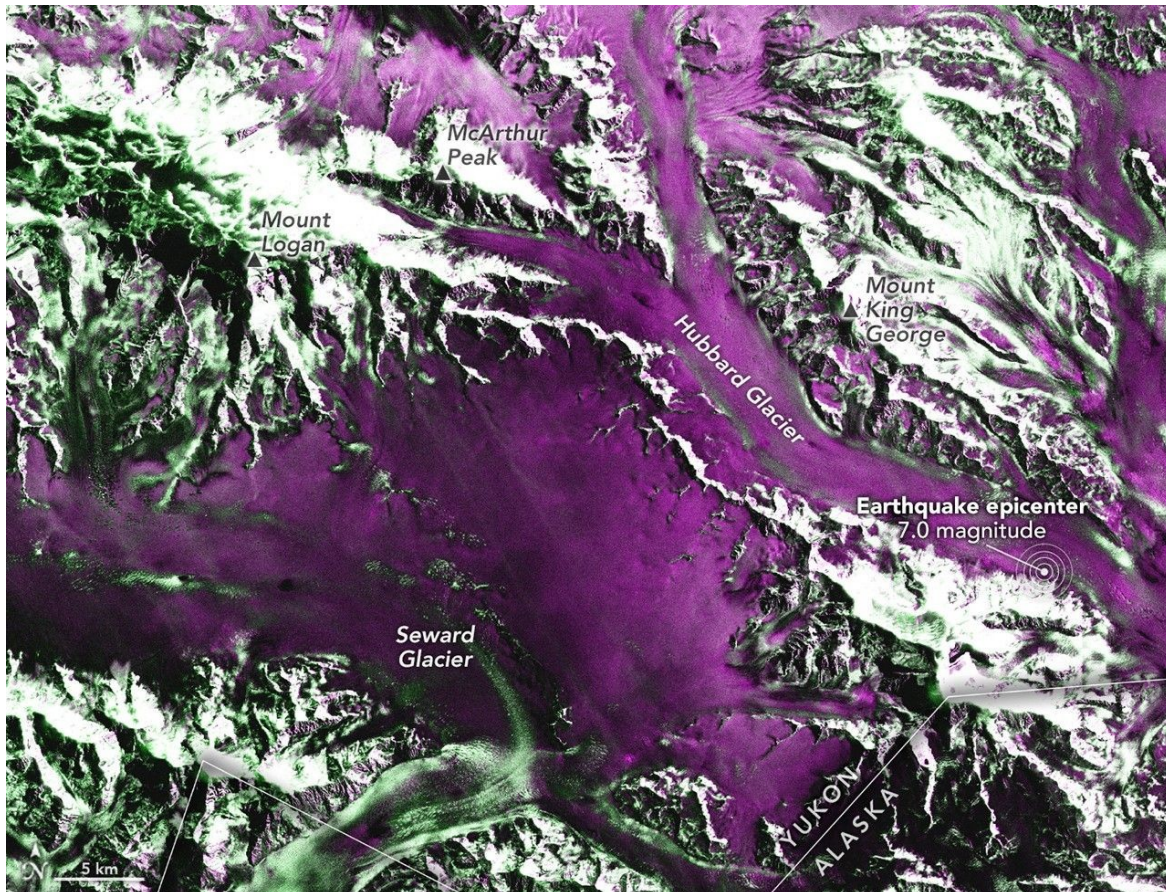


March 2, 2026

## News and notes



**Landslide and Avalanche Debris Litter Hubbard Glacier**

**Credit: [NASA Earth Observatory](#), public domain**

This week, before going on to discuss the geology and mineral resources of Nicaragua, we will first look at some news items I thought were interesting. The picture above is the [Image of the Day for February 25, 2026](#) from the [NASA Earth Observatory](#). “Satellite-based radar images show where a powerful earthquake in the Yukon, Canada, sent rock, snow, and ice spilling across the frozen landscapes of the St. Elias Mountains”.

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](mailto:raymondreichelt@gmail.com).

## Geopolitics

- Wars

- [U.S., Israel attack Iran: Canada supports U.S. action. Live updates here.](#)
- [Pakistan defence minister says country in 'open war' with Afghanistan after strikes.](#)
- Ukraine war: [Russia Faces Five Geostrategic Challenges As The Special Operation Enters Its Fifth Year.](#)
- Oil and Geopolitics:
  - [Oil prices jump after ships attacked near Strait of Hormuz.](#)
  - [How America's Action in Venezuela Guaranteed Guyana's Oil Future.](#)
  - [Russia Shipped 80% of its 2025 Oil Exports to China and India.](#)
  - ["Breakneck Production Growth": Exxon Leverages Guyana Boom In Global Oil Talks.](#)
  - [Supertanker Rates Hit Six-Year High: Here's What Driving It.](#)

## Research and News

- [March/April 2026 Edition of GSA News.](#)
- [Single crystal elasticity of clinopyroxene along Diopside–Hedenbergite solid solution.](#)
- [Late Miocene sedimentation and basin evolution during initial marine flooding into the Gulf of California: Evidence from the Boleo Formation, Baja California Sur, México.](#)
- [Magnetic Reversals During the Deccan Volcanism: Paleomagnetic Insights From the Pachmarhi Dykes.](#)
- Planetary Geology: [An intermittent dynamo linked to high-titanium volcanism on the Moon.](#)
- [Spherulite in the modern aragonitic travertine stromatolite has a calcite core with exopolymers.](#)
- [Slowly Migrating Fracture Swarms in an Actively Serpentinizing Borehole.](#)

## Plate Tectonics

- [Active protothrusts and fluid highways: Seismic noise reveals hidden subduction dynamics in Cascadia; Phys.org summary \[here\]\(#\).](#)
- [The Paleo-Tethys Suture Zone in the Afghan Hindu Kush–Pamir: Geo-Thermochronology, Geochemistry, Tectonics.](#)
- [Late-Stage Rift Evolution at Back Arc Basins: Insights From a Tomography Experiment at Orca Volcano, Bransfield Basin.](#)
- [Deep Learning-Based Tracking of Subduction Zones in Mantle Convection Models.](#)
- [Tectonism rather than “snowball Earth” glaciation is responsible for the Great Unconformity; Phys.org summary \[here\]\(#\).](#)

- [On the relations between morphotectonics, seismicity, perennial and sporadic hydrothermalism on the volcanic island complex of Milos \(Greece\).](#)

## Paleontology

- Video: [The Most Brutal Deaths Ever Preserved In Fossils.](#)
- [Description of fossil amber with ant syninclusions](#); Phys.org summary [here](#).
- [The ontogenetically youngest known pachycephalosaur \(Dinosauria: Ornithischia\) postcranium.](#)
- [The Cretaceous Dinosaur Record from Normandy \(NW France\): A Review.](#)
- [AI and paleontology: effects of vertebrate fossil sample size on machine learning image classification](#); Phys.org summary [here](#).
- [Resilient tropical marine ecosystems during early Eocene global warming events.](#)
- [Carbon/phosphorus burial ratio reveals a rapid spread of land plants during the Late Ordovician](#); Phys.org summary [here](#).
- [The suid assemblage from the Vallesian locality of Can Llobateres 1 \(Vallès-Penedès Basin, NE Iberian Peninsula\) revisited.](#)
- [A diverse early Miocene \(Burdigalian\) turrilline-dominated gastropod assemblage from the Dwarka Basin of Kathiawar Peninsula, western India.](#)
- [An isolated skull from Las Hoyas \(Early Cretaceous, Spain\) informs the early evolution towards elongated rostra in enantiornithine birds \(Aves, Ornithothoraces\).](#)
- [Systematics and palaeoneurology of a new Pliocene raccoon dog \(Canidae, Nyctereutes\) from Jradzor \(Armenia\).](#)
- [Fossil ruminants from the Pliocene site of Jradzor, Armenia.](#)
- [A new genus and species of Pliohyracidae \(Hyracoidea, Mammalia\) from the Pliocene of Jradzor, Armenia.](#)
- If you are planning to visit Cartersville, Georgia, check out the [Tellus Science Museum: The "dinosaur killer" now on display](#).
- [Uniqueness and predictability in evolution and the history of mollusks.](#)
- [250 million-year-old amphibian fossils from Australia reveal global spread of 'sea-salamanders'.](#)

## Ore Deposit Geology

- [Quantifying Gas and Thermal Energy Emissions in an Active Geothermal Area: Insights From Le Biancane \(Larderello Field, Italy\).](#)

- [Integrated geological, petrological, mineralogical, and mineral chemistry investigations of the Neoproterozoic Buem Structural Unit, eastern Ghana: Implications for Fe and Ni-Cu mineralization.](#)
- [The middle Triassic tungsten mineralization event in the western Beishan orogenic belt: constraints from U-Pb and <sup>40</sup>Ar-<sup>39</sup>Ar geochronology of the Juyuan Deposit, China.](#)
- [Hydrothermal activity drives paleoenvironmental change and manganese mineralization in South China during the Neoproterozoic interglacial.](#)
- [Genesis and quality evaluation study of high-purity quartz deposit hosted in NYF-type granite pegmatite in the Central Asian Orogenic Belt, NW China.](#)
- [SHRIMP U-Pb age and geochemistry of hydrothermal xenotime and monazite from the Huachanggou gold deposit, Qinling orogen, northern China.](#)
- [Contrasting whole-rock geochemistry and mineralogy of REE- and U-fertile granites: Implications for the formation of regolith-hosted REE and granite-related U deposits.](#)
- [Structural organization of the Lorraine coal basin and formation of the Alsting thrust fold.](#)

## **Mining and Energy**

- [Investors seek harbour in gold as US and Israel strike Iran.](#)
- [Venezuela Suspends 19 Oil Production Contracts.](#)
- [A \\$40 billion copper boom in Argentina hinges on revamped glacier law.](#)
- [Dominican Republic has over 150 million tons of rare earth deposits, president says.](#)
- [Zimbabwe Lithium Disruption Has Goldman Eyeing This Trade.](#)
- [“Green energy”: Drax to stop burning controversial Canadian wood within next year.](#)
- Visual Capitalist: [Ranked: U.S. Import Reliance for 37 Critical Minerals.](#)
- [Column: Congo’s cobalt curbs expose China’s critical metals weak spot.](#)
- [Canadian mining giant discovers rare earth and critical mineral in Botswana amid U.S.–China supply race.](#)
- [Canada’s Oil Patch Swept Up in Record \\$38B Consolidation Wave.](#)

## **Environmental Geology and Hydrogeology**

- Under [whiskey’s for drinking, water’s for fighting](#):
  - [Data Centers Water Footprint: The Need for More Transparency.](#)
  - [Ancient stepwells brought back to life as India begins to run out of water.](#)

- Manitoba: [Low water levels prompt Town of Virden to sue province and engineering firm](#); I know the geoscientist named in the report.
- India: [Deforestation, Poppy Cultivation, Illegal Timber Trade and Sand Mining Blamed for Manipur's Water Scarcity](#).
- [Residents of US community outraged after learning why their water supply suddenly ran dry: 'Who is going to compensate us?'](#)
- A Thermodynamic Framework for Turing-Type Instabilities in Porous Media: [Part 1](#) and [Part 2](#).
- [Assessing the impact of acid mine drainage on groundwater resources using 3D solute transport modelling in fractured rock settings: The Dareh-Zar copper mine, Iran](#).
- [Impacts of microplastics on terrestrial soil carbon dynamics](#).
- [Tracing arsenic and antimony in mining-impacted environments: New insights from antimony isotopes](#).
- [Up, down and back again: Value judgements in polymer recycling](#); Phys.org summary [here](#).
- Groundwater: [Hydrothermal vents in sulfuric acid speleogenesis karst: isolated feeders with pristine hypogenic water or interconnected conduits with rapid flow and recycled water?](#)  
Earth.com summary [here](#).

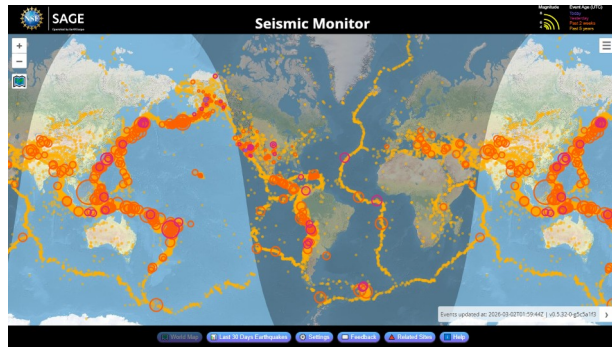
## Glaciers and Climate Change

- [A new coastal ice-core site identified in Dronning Maud Land, Antarctica, for high-resolution climate reconstructions to the Last Glacial Maximum](#).
- [Northernmost no more? The fragmentation of Nordmannsjøkelen in Norway](#).
- [Disequilibrium and Soft Tissue Pump Contributions to Glacial CO<sub>2</sub> Drawdown](#).

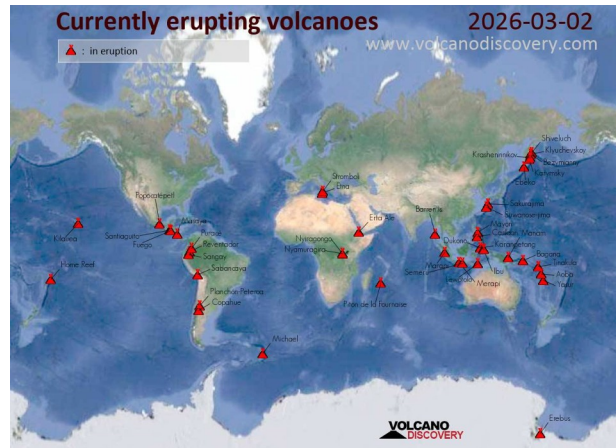
## Bad Science

- [Chemist nears three dozen retractions for image duplication, self-citation and more](#).
- [What can be done to ensure scientific integrity?](#)
- [AI is turning research into a scientific monoculture](#).

## 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: [Echinus Geyser is back in action! For now...](#)
  - [Cascades Volcano Observatory Weekly Update](#).
  - Volcano Watch – [Mauna Loa has lessons to teach during quiet times](#).
- 02/26 [‘A gift that falls from the sky’: why farmers are using Etna’s ash as fertiliser](#).

### Earthquakes

- [Euro-Mediterranean Seismological Centre \(EMSC\)](#).
- [Earthquakes Monitoring Live Worldwide](#).
- [Influence of the Loading Stiffness on Sheared Granular Fault Gouge, and Applicability to Slip-Weakening Theory](#).
- [M5.3 earthquake shakes Kolkata and Dhaka](#); USGS summary [here](#).

### Geohazards

- [Ice-patch collapse and early-warning implications from a Himalayan flash flood: emerging cryo-hydrological hazards under deglaciation](#).

## 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](#).

## Upcoming Events

- [March 15-21, 2026, Provincial Engineering and Geoscience Week, Manitoba](#).
- [AGS Annual Conference 2026, 19th Mar 2026, One Great George Street, London, U.K.](#)
- [ISMPP U: Restoring Trust in Science: Storytelling, AI, and Integrity in Scholarly Publishing \(Mar. 26, 2026, 10:00 am ET\)](#).
- [14-15 April 2026: 2026 IAH Ireland Conference – Groundwater 2035, Tullamore, Ireland](#)
- [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](#).
- [Society of Petroleum Engineers Distinguished Lecturer Schedule](#).
- [American Geophysical Union List of Upcoming Meetings](#).
- The Geological Society: [Events & Courses](#).

March 2, 2026

## Geology and Mineral Resources – Nicaragua

### Introduction



Figure 1 – Nicaragua

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

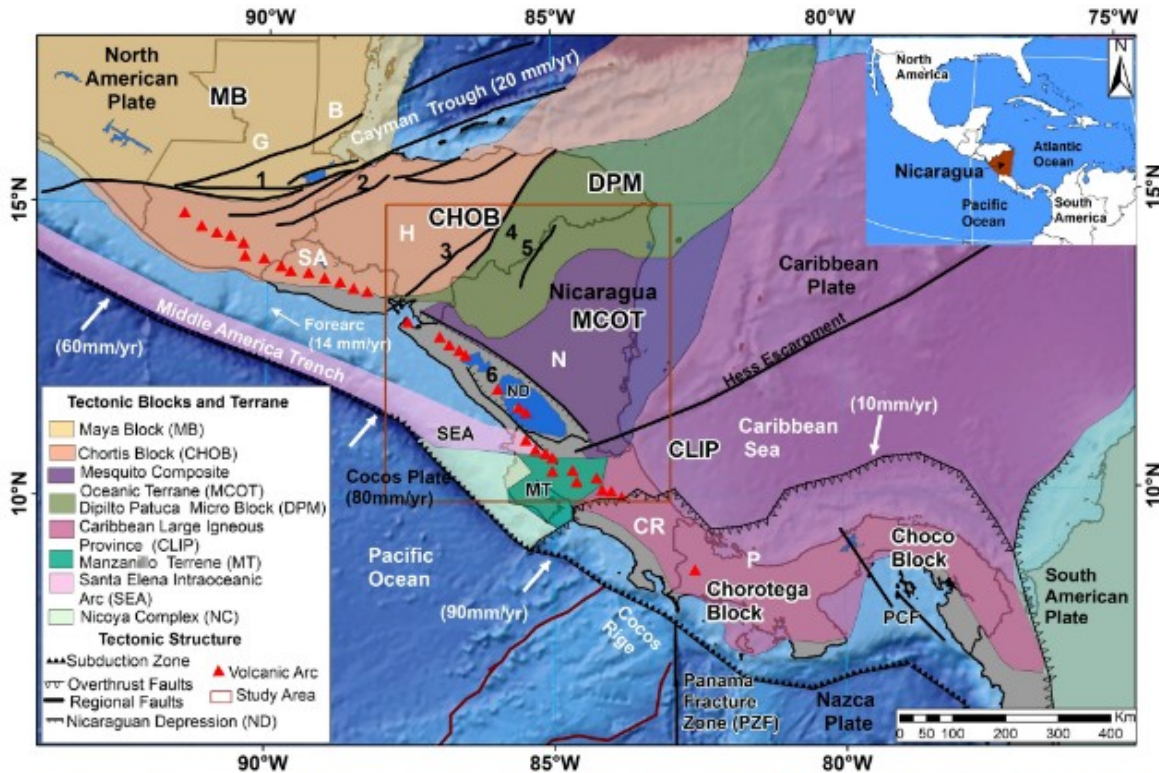
The [Republic of Nicaragua](#) is a country of [6,800,490](#) people in [Central America](#) with a [tragic history](#). The country has an area of 130,375 square kilometres and borders on: the [Pacific Ocean](#), to the west; [Honduras](#), to the north; the [Caribbean Sea](#), to the east; and [Costa Rica](#), to the south.

Nicaragua is a relatively poor country with a per capita [GDP \(PPP\)](#) of \$8,492 and a high [Human Development Index](#) of 0.706. Agriculture represents about 15% of GDP, and remittances account for over 15% of its GDP. Almost one billion dollars are sent annually to the country by Nicaraguans living abroad, mostly in the [United States](#). In 2024, the top [exports](#) of Nicaragua were: gold, clothing (knit t-shirts), insulated wire, coffee, and rolled tobacco (cigars). The top destinations were United States, Mexico, Canada, El Salvador, and Honduras. In 2024, the top [imports](#) of Nicaragua were refined and

crude petroleum, fabrics, packaged medications, and delivery trucks. The top origins were United States, China, Guatemala, Mexico, and Honduras.

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

## Geology



Tectonic Context of Central America and Nicaragua (Based on Andjić et al. 2019; Gazel et al. 2021; Rojas-Barrantes et al. 2021). Abbreviations: Maya Block (MB), Chortis Block (CHOB), Dipilto Paluca Microblock (MDP), Mesquito Composite Oceanic Terrane (MCOT), Caribbean Large Igneous Province (CLIP), Manzanillo Terrane (MT), Santa Elena Intraoceanic Arc (SEA), and Nicoya Complex (NC), Panama Fracture Zone (PFZ), and Panama Canal Fault (PCF). Major structures: Polochic–Motagua Fault and Baja Verapaz Shear Zone (1), Jocotan–Chamelecon and La Ceiba–Aguan Faults (2), Jalan Fault (3), Guayape Fault (4), Bocay Fault (5) and Nicaraguan Depression (ND) (6). The country boundaries shown are of Belize (B), Guatemala (G), Honduras (H), El Salvador (SA), Nicaragua (N), Costa Rica (CR), and Panama (P)

**Figure 2 – Tectonic Context of Central America and Nicaragua**

**Credit: Figure 1 in [Zambrana-Areas, X.E., Flores-Márquez, E.L., Chávez-Segura, R.E. et al, 2024](#)**

Central America and Nicaragua are the result of the [dynamic interaction](#) between tectonic blocks of continental and oceanic crust beginning during the [Cretaceous](#) and continuing to the present. Nicaragua sits on the [Caribbean Plate](#). A [subduction zone](#) forms the western border of [Caribbean Plate](#) with the [Cocos Plate](#) at the [Middle America Trench](#). Smaller tectonic blocks within Nicaragua include:

- The [Dipilto Paluca Microblock](#);
- The [Mesquito Composite Oceanic Terrane](#);
- The [Nicaraguan Depression](#);
- The [Chortis Block](#); and

- To the east, within the Caribbean Plate is the [Caribbean Large Igneous Province](#).

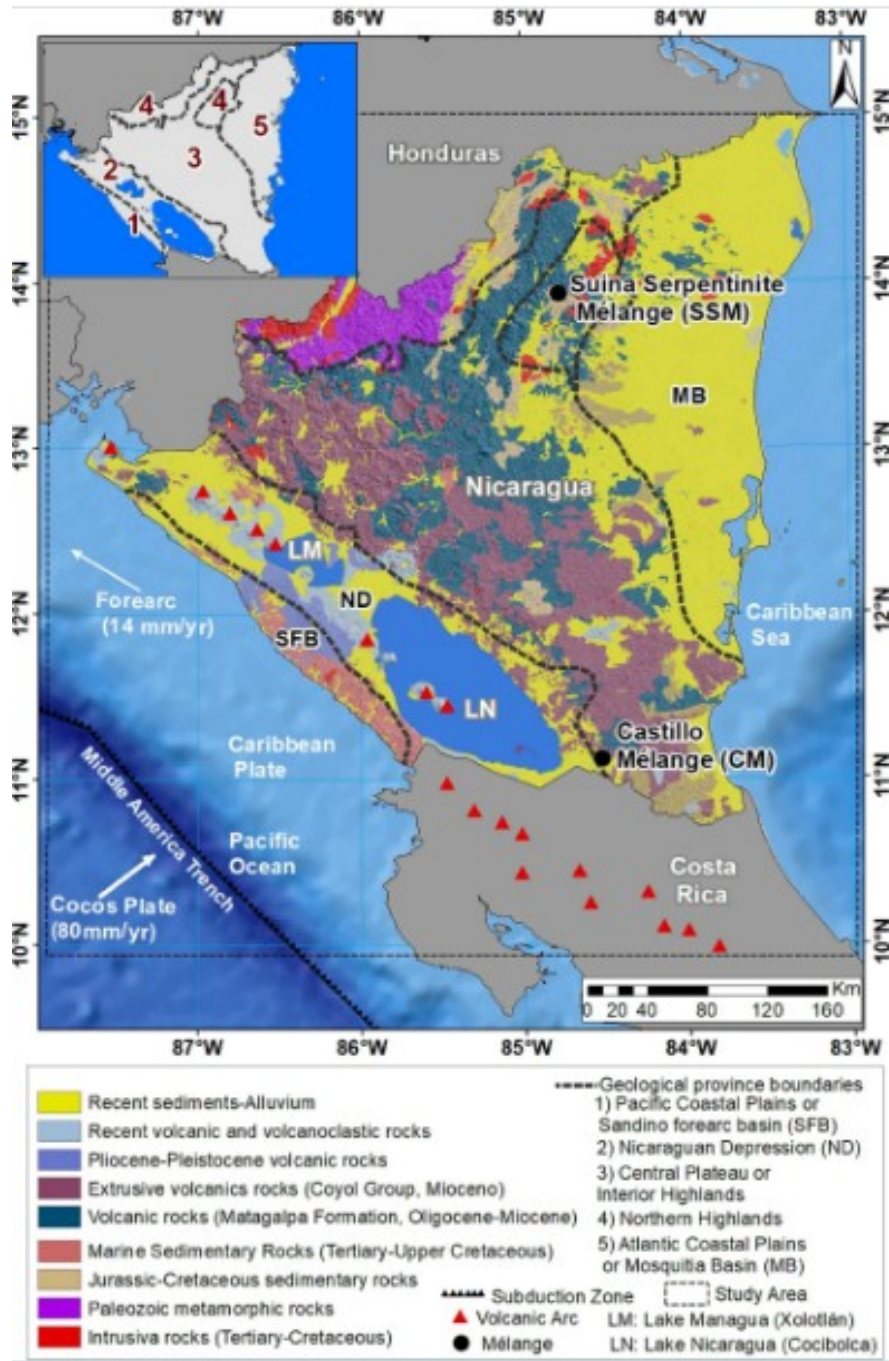


Figure 3 – Simplified Geology of Nicaragua

Credit: Figure 2 in [Zambrana-Areas, X.E., Flores-Márquez, E.L., Chávez-Segura, R.E. et al, 2024](#)

The five main geological provinces in [Nicaragua](#) are:

1. The Pacific Coastal Plain, a.k.a. the [Sandino forearc basin](#) (SFB).

Forming the coastal plain, continental shelf and slope of western Nicaragua, the SFB extends northwestward into Costa Rica. This basin is located east of the the Middle America Trench. The SFB basin may Also extend northwestward to the [Tehuantepec basin](#) off the coasts of Guatemala and southwestern Mexico. The SFB basin is predominately made up of sedimentary rocks ranging in age from Cretaceous to [Neogene](#) that were deposited in shallow marine to deep water [depositional environments](#). In the tectonic geology of the region, the SFB forms part of the [forearc](#), which is rotating counterclockwise in a northwesterly direction at a rate about 14 mm/year. This forearc motion has caused both shortening and elongation of the basin since the [Miocene](#).

2. The [Nicaraguan Depression](#) (ND).

The ND is part of a larger set of Neogene aged [basins in southern Central America](#) that extend from the [Salvador Volcanic Front](#) to northern Costa Rica. The ND is an [intra-arc basin](#) between the Pacific Coastal Plain and the Central Plateau being bounded by lateral northwest trending transtensional faults. The [Nicaraguan volcanic chain](#) is found in the ND and it also contains two large lakes: [Lake Nicaragua](#) and [Lake Managua](#). The ND resembles a [graben](#) structure that may have originated from [isostatic](#) compensation related to the deposits of Neogene and [Paleogene](#) aged volcanic rocks in the interior highlands.

3. The [Central Plateau or Interior Highlands](#).

The Central Plateau or Interior Highlands of Nicaragua are made up of mostly Neogene and Paleogene volcanic rocks. The Oligocene-Late Miocene rocks of this region were formed at a [convergent plate boundary](#) (i.e. protoarc). The rock found here include various lavas such as: [calc-alkali basalt](#), [andesitic](#) lava, [dacite](#), [rhyolite](#), [ignimbrite](#), [dykes](#), [tuff](#) and [volcanic breccia](#). There are two main groups in this geological province: the [Coyol Group and the Matagalpa Formation](#).

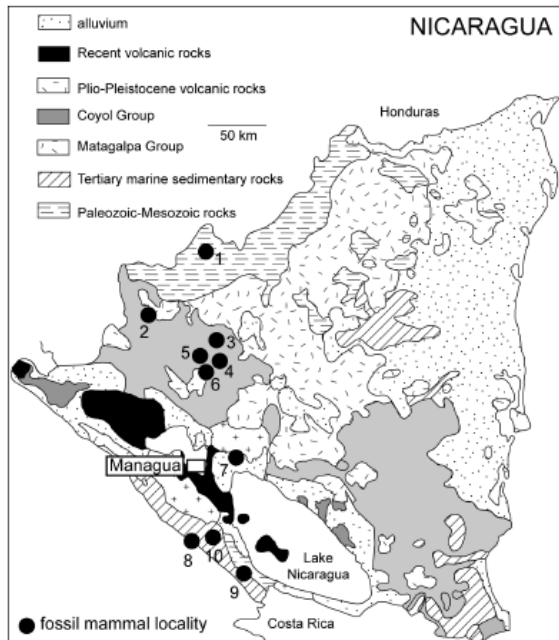
4. The [Northern Highlands Province](#).

The oldest rocks in northern Nicaragua are found in the Northern Highlands Province. The Province contains [Paleozoic](#) aged metamorphic rocks of the [Nueva Segovia Complex](#) together with crystalline [plutonic intrusions](#) such as the [Dipilto Paluca Microblock](#) (DPM). Between the borders of Honduras and Nicaragua there are also [volcanic arc sequences](#) ranging age from the [Jurassic](#) to the [Eocene](#).

5. The [Atlantic Coastal Plain and Mosquitia Basin](#) (MB).

The Atlantic coastal plains are made up of Quaternary age deposits that overlay a succession of Neogene to Paleogene aged sedimentary and magmatic rocks. The MB is a sequence of sedimentary rocks that range in age from Jurassic to Neogene. Also in this Province, in the North Atlantic Autonomous Region, is an important geological structure the [Siuna Serpentinite Mélange](#) (SSM). The SSM composed of several igneous and sedimentary blocks that have undergone metamorphic processes and is associated with an ancient subduction zone. The SSM is on the southern margin of the DPM, marking the boundary between a continental and oceanic zone of the western margin of the Caribbean Plate.

## Paleontology



Generalized geologic map of Nicaragua (after Weinberg, 1992) showing fossil mammal localities: 1 = Jalapa, 2 = El Bosque, 3 = Jinotepe, 4 = Sebáco, 5 = Matagalpa, 6 = Río Viejo, 7 = Las Banderas, 8 = Masachapa, 9 = El Palmar, 10 = Mine K-11.

**Figure 4 – Fossil Localities in Nicaragua**  
**Credit: Figure 1 in [Lucas et al, 2008](#)**

One of the main sources of information of fossils in Nicaragua is: Lucas, Spencer & Garcia, Ramiro & Espinoza, Edgar & Guillermo, Alvarado & Hurtado, Luis & Hurtado de Mendoza, Luis & Vega, Eduardo. (2008). *The fossil mammals of Nicaragua*. New Mexico Museum of Natural History and Science. 44. 417-429. <https://www.researchgate.net/publication/281863274> [The fossil mammals of Nicaragua](#)

Let's look at a couple of these fossil creatures.

### *Eremotherium laurillardi*



**Figure 5 - *Eremotherium laurillardi***  
**Credit: [Kamraman](#), [Creative Commons Attribution-Share Alike 2.5 Generic license](#)**

[\*Eremotherium laurillardii\*](#) was a giant ground sloth that lived during the Pleistocene. Fossil bones of *E. laurillardii* were found in [El Bosque](#) by J. Espinoza in 1976 (Espinoza, J., 1976, *Evaluaciones arqueológicas en “El Bosque”*. Instituto Geográfico Nacional, Managua, Ministerio de Obras Publicas 1, p. 22-45.). [People hunted these animals.](#)

*Mammuthus columbi*

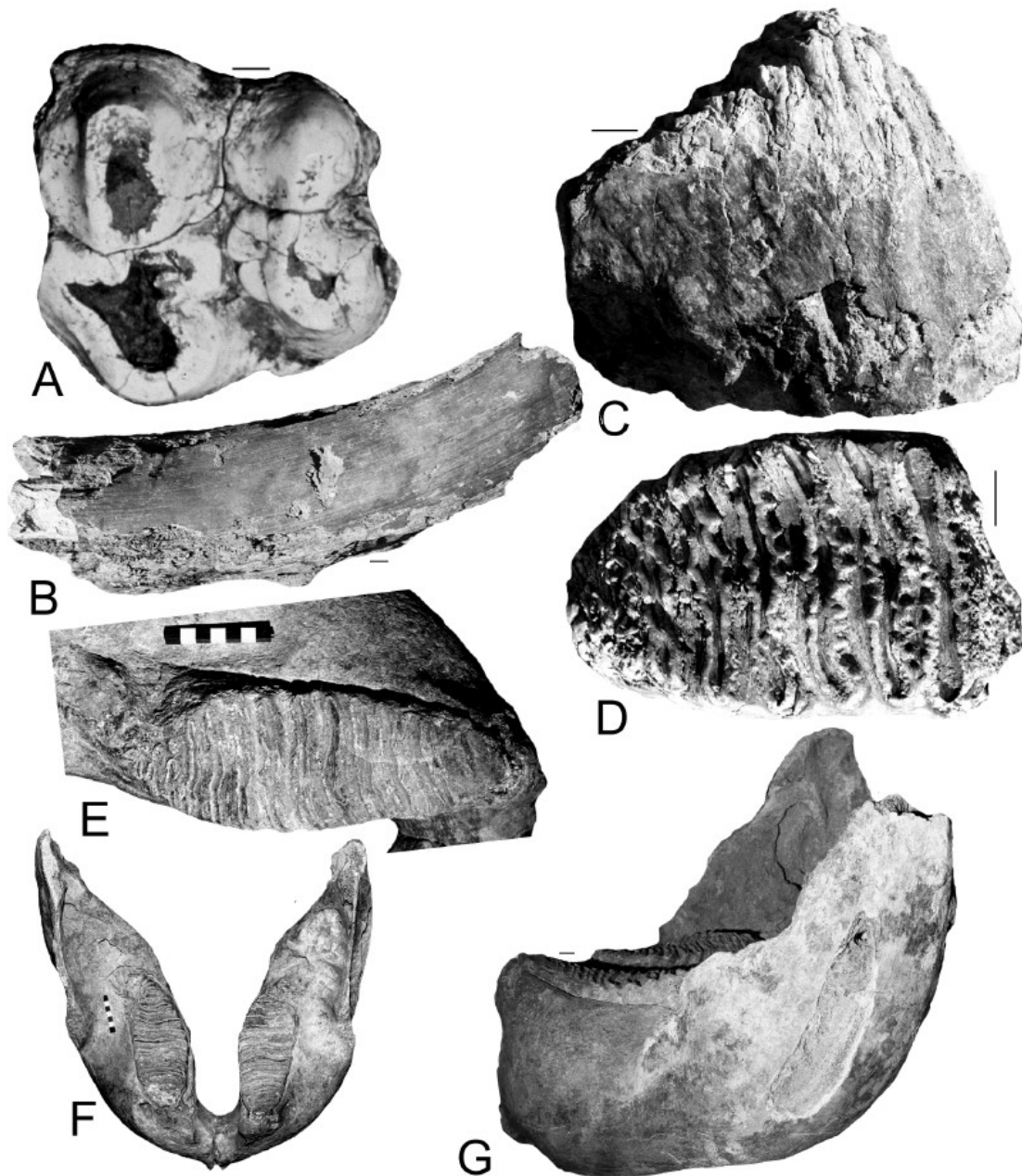


FIGURE 7. Selected proboscidean fossils from Nicaragua. A, Occlusal view of incomplete molar (now lost) of *Cuvieronius hyodon* from El Bosque (courtesy of Wade Miller). B-D, *Mammuthus* teeth from Masachapa in the MNN collection, tusk fragment (B) and incomplete M3 in lateral (C) and occlusal (D) views. E-G, Lower jaw of *Mammuthus columbi* from El Palmar in the MNN collection, occlusal view of left m3 (E), antero-occlusal view of entire jaw (F) and lateral view of jaw (G). Scale bars = 2 cm, except for E-F, which have a scale in cm.

**Figure 6 – Selected Proboscidean Fossils from Nicaragua**

**Credit: Figure 7 in [Lucas et al, 2008](#)**

Another Pleistocene aged fossil found in Nicaragua was that of the Columbian Mammoth, [Mammuthus columbi](#). Fossils of the Columbian Mammoth were found in [El Palmar](#) by [Laurito and Aguilar, 2007](#) and from [Masachapa](#) by an unknown collector. This [Facebook posting](#) also reports two varieties of Columbian Mammoth: the Columbian Mammoth proper and the Imperial Mammoth.

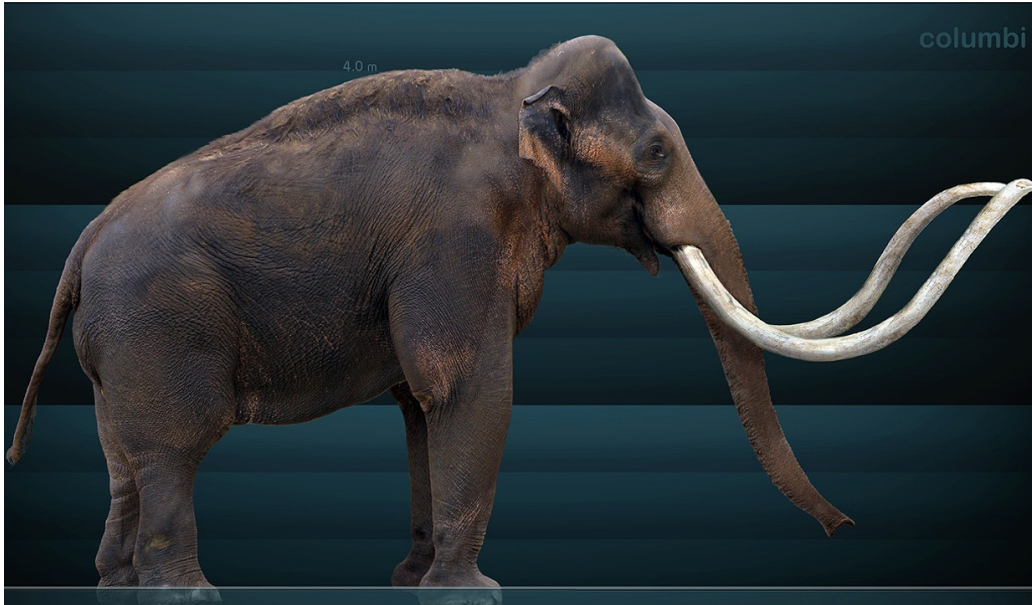


Figure 7 - *Mammuthus columbi*

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

People also hunted these animals, [possibly to extinction](#).

## Mineral Resources



Figure 8 - Pouring molten gold into ingot mold at the former [La Luz Mine](#)

**Credit:** [Allen Drebert](#), [public domain](#)

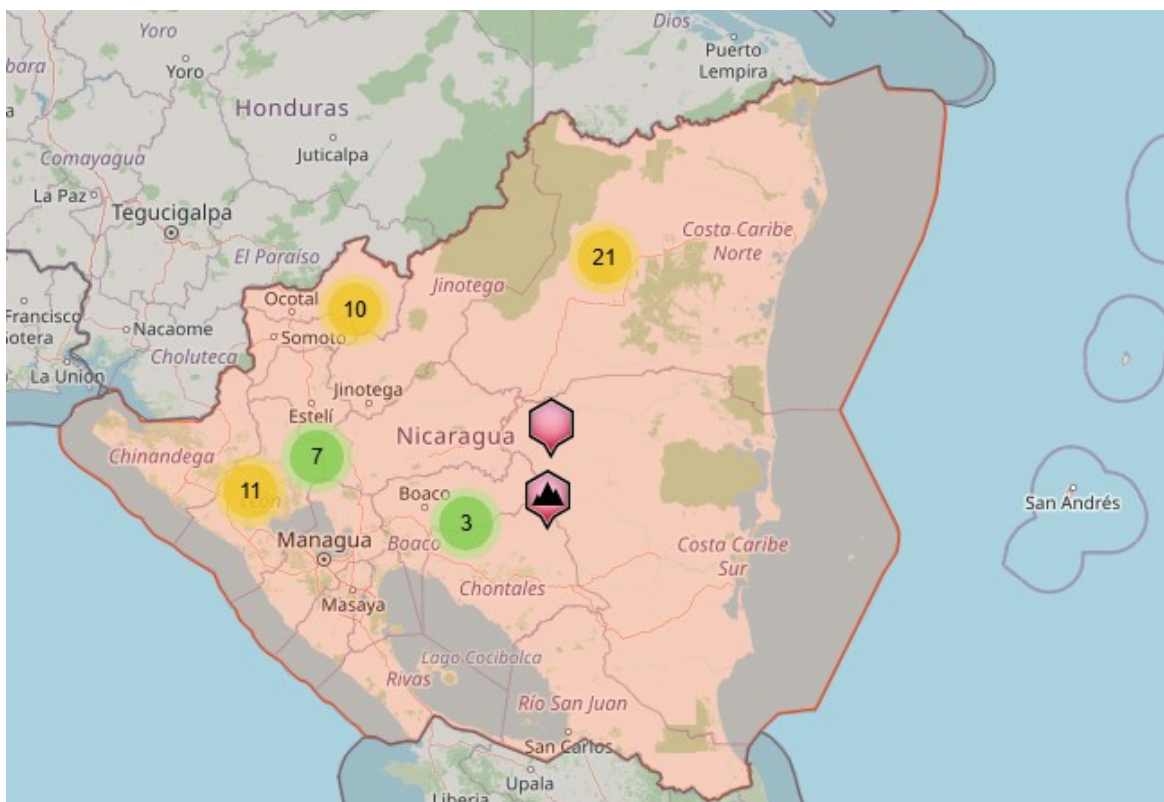
According to the most recent, 2020-21, [USGS Minerals Yearbook on Central America](#), the mineral industry of Nicaragua is largely restricted to the production of cement, for construction, and for gold. Gold mines include:

- The [La Libertad, Limon, and Pavón Norte](#) mines operated by [Equinox Gold Corp.](#)
- The [San Albino Mine](#) operated by [Mako Mining Corp.](#); technical report [here](#).
- The [Hemco Mine](#) operated by [Mineros](#).
- Also, [artisanal gold production](#) is a long established activity in Nicaragua.

There are companies currently [exploring for gold in Nicaragua](#). Note that the history of [gold development in Nicaragua](#) for industrial developments has not been a happy one. Essentially, if pesky locals get in the way of a gold mine, [they are shot](#).

In other potential mineral plays, in [2013](#) and [2016](#), the Nicaraguan government issued licenses for oil exploration in their territorial waters in the Caribbean. The most recent news on the play was from [2021](#), [this site](#) reports on offshore oil exploration new from Nicaragua.

The most recent production statistics from the USGS are [here](#). Figure 9 links to an interactive mineral occurrence map for Nicaragua from [Mindat.com](#).



**Figure 9 - Interactive Mineral Occurrence Map for Nicaragua**  
**Credit: [Mindat.org](#)**

## Summary



**Figure 10 - Great Corn Island, Nicaragua**

**[Credit: Ridiculopathy, Creative Commons CC0 1.0 Universal Public Domain Dedication](#)**

For gold bugs, Nicaragua might be a promising place to explore. If you choose to do so, understand that the country is ruled by a authoritarian dictatorship, nominally socialist, but generally conforming to the [Latin American pattern of governance](#). A similar caveat can be issued for those pursuing offshore petroleum deposits.

## 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.