

April 20, 2026

News and notes

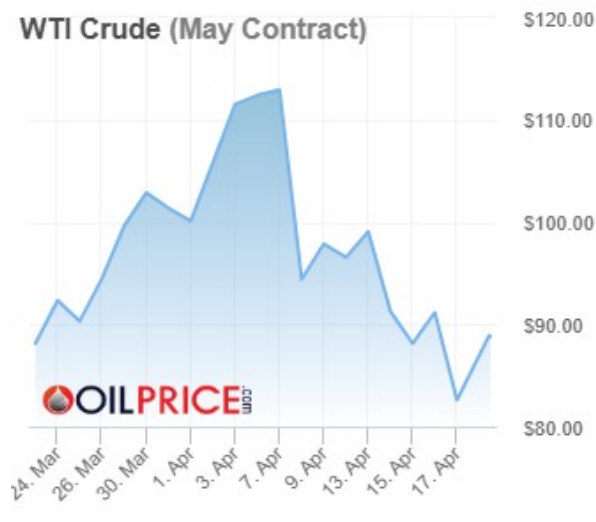
This week, before going on to discuss the geology and mineral resources of Panama, we will first look at some news items I thought were interesting.

If you enjoy my blogs, bookmark the site and check on Mondays rather than relying on social media postings which can get lost in the shuffle. For my news items, I try to stick to open access papers.

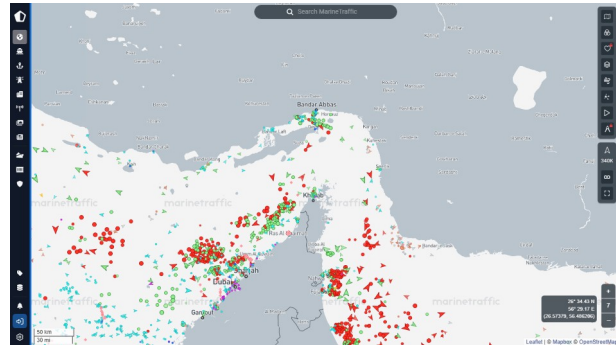
Comments

If anyone has comments on any of my postings, please leave a comment on the LinkedIn page for the posting or email me at raymondreichelt@gmail.com.

Geopolitics



Oil prices up to April 20, 2026
Credit: Oilprice.com



Marine Traffic in Strait of Hormuz April 20
Credit: marinetráfico.com

Iran War

- [Ongoing coverage of the Iran War, AP News.](#)
- [Strait of Hormuz Faces Full Shutdown as Iran Escalates Standoff.](#)
- [Israel, Lebanon agree to ten-day ceasefire, Netanyahu confirms.](#)
- Opinions on the war:
 - [Tim Morgan,](#)
 - [Victor D. Hansen,](#)
 - [William S. Lind,](#)

- [War on the Rocks.com](#),
- [Kurt Cobb](#),
- [Military News.com](#).

Other Geopolitics

- [Bessent urges World Bank to shift funding towards critical minerals](#).
- [Exclusive: Pentagon ramps up planning for possible military ops in Cuba](#).
- [Canada urgently needs a civilian defence strategy – before the next crisis forces one](#).
- [Irish Patriots Are Fighting Back](#), see also the [New Republican Movement](#).
- Related to today's posting: [Panama Canal Shows Cold War Playing Out in Slow Motion](#).

Research and News

- [Determining Magnetic Field Intensity and Direction From the Anisotropy of Magnetic Remanence in Sediments](#).
- Amphibole: [Negative Frictional Healing in Icelandic Geothermal \(IDDP-2\) Core Samples: Potential Implications for Detachment-Fault Mechanics](#).
- [Light calcium isotope anomaly in the Pitcairn mantle plume: a signal of pyroxenite melting](#).
- [Magnesium and iron isotope signatures of Udachnaya-East kimberlites – Insights into the origin of kimberlite magmas](#).
- [Revisiting the greatness of Earth's great oxidation](#).
- [Late Miocene Colorado River arrival in the Bidahochi basin supports spillover origin of Grand Canyon](#); Live Science summary [here](#).
- New mineral: [Tantalaeschynite-\(Ce\), a new Ta- dominant member of aeschynite- group from Ta-enriched pegmatite at Huangshan, South China](#).
- Fluvial geology: [Quantitative analysis of channel characteristics of distributive fluvial systems](#).
- [Late Eocene to Early Oligocene \(36–26 Ma\) Rock Magnetism and Magnetostratigraphy of IODP Site U1553, Southwestern Pacific: Defying the Challenges of Carbonate Dilution and Reductive Diagenesis](#).

Plate Tectonics

- [The tectonic and kinematic evolution of an intra-terrane shear zone – the case of North Purulia Shear Zone and its relation to Rodinia assembly](#).
- [Variable Oceanic Crust Accretion at a Slow-Spreading Ridge: A Vp/Vs Ratio Evidence Across the Southwest Sub-Basin of the South China Sea](#).

- [Spatial and Temporal Evolution of Graben Formation During Rift Linkage Using Quantitative Geomorphology: Insights From Central Afar.](#)
- [Episodic Rifting of a Large Igneous Province Concentrated Along a Microcontinent Boundary.](#)
- [Strain accumulation associated with locked subduction megathrusts revealed by deep-ocean borehole observations.](#)
- [Surface Deformation of the Nanga Parbat Crustal Diapir in the Northwestern Himalaya Imaged With GNSS and InSAR.](#)

Paleontology

- [Quantitative morphological analysis reveals a greater morphological diversity in Cretaceous Helotidae \(Coleoptera, Nitiduloidea\), with description of a new genus and species from mid-Cretaceous Kachin amber.](#)
- [Bicharracosaurus dionidei, gen. et sp. nov., a new macronarian \(Dinosauria, Sauropoda\) from the Late Jurassic Cañadón Calcáreo Formation of Argentina and the problematic early evolution of macronarians; Phys.org summary \[here\]\(#\).](#)
- [A short-snouted ‘sphenosuchian’ with unusual feeding anatomy demonstrates that ecological specialization occurred early in crocodylomorph evolution; Phys.org summary \[here\]\(#\).](#)
- [Body reconstruction and size estimation of plesiosaurs.](#)
- [A new taxon of saurischian dinosaur from the Coelophysis Quarry of New Mexico, USA \(Triassic: latest Norian or Rhaetian\) highlights herrerasaurian diversity in the latest Triassic; ScienceDaily summary \[here\]\(#\).](#)
- [The first Victorian record of Owen’s Giant Echidna *Megalibgwilia owenii* from Buchan Caves in East Gippsland, Australia; summary in \[The Conversation\]\(#\).](#)
- [Stromatolites: A snapshot of an Ediacaran microbialite assemblage from the Byng Formation \(Neoproterozoic Miette Group, Alberta, Canada\).](#)

Ore Deposit Geology

- [Olivine and Fe-isotopes in kimberlites indicate an iron-rich substrate for CLIPPIR and other sub-lithospheric diamonds.](#)
- [Homogeneous He-Ar-S-Pb isotopic compositions of new-type stratiform Cu deposits in the Jianglang Dome, southeastern Songpan-Ganze Orogen.](#)
- [Afghanistan’s mineral resources: a historical review of geological studies and discoveries.](#)
- [Arsenic substitution and galvanic coupling in pyrite trigger uranium mineralization in sandstone.](#)
- [Spatial and Temporal Variations in Scheelite Composition Record Fluid Evolution Pathways in the Yongping Cu-W Skarn Deposit, South China.](#)

Mining and Energy

- [Despite a diplomatic clash, the US is investing in an experimental South African rare earths project.](#)
- [Copper price within sight of all-time high as Chinese smelters hit record activity.](#)
- [Burkina Faso tells Australian miner it wants 40% stake in gold mine after company projects up to 490,000 ounces in 2026.](#)
- [China's Nuclear Power Boom Is Accelerating Faster Than Expected.](#)
- [Federal Government Puts Timeline in Place for Port of Churchill Project for LNG Shipment: Premier Wab Kinew.](#)
- [Corb Lund: Facts dispute industry claims on coal mining.](#)
- [Canadian firm ignored worker complaints over drug cartel-management links at Mexican gold mine, sources say.](#)
- [Soaring tungsten prices add impetus to Vietnam mine sale effort.](#)
- [U.S. natural gas exports to grow nearly 30% by 2027 as LNG facilities ramp up.](#)
- [China's Ministry of Natural Resources has announced an additional 10.7 million metric tons of rare earth oxides, reigniting the "neodymium rush" that will determine how many electric cars and drones the world will be able to produce over the next 20 years.](#)
- [DRC boosts US copper sales fivefold to 500,000 tonnes.](#)
- [Fire Erupts At Major Australian Refinery, Amplifying Fuel Shock As "Green" Killed Refining Buffer; meanwhile: Australia's petrol stations run dry as energy crisis turns existential.](#)

Environmental Geology and Hydrogeology

- [Regional and local controls on groundwater salinity in California's southwestern San Joaquin Valley, United States: Insights from airborne electromagnetic surveys.](#)
- [Thousands suffer nausea, delirium, other health issues from toxins in Tijuana River.](#)
- [Review of Greenland's thermal springs.](#)
- [Enhanced transport with early arrivals and reduced attenuation in ensemble realisations of discrete fracture networks with internal fracture heterogeneity.](#)

Glaciers and Climate Change

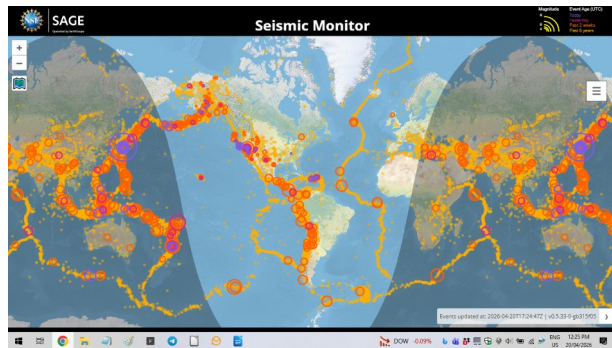
- Lots of recent papers on glaciers in [The Cryosphere](#) from the EGU.
- Glacial Lake Agassiz: [The lost inland sea that dwarfed the Great Lakes and reshaped North America.](#)

- [Valuable minerals under Antarctica’s melting ice could mean a drilling-ban reversal.](#)

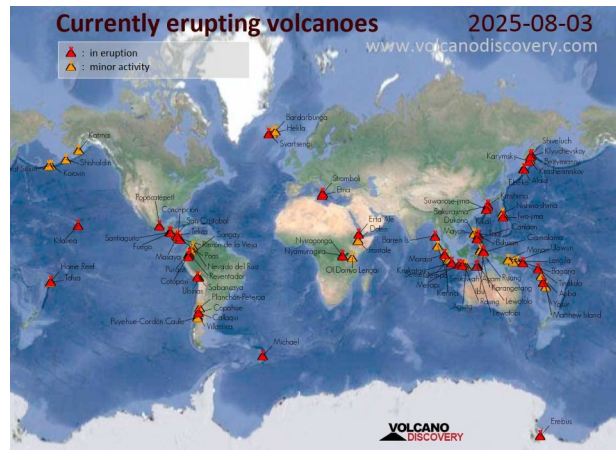
Bad Science

- [The reproducibility crisis in phylogenetic analyses.](#)
- [‘Academic fraud may be the symptom of a much more systemic problem’.](#)

Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



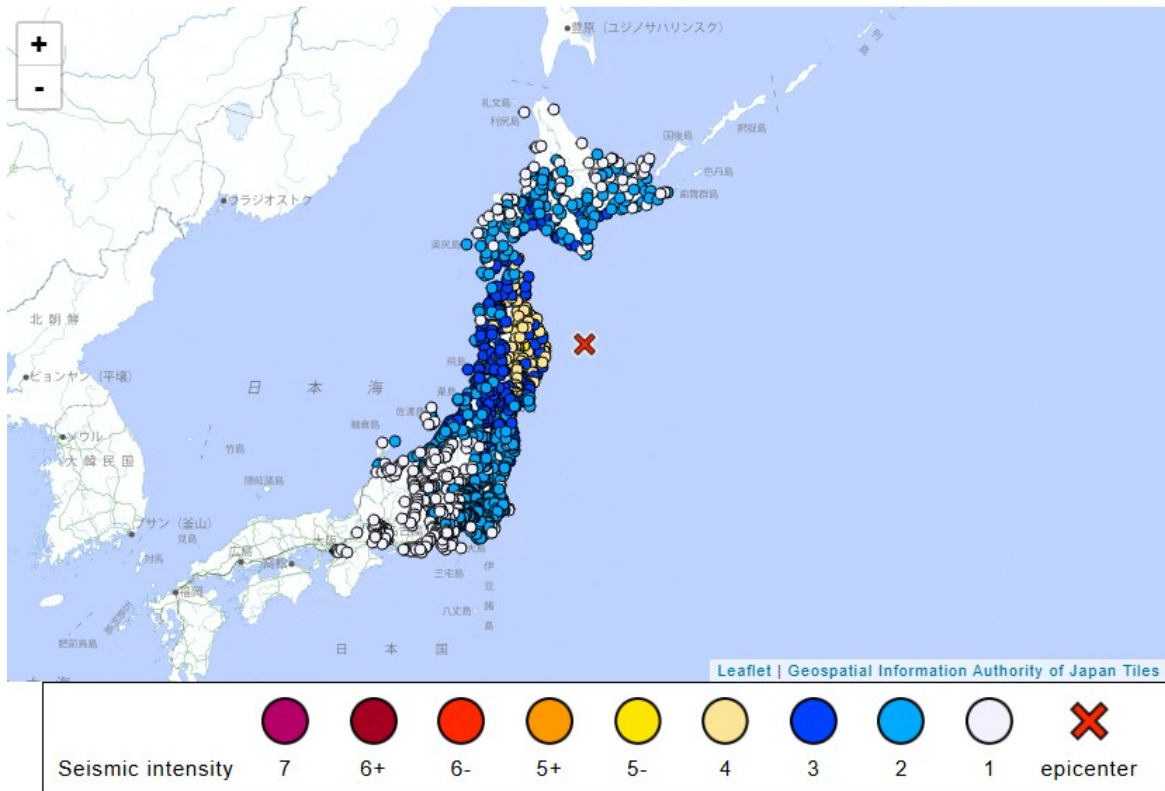
[Active Volcano Map](#)

Volcanoes

- [Smithsonian / USGS Weekly Volcanic Activity Report.](#)
- United States Geological Survey (USGS) Volcano Observatories:
 - Yellowstone Caldera Chronicles: [No longer in the dark: Shining a light on Yellowstone’s hydrothermal explosions.](#)
 - [Cascades Volcano Observatory Weekly Update.](#)
 - Volcano Watch – [Fountains and festivities: Kilauea erupts episode 44 as Merrie Monarch begins.](#)
 - [Mount Rainier Volcanic Hazard Information.](#)
- [March 17, 2026 - Axial Seamount seems to be taking a spring break! The rates of uplift & seismicity are low.](#)
- Predicting explosive volcanic eruptions: [Validating Thermodynamic Models of Arc-Magma Differentiation and Training Neural Networks for Rapid Thermodynamic Property Inference.](#)
- [High-enthalpy Larderello geothermal system, Italy, powered by thousands of cubic kilometres of mid-crustal magma;](#) Phys.org summary [here.](#)

- [Tracking Deep Magma Migration Through Diffuse CO₂ Degassing: Insights From Piton de la Fournaise Volcano \(2013–2023\)](#)

Earthquakes



- [80-Centimetre Tsunami After 7.4-Magnitude Earthquake Hits Northern Japan](#); Japan Meteorological Agency summary [here](#).
- [Rapid Earthquake Magnitude Estimation for Local Early Warning Systems Using Seismogeodesy](#).
- [M5.7 earthquake rattles Nevada](#); USGS summary [here](#).

Geohazards

- [A weakened diurnal weather constraint leads to longer burning hours in North America](#).
- [New and existing settlements built on hillslopes weakened by the 2023 Kahramanmaraş earthquake sequence](#).
- [Characterizing changes in postfire debris-flow hazard as burned areas recover](#).

Free Geology Books and Other Stuff

Free geology books can be downloaded from these sites:

- [OreZone Readers and Experts Telegram Channel](#); the Ore Zone channel also shows employment opportunities for geologists.
- [The Groundwater Project](#) has many groundwater geology books for free download together with free online courses, listed [here](#).
- Free [Groundwater Modeling Courses](#) from the HydroGeoCenter.
- From Western Australia: [Carbonatite, lamprophyre and host rocks in the northern Aileron Province](#).
- The Geology of Indonesia: [Volume 1](#) and [Volume 2](#).
- Brett Davis' book on veins in a deforming rock mass: "[The Veining Bible](#)"; also at [this site](#).
- From the Mineralogical Society of America: [Handbook of Mineralogy](#).
- [Systematic geochemical classification of felsic igneous rocks of the Yilgarn Craton](#).
- From the Arizona Geological Survey: [Geochemistry Diagram Generator v 1.0](#).
- Online app: [Australia's full national topographic library at your fingertips](#).

Upcoming Events

- [May 7-8, 2026, Core Conference 2026, Alberta Energy Regulator, Core Research Centre, 3545 Research Way NW \(University Research Park\) Calgary, Alberta](#)
- [GAC-MAC 2026 St. John's NL, St. John's Convention Center, May 25-28, 2026](#).
- [PEG2026: 11th International Symposium on Granitic Pegmatites; 16th–19th August 2026, in Perth, Western Australia](#).
- [14-18 September 2026, IAH 2026, 53rd Congress of the International Association of Hydrogeologists; Budapest Congress Center](#).
- [September 30 - October 3, 2026 SEG 2026 Conference Salt Lake City, United States](#).
- [Paleoamerican Odyssey 2026, October 14-17, 2026, Santa Fe Convention Center, Santa Fe, New Mexico](#).
- [November 2-3, 2026 CCMEC 2026 Victoria Inn Hotel & Convention Centre, Winnipeg, Manitoba](#).
- [12-20 August 2028, Geosciences for Humanity, 38th International Geological Congress, in the BMO Centre, Calgary](#).
- [Society of Petroleum Engineers Distinguished Lecturer Schedule](#).
- [American Geophysical Union List of Upcoming Meetings](#).
- The Geological Society: [Events & Courses](#).
- [Upcoming Distinguished Geoscience Australia Lectures \(DGALs\)](#).

April 20, 2026

Geology and Mineral Resources – Panama

Introduction



Figure 1 – Panama

Credit: [Mapland](#), [Creative Commons Attribution-Share Alike 3.0 Licence](#)

The [Republic of Panama](#) is a country of [4,404,108 people](#) in [Central America](#). The country has a total area of 74,177.3 square kilometres including the mainland and numerous offshore islands. Land borders include [Costa Rica](#), to the west and [Columbia](#), to the southeast. To the north is the [Caribbean Sea](#) and to the south is the [Pacific Ocean](#); the two are linked by the [Panama Canal](#), a strategic waterway discussed in this [geopolitical news](#) item (also linked above).

Panama is a moderately wealthy country with a per capita [GDP \(PPP\)](#) of \$42,772 and a very high [Human Development Index](#) of 0.839. The economy of Panama is dominated by service industries in: commerce, especially [banking](#); in transportation and shipping, i.e. the [Panama Canal](#); [tourism](#); and general trade. In 2024, [the top exports of Panama](#) were: passenger ships, cargo ships, and other sea vessels; bananas; refined petroleum; and packaged medications. The top destinations were United States, Costa Rica, Netherlands, Denmark, and Thailand. In 2024, the top [imports of Panama](#) were crude petroleum, passenger and cargo ships (for [registration](#) and re-export), refined petroleum, nitrogen heterocyclic compounds, and cars. The top origins were China, United States, Ecuador, Japan, and Colombia.

For more details on the country, check out the [Wikipedia](#) and [Grokopedia](#) articles on the country.

Geology

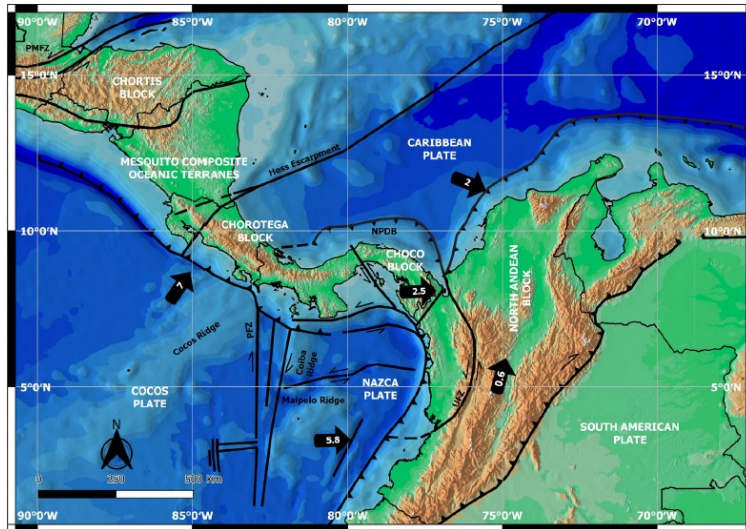


Figure 2 - Tectonic and Geological Context of Panama [Credit: Figure 1 in Redwood, 2020, CC BY-NC-SA 4.0](#)

Tectonically, Panama is located at the junction of [Nazca](#), [Cocos](#), [Caribbean](#) and [South American](#) plates. Within Panama the two major tectonic blocks are the [Chorotega](#) and the [Choco](#) blocks.

The [Panamanian Isthmus](#) is primarily a [volcanic island arc](#) formed by a fairly [complex geological history](#). The major events of [this history](#) include:

- The [convergence](#) between the oceanic [Farallon](#) and Caribbean Plates during [Late Cretaceous-Paleogene](#);
- [Deformation of Panama](#) by extension from the [Eocene](#) to the [Miocene](#); and
- The [Middle Miocene](#) collision of the [Panama-Choco](#) block with the [South America Plate](#).

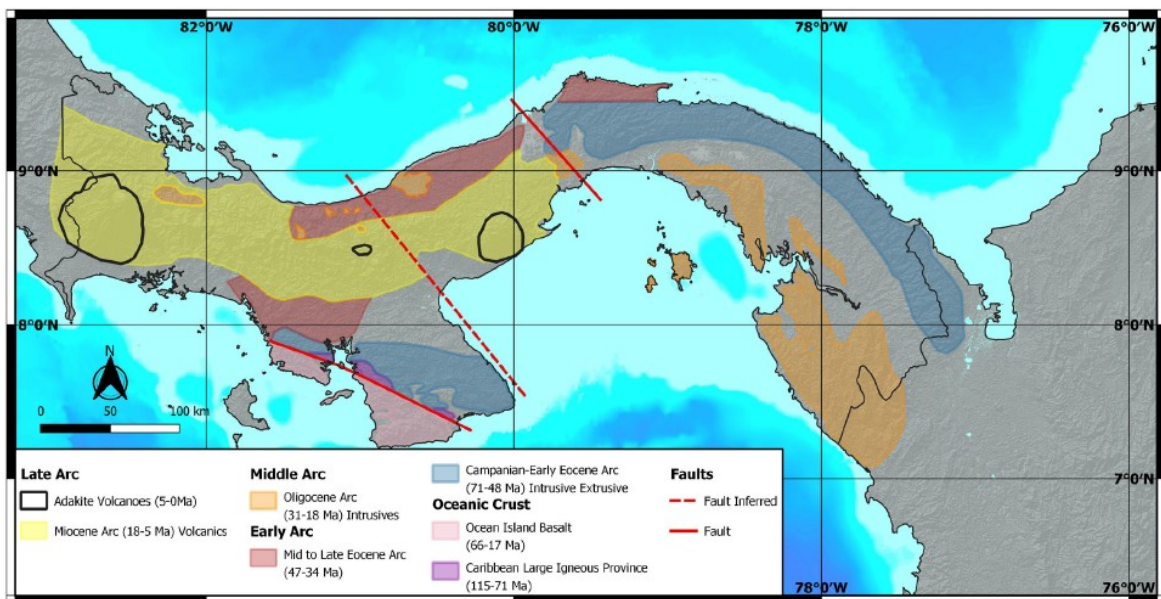


Figure 3 – Ages of Volcanic Rocks in Panama [Credit: Figure 4 in Redwood 2020, CC BY-NC-SA 4.0](#)

The oldest rocks in Panama are those of the [Caribbean Large Igneous Province](#), ranging in age from 115 to 71 million years ago (Mya) ([Aptian](#) to [Maastrichtian](#)). These deposits are primarily [oceanic basalts](#) and also includes copper and gold deposits (more on those below).

Next younger 71 to 48 Mya are the [Campanian](#) to [Early Eocene](#) volcanic arc [intrusive and extrusive deposits](#). These deposits range from [tholeiitic](#) to [calc-alkaline](#) basalts. These volcanic rocks also includes [metallic mineral deposits](#).

Ranging in age from 66 to 17 Mya ([Danian](#) to [Burdigalian](#)) are the [Ocean Island Basalts](#). As you might guess, these are also [oceanic basalts](#).

Island arc deposits in Panama include: the [Early Arc Deposits](#), 47 to 34 Mya ([Middle](#) to [Late Eocene](#)); and the [Oligocene](#) aged [Middle Arc Deposits](#) (31-18 Mya).

The youngest volcanic deposits are the [Miocene](#) aged [Miocene Arc Deposits](#) and the [Adakite Volcanoes](#) (5 - 0 Mya) that began erupting during the [Pliocene](#).

Figure 4 links to an interactive geological map of Panama.

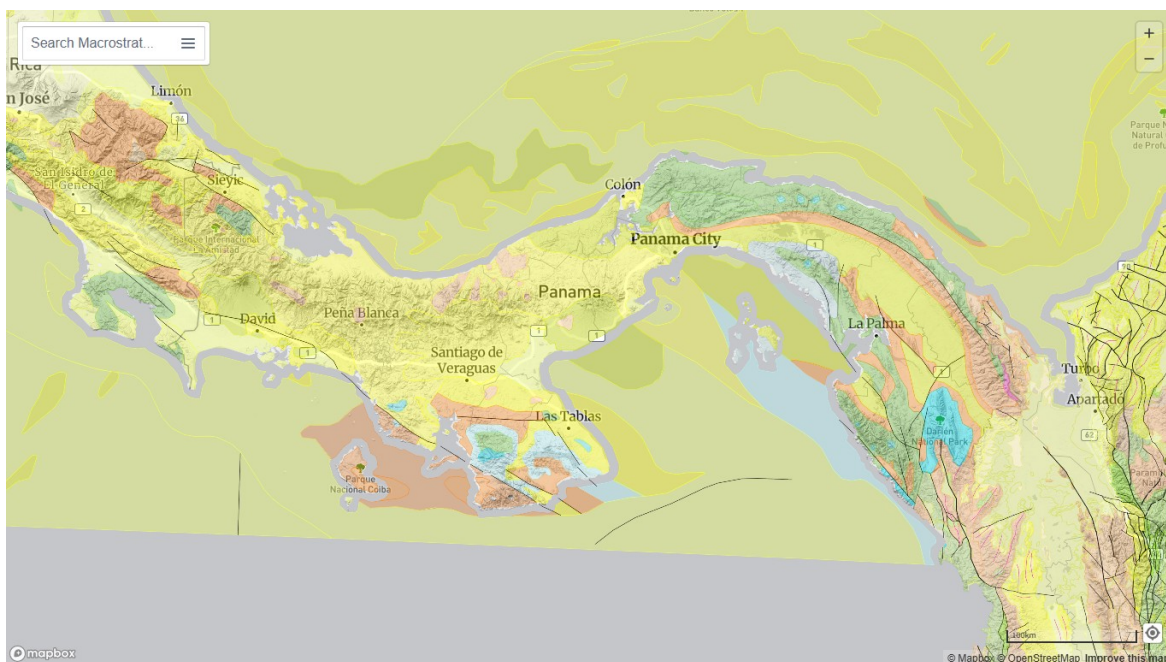


Figure 4 – Interactive Geology Map of Panama
[Credit: Macrostrat, CC-BY-4.0](#)

There are lots of good geology papers on Panama; for further reading start with:

- Fowler, G. D. ,2015, *Geology and Geochemistry of the Western Panamá Canal Basin Volcanic Arc Rocks*, Thesis, http://purl.flvc.org/fsu/fd/FSU_2016SP_Fowler_fsu_0071N_12915
- Redwood, S. D., 2020, *The mineral deposits of Panama: Arc metallogenesis on the trailing edge of the Caribbean large igneous province*, *Boletín de la Sociedad Geológica Mexicana* 72(3):1-69, [DOI:10.18268/BSGM2020v72n3a130220](https://doi.org/10.18268/BSGM2020v72n3a130220). (also in [Research Gate](#))

- Barat, Flore & de Lépinay, Bernard & Marc, Sosson & Müller, C., 2012, *Geologic Evolution of the eastern Panama Isthmus from biostratigraphic, tectonic and geophysical data*, [Research Gate](#).
- Montes, Camilo & Bayona, Germán & Cardona, Agustin & Buchs, David & Silva, C. & Polanco, Sara & Hoyos, Natalia & Ramirez, Diego & Jaramillo, Carlos & Valencia, Victor, 2012. *Arc-Continent Collision and Orocline Formation: Closing of the Central American Seaway*. *Journal of Geophysical Research (Solid Earth)*. 117. 4105-. 10.1029/2011JB008959, <https://doi.org/10.1029/2011JB008959>

Paleontology

With all the volcanic rocks in Panama, you might not expect to find fossils. However, some [31 formations in Panama](#), ranging in age from the [Eocene](#) to the [Holocene](#) have yielded fossils. Here are a few examples.

Nodipecten



Figure 5 – *Nodipecten* sp.
Credit: [Randolph Femmer](#), public domain

Found in the Oligocene [Panama Formation](#), *Nodipecten clydonus* was a [sea scallop](#). The fossils were found in [tuffaceous](#) sediments -conglomerates, sandstones, and shales made up of [volcanic tuff](#) – and [described](#) by [W. P. Woodring](#) in 1982.

Paratoceras



Figure 6 - *Paratoceras*
Credit: [karkemish00-d5b9mtm](#), in [Dinopedia](#), CC-BY-SA

Paratoceras tedfordi

[*Paratoceras*](#) was a genus of [Artiodactyla](#), of the family [Protoceratidae](#), that lived in North and Central America during the [Early](#) to [Middle Miocene](#), 20.4 to 10.3 Mya. [Paratoceras](#) resembled deer, but were probably more closely related to [chevrotains](#), so-called “[mouse deer](#)”. They had three horns, two on the top of the head and a third horn on the snout. In Panama, [Paratoceras coatesi](#) was [found](#) in the [Cucaracha Formation](#).

Purussaurus

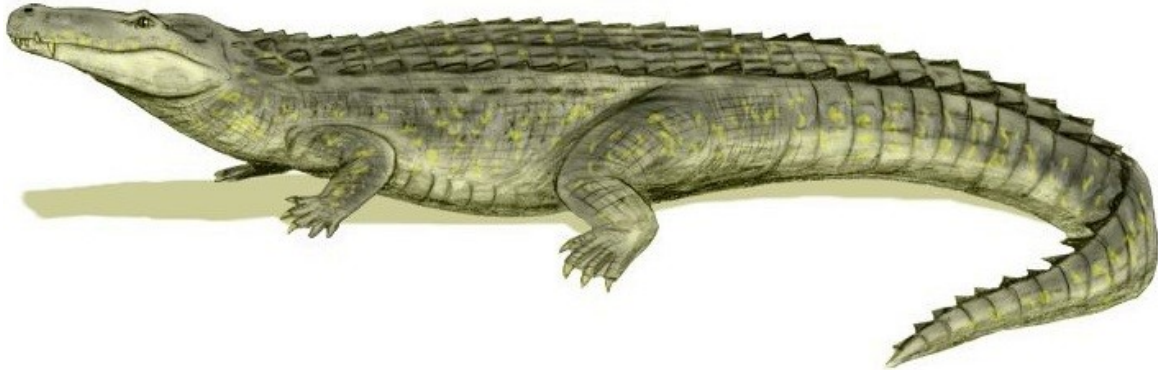


Figure 7 - *Purussaurus*

Credit: Nobu Tamura, [Creative Commons Attribution 3.0 Unported](#) license

[Purussaurus](#) was a genus of giant caimans that lived in the Americas during the Miocene. Specimens of [Purussaurus](#) have been found in [Argentina, Brazil, Panama, and Venezuela](#). In Panama, [Purussaurus](#) were found in the [Culebra Formation](#).

Equids: Cormohipparion and Dinohippus



Figure 8 - *Cormohipparion*

Credit: [Bernor et al, 2018, Creative Commons Attribution-Share Alike 4.0 International](#) license

The [Late Miocene Alajuela Formation](#) of central Panama has yielded two examples of extinct horses: [Cormohipparion](#) and [Dinohippus](#). Both genera were widespread in North and Central America.



Figure 9 – *Dinohippus*

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

Pyruclia sp.



Figure 10 – *Pyruclia sp.*

Credit: [Shellnut, Creative Commons](#)

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Who says that geologists have no sense of humour. In 2016, Bernard Landau, Richard E. Petit, and Carlos M. Da Silva published [a paper in the Journal of Paleontology](#) describing various [gastropod](#) fossils from the Miocene ([Serravallian-Tortonian](#)) aged [Gatun Formation](#) in Panama. Among the many snail fossils they found were two species of the genus *Pyruclia*, one they named *P. tweedledee* and the other they named *P. tweedledum* after [two characters](#) in [Lewis Carol's](#) book [Through the Looking-Glass, and What Alice Found There](#).

Marsupina sp.



Figure 11 - *Marsupina bufo*

Credit: [Shellnut, Creative Commons](#)

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[Fossils of two gastropod species](#) of the genus *Marsupina*, *M. bufo* and *M. nana* have been found in the tuffaceous shales of the Pliocene aged [Charco Azul Formation](#). Also called the [chestnut frog shell](#), *M. bufo* was first identified by [Jean Guillaume Bruguière](#) in 1792, the snail lives today throughout the Gulf of Mexico, the Caribbean Sea and the Lesser Antilles; in the Atlantic Ocean from North Carolina to Northern Brazil. The smaller *M. nana*, also called the dwarf frog shell, was first identified in 1829 by [William Broderip](#) and [George Brettingham Sowerby](#), and is currently confined to the Pacific coast from the [Mar de Cortes](#) to Peru. The presence of both species in the Charco Azul Formation points to a time when the Isthmus of Panama was being formed, as discussed in [this paper](#).

Mineral Resources



Figure 12 - Protests in Panama in 2023. Sign indicating that "Mining is Death"
Credit: AnyGang, [Creative Commons CC0 1.0 Universal Public Domain Dedication](#)

The mineral industry in Panama [has its challenges](#). In [2023](#) there were serious protests that lead to the closure of the [Cobre Panamá mine](#), which was once the largest [copper mine in the region](#) and the only copper mine in Panama. Recently, the owners of Cobre Panamá have been allowed to [remove stockpiled copper ore from the site](#). Silver and gold were also formerly produced at the Cobre Panamá mine

In other mineral production, the [USGS Minerals Yearbook for Central America](#) indicates that Panama's mineral industry produces cement at two cement plants. The most recent statistics from the USGS for mineral production in Panama can be found [here](#).

Figure 13 links to an interactive mineral occurrence map of Panama from [Mindat.org](#).

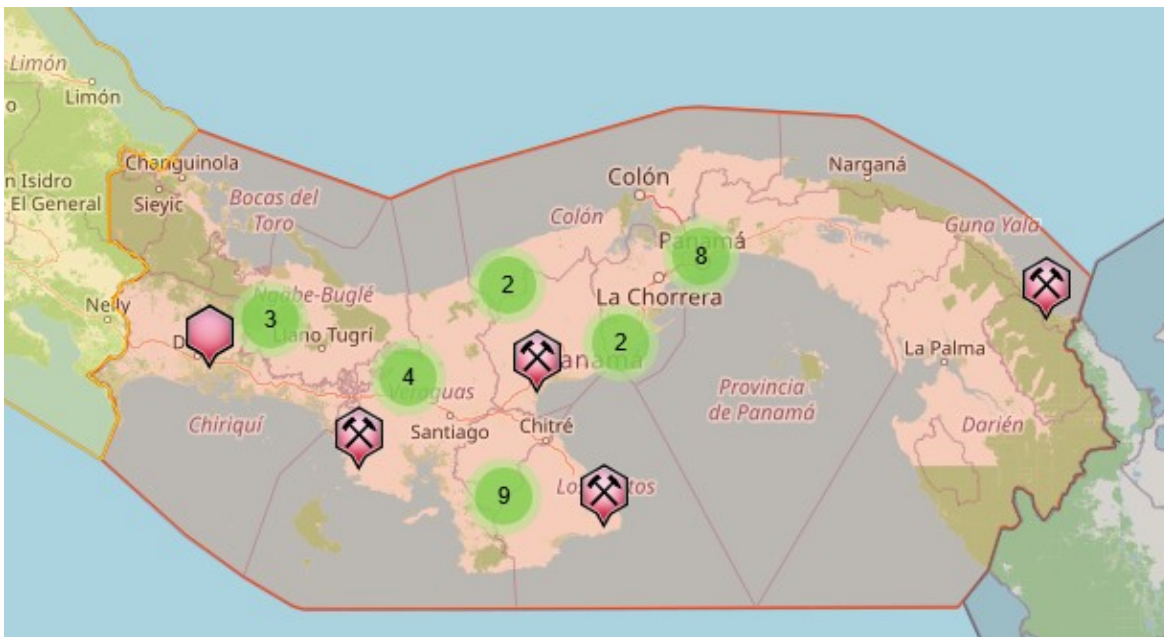


Figure 13 – Interactive Mineral Deposit Map of Panama
Credit: [Mindat.org](#)

Summary



Figure 14 - Gatun Locks of the Panama Canal

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

Panama does not look to be a promising place for mineral exploration. While the [geology is favourable](#) for copper/gold/silver deposits, like the [Cobre Panamá mine](#), the politics are not favourable. The protests against mining were part of a general wave of [dissatisfaction with the government](#) and until [these issues](#) have been resolved, Panama is unlikely to be a good place for mineral exploration. There maybe upcoming opportunities for offshore petroleum exploration, as [recent announcements indicate](#), so that may be worth keeping in mind. However, as with other countries in Latin America, Panama retains its [Latin American pattern of governance](#), for good or for ill. So be warned if you plan to work there.

Standard Caveat

[J. Robert Oppenheimer on freedom and scientific inquiry](#)

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.