

May 15, 2023

News and notes

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

Research

- General science, comment: [Professor says 'junk citations' have created 'distrust' in academic research](#).
- Geophysics, global ocean cycle modelling: [Widespread global disparities between modelled and observed mid-depth ocean currents](#); Phys.org summary [here](#).
- More oceanography: [Climate: modelling micro-algae to better understand the workings of the ocean](#).
- More geophysics: [Semi-Brittle Deformation of Talc at the Base of the Seismogenic Zone](#); Phys.org summary [here](#).
- Geological history: [Reconstructing Holocene fire records using dune footslope deposits at the Cooloola Sand Mass, Australia](#); Phys.org summary [here](#).
- [Primordial helium extracted from the Earth's core through magnesium oxide exsolution](#); Phys.org summary [here](#).
- Sedimentology: [Evolution of the crustal phosphorus reservoir](#); Phys.org summary [here](#).
- Diagenesis and sedimentology: [Two modes of gypsum replacement by carbonate and native sulfur in the Lorca Basin, SE Spain](#).
- Plate tectonics: [Supercritical fluid in deep subduction zones as revealed by multiphase fluid inclusions in an ultrahigh-pressure metamorphic vein](#).
- Coastal geology: [Using salt marshes for coastal protection: Effective but hard to get where needed most](#); Eureka Alert summary [here](#).
- Petrology: [The source of tungsten-associated magmas in the northern Canadian Cordillera and implications for the basement](#).

Paleontology

- [The curious case of Central Park's dinosaurs: The destruction of Benjamin Waterhouse Hawkins' Paleozoic Museum revisited](#); Phys.org summary [here](#).
- [Spatial distributions of *Tribrachidium*, *Rugoconites*, and *Obamus* from the Ediacara Member \(Rawnsley Quartzite\), South Australia](#); behind a paywall, Phys.org summary [here](#).
- Fernie, British Columbia: [The "Fossil Truck Tire"](#).

- [*Kekveus brevisulcatus* sp. nov., a new featherwing beetle from mid-Cretaceous amber of northern Myanmar \(Coleoptera: Ptiliidae\).](#)

Glaciers and Climate Change

- Antarctica: [Melt rates in the kilometer-size grounding zone of Petermann Glacier, Greenland, before and during a retreat.](#)
- Glacial rebound: [Probabilistic projections and past trends of sea level rise in Finland;](#) Phys.org summary [here](#).
- [Indian Ocean salinity build-up primes deglacial ocean circulation recovery;](#) behind a paywall, Phys.org summary [here](#).
- [Arctic mercury flux increased through the Last Glacial Termination with a warming climate;](#) behind a paywall, Phys.org summary [here](#).
- Climate history: [Carbon isotope fractionation by an ancestral rubisco suggests that biological proxies for CO₂ through geologic time should be reevaluated.](#)
- Sorcerer's apprentice: [How Shocking the Ocean Could Turn It Into a Carbon Removal Powerhouse.](#)

Environmental Geology and Hydrogeology

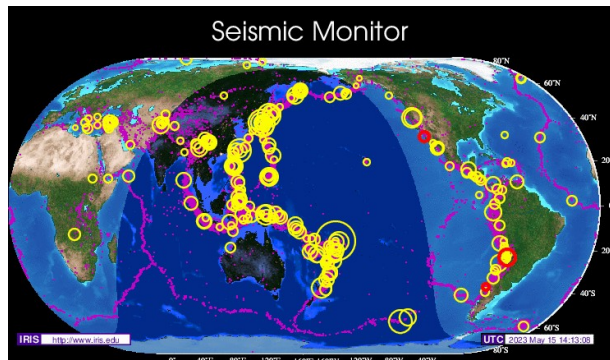
- Remediation news: [All Oil Recovered from Creek after December's Keystone Pipeline Leak.](#)
- Polycyclic aromatic hydrocarbon (PAH) remediation: [Phenanthrene sorption studies on coffee waste and diatomaceous earth-based adsorbents, and adsorbent regeneration with cold atmospheric plasma.](#)
- Characterization techniques: [Benthic foraminifera as bioindicators for the heavy metals in the severely polluted Hurghada Bay, Red Sea coast, Egypt.](#)
- [Microplastics: we've found startling quantities in the ice algae that are essential for all Arctic marine life.](#)
- [Long-term effects of land-use change on water resources in urbanizing watersheds;](#) Phys.org summary [here](#).
- [A 350,000-year history of groundwater recharge in the southern Great Basin, USA;](#) Phys.org summary [here](#).
- Groundwater flow: [Measurement of In-Situ Flow Rate in Borehole by Heat Pulse Flowmeter: Field-Case Study and Reflection.](#)

Energy and Mining

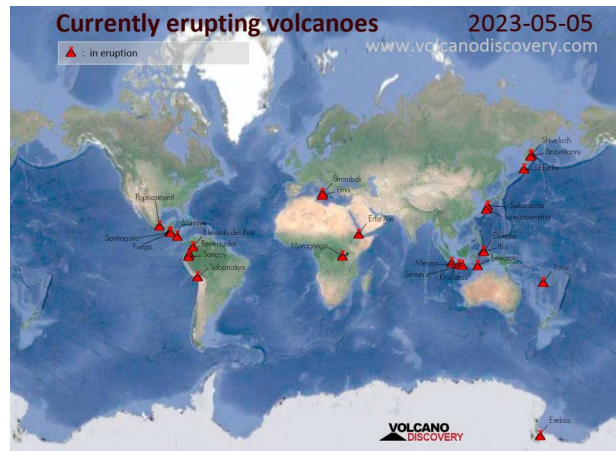
- Exploration activity: [US Weekly Natgas Rig Count Falls by Most Since 2016 – Baker Hughes.](#)
- Go woke, go broke: [An Oil Production Phaseout Would Cost Canada \\$74 Billion.](#)

- Geology of an ore deposit: [Stratiform Host-Rock Replacement via Self-Sustaining Reactions in a Clastic-Dominated \(CD-type\) Zn Deposit.](#)
- [What Canada's new Modern Slavery Act means for miners.](#)
- More ore deposit geology: [Using association rules analysis to determine favorable mineralization sites in the Jiaojia gold belt, Jiaodong Peninsula, East China.](#)

Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

- [Early Evolution of the Stratospheric Aerosol Plume Following the 2022 Hunga Tonga-Hunga Ha'apai Eruption: Lidar Observations From Reunion \(21°S, 55°E\).](#)
- From the United States Geological Survey (USGS): [Volcano Watch – Explosive Eruptions from Halema'uma'u in 1924.](#)
- Volcano research: [Eruption style transition during the 2017–2018 eruptive activity at the Shinmoedake volcano, Kirishima, Japan: surface phenomena and eruptive products.](#)
- More volcano research: [Multi-parametric observations of intermittent hydrothermal water discharge in West Crater of Iwo-Yama volcano, Kirishima Volcanic Complex, Japan.](#)
- Volcanoes and earthquakes: [Modelling the seismic response of the Mýtina maar volcanic structure.](#)
- More volcanoes and earthquakes: [Deep Long-Period Earthquakes at Akutan Volcano From 2005 to 2017 Better Track Magma Influxes Compared to Volcano-Tectonic Earthquakes.](#)
- Earthquake research: [Predicted results of the velocity structure at the target site of the blind prediction exercise from microtremors and surface wave method as Step-1, Report for the experiments for the 6th international symposium on effects of surface geology on seismic motion.](#)
- [Regression analysis and variable selection to determine the key subduction-zone parameters that determine the maximum earthquake magnitude.](#)

May 15, 2023

Geology and the Fate of Societies – The Lesser Antilles

As I mentioned in a [previous posting](#), sometimes it's more convenient to talk about a group of states rather than single, small countries. This is the case with the [Lesser Antilles](#), which we'll look at this week.



Figure 1 – Location of the Lesser Antilles
Credit: [M.Minderhoud](#), public domain

The Lesser Antilles are a group of islands in the [Caribbean Sea](#) north of [South America](#) and southeast of the islands of the [Greater Antilles](#) (mainly [Cuba](#), [Hispaniola](#), [Puerto Rico](#), [Jamaica](#), and [the Cayman Islands](#)). The many islands of the Lesser Antilles are typically divided into four main groups, as follows.

1. The [Leeward Islands](#) consisting of:
 - [Anguilla](#) (UK)
 - [Saint Martin](#) (Fr.) / [Sint Maarten](#) (Neth.)
 - [Saint Barthélemy](#) (Fr.)
 - [Saba](#) (Neth.)
 - [Sint Eustatius](#) (Neth.)
 - [Saint Kitts](#) (St. Kitts and Nevis)
 - [Nevis](#) (St. Kitts and Nevis)

- [Barbuda](#) (Antigua and Barbuda)
- [Antigua](#) (Antigua and Barbuda)
 - [Redonda](#) (Antigua and Barbuda) uninhabited
- [Montserrat](#) (UK)
- [Basse-Terre](#) and [Grande-Terre](#) (often combined as [Guadeloupe](#) Fr.)
 - [La Désirade](#) (Guadeloupe dependency) (Fr.)
 - [Marie-Galante](#) (Guadeloupe dependency) (Fr.)
 - [Îles des Saintes](#) archipelago (Guadeloupe dependency) (Fr.)

2. The [Windward Islands](#), which consist of:

- [Dominica](#) (Commonwealth)
- [Martinique](#) (Fr.)
- [Saint Lucia](#) (St. Lucia)
- [Saint Vincent](#) (St. Vincent and the Grenadines)
- [Grenadines](#) (St. Vincent and the Grenadines)
- [Carriacou and Petite Martinique](#) (Grenada)
- [Grenada](#) (Grenada)

3. The [Leeward Antilles](#), which are islands north of the Venezuelan coast consisting of:

- [Aruba](#) (Neth.)
- [Curaçao](#) (Neth.)
- [Bonaire](#) (Neth.)
- [Federal Dependencies of Venezuela](#) (Ven.)
 - [Los Monjes Archipelago](#)
 - [La Tortuga Island](#)
 - [La Sola Island](#)
 - [Los Testigos Islands](#)
 - [Los Frailes Islands](#)
 - [Patos Island](#)
 - [Los Roques Archipelago](#)
 - [La Blanquilla Island](#)
 - [Los Hermanos Archipelago](#)
 - [La Orchila](#) Island
 - [Las Aves Archipelago](#)
 - [Aves Island](#)
- [Nueva Esparta](#) (Ven.)

- [Margarita Island](#)
- [Coche](#)
- [Cubagua](#)

4. Plus two isolated islands in the Lesser Antilles

- [Barbados](#)
- [Trinidad and Tobago](#)

Census data from 2005 indicates a population of about 4 million people on all the islands of the Lesser Antilles. Languages spoken include: Dutch, English, French and Spanish plus local dialects of each of those major languages.

Geology

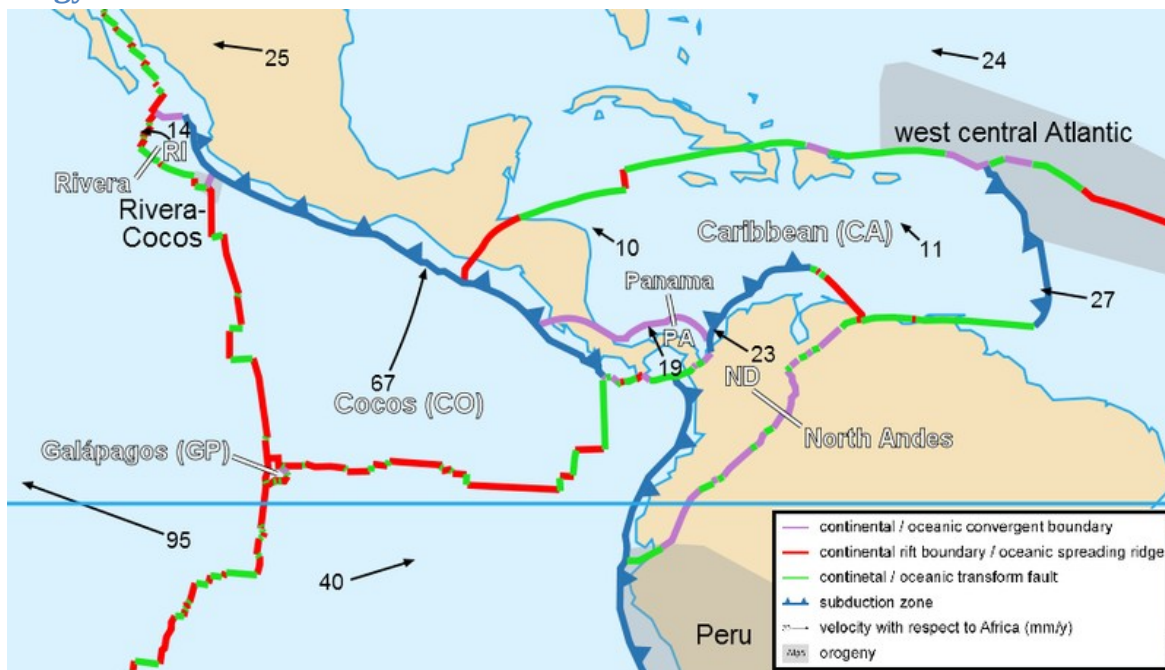


Figure 2 – Caribbean Plate Tectonics

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

The Lesser Antilles lies on the east and south margins of the [Caribbean Plate](#). The east margin is a [subduction zone](#) known as the [Lesser Antilles Subduction Zone](#). The south margin is complex and includes a [transform fault](#), a zone of [seafloor spreading](#) and a subduction zone.

Lesser Antilles Subduction Zone and Volcanic Arc

The [Lesser Antilles Volcanic Arc](#) is formed by the subduction of [oceanic crust](#) under the Caribbean Plate, The oceanic crust is mostly from the [South American Plate](#) but includes parts of [North American Plate](#). There are 21 active volcanoes associated with the Lesser Antilles Volcanic Arc. According to [volcanodiscovery.com](#), while there are no currently erupting volcanoes in the Lesser Antilles Volcanic Arc, the [Soufrière de Guadeloupe volcano](#) and the [Pelée volcano](#) are both showing signs of unrest.

The volcanoes of the Lesser Antilles Volcanic Arc are on the following islands:

- [Dominica](#)
- [Grenada](#)
- [Guadeloupe](#)
- [Martinique](#)
- [Montserrat](#)
- [Saint Kitts and Nevis](#)
- [Saint Lucia](#)
- [Saint Vincent and the Grenadines](#)

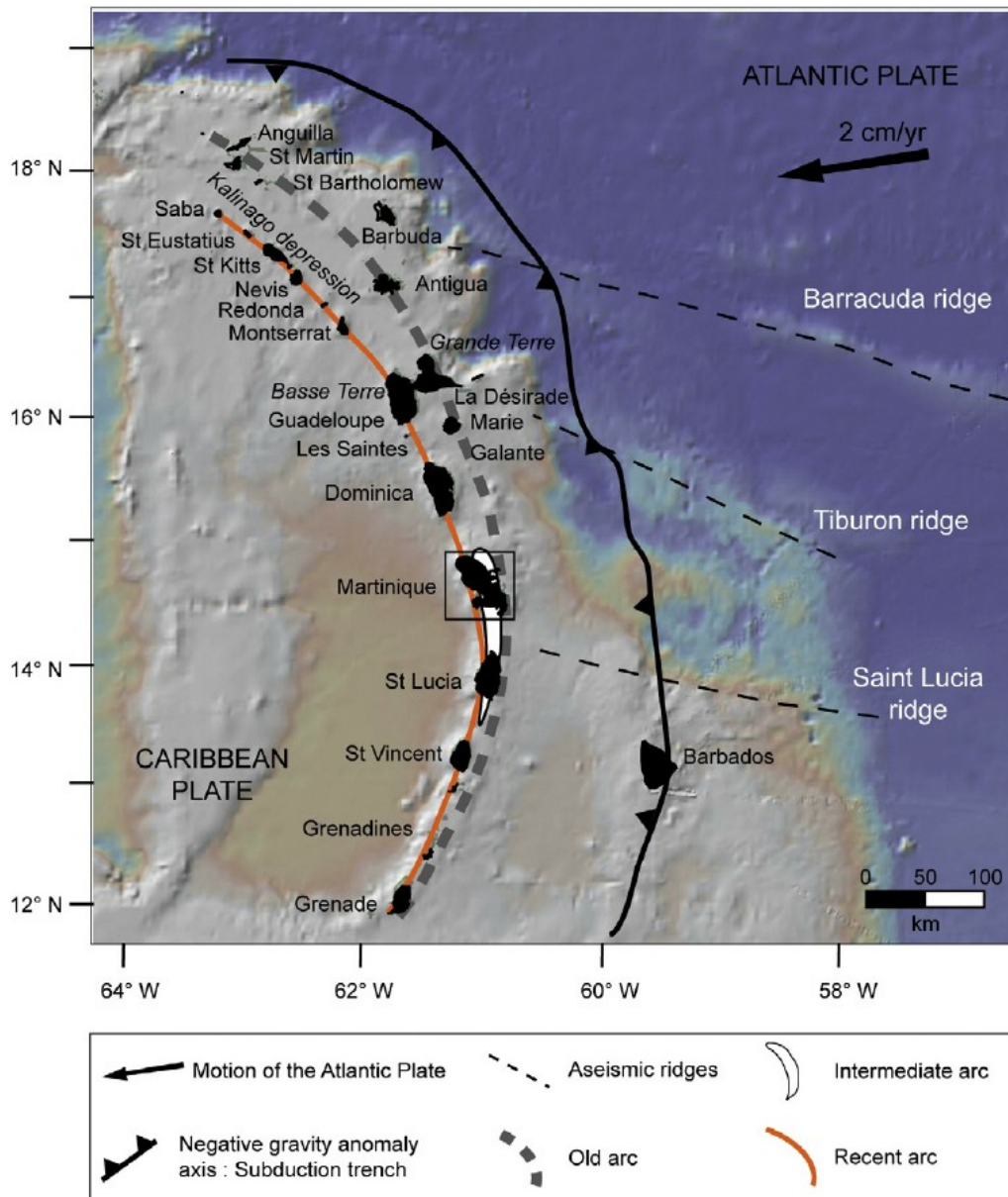


Figure 3 – Geodynamic Setting of the Lesser Antilles Volcanic Arc

[Credit: Figure 1 in Germa et al 2012](#)

Southern Boundary

The interaction between the Caribbean Plate and the South American Plate has created the Leeward Antilles as well as Barbados, Trinidad and Tobago. The [complex history of the interaction](#), with a transform fault, [thrust faulting](#), a zone of seafloor spreading and some subduction, seems to have created an ideal situation for petroleum deposits. In addition to the [Venezuelan deposits](#), [Trinidad and Tobago](#) are also noted for their petroleum deposits.

Resources

Agricultural Resources

The rich volcanic soil of the [Lesser Antilles](#) is conducive to a wide range of tropical crops such as bananas, coffee and sugar cane as well as citrus and tropical fruits. There is also stock rearing for beef, goats and sheep as well as some cereal cultivation. Grenada has also become known for [spice production](#). The biggest problem on the islands of the Lesser Antilles is that the islands are small and arable land is limited. As well, the production of cash crops for export, such as sugar cane and bananas, often lead to the islands being dependent on imported food. This was especially the case [in the past](#), when almost all of the arable land was devoted to sugar production, with most of the food for the enslaved workers being imported in the [notorious triangle trade](#).

Mineral Resources

The natural gas and petroleum deposits of [Trinidad and Tobago](#) are the major mineral resource in the Lesser Antilles. [Oil production in 2022](#) was 67,000 barrels/day and [natural gas production](#) was 2 billion cubic feet/day. [Aruba](#) and [Curaçao](#) are both major oil refining centres.

In addition to the oil and gas, there are [gold and precious metals occurrences](#) in the Lesser Antilles.

Climate

The [Lesser Antilles have a humid tropical climate](#) with rainfall over 2000 mm / year. The warm and pleasant climate makes island a major destination for tourism.

History and Geopolitics

Prior to contact with European explorers, the Lesser Antilles was the home to the [Caribs](#), [Taino](#), and [Arawak](#) peoples. While not peaceful, lives were perhaps better than what happened when the Europeans set up shop.

The main business of the various European powers in the Lesser Antilles after the arrival of [Christopher Columbus](#) in 1492, was the production of [sugar from sugar cane](#). The locals were enslaved for this enterprise, until they died out from overwork. African slaves were then imported and the majority of the inhabitants of the Lesser Antilles [are descended](#) from those slaves. In the 19th century, slavery and the slave trade were [gradually abolished](#) and many of the islands in the Lesser Antilles became independent nations in the second half of the 20th Century.

Another interesting part of the history of the Lesser Antilles was the [history of piracy](#) during the 17th and 18th century. Once the European colonies were established, the volume of trade through the Caribbean made piracy profitable, at least until it was suppressed in the early 19th century.

Geopolitically, the islands of the Lesser Antilles are important primarily for their location, since they sit astride trade routes. The most important commodities that are shipped through this region are petroleum and liquefied natural gas. Anyone wanting to restrict that trade would want to set up shop on one of the islands of the Lesser Antilles. It was fear of such interference that probably lay behind the American invasion of Grenada in 1983.

Another trade route that goes through the Lesser Antilles is the one in illegal drugs. Highly profitable, the trade is often overlooked by officials who get a piece of the action. To be fair, in some case the officials are offered either silver (a bribe to look the other way) or lead (a bullet to the head).



Figure 4 – Pigeon Point Beach, Tobago

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The other geopolitical fact about the islands of the Lesser Antilles is their extreme dependence upon northern countries for revenue from tourism. If air travel ever becomes prohibitively expensive for ordinary people from North America and Europe, the economies of the islands of the Lesser Antilles would crash. I will leave it up to you, dear reader, to imagine the human suffering that such a change would entail. Remember that, in most cases, there is not enough domestic food production in the islands of the Lesser Antilles to feed the local population.

That kind of wraps up this quick look at the Lesser Antilles. Check out the links if 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.