and
- The [Gulf Basalt](#).

Resources

Agriculture



Figure 5 – Flock of Somali Goats in Ali Sabieh, Djibouti
Credit: Cpl. Paula M. Fitzgerald, USMC, public domain

According to the CIA World Factbook, 73.4% is used for agricultural almost all of which is 73.3% permanent [pasture](#) leaving only 0.1% for [arable land](#). An insignificant amount of the land is classified as forest (0.2%) and the remainder, 26.4%, has other, or no use, such as urban areas and desert wasteland.

[Cattle](#), [camels](#), [sheep](#) and especially [goats](#) are the main livestock raised for food in Djibouti; [horses](#) and [donkeys](#) are also raised for riding and draft animals. Arable agriculture is largely restricted to [irrigated land](#). Another significant source of food in Djibouti is fishing. The most recent data [United Nations Food and Agriculture Organization](#) (FAO) on fishing in [Djibouti is from 2014](#) where roughly 2,300 tons of fish were caught.



Figure 6 – Fisherman in Djibouti
Credit: Jeffhail, Creative Commons Attribution-Share Alike 4.0 International license

Overall, Djibouti is a desperately poor country where [42% of people live in poverty](#) and where close to half the population, 49.2 %, suffer from [moderate to severe food insecurity](#). The [World Food Program](#) estimates that [90% of the food consumed in Djibouti is imported](#). Statistics on the food production and other indicators from the FAO can be found [here](#) and [here](#).

Mineral Resources



Figure 7 – Salt Production at [Lake Assal](#)

Credit: [Charles Fred](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

[Mineral production in Djibouti](#) is pretty much limited to the production of building materials, cement, clay, crushed stone, sand and gravel as well as salt production from a mine at [Lake Assal](#). The salt mines are advertised as a [tourist destination](#) although the [British Broadcasting Corporation describes it as an “inhospitable alien landscape”](#).

For a place with a complex geology located at the intersection of three tectonic plates, you might think that there was more potential for mineral resources. And you would be right. At least one [study](#) sees potential for [epithermal gold](#) occurrences. In 2016 the government of Djibouti [reformed the mining laws](#) to encourage exploration and investment in the mineral industry.

For energy resources, at least one [study](#) has been done on the hydrocarbon potential of the nearby Gulf of Aden. Another potential energy source that makes sense in a tectonically active area is geothermal energy, and a couple of studies [here](#) and [here](#) have explored the potential.

Finally, as a desert country, [groundwater resources in Djibouti](#) are important. Groundwater is the [country's main source of water](#) for domestic, agricultural and industrial use.

Figure 8, below, leads to an interactive map of mineral occurrences in Djibouti.

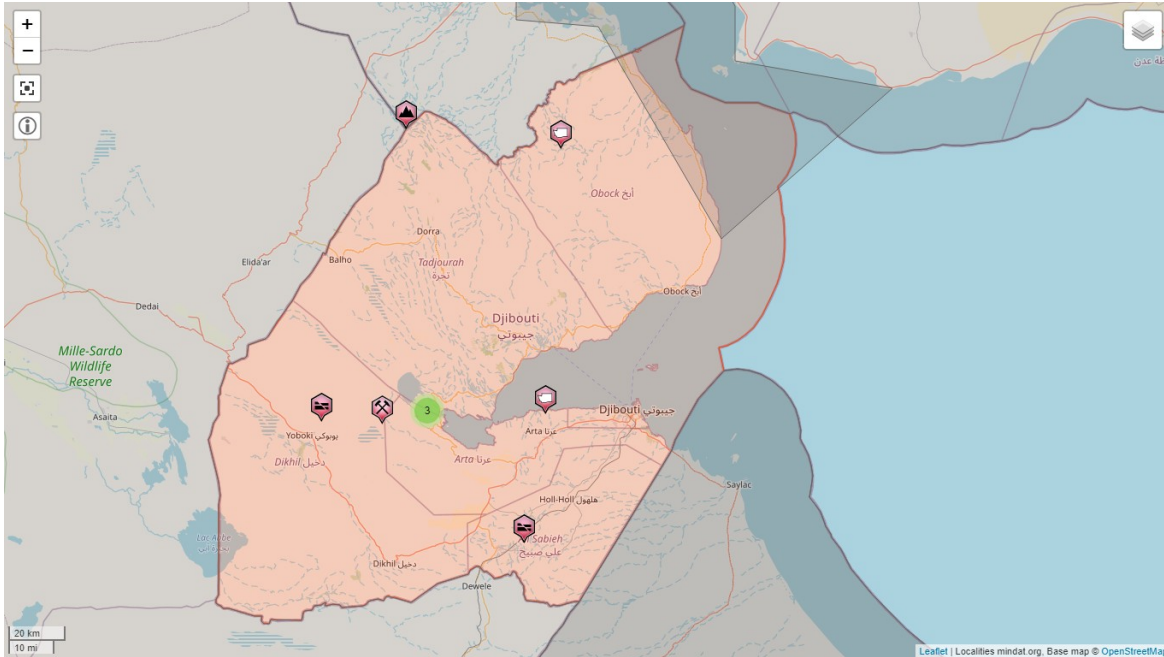
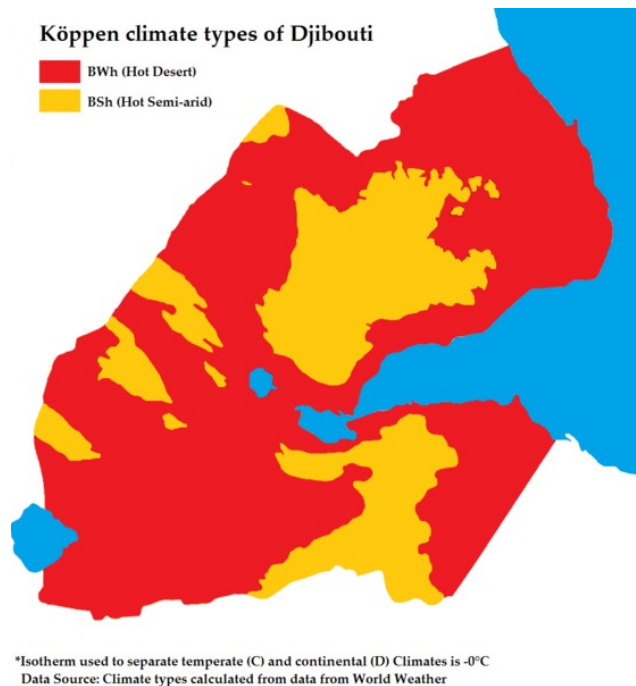


Figure 8 – Interactive Mineral Occurrence Map of Djibouti
 Credit: [Mindat.org](#)

Climate



Djibouti is one big desert. The two main climate types are Hot Desert ([BWh](#)) and slightly more humid Hot Semi-arid ([BSh](#)). [Climates to Travel](#) describes it as a “tropical desert on the coast and at in the lowlands, while it becomes semi-desert in the mountainous areas of the interior”.

If you like desert countries, Djibouti might be a pleasant place to visit. A least one website invites you to discover its [local culture and traditions](#). [Lonely Planet](#) describes it as a beautiful country with weird landscapes. Travel advisories ([here](#) and [here](#)), on the other hand, advise a high degree of caution, due to terrorism and crime, and to stay away from the border with Eritrea. Criminals often see tourists as walking [ATM](#) and terrorists see a good political target.

Figure 9 – Köppen Climate Types in Djibouti
 Credit: [Skilla1st](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license

History and Geopolitics

History – At the Horn of Africa

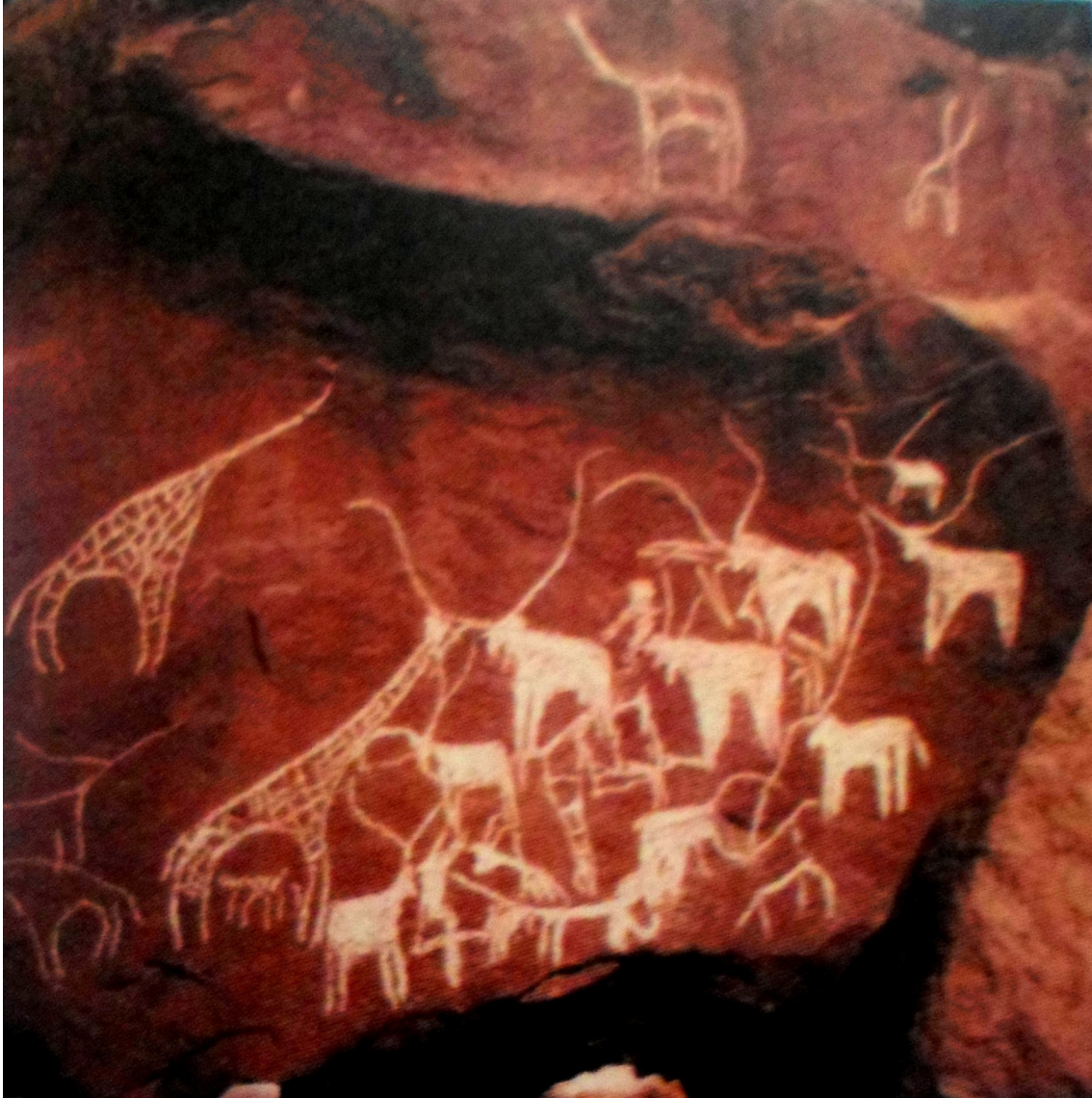


Figure 10 – Rock Art at [Balho](#)

Credit: [Skilla1st](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license

The [history of Djibouti](#) is interesting. [Human presence in East Africa](#) goes back to the [Middle Pleistocene](#) and pre-human [hominins](#), such as *Homo habilis*, lived in the region of the Horn of Africa during the [last age](#) of the [Pliocene](#). There is a whole area of [study in East African archaeology](#) that is worth pursuing.

During the late [Paleolithic](#) and early [Neolithic](#), the [climate was less severe than it is now](#) and farming was introduced to the earliest speakers of the [Afro-Asiatic language group](#), who seem to have originated in East Africa. The rock art at [Balho](#) dates from this period. With the deteriorating climate after the end of the [African humid period](#) the inhabitants near [Bab-el-Mandeb](#), modern Djibouti, took up a nomadic existence, depending on their livestock for a livelihood.

Moving closer to modern times, the ancient [Egyptians](#) traded with the inhabitants of Bab-el-Mandeb, calling the place [Punt](#). Later, during medieval times, the [Adal](#) and [Ifat](#) Sultanates took control of the region and introduced the [religion of the Prophet](#). With the withering away of the Adal and Ifat Sultanates, the [Pashas](#) of [Ottoman Egypt](#), especially under [Muhammad Ali Pasha](#), extended their control over the region including Yemen.

European interest in the region around Bab-el-Mandeb began with the [British](#) occupation of [Aden in In 1839](#). The [French](#) then took the opportunity to move into the town of [Zeila](#) in 1841, kicking out the Egyptian garrison. After negotiations, the Egyptian returned, but the French and the British kept a covetous watch on the place.

In 1896, the French returned in force and set up the colony of [French Somaliland](#). The French formalized their presence through treaties with the local [Somali](#) and [Afar](#) Sultans who also had a claim on the place. A major accomplishment of the French was the construction of the [Imperial Ethiopian Railway](#) that ran west into [Ethiopia](#) out of Djibouti. Another, slower moving event, was the growth in the number of ethnic Somalis in Djibouti, eventually outnumbering the Afars.

The French renamed their territory in Djibouti as the [French Territory of the Afars and the Issas](#) in 1967. A decade later, the people of Djibouti voted for independence, officially marking the establishment of the Republic of Djibouti. The pro-independence vote was mostly from ethnic Somali, while the Afars favoured continued French presence. For this, and other reasons, the French kept some armed forces in Djibouti post-independence.



Figure 11 – Armoured Car of the [13th Demi-Brigade of the Foreign Legion](#) in Djibouti, ca. 2005
[Credit: davric, public domain](#)

Independence has not been entirely peaceful for Djibouti. The last years of French rule were marked by continuing tension between the two main ethnic groups, the Afars and the Somalis. In 1981, the President, [Hassan Gouled Aptidon](#), declared the Republic to be a one-party state. Aptidon was an ethnic Somali and ethnic Afars opposed his dictatorial rule, fearing mistreatment by the Somalis. The result was a [civil war](#) between the mostly Somali government forces and the Afar [Front for the Restoration of Unity and Democracy](#). The war ran from 1991 to 1994 and was resolved by negotiation. In 1999 Aptidon resigned as President, to be replaced by his nephew, Ismail Omar Guelleh, the current dictator. In 2008, Djibouti fought a [border war with Eritrea](#). The dispute was [not settled until 2018, with negotiation](#).

In 2021, Guelleh was re-elected to a fifth term. He is 77 years old now and could conceivably reign for a long time, his uncle and predecessor was 83 when he resigned. However, as with us all, the [Grim Reaper](#) will eventually arrive for him. After that, they could easily slip back into another civil war.

Geopolitics – Ethnic Tensions and Shipping Routes

The geopolitical situation in Djibouti has a number of internal and external factors. Internally, the ongoing ethnic tensions between the Somali and Afar tribes will [continue to be a source of instability](#). This tension occasionally [explodes into violence](#), and could lead to further trouble in the future.

Djibouti's neighbours aren't exactly the most stable either:

- Violence [between Somalis and Afars in Ethiopia](#) has threatened to spill over into Djibouti in the past and could easily do so in the future.
- To make things worse, some think that Ethiopia [could take over Djibouti to gain control of the port](#), remember that railway? Last year, [Djibouti rejected Ethiopian requests for access to the Red Sea](#).
- Eritrea and Djibouti fought a war 2008 to 2010, and only [normalized relations in 2018](#). Relations between the two could break down again. Somalia is in the [midst of many internal troubles](#). These troubles could easily spill over into Djibouti.
- Finally, across the Bab-el-Mandeb, is Yemen, a country in the midst of a [civil war](#) that includes [attacks on shipping in the Red Sea](#).

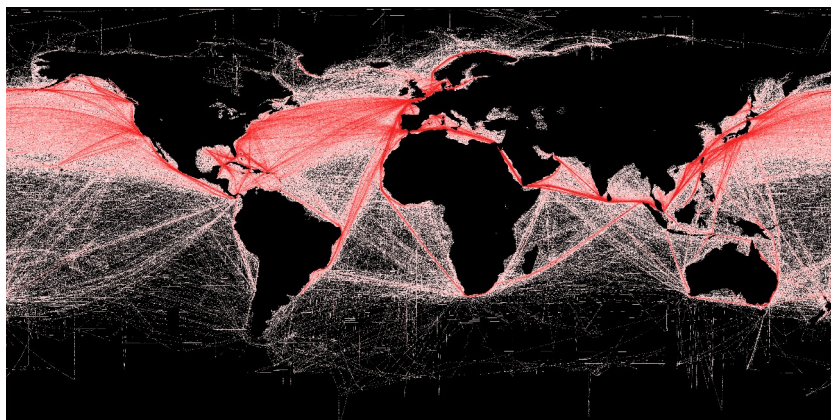


Figure 12 – World Shipping Routes

Credit: [Grolltech](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

Powers from outside the region have a strong interest in Djibouti. The answer is obvious when you realize that [30% of the world's container traffic used to pass through the Bab-el-Mandeb](#). The escalation in the Yemen civil war has affected that trade and [big bucks](#), billions of dollars, are at stake. Here is another look at the bottleneck of Bab-el-Mandeb in Figure 13.



Figure 13 – Bab-el-Mandeb
Credit: [NASA World Wind](#), public domain

So, the location of Djibouti is the very definition of a serious geopolitical issue. To protect their interests in the Bab-el-Mandeb, a number of foreign powers maintain a military presence in Djibouti:

- The [French](#) keep a military garrison in Djibouti made up of the [13th Demi-Brigade of the Foreign Legion](#).
- [Camp Lemonnier](#), an [American](#) facility at [Djibouti-Ambouli International Airport](#) and home to the [Combined Joint Task Force – Horn of Africa](#) of the [U.S. Africa Command](#).
- [Japan](#) also opened a local naval base in 2011 with 180 [personnel for marine defence](#); the Djibouti government is expected to make \$30 million off of this arrangement.
- The [Chinese Peoples Liberation Army](#) naval forces [maintain a support base](#) in Djibouti made up of 1,000–2,000 navy personnel; there may be plans to build a second base.

Anybody else want to build a naval base in Djibouti? [India](#) is a growing regional power with [an interest in the conflicts around the Gulf of Aden and Bab-el-Mandeb](#) but so far has not shown an interest in building a base in Djibouti. The [Russians](#), however, **would** like to establish a naval base in Djibouti.

Djibouti, or rather [the ruling clique](#), makes money off of renting space to foreigners who want to keep an eye on the Bab-el-Mandeb. This could hurt them in the long run if Djibouti becomes a battleground in a [great power conflict](#). Keep an eye on this one as well as the conflicts in Yemen and Ethiopia. Follow up on the links of any of this interests you.

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.