

July 17, 2023

News and notes

Before going on to discuss how geology has affected the fate of [Bangladesh](#), here are some news items I thought were interesting.

Research

- From Brock University: [International experts choose Brock-led proposal for Crawford Lake as site for proposed Anthropocene](#); related story [here](#).
- Sedimentology: [Sedimentary evolution of the embayed beach from Qinghai Lake, northern Qinghai-Tibetan Plateau, China](#); behind a paywall, Phys.org summary [here](#).
- More sedimentology: [Sedimentary Processes and the Temporal Resolution of Sedimentary Strata](#); Phys.org summary [here](#).
- [Cratonic basins as effective sediment barriers in continent-scale sediment routing systems of Paleozoic North America](#).
- Plate tectonics, far eastern Siberia is on the North American Plate: [M5.2 earthquake in remote Siberia highlights wide continental rift](#).

Paleontology

- [‘Most important dig site east of the Mississippi’: Ancient river ‘bone bed’ reveals dinosaur fossils in Maryland](#).
- Fossil pollen studies: [A high-resolution record of landscape changes and land use over the last 5000 years in western Calabria \(S. Eufemia Gulf, southern Tyrrhenian Sea, Italy\)](#); Phys.org summary [here](#).
- Marine fossils and changing ecosystems: [The quality of the fossil record across higher taxa: compositional fidelity of phyla and classes in benthic marine associations](#); Phys.org summary [here](#).
- Megalodon: [Dental geochemistry reveals thermoregulation in the Neogene ocean’s most infamous superpredator](#).

Energy and Mining

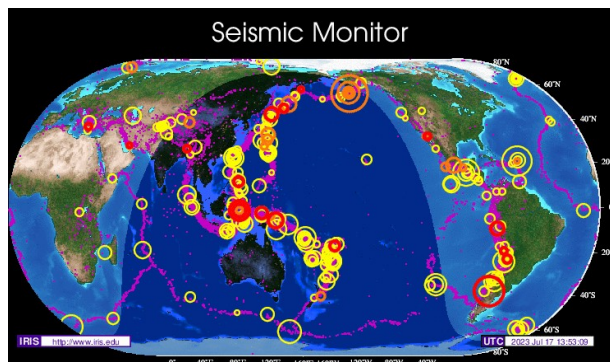
- [DEEP provides detailed updates on Saskatchewan, Canada geothermal project](#).
- From the International Energy Agency: [Record deployment of clean energy technologies such as solar PV and batteries is propelling unprecedented growth in critical minerals markets](#).
- Exploration activity: [U.S. Drillers Cut Oil and Gas Rigs for 10th Time in 11 Weeks – Baker Hughes](#).
- [ND geologists strike another Rare Earth Mineral jackpot](#).

- Deep sea mining problems: [Climate change to drive increasing overlap between Pacific tuna fisheries and emerging deep-sea mining industry](#); Phys.org summary [here](#).
- Ore geology: [The global lead isotope system: Toward a new framework reflecting Earth's dynamic evolution](#); behind a paywall, Phys.org summary [here](#);
- More ore geology: [Mantle-to-crust metal transfer by nanomelts](#).
- Even more ore geology: [Genesis of the 1.45 Ga Kratz Spring Iron Oxide-Apatite Deposit Complex in Southeast Missouri, USA: Constraints from Oxide Mineral Chemistry](#).
- [Canada to speed up critical minerals permits in bid to erode China's dominance](#).
- [Rare earths prices sink to lowest since 2020 as China ramps up supply](#).

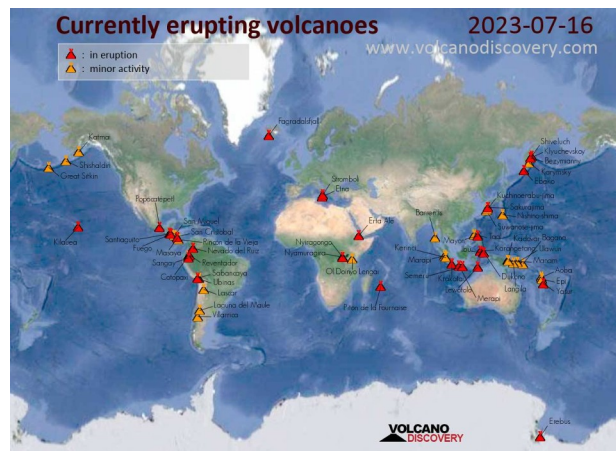
Environmental Geology and Hydrogeology

- [CEO of defunct Banks Island Gold guilty of environmental violations at British Columbia mine](#).
- [Evaluation of groundwater quality in the rural environment using geostatistical analysis and WebGIS methods in a Hungarian settlement, Báránd](#).

Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

- From the United States Geological Survey (USGS): [Volcano Watch — Two hundred years of written observations of Kīlauea's summit activity](#).
- Volcano research: [Multi-method constraints on the age and timescale of silicic small-volume eruptions of Puketerata Volcanic Complex, Taupō Volcanic Zone, New Zealand](#).
- [Reykjanes volcano update: eruption site remains closed](#).
- [M7.2 earthquake offshore Alaska occurred in seismic gap](#); USGS report [here](#).
- [Unusual M6.6 earthquake shakes much of the Caribbean](#); USGS report [here](#).

July 17, 2023

Geology and the Fate of Societies – Bangladesh



Figure 1 – Map of Bangladesh

Credit: Oona Räisänen ([Mysid](#)), [Creative Commons Attribution 3.0 Unported](#) license.

The People's Republic of [Bangladesh](#) is a relatively small country with a large population located on the [Indian Subcontinent](#). To the west and north of Bangladesh is [India](#), to the east is [Myanmar](#) and to the south is the [Bay of Bengal](#). Bangladesh is narrowly separated from [Bhutan](#) and [Nepal](#) by the [Siliguri](#)

[Corridor](#) of India. It is also separated from [China](#) by the Indian state of [Sikkim](#) in the north. The [delta](#) of the [Ganges](#) and [Brahmaputra](#) rivers dominates the geography of Bangladesh.



Figure 2 – Ganges-Brahmaputra Delta

Credit: [NASA](#), public domain

The United States Central Intelligence Agency [World Factbook](#), estimates the population of Bangladesh at 167,184,465 (as of 2023, it's a pretty precise "estimate"). These some 167 million people live on a land that contains a total of 148,460 square kilometres (km²) of which 130,170 km² is land and 18,290 km² is water. Bangladesh is among the most densely populated countries in the world with a population density of 1,141 people/km², making it the 11th [most densely populated country](#) in the world.

[Dhaka](#) is the capital and largest city and is Bangladesh's political, financial and cultural centre. [Chittagong](#) is the second-largest city in the country and is the busiest port on the Bay of Bengal.

Geology

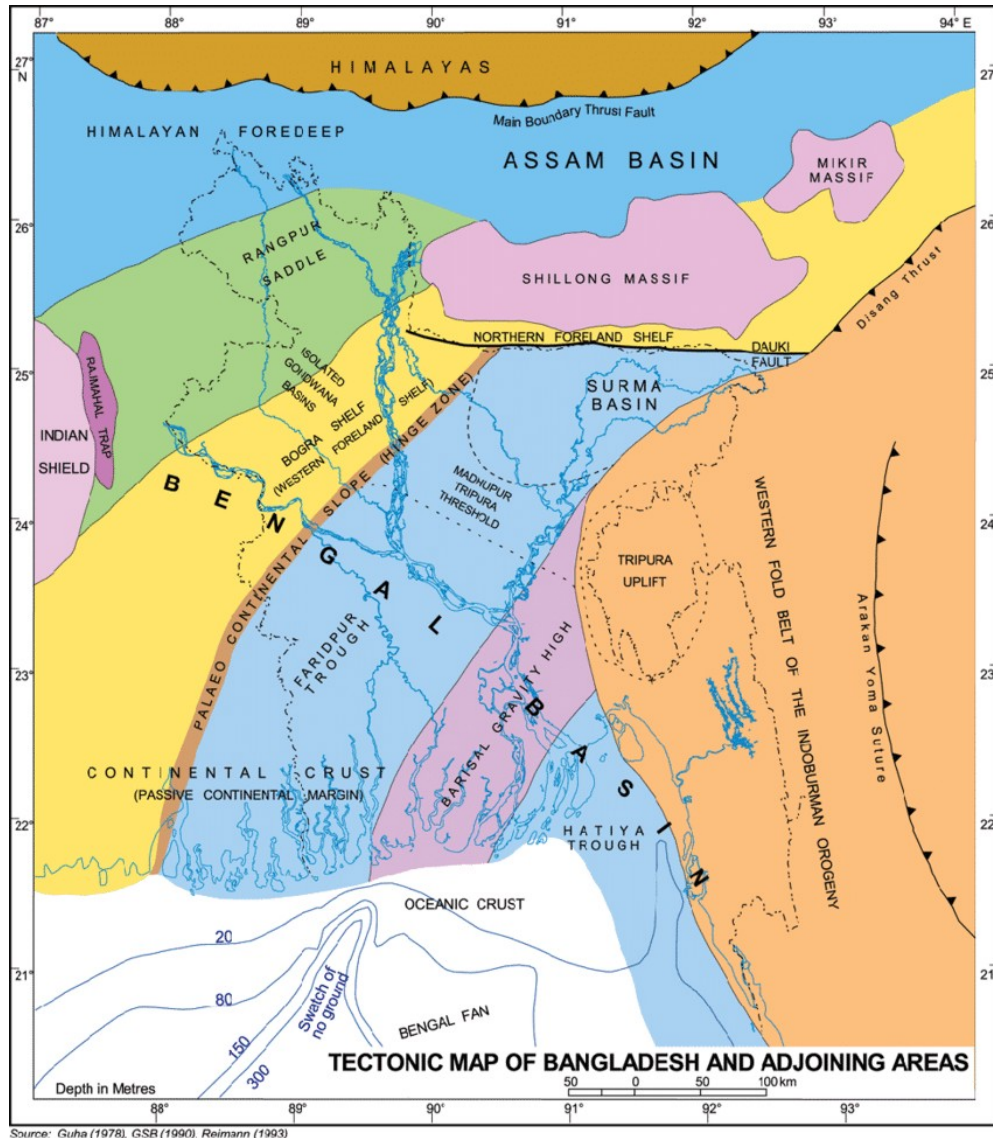


Figure 3 – Tectonic Map of Bangladesh
Credit: Figure 1 in Alam and Islam, 2009

To understand [Bangladesh's geology](#), start with the tectonic context. Bangladesh lies at the junction of the [Indian Plate](#), the [Eurasian Plate](#) and the [Burma Plate](#). The Indian Plate split off from [Gondwana](#) during the [Triassic](#) and moved northward during the [Cretaceous](#) colliding with the Eurasian Plate in the [Himalayan Orogeny](#) during the [Cenozoic](#).

While not within Bangladesh proper, the [Himalayan Mountains](#) are intimately connected with the country's geology as the source of the Ganges and Brahmaputra rivers and thus the source of all the sediments in the delta formed by those rivers.

Structurally, Bangladesh consist of a stable [craton](#), underlain by crystalline [basement rock](#) of the Indian Plate, a huge [geosyncline](#) and a [hinge zone](#). The deposits of the Ganges-Brahmaputra Delta form a [geosyncline](#) consisting of an approximately 20 km thick sequence of sedimentary rocks. Between the

Ganges-Brahmaputra geosyncline and the stable rocks of the Indian Plate is a geological hinge zone, where the sedimentary layers dip steeply into the geosyncline.

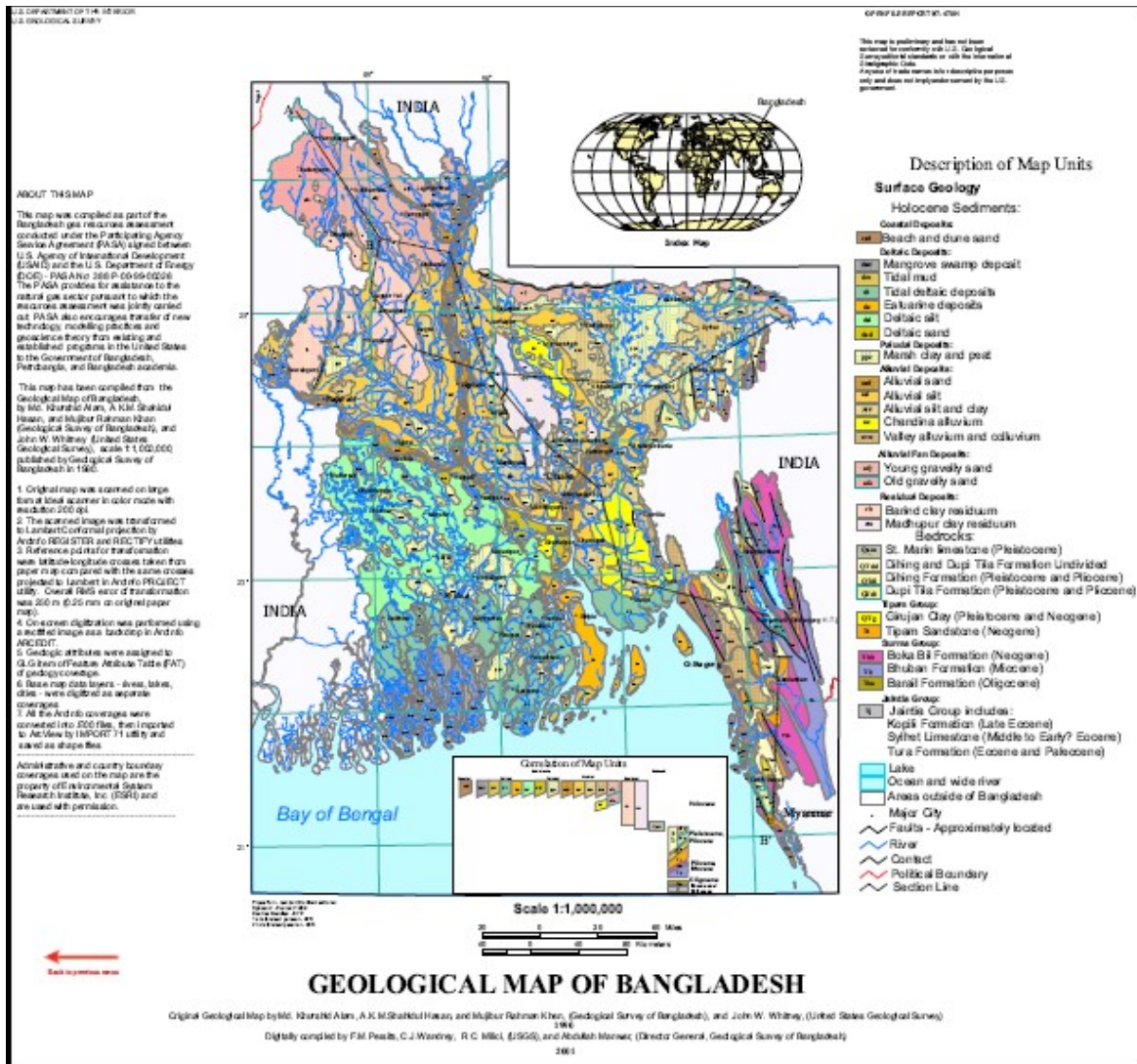


Figure 4 – Geological Map of Bangladesh
Credit: Persits et al, 1997, USGS, public domain

Holocene Deposits

As shown in Figure 3, above (you can download the PDF of the map [here](#) to get a better look), recent Holocene deposits in Bangladesh include:

- Beach and dune sand;
- Mangrove swamp deposit;
- Deltaic sand;
- Deltaic silt;
- Estuarine deposits;
- Tidal mud;
- Marsh clay and peat;

- Alluvial gravel, sand, silt, and clay;
- The [Barind Clay](#) and [Madhupur Clay](#) deposits.

Pleistocene Deposits

[Pleistocene](#) deposits in Bangladesh include the St. Marin [Limestone](#) together with the [Dihing](#) and [Dupi Tila](#) formations.

Neogene Deposits

Both the Dihing and Dupi Tila formations include [Neogene](#) members. The [Girujan Clay](#) also straddles the Pleistocene and Neogene. Other Neogene deposits in Bangladesh include the [Tipam Sandstone](#), the [Bhuban Formation](#), and the [Boka Bil Formation](#)

Paleogene Deposits

[Paleogene](#) aged deposits in Bangladesh include the [Barail Formation](#), the [Kopili Formation](#), [Sylhet Limestone](#), and the [Tura Formation](#).

Mesozoic Deposits

[Mesozoic](#) aged deposits in Bangladesh include:

- The Cretaceous aged Sibganj Formation includes layers of white [kaolinite](#) sandstone, iron-rich [trapwash](#) sandstone, red shale, claystone, clay, tuff, and sedimentary beds fossilized plants.
- The [Jurassic](#) aged [Rajmahal Formation](#) that consists of layers of [hornblende basalt](#), [olivine basalt](#) and [andesite](#) as well as associated [ash beds](#), [tuff](#) and [agglomerate](#) as well as a small one meter thick sedimentary bed which preserve fossilized plants.

Paleozoic Deposits

[Paleozoic](#) deposits in Bangladesh are [Permian](#) and [Carboniferous](#) aged rocks of the [Gondwana Group](#).

These include:

- The late Permian Paharpur Formation which consists of primarily grey, [feldspathic sandstone](#) with some deposits of [kaolin](#); and
- The early Permian Kuchma Formation which is a sequence of sandstone, shaly sandstone, black carbonaceous shale and white sandstone.

Precambrian Basement

The Paleozoic deposits in Bangladesh [unconformably](#) overlie crystalline basement rocks, presumed to be [Precambrian](#) in age. These rocks consist of [gneiss](#), [granite](#), [granodiorite](#) and smaller sequences of [schist](#), [amphibolite](#) and [gabbro](#).

Resources

Agriculture

Almost half the population of Bangladesh is engaged in [food production](#) and around 70% of the land in the country is used for food production. Major crops cultivated include rice, jute, wheat, tea, pulses, oil-seeds, vegetables and fruits. [Poultry](#) farming and [shrimp cultivation](#) are also important in food production.

Most farmers in Bangladesh are engaged in [subsistence farming](#) and, despite their great efforts, much of the population suffers from [food insecurity](#). [Improvements to infrastructure](#) could go a long way to improving the lives of these people.

In addition of food insecurity, the peasant farmers of Bangladesh are also afflicted with [pollution from pesticides](#) and [arsenic contamination in groundwater](#).

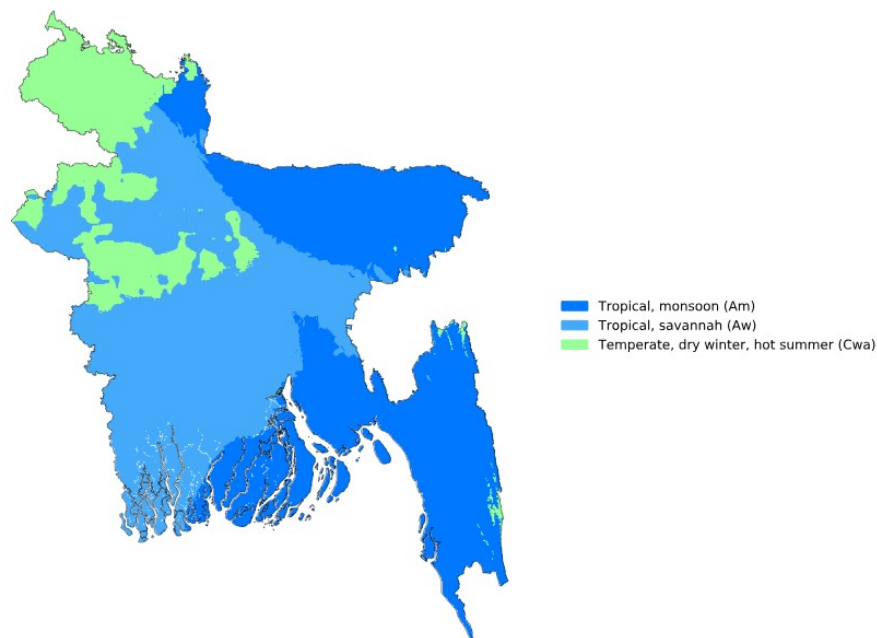
Mineral Resources

According to the [USGS 2019 Minerals Yearbook for Bangladesh](#), the country produced the following in 2018:

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- 1,500,000 tonnes of sea salt;
- 1,077,265 crushed stone;
- 805,695 tonnes of coal;
- 27,233 million cubic metres of natural gas;
- 622,000 tonnes of ammonia fertilizer (made from natural gas);and
- 4,143,000 thousand barrels of crude oil.

Climate

Köppen-Geiger climate classification map for Bangladesh (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 5 – Köppen-Geiger Climate Map of Bangladesh
Credit: Beck et al, 2018, Creative Commons Attribution 4.0 International license

[Bangladesh is hot year round](#) and has a tropical [monsoon-type climate](#). Average temperatures range from 26° C in January to between 33° and 36° C in April. The monsoon months are between June and September when most of the rain falls on the country.

History and Geopolitics



Figure 6 – Bangladesh Landscape

Credit: [Abu Hasan Mehedi](#), [Creative Commons Attribution 2.0 Generic](#) license

Although the Peoples Republic of Bangladesh was only recently founded, in 1971, [the history of the region](#) goes back to earliest times.

[Early humans hunted in the Ganges Delta](#) during the [Paleolithic](#). The forests and mangrove swamps of [Bengal](#) were first exploited by farmers beginning in the first millennium B.C. A succession of [Hindu](#) and [Buddhist](#) kingdoms and empires that [fought for control of the Bengal region](#) from 500 B.C till 500 A.D. Following the arrival of [Islam](#) in the 6th century A.D, and the conquest of Bengal by Muslim adventurers such as [Bakhtiyar Khalji](#), various Muslim polities ruled the country, culminating in the [Bengal Sultanate](#) and the [Mughal Empire](#). The Mughal Empire fell apart in the 17th Century and the [Nawabs of Bengal](#) ruled the country. Following the [Battle of Plassey](#), the [British East India Company](#) took over until Bengal and the rest of the subcontinent, all of which was incorporated into British India, a.k.a. [The Raj](#).

The [British Empire](#) profited greatly from The Raj. For the people of British India, including those of modern Bangladesh, British rule [was a mixed blessing](#). The British built much of the industrial infrastructure of the subcontinent, primarily railways and telecommunications. The British also kept the peace and introduced British jurisprudence. However, many British profits from their colony in Bengal came at the expense of the locals. For example, the previously thriving textile industry of Bengal [driven out of business](#) by imports of inexpensive industrial textiles from Britain. The British Raj was often heartlessly cruel in their maladministration of the country during famines, such as the [1943 Bengal famine](#) and an [earlier famine in 1770](#).

Needless to say, many inhabitants of the Raj were happy to see the British go in 1947. British India was [partitioned](#) between the new Hindu and Muslim states of India and [Pakistan](#), with [East Bengal](#) becoming the [East Pakistan](#) section of the new Muslim state. The partition of India was a [bloody mess](#) and the new state of Pakistan was an unstable collection of [mutually antagonistic ethnic groups](#). The [disputes between](#)

[West and East Pakistan](#) came to head in 1971 when [Bangladeshi independence](#) was declared by [Sheikh Mujibur Rahman](#) – a declaration that led to a nine month [War of Independence](#) marked by numerous [atrocities](#). The decisive step in the war was the intervention by the [Indian Army](#), which led to the defeat of the [Pakistani](#) forces and an independent Bangladesh.

Life in Bangladesh has not been easy since independence in 1971. Famine, natural calamities, and extreme poverty has been the lot of many of its inhabitants. For its rulers: political unrest, and military coups have been common occurrences. The current parliamentary regime, established in 1991, has led to some improvement in living conditions and even a re-establishment of [Bangladesh's ancient textile industry](#).

Geopolitically, Bangladesh is caught between two powerful nations, India and China, both of which are mutually antagonistic. Relations between Myanmar and Bangladesh are also strained.

India is the dominant state on the Indian subcontinent, and relations between the India and Bangladesh have [matured](#) to one that is generally mutually beneficial. Recently, the two nations have come to a [trade agreement](#) on what currency to use in future exchanges ([India wants to leave the use](#) of the United States Dollar in international exchanges). Ongoing issues between the two countries include a [dispute over water use](#), a [dispute over the border between the two countries](#) and [refugee problems](#). India is unlikely to try to directly take over Bangladesh [since the last thing](#) that predominately Hindu India needs is more Muslims. India also has bigger fish to fry, so to speak, in its [ongoing rivalry with China](#), and has an incentive to keep Bangladesh as an ally.

[China's interest in Bangladesh](#) is mostly trade. Consequently, [China has invested in Bangladesh](#) to further its trade ambitions. China may also be seeking geopolitical advantages in the region, but they are playing [a long game](#) in this matter and Bangladesh is just another bit player. For Bangladesh, however, Chinese investment brings up the problem of potential “[debt colonialism](#)” where failure to repay loans leads to overt Chinese takeover of the assets that were built with money borrowed from China. India may be none too happy with increasing Chinese influence in Bangladesh, and trouble could follow.

Compounding the problems of a poor country, Bangladesh has been the recipient of [Rohingya refugees](#) fleeing persecution in Myanmar. Persecution is perhaps too mild a term for the [bloody atrocities](#) perpetuated by the Burmese upon the Rohingya inhabitants of Myanmar. For Bangladesh, the problem is what to do with the people, some 655,500 since 25 August 2017, fleeing to their country. Remember Bangladesh is already a densely populated country and more people is bound to cause more problems. Much of the [world's reaction](#) to the Rohingya refugees problem has been fine words with [minimal real help](#). Meanwhile, people in Bangladesh are [taking out their own frustrations](#) on the refugees. It is hard to see a happy ending to this.

Winding it Up

That sort of winds up our short look at the unhappy country of Bangladesh. If any of this interests you, follow up on the links provided.

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.