

September 25, 2023

## News and notes

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

## Research

- The short answer is no: [Will AI replace geologists in mineral discovery?](#)
- Geological history: [Deglacial volcanism and reoxygenation in the aftermath of the Sturtian Snowball Earth](#); Phys.org summary [here](#).
- [Plate tectonics 4 billion years ago may have helped initiate life on Earth](#); research articles: [Deep formation of Earth's earliest continental crust consistent with subduction](#) and [Forming the oldest-surviving crust](#).
- More plate tectonics: [Formation of lower arc crust by magmatic underplating revealed by high-precision geochronology](#).
- Geochemistry: [A whole-lithosphere view of continental growth](#); Phys.org summary [here](#).
- More geochemistry: [High rates of rock organic carbon oxidation sustained as Andean sediment transits the Amazon foreland-floodplain](#).

## Paleontology

- [Do grazers equal grasslands? Strengthening paleoenvironmental inferences through analysis of present-day African mammals](#); behind a paywall, Phys.org summary [here](#).
- [Fish's big mistake preserved an unusual fossil for us](#).
- [Deinotherium levius and Tetralophodon longirostris \(Proboscidea, Mammalia\) from the Late Miocene hominid locality Hammerschmiede \(Bavaria, Germany\), and their biostratigraphic significance for the terrestrial faunas of the European Miocene](#); Phys.org summary [here](#).
- [The origins of colour patterns in fossil insects revealed by maturation experiments](#); Phys.org summary [here](#).
- [Origins of slow growth on the crocodylian stem lineage](#); behind a paywall, Phys.org summary [here](#).
- [A large brush-footed trapdoor spider \(Mygalomorphae: Barychelidae\) from the Miocene of Australia](#); New Scientist summary [here](#).
- [Preservation of corneous  \$\beta\$ -proteins in Mesozoic feathers](#); Phys.org summary [here](#).
- [Constraining the onset and environmental setting of metazoan biomineralization: The Ediacaran Nama Group of the Tsau Mountains, Namibia](#); Phys.org summary [here](#).

## Geopolitics

- Bloomberg: [The Global Economy Enters an Era of Upheaval](#).
- Whisky's for drinking, water's for fighting: [BRICS Now Owns Egypt and Ethiopia's Nile Dam Dispute](#).
- [Wagner-linked gold miner in Sudan halts operations over conflict](#).
- [African Nations resist China's predatory practices in rare earth mineral sector](#).
- [Are diamonds forever? The scientific geopolitics of Africa](#).
- Monitoring nuclear testing in North Korea: [Seismic moment tensor inversion with theory errors from 2-D Earth structure: implications for the 2009–2017 DPRK nuclear blasts](#).

## Crooked Dealing

- Caveat emptor: [Europe's largest copper producer is the victim of metal swindle worth \\$198 million – and insiders may have been involved](#).
- [Criminal syndicate at Barrick subsidiary's mine was pocketing up to US\\$31-million, report found](#).

## Mining and Energy

- [Giga Metals Announces Positive Pre-Feasibility Study for the Turnagain Nickel-Cobalt Deposit](#).
- [Copper prices may jump 20%, aluminum by 36% as demand outpaces supply: forecast](#).
- Ore deposit geology: [A magmatic copper and fluid source for the sediment-hosted Mount Isa deposit](#).
- Diamond deposit geology: [Emplacement of the Argyle diamond deposit into an ancient rift zone triggered by supercontinent breakup](#); Live Science summary [here](#).
- ['Entire walls of just spodumene': Here's why lithium explorers fought tooth and nail for ground in the Black Hills of South Dakota](#).
- [Rio Tinto sees building its own lithium mines as better than buying](#).
- Kiruna, Sweden: [European city moving buildings 'one by one' after rare earth metals worth billions found](#).
- Lithium-tantalum project in Western Australia: [Wildcat Resources roars over lithium discovery at Tabba Tabba](#).
- Processing technology: [Chinese scientists make key breakthroughs in rare earth mining](#).
- [Oil executives at World Petroleum Congress see global demand growing, not falling](#).
- [Where Does Oil Come From? Because It Isn't Dinosaurs](#).



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## Geology and the Fate of Societies – Benin



Figure 1 – Benin

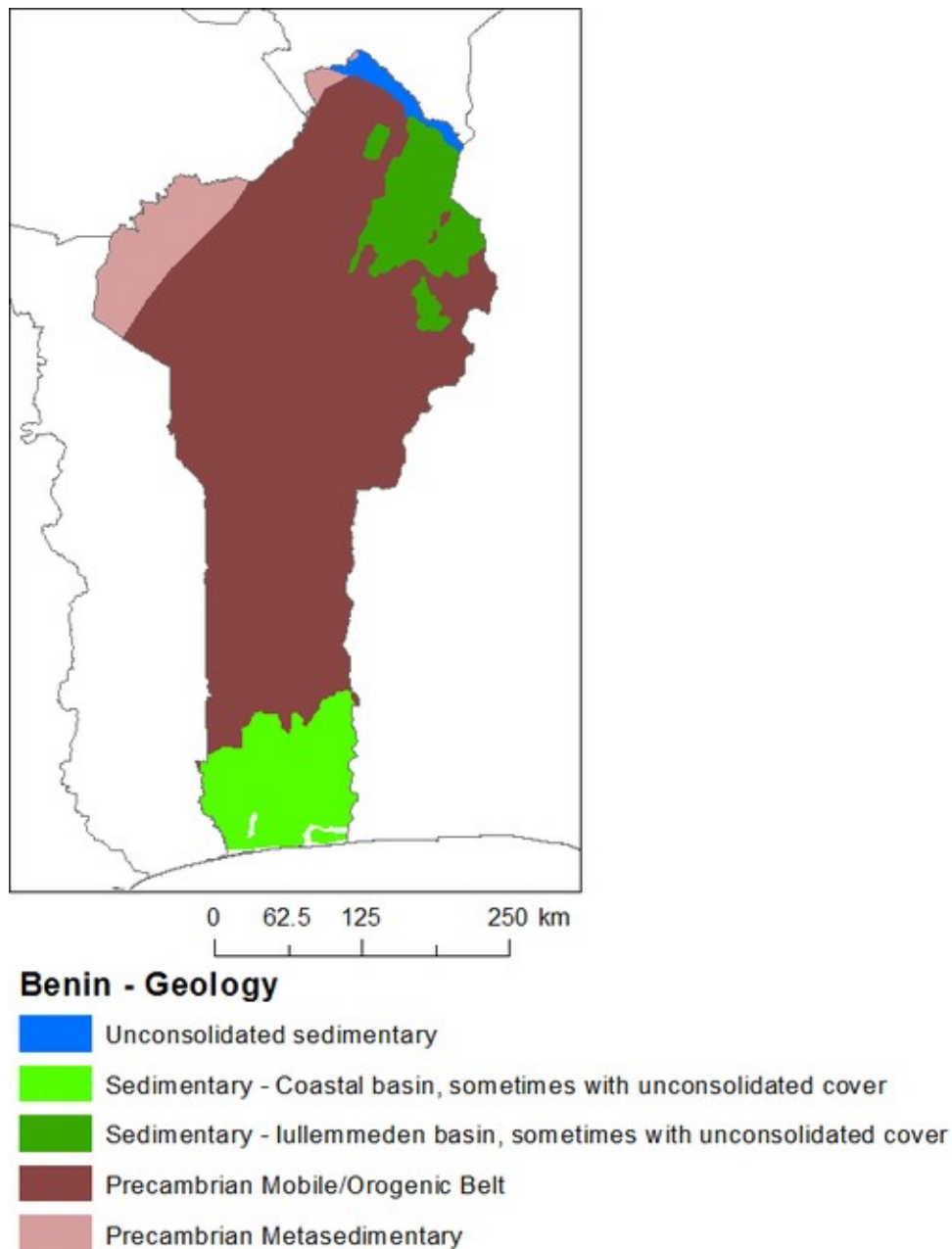
Credit: United States [Central Intelligence Agency's World Factbook](#), public domain

The next nation in our [alphabetical list of nations](#) for consideration is the Republic of [Benin](#), formerly called [Dahomey](#). A small country on the [Bight of Benin](#) in West Africa, Benin borders on Togo, to the west; [Burkina Faso](#), to the northwest; [Niger](#), to the northeast; and [Nigeria](#), to the east.

According to the United States [Central Intelligence Agency's World Factbook on Benin](#), the country has a total area of 112,622 square kilometres (km<sup>2</sup>) of which 110,622 km<sup>2</sup> is land and 2,000 km<sup>2</sup> is water. The [CIA estimates](#) Benin's population at 14,219,908 people. The ethnic breakdown is: 38.4% [Fon](#) and related; 5.1% [Adja](#) and related; 12% [Yoruba](#) and related; 9.6% [Bariba](#) and related; 8.6% [Fulani](#) and related; 6.1% [Ottamari](#) and related; 4.3% [Yoa-Lokpa](#) and related; 2.9% [Dendi](#) and related; and 2.8% others, including foreigners. [French](#), the language of the former colonial power (see history, below), is the language of public administration. The largest religious group in Benin is [Christianity](#) (52.2%), followed by [Islam](#) (24.6%) and [traditional faiths](#) (17.9%)

The capital city of Benin is [Porto-Novo](#) (pop. 264,320) and the largest city in the country is [Cotonou](#) (pop. 679,012). Benin is a member of the [United Nations](#), the [African Union](#), the [Economic Community of West African States](#) (ECOWAS), the [Organisation of Islamic Cooperation](#), the [South Atlantic Peace and Cooperation Zone](#), le [Francophonie](#), the [Community of Sahel–Saharan States](#), the [African Petroleum Producers Association](#) and the [Niger Basin Authority](#). Benin is officially a presidential republic, the current president is [Patrice Talon](#).

## Geology



**Figure 2 – General Geology of Benin**  
**Credit: in Boukari et al, 2022**

Benin sits on the [West Africa Craton](#) and generally consists of [Proterozoic](#) rocks formed during the [Panafrikan Orogeny](#) (sometimes called the [Dahomeyide Orogeny](#)) flanked by Proterozoic metasedimentary rocks and more recent sediments ranging in age from [Cretaceous](#) to [Holocene](#). Here is a summary of the deposits shown in Figure 2, going from the youngest to oldest:

- The youngest are [Quaternary](#) aged [alluvial](#) deposits of [clay](#), [silt](#), [sand](#), and [gravel](#) deposited along the [Niger River](#) that forms the northern boundary of Benin.

- In the south of the country is the Benin Sedimentary Coastal Basin, a [coastal plain](#) consisting mostly of marine sediments, [sandstone](#), [limestone](#), clay, [marl](#) and [conglomerate](#) belonging to the regional [Keta Basin](#) and ranging in age from [Lower Cretaceous](#) to Quaternary.
- In the northeast part of Benin includes part of the [Iullumeden Basin](#): [continental deposits](#) of conglomerate, sandstone, siltstone and clay, ranging in age from Lower [Paleozoic](#) to Cretaceous.
- Towards the northwest part of Benin are metasedimentary deposits belonging to two distinct groups: 1. the Late [Precambrian](#) to Lower Paleozoic [Voltaian](#) (or Pendjari) Basin – sandstone, [shale](#) and [siltstone](#) of; and 2. the Late Precambrian volcanic-sedimentary [Buem Series](#) – sandstone, quartzite, [rhyolite](#) and [andesite](#).
- In the centre of country is a Precambrian [Mobile/Orogenic Belt](#), also made up of two main groups: 1. a [basement](#) complex consisting of [gneiss](#) and [granulite](#) with [granite](#) and [syenite](#) intrusions; and 2. the Precambrian [Atacora](#), Kande and Kouande series consisting of highly metamorphosed [quartzite](#) and [schist](#) formed during the Panafrican (Dahomeyide) Orogeny.

## Resources

### *Agriculture and Forests*

Benin is predominately a rural society with about 70% of the population living in the countryside, so agriculture is critical to the livelihood of most people in the country. [Agriculture in Benin](#) is divided into two main sectors: [subsistence agriculture](#) and [commercial agriculture](#). Approximately 93% of total agricultural production goes into food production. Often that is not enough with about 35% of the population living in [dire poverty](#). Overall, 36% of households depend solely upon agricultural (crop) production for income, and another 30% depend on a mixture of crop production, livestock, or fishing for income.

In [2018, Benin produced](#):

- 3.8 million tons of cassava (17th largest producer in the world);
- 2.7 million tons of yam (4th largest producer in the world, losing only to Nigeria, Ghana and Ivory Coast);
- 1.5 million tons of maize;
- 758 thousand tons of cotton (12th largest producer in the world);
- 598 thousand tons of palm oil;
- 459 thousand tons of rice;
- 372 thousand tons of pineapple;
- 319 thousand tons of sorghum;
- 253 thousand tons of tomatoes;
- 225 thousand tons of peanut;
- 221 thousand tons of soy bean;
- 215 thousand tons of cashew nuts (5th largest producer in the world, losing only to Vietnam, India, Ivory Coast and Philippines); and
- smaller productions of other agricultural products, like sheanut (13 thousand tons), orange (15 thousand tons) and coconut (17 thousand tons).

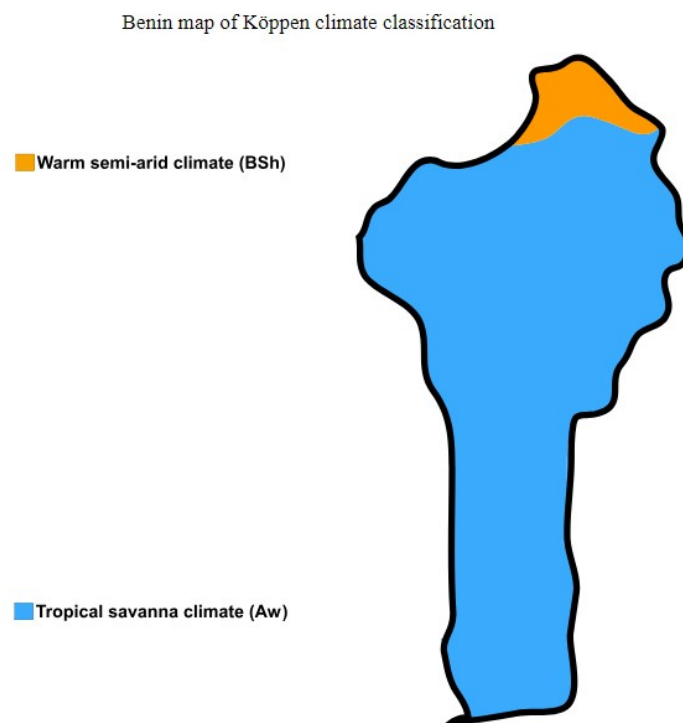
Benin has a large percentage of land that can be considered grassland cover, over 90%, so livestock, cattle, goats and sheep, are significant products with a [total meat production of 84,567 tonnes in 2021](#). Fishing is also important; total fisheries production in 2021 [was](#) 78,765 tonnes.

Forestry in Benin is mostly small scale harvesting for fire wood, charcoal production and building timber. In the aggregate, the use of forests has resulted in an [overall reduction of forest cover](#) from 436 kilohectares (kha) in 2010 to 434 kha in 2022.

### ***Mineral Resources***

Benin has a fairly [small mineral industry](#). The main products are cement and aggregate. There has been mineral exploration for iron, tantalum and petroleum but no economic deposits have been found. Of course, the gold bugs have been at work, [here is a review of their work](#).

## **Climate and Disease**



**Figure 3 – Köppen Climate Map of Benin**

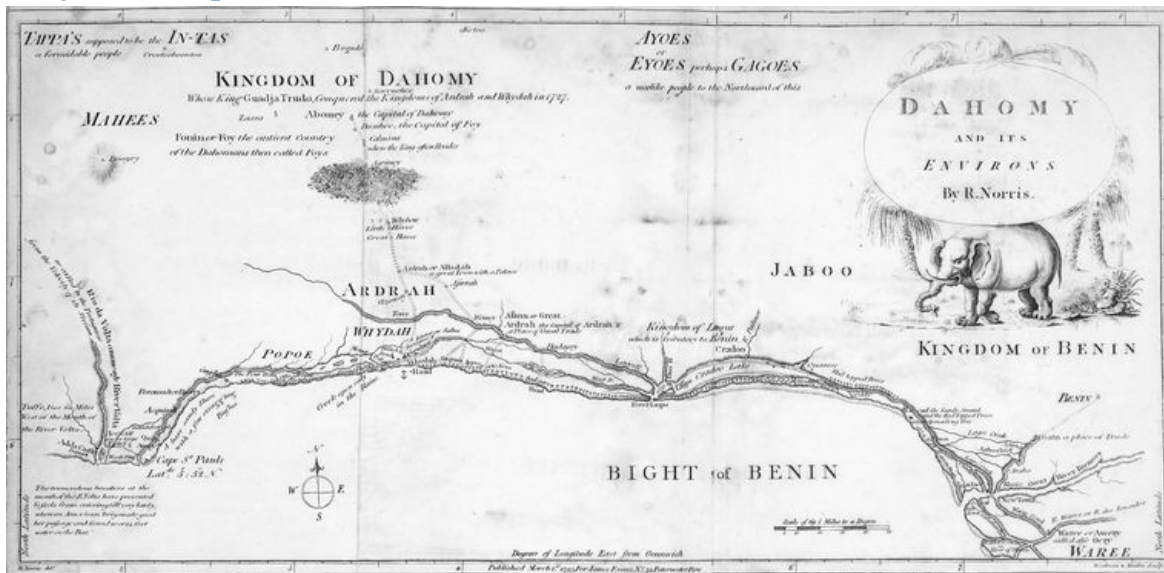
**Credit: [Ali Zifan, Creative Commons Attribution-Share Alike 4.0 International](#) license**

Most of Benin is has a [tropical savanna climate](#), although the northern regions have a [warm semi-arid climate](#). Like many tropical regions, Benin experiences a wet season, from mid-March to October and a dry season the rest of the year with the wet season being shorter in the north running from May to September. Annual precipitation ranges from less than 1,000 millimetres (mm) in the north to up to 1,300 mm in the south.

Overall, a pleasant tropical climate, especially if you like it scorching hot. However, don't pack you're bags to move to Benin unless you're prepared for the [many diseases that afflict its inhabitants](#). Malaria is [endemic in Benin](#), accounting for around 40% of childhood deaths and lowering the overall health of

adult survivors. Waterborne diseases such as [cholera are also endemic](#), although the government is [gradually improving](#) the delivery of safe drinking water (the best way to prevent [enteric disease](#)). For those who want to live in the fast lane, be aware that [HIV/AIDS is also common in Benin](#), although preventative measure resulted in a [decline in that disease](#) from 1993 to 1999. The [average life expectancy in in Benin](#) is around 61 years.

## History and Geopolitics



**Figure 4 – Kingdom of Dahomey, 1793**  
**Credit: Archibald Dalziel, public domain**

### *A Sad History of Exploitation*

As the [cradle of mankind](#), human occupation in Africa goes back to the [Stone Age](#). Archaeology studies note [Neolithic settlements in West Africa](#) that derived their subsistence from hunting, gathering and early forms of agriculture. The growing populations that resulted from agriculture led to the development of various small scale polities, such as city states and, eventually, regional empires such as the [Kingdom of Dahomey](#) and the [Oyo Empire](#).

A normal part of the [endemic warfare](#) between the various polities in West Africa was [slavery](#). The winners of a conflict would enslave the losers, possibly trading them to other polities. When [European traders began to arrive](#) in the 16<sup>th</sup> century, among the things traded by the Africans for European goods were human beings. The Europeans took to calling the area of Benin the [Slave Coast](#). The desirability of European goods probably drove ambitious tribal leaders to conduct raids on their neighbours in order to acquire the slaves that they would later trade for guns and other European goods. Firearms were the key, since they gave their owners power over the unarmed and enabled the enslavement of more unfortunate people.

Among the Europeans trading on the Slave Coast were the [French](#), who began trading in Benin around 1872, eventually taking over Porto-Novo from its [Portuguese](#) founders. The French made war on the Kingdom of Dahomey [beginning in 1890](#) and established the [French colony of Dahomey](#) in 1894 following the defeat of Dahomey [in a second war](#). By 1894, [slavery was abolished](#) in the French Empire,

but there was still plenty for the French to enrich themselves, such as cash crop plantations. On the positive side, the French built railway infrastructure, to transport plantation produce for export, and began some public education, [often by Catholic missionaries](#).



**Figure 5 – The [RNIE 3](#) highway in Province Atakora – Benin**  
**Credit: [Martin Wegmann](#), [Creative Commons Attribution-Share Alike 3.0 Unported, 2.5 Generic, 2.0 Generic and 1.0 Generic license](#).**

Ultimately, the overt colonization of Benin, and other African holdings, proved to be a losing proposition for France and, in 1960, the French colony of Dahomey became the independent Republic of Dahomey. Later, in 1990, the country's rulers changed the country's name to Benin. From 1960 to 1990 Dahomey experienced lots of political upheaval. Experiments with military rulers and [Marxist-Leninism](#) did little to improve the country. Since 1990, democratic rule has been established and generally peaceful conditions have allowed for a modicum of economic growth.

### *The Geopolitics of a Small Country*

Geopolitically, the main concerns for Benin are:

- managing relations with neighbours;
- managing relations with the former colonial power, France; and
- managing relations with possible future colonial adventurers and global powers.

Benin's relations with its neighbours are currently peaceful, although the recent [coup in neighbouring Niger](#) has the possibility of [escalating into a regional war](#) led by countries allied with France against the

Nigerien coup leaders. Here is where relations with France are important to Benin. Although politically independent, Benin, and the other former French colonies in West Africa, remain in close commercial relations with France, to the point that many accuse France of continuing [colonial exploitation by other means](#).

The [big regional player in West Africa is Nigeria](#). As Africa's largest country by population, Nigeria could easily play a big role in keeping order in their part of the world. Many ethnic group have members in both Nigeria and Benin, so [intertribal disputes](#) within Benin could bring Nigerian intervention. Benin has [had disputes](#) with Nigeria in the past and living next to an [awakening power like Nigeria](#) might prove uncomfortable for Benin.

Other concerns for Benin include the ambitions of global powers such as the [United States](#), [Russia](#) and [China](#). In recent years the [Wagner Group](#) of mercenaries has been [active in Africa](#), officially as a private company but almost certainly with the permission of the Russian state. Whether Russia's interest in West Africa is to disrupt French activities or prepare for future colonial adventures is not known at this time.

Another possible colonial adventurer is China, [who have taken an interest](#) in commercial relations with West Africa. Many African nations are now leery of Chinese involvement in their countries, as in this [news item](#) (also shown in today's News and notes, Geopolitics). China is likely to remain an important player in the world, so don't expect them to abandon their African ambitions anytime soon.

The United States has generally left the former French colonies for France to take care of, but they may take a more active interest if Russia and China get involved and if France is unable to handle it. A lot will depend on the actions of other big players like Russia and China. As in the [Cold War](#) period, Africa could again become the playground for geopolitical games among global powers.

Unfortunately, small nations like Benin can get caught between these larger geopolitical actors. We can wish them well but we should be aware that political ambitions are often cold blooded exercises in power where small actors get inadvertently crushed.

## 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.