

March 10, 2025

## News and notes

Before going on to discuss the geology and geopolitics of Indonesia, here are some news items I thought were interesting.

## 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).

## 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; new publication: [Hydrogeology and Geochemistry of Bottled Spring Water in the United States](#).
- Free Groundwater Modeling Course – [HydroGeoCenter](#).
- From Western Australia: [Carbonatite, lamprophyre and host rocks in the northern Aileron Province](#).
- Two volumes of Geology of Indonesia now can be accessed for [FREE/GRATIS](#). The books can be accessed from: vol 1 <https://lnkd.in/eH6Gcka4>; vol 2 <https://lnkd.in/egTYmpjk>.

## Geopolitics

- [US, Congo in 'exploratory talks' over minerals deal: FT](#).
- [South Africa and Its Disastrous Battle for the Congo](#).

## Research and News

- Plate tectonics: [Mantle Dynamics in the Mediterranean and Plate Motion of the Adriatic Microplate: Insights From 3D Thermomechanical Modeling](#).
- [A Machine Learning Approach to Single Garnet Geothermometry and Application to Tracing the Fingerprint of Superdeep Diamonds](#).
- Geophysics: Magnetic Recording Fidelity of Basalts Through 3D Nanotomography.
- [Records of Ground Deformation in Northern Kefalonia Inferred from Cosmogenic <sup>36</sup>Cl Geochronology](#).
- [Water in Eclogite and Pyroxenite Xenoliths From the Bottom 100 km of the Slave Craton \(Canada\) Mantle Root](#).

- Formation of the Earth's core: [Nitrogen-carbon-argon features of the silicate Earth established by deep core-mantle differentiation.](#)
- [A Paleoarchaeon impact crater in the Pilbara Craton, Western Australia](#); summary in The conversation [here](#).
- [Petrology and Geochemistry of Ophiolitic Pyroxenite in the Eastern Desert of Egypt: Genesis of Ultramafic Cumulates and Implications for Neoproterozoic Supra-Subduction Seafloor Metamorphism.](#)
- [Detrital zircon data suggest multiple Cryogenian–Cambrian active margins along northern and western Baltica and close ties with Siberia.](#)
- [Tracking the spatial and temporal links between late Cenozoic extension and magmatism in the Death Valley region \(California, USA\).](#)
- [Fault–fracture mesh development produces tectonic tremor in fluid-overpressured serpentinized mantle wedge.](#)
- [A Rare Glimpse of Paleoproterozoic Sub-Arc Mantle: The Ussuit Peridotite, West Greenland.](#)
- [Crustal versus mantle-level aggregation of heterogeneous melts at mid-ocean ridge.](#)
- Eclogite: [Stress-controlled reaction pattern in the layered lower crust: Field evidence.](#)
- [Adelaide black granite: geomechanical characterisation for underground design.](#)
- Video: [Economic Geology Insights—Reflections with Professor Ed Spooner.](#)
- [Consequences of a Global Slowdown in Seafloor Spreading for Sea Level and Mantle Heat Loss](#); Live Science summary [here](#).

## Sedimentary Geology

- [Petrography and Geochemistry of Lower Jurassic Sandstones in the Eastern Junggar Basin: Implications for Provenance and Tectonic Setting.](#)
- [A Novel Approach of Semi-Quantifying Gypsum in Sedimentary Rocks by Visible and Near-Infrared Diffuse Reflectance Spectroscopy.](#)
- [Characterization of the Miocene successions in the Schoten borehole \(southern North Sea Basin, northern Belgium\) and regional correlation with the Netherland.](#)
- [Drilling the New Jersey shallow shelf to evaluate Miocene continental margin sequences, sea level, and resources.](#)
- Carbon sequestration and sedimentary geology: [Twice the global average carbon burial efficiency in the Helgoland Mud Area of the North Sea: Insights into carbon sequestration in small-size depocenters on sand-dominated shelves.](#)

- [Trace element and OH content of quartz grains in the Amazon river: Potential application in provenance analysis.](#)
- [Current concepts in mudstone description and deposition: A synthesis for mudstone initiates.](#)
- [Quantitative sedimentological analysis of the aeolian–fluvial Triassic Sherwood Sandstone Group, Cheshire Basin, UK.](#)

## Paleontology

- [Automated segmentation of synchrotron-scanned fossils.](#)
- [Foraminiferal assemblages from the Toarcian \(Lower Jurassic\) ‘Spotted limestone’ of the northern Adriatic Carbonate Platform.](#)
- [The Ediacaran Aquarium: insights from the Nilpena Ediacara National Park 1T-F Marine Ecosystem \(Ediacara Member, Rawnsley Quartzite\).](#)
- [The modern pattern of insect herbivory predates the advent of angiosperms by 60 My; Smithsonian Magazine summary \[here\]\(#\).](#)
- [Waterbird foraging traces from the early Eocene Green River Formation, Utah; Phys.org summary \[here\]\(#\).](#)

## Ore and Petroleum Deposit Geology

- Ore deposit geology: [The Composition of Volatiles in Quartz and Pyrite from the Konduyak Gold Deposit \(Yenisei Ridge, Russia\).](#)
- [Mapping Alteration Minerals Associated with Aktogay Porphyry Copper Mineralization in Eastern Kazakhstan Using Landsat-8 and ASTER Satellite Sensors.](#)
- [Ten kilometers ascent of porphyry Cu \(Au, Mo\)-forming fluids in the Sanjiang region, China.](#)
- [Accessibility Assessment of the Iron Deposits on the Qinghai–Xizang Plateau: Integrating Transport Networks, Economic Dynamics, and Ecological Constraints.](#)
- [Multiple Solutions of Ore-Forming Fluids of Carbonate Rock-Related Nephrite Deposits Constrained by Hydrogen and Oxygen Isotopes.](#)
- Petroleum reservoir geology: [Segmentation characteristics of the strike-slip fault and their controls on the hydrocarbon accumulation and enrichment in the northern Tarim Basin, NW China.](#)
- [Hyperspectral characteristics of the GRE46 epithermal gold deposit, Cowal \(NSW\).](#)
- More petroleum reservoir geology: [Mineral composition and pore structure on spontaneous imbibition in tight sandstone reservoirs.](#)
- Related to today’s posting: [The Ertsberg copper skarn deposit: A geologic and mining story like no other.](#)

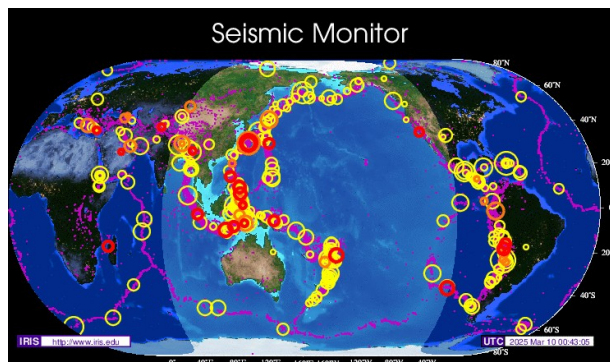
## Mining and Energy

- [Nigeria Boosts Oil Production Above Its OPEC+ Quota.](#)
- Related to today's blog: [Indonesia's Gas Demand Rising as LNG Starts to Replace Diesel for Power.](#)
- [Mali partially lifts suspension on issuance of mining permits.](#)
- [China fuels EV battery boom as industry landscape shifts, Adamas says](#)

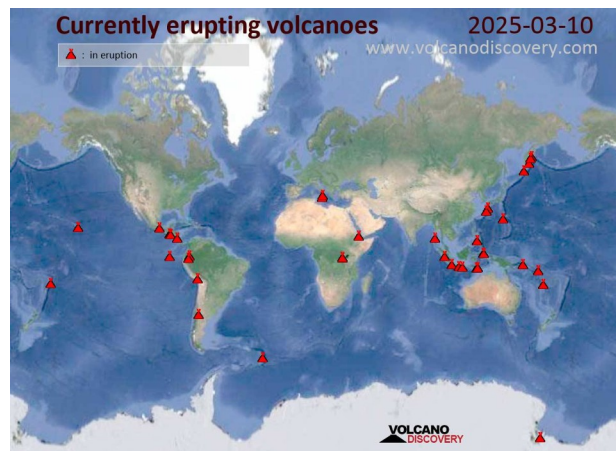
## Environmental Geology and Hydrogeology

- Physics of fluids in the Earth's crust: [Convection, but How Fast Does Fluid Mix in Hydrothermal Systems?](#)
- Fluid flow in fractured rock: [Discrete fracture network modelling reconstructs fracture array evolution and related petrophysical properties over geological time.](#)
- [Monitoring benthic plumes, sediment redeposition and seafloor imprints caused by deep-sea polymetallic nodule mining](#); Phys.org summary [here](#).
- [Analysis of Groundwater Storage at The Local Scale in the Missan Region, Iraq, Based on GRACE Satellite and Well Data.](#)

## Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

## Volcanoes

- United States Geological Survey (USGS) Volcano Observatories:
  - [When have lava fountains formed on Kīlauea and what are their hazards?](#)
  - [Mountains of the Greater Yellowstone Ecosystem: The Wind River Range and the Laramide Orogeny.](#)

- [Smithsonian / USGS Weekly Volcanic Activity Report](#).
- [A 34-Year Record of Seismic Activity on Vulcano Island, Italy](#).
- Video: [Mar 4, 2025: Pyroclastic Flow Races Down Santiaguito Volcano in Guatemala](#).
- [High heels and risky selfies: Etna eruptions cause despair among mountain rescuers](#).
- [Scientists monitor Mount Rainier following 1,000 years of dormancy](#).

### *Earthquakes*

- [Euro-Mediterranean Seismological Centre \(EMSC\)](#).
- [Earthquakes Monitoring Live Worldwide](#).
- Video: [Quake Rattles Puget Sound area of Washington and British Columbia: Geologist Analysis](#).
- January 2025 earthquake in southern Tibet: [What's a normal fault doing in a collisional orogen?](#)

### **Upcoming Events**

- [Williston Basin Petroleum Conference, April 28-30, Regina Saskatchewan](#); the last day to book rooms at the [hotel hosting the venue](#) is Wednesday, April 2, 2025
- European Geosciences Union: [EGU General Assembly 2025, Vienna, Austria & Online 27 April–2 May 2025](#).
- [The USGS David A. Johnston Cascades Volcano Observatory will be hosting an Open House for the public on May 10, 2025!](#)
- [Geoscience Beyond Borders, GAC-MAC-IAH-CNC 2025 Ottawa, Ontario, May 11-14, 2025](#).
- [Sedimentary Geology and the Energy Transition Conference, June 2-5, 2025 – Salt Lake City, UT USA](#).
- [Society for Sedimentary Geology conference, Mountjoy IV – August 10-13, 2025, in Montreal, Canada](#).
- [Copper to the World Conference, Tuesday 26 – Wednesday 27 August 2025](#), in Adelaide, Australia; report on 2024 conference [here](#).
- [5th International Professional Geology Conference \(IPGC\), November 5 to 7, 2025, Zaragoza, Spain](#).
- 2025 [Society of Petroleum Engineers Distinguished Lecturer Schedule](#).
- [List of geoscience events in 2025 from the International Union of Geological Sciences](#).
- [American Geophysical Union List of Upcoming Meetings](#).
- The Geological Society: [Events & Courses](#).

March 10, 2025

## Geology and the Fate of Societies – Indonesia



**Figure 1a – Indonesia**

**Credit:** [CIA World Factbook, public domain](#)



**Figure 1b – Location of Indonesia**

**Credit:** [CIA World Factbook, public domain](#)

Located between the [Indian](#) and [Pacific](#) oceans in [Southeast Asia](#) and [Oceania](#), is the [Republic of Indonesia](#). The nation consists of over [17,000 islands](#), the most important of which are [Sumatra](#), [Java](#), [Sulawesi](#), as well as parts of [Borneo](#) and [New Guinea](#). Although mostly surrounded by water, Indonesia also has land boundaries with [Eastern Malaysia](#), [Papua New Guinea](#), and [Timor Leste](#). Indonesia shares maritime boundaries with [Singapore](#), [Peninsular Malaysia](#), [Vietnam](#), [Thailand](#), the [Philippines](#), [Australia](#), [Palau](#), and [India](#).

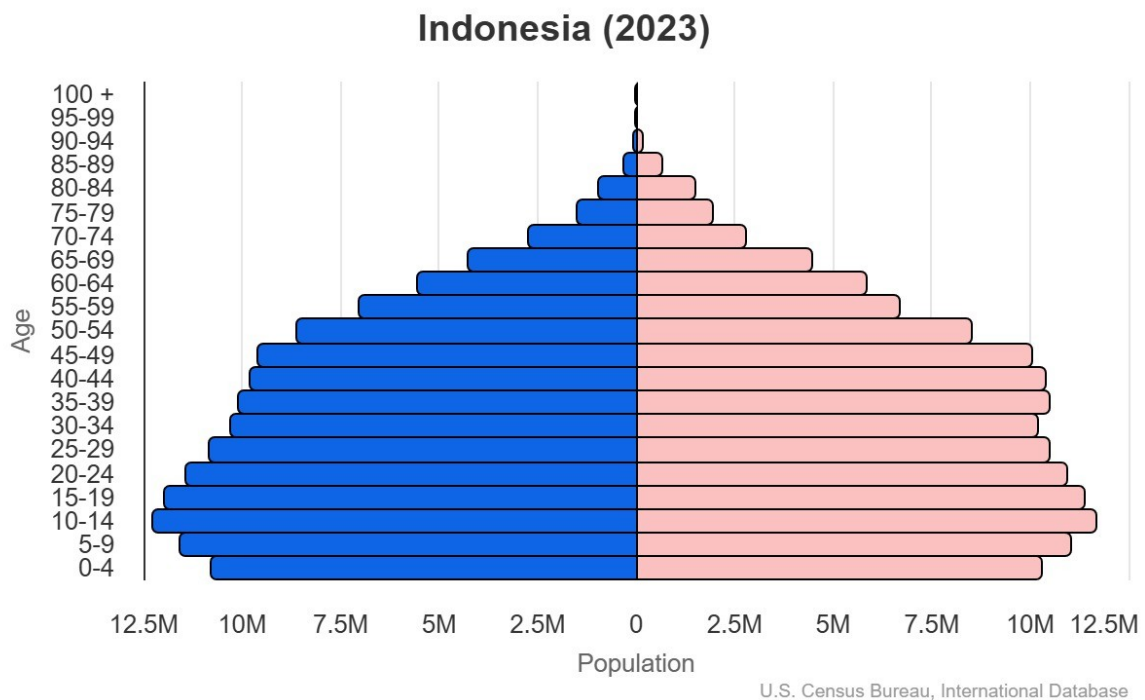
Indonesia is a unitary [presidential republic](#). The President is [Prabowo Subianto](#) and the Vice President is [Gibran Rakabuming Raka](#). The legislature, the [People's Consultative Assembly](#) (MPR) consists of an Upper House, the [Regional Representative Council](#) (DPD), and a Lower House, the [House of Representatives](#) (DPR) whose Speaker is [Puan Maharani](#). Two other important institutions are the Supreme Court, the [Sunarto](#), and the Constitutional Court, the [Suhartoyo](#).

According to the [Central Intelligence Agency](#)'s (CIA) [World Factbook on Indonesia](#), the country has a total area of 1,904,569 square kilometres (km<sup>2</sup>) of which 1,811,569 km<sup>2</sup> is land and 93,000 km<sup>2</sup> is water. Also according to the World Factbook, 281,562,465 people live in Indonesia with the largest concentration of people on the island of Java. Indonesia has a diverse ethnic composition, with over [600 ethnic groups](#). Of these: 40.1% are ethnic [Javanese](#); 15.5% are [Sundanese](#); 3.7% are [Malay](#); 3.6% are [Batak](#) people, 3% are [Madurese](#), 2.9% are [Betawi](#); 2.7% are [Minangkabau](#); 2.7% are [Buginese](#); 2% are [Bantenese](#); 1.7% [Banjarese](#); 1.7% are [Balinese](#); 1.4% are [Acehnese](#); 1.4% are [Dayak](#); 1.3% are [Sasak](#); 1.2% are [ethnic Chinese](#); and 15% are some other ethnicity. With the ethnic diversity you would expect there to be many languages spoken, and you would be right: more than [700 languages](#) are used in

Indonesia. The official language is [Bahasa Indonesia](#), a standardized version of [Malay](#) that has been used as a language of commerce for many centuries.

Most, 87.4%, Indonesians are [Moslem](#). Of the remainder: 7.5% are [Protestant Christians](#); 3.1% are [Roman Catholic Christians](#); 1.7% are [Hindu](#); and 0.8% are something other including [Buddhists](#), [Confucians](#), and [traditional folk religions](#). In terms of education, 96% aged 15 and over can read and write and people can expect to attend school for 14 years.

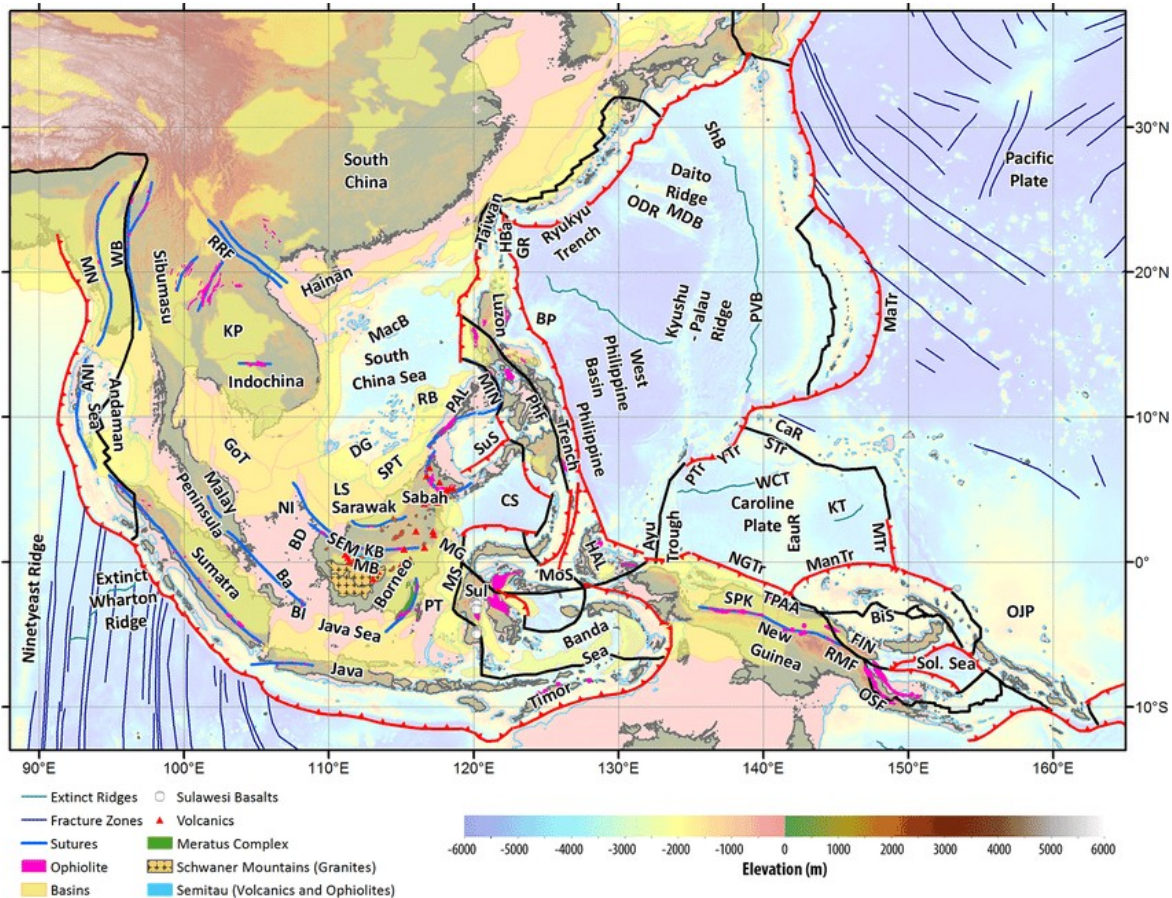
Economically: the per capita [GDP \(PPP\)](#) of Indonesia is \$16,542; the [Gini](#) coefficient is 37.9m, indicating medium inequality; and the [Human Development Index](#) is high at 0.713. The [top exports of Indonesia](#) are coal briquettes (\$38.8b), palm oil (\$24.8b), ferroalloys (\$14.8b), lignite (\$10.7b), and petroleum gas (\$9.26b), exporting mostly to China (\$70.7B), United States (\$27.9B), India (\$24B), Japan (\$23.7B), and Singapore (\$15.8B). In 2023, Indonesia was the world's biggest exporter of palm oil (\$24.8b), ferroalloys (\$14.8b), lignite (\$10.7b), nickel mattes (\$7.58b), and large flat-rolled stainless steel (\$5.85b). The [top imports of Indonesia](#) are refined petroleum (\$19.5b), crude petroleum (\$10.2b), integrated circuits (\$4b), broadcasting equipment (\$3.8b), and petroleum gas (\$3.69b), importing mostly from China (\$62.7B), Singapore (\$18.2B), Japan (\$15.4B), United States (\$11B), and Malaysia (\$10.9B). In 2023, Indonesia was the world's biggest importer of raw sugar (\$2.85b), soybean meal (\$2.6b), rice (\$1.76b), steam boilers (\$648m), and steam turbines (\$401m).



**Figure 2 – Demographic Profile of Indonesia**  
**Credit: U.S. Census Bureau, International Database, public domain**

[Indonesia's demographic profile](#) shows fairly young population that is in the process of stabilizing; 23.8% of the population is under 15 years of age and 68.3% are between 15 and 64 years of age. The total fertility rate is 1.99 births per woman and the annual growth rate is 0.76%. Net migration is -0.7 migrant(s)/1,000 population. The life expectancy at birth for both sexes is 73.3 years.

## Geology



**Regional tectonic setting with plate boundaries (MORs/transforms = black, subduction zones = teathed red) from Bird (2003) and ophiolite belts representing sutures modified from Hutchison (1975) and Baldwin et al. (2012). West Sulawesi basalts are from Polvé et al. (1997), fracture zones are from Matthews et al. (2011) and basin outlines are from Hearn et al. (2003). ANI-Andaman and Nicobar Islands, BD-Billiton Depression, Ba-Bangka Island, BI-Belitung (Billiton) Island, BiS-Bismarck Sea, BP-Benham Plateau, CaR-Caroline Ridge, CS-Celebes Sea, DG-Dangerous Grounds, EauR-Eauripik Ridge, FIN-Finisterre Terrane, GoT-Gulf of Thailand, GRGagua Ridge, HAL-Halmahera, HBa-Huatung Basin, KB-Ketungau Basin, KP-Khorat Platform, KT-Kiilsgaard Trough, LS-Luconia Shoals, MacB-Macclesfield Bank, ManTr-Manus Trench, MaTr-Mariana Trench, MB-Melawi Basin, MDB-Minami Daito Basin, MG-Mangkalihat, MIN-Mindoro, MN-Mawgyi Nappe, MoS-Molucca Sea, MS-Makassar Straits, MTr-Mussau Trench, NGTr-New Guinea Trench, NI-Natuna Islands, ODR-Oki Daito Ridge, OJP-Ontong Java Plateau, OSF-Owen Stanley Fault, PAL-Palawan, PhFPhilippine Fault, PT-Paternoster Platform, PTr-Palau Trench, PVB-Parece Vela Basin, RB-Reed Bank, RMF-Ramu-Markham Fault, RRF-Red River fault, SEM-Semitau, ShB-Shikoku Basin, Sol. Sea-Solomon Sea, SPK-Sepik, SPT-Sabah-Palawan Trough, STrSorol Trough, Sul-Sulawesi, SuS-Sulu Sea, TPA-A-Torricelli-Prince Alexander Arc, WB-West Burma, WCT-W Caroline Trough, YTr-Yap Trough.**

**Figure 3 – Regional Tectonic Setting of Indonesia**  
**Credit: Figure 1 in [Zahirovic et al, 2014, CC BY 4.0](#)**

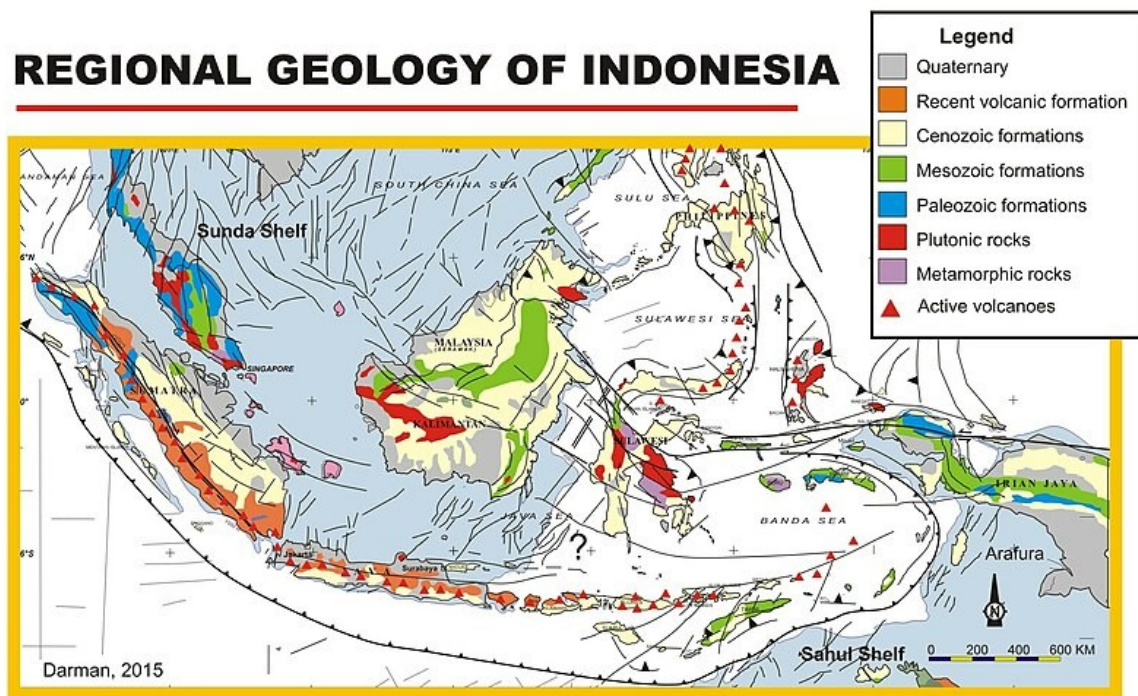
Tectonically, Indonesia is the result of the complex collision of several tectonic plates including: the Sahul Shelf, the Sunda Plate, the Caroline Plate, the Pacific Plate, the Philippine Sea Plate, and the Indian Plate.

Western Indonesia is a volcanic arc formed by the subduction of the Indian Plate under the Sunda Plate. The islands in this volcanic arc include Sumatra, Java, Bali, and the Lesser Sunda Islands. This is one of the most seismically active areas on the planet with a long history of powerful volcanic eruptions,

[earthquakes](#), and destructive [tsunamis](#). The eastern portion of Indonesia is the result of the interaction between the Pacific and Sahul plates.

The major structural features in Indonesia include:

- The [Great Sumatran Fault](#) is a 1,900 km long dextral [strike-slip fault](#) along Sumatra Island whose formation is related to the subduction zone west of Sumatra;
- The [Palu-Koro Fault](#) is a major structural unit that runs across central Sulawesi, extends west across the [Makassar Strait](#), ending in the [Mangkalihat Peninsula](#); and
- The [Sorong Fault](#) that is a 2000 km long [left lateral fault](#) that runs from West Papua to East Sulawesi.



**Figure 4 – Regional Geology of Indonesia**  
**Credit: Herman darman, [Creative Commons Attribution 3.0 Unported license](#)**

The [tectonic history of Indonesia](#) has resulted in a fairly complex geology (check out the open access book on the Geology of Indonesia [here](#) and [here](#)). The most recent deposits in Indonesia are [Quaternary](#) aged sedimentary formations including marine [clastic](#) and [carbonate rocks](#). Many of the volcanic deposits in Sumatra, Java, Bali, and the Lesser Sunda Islands are Quaternary, [Neogene](#), and [Paleogene](#) in age. Other [Cenozoic](#) deposits in Indonesia include [basin sedimentary complexes](#). Older rocks in the country include [Mesozoic](#) and [Paleozoic](#) aged deposits. Plutonic intrusions and metamorphic rocks of various ages are also found in Indonesia.

Digging deeper into Indonesian geology shows even more complexity: here are links to summaries of the major elements of the [regional geology](#) of Indonesia:

- The [Geology of Sumatra](#);

- The geology of the [Natuna Islands](#);
- [Java and the Java Sea](#) geology;
- The [Geology of Kalimantan](#);
- The [Geology of the Makassar Strait](#);
- The geology of the [Sulawesi Sea](#) and [Sulawesi Island](#);
- The geology of the [Lesser Sunda Islands](#);
- The [Halmahera Islands](#) geology;
- The [Geology of the Banda Arc](#);
- [Timor Island](#) geology;
- The geology of the [Arafura Sea](#); and
- The [Geology of Papua](#).

There is a lot to read, even in summary form. You may want to concentrate on the areas that interest you most or simply take the time to read as much as you can take in.

## Resources

### *Agriculture and Food Production*



**Figure 5 – A rice paddy with irrigation system alongside Jalan Raya Muncan**

**Credit:** [CEphoto, Uwe Aranas](#); [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

According to the CIA World Factbook on Indonesia, 31.2% of the country's land is agricultural (13% arable land, 12.1% permanent crops, 6.1% permanent pasture). Of the remainder, 51.7% is forest and 17.1% is something other (2018 est.). Indonesia's agriculture accounts for 12.5% of the country's GDP and [employs 41%](#) of the country's total labour force. The top ten agricultural commodities of Indonesia, based on tonnage produced, are oil palm fruit, rice, sugarcane, maize, coconuts, cassava, bananas, eggs, chicken, mangoes/guavas. Production statistics for Indonesian agriculture from the United Nations Food and Agriculture Organization can be found [here](#). The FAO also indicates that [4.9%](#) of the Indonesian population suffers from moderate to severe food insecurity.



An important agricultural product from Indonesia are spices, such as [nutmeg and mace](#) from seeds within the fruit of the nutmeg tree *Myristica fragrans*. Nutmeg is native to the Indonesian [Banda Islands](#) in the [Molucca Islands](#). Spices from the Moluccas, including nutmeg, [cardamon](#), and [pepper](#), have been [traded internationally](#) since ca. 1500 BC. It was the craving of Europeans for spices such as nutmeg (and the profits from their sale) that was one of the spurs for the [Age of Exploration](#).

In 2023, Indonesia [produced](#) 43,790 tonnes of nutmeg, mace, and cardamons, as well as 70,169 tonnes of pepper and 159,510.7 tonnes of other stimulant, spice and aromatic crops.

**Figure 6 – Nutmeg Seed with Red Mace**  
**Credit:** [Alexander Daniel, Creative Commons Attribution-Share Alike 3.0 Unported](#) license



**Figure 7 – Fishing at Gili Islands, Lombok, Indonesia**  
**Credit:** [Vyacheslav Argenberg, Creative Commons Attribution 4.0 International](#) license

As you might expect in a nation made up of islands in the sea, [fishing](#) is an important source of food in Indonesia. The industry includes marine (saltwater) fisheries, inland (freshwater) fisheries, aquaculture, and [sports fishery for tourists](#). Major types of fishes caught in the marine fishery include tunas, scads, sardinellas, squids, shrimps/prawns, seerfishes, jacks, crevalles, pomfrets, crabs, snappers, bivalves, mackerels, and anchovies. The major types of fishes caught in the inland fishery include tilapia, catfishes, snakeheads, gourami, common carp, shrimps/prawns. Aquaculture production includes seaweeds, tilapia, catfishes, shrimps/prawns, milkfishes, common carp, gourami, bivalves, and snakeheads. Production statistics from the FAO can be found [here](#).

### *Forestry*



**Figure 8 – Forest in East Bali, Indonesia**

**[Credit: Vyacheslav Argenberg, Creative Commons Attribution 4.0 International license](#)**

Indonesia's forest area spans [125,793.18](#) thousand hectares, making Indonesia the second largest [tropical rainforest](#) in the world after the Democratic Republic of the Congo. Forest production, including wood production and pulp and paper accounts for 0.39% of Indonesia's GDP. The [major commercial variety](#) harvested are various species of [acacia](#). The other varieties of trees harvested [are described](#) as mixed forest group, the [meranti](#) group, the beautiful wood group, and the [ebony](#) group. Statistics on forestry production can be found [here](#).

The best way to describe the types of trees growing in Indonesia is to make reference to the two major [bioregions](#): [Sundaland](#) and [Wallacea](#). These two bioregions are divided by the famous [Wallace Line](#), a faunal boundary line first discovered in 1859 by the British naturalist [Alfred Russel Wallace](#). Essentially, Wallace noted a dramatic difference in the flora and fauna found in the islands of Indonesia, a difference that is the result of the tectonic history of the islands.

## Mineral Production



Figure 9 – Monument at the Ombilin Coal Mine

Credit: [indonesia.go.id](https://indonesia.go.id), public domain

As you might guess from the complex geology of Indonesia, the country has a wide variety of mineral resources. According to the [USGS](https://www.usgs.gov), the mineral industry of Indonesia includes metallic minerals, industrial minerals and energy minerals.

Metallic mineral production includes bauxite, cobalt, copper: chromium, nickel, gold, iron, lead, manganese, nickel, silver, tin, titanium, zinc, and zirconium. Industrial minerals produced in Indonesia include cement, bentonite, kaolin, feldspar, iodine, ammonia, sulphur, salt, silica sand, construction sand and gravel, crushed limestone, marble, and zeolites. Energy minerals produced in Indonesia includes coal, petroleum and natural gas. In 2022, Indonesia produced 235,000 thousand barrels of oil.

A list of major mines and production facilities can be found on Table 2 of the [USGS report](https://www.usgs.gov). Figure 10 links to an interactive map of mineral occurrences in Indonesia.

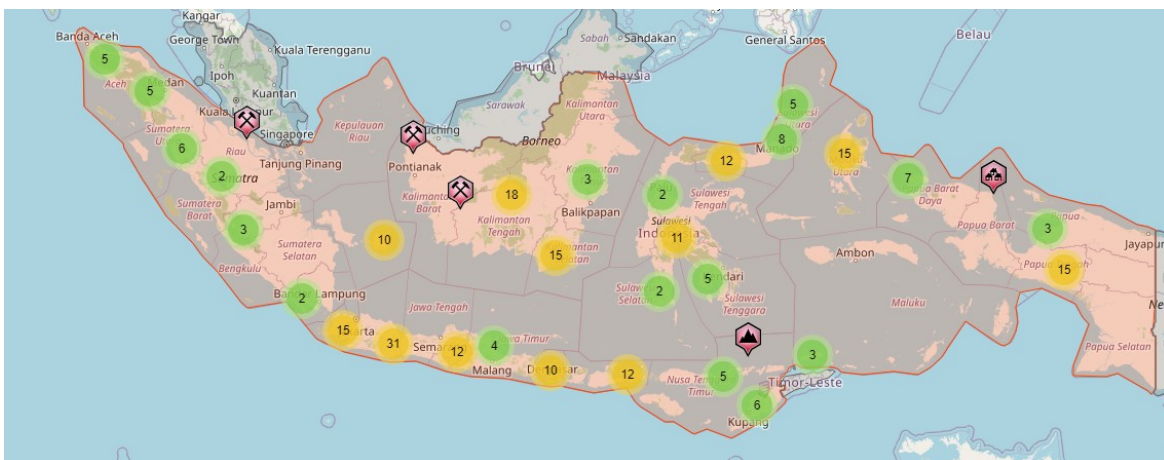


Figure 10 – Interactive Map Of Mineral Occurrences in Indonesia

Credit: ©Mindat.org

## Climate

Indonesia map of Köppen climate classification

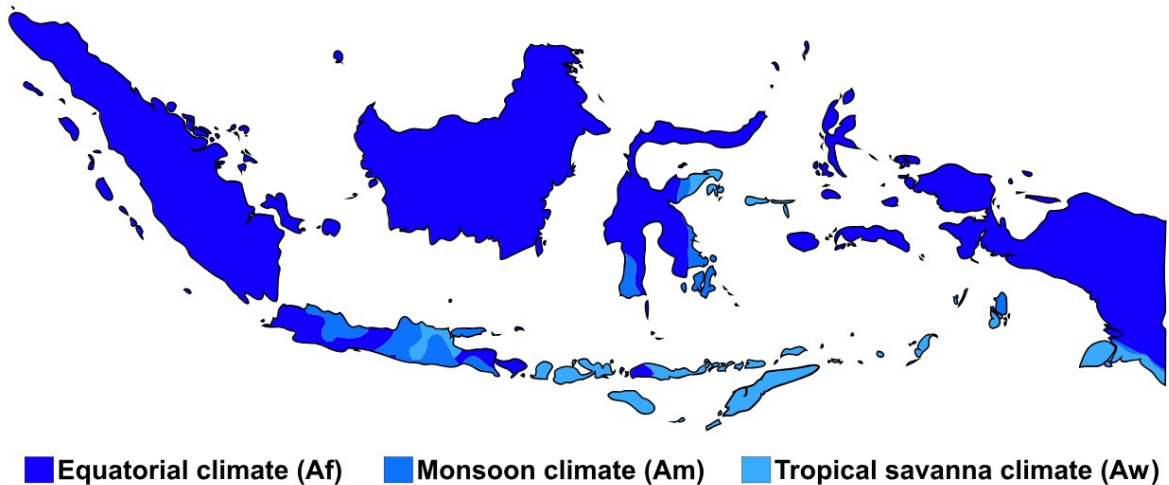


Figure 11 – Köppen Climate Classification, Indonesia

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

Indonesia has a tropical climate, hot, humid, and more moderate in highlands. The country's climate is divided into three zones: equatorial climate ([Af](#)), monsoon climate ([Am](#)), and tropical savannah climate ([Aw](#)).

If you plan to visit Indonesia, take a look at the travel advisories [here](#) and [here](#). Among the hazards they list are natural disasters such as volcanic eruptions and civil unrest in:

- Central Sulawesi, in Palu, Poso and Tentena;
- Maluku, especially in Ambon; and in
- Indonesian Papua



The travel advisories also warn of the yearly complete shutdown of the Island of Bali during [Nyepi](#), the [Day of Silence](#), to be held on March 29<sup>th</sup> this year. The day is intended to be one of spiritual reflection and involves the complete shutdown of society with no lights, music, nor noise. All transport is halted, and everyone must stay home. So if you are looking for a really quiet vacation, get to Bali in time for Nyepi.

Figure 12 – Prayers before Nyepi

Credit: [Ihsan ef](#), [Creative Commons Attribution 4.0 International](#) license

## History and Geopolitics

### History



Figure 13 – Map of the Majapahit Empire ca. 1365

Credit: [Adniii](#), [Creative Commons Attribution 4.0 International](#) license

The main divisions of the History of Indonesia are as follows:

### Prehistory

Hominids migrated to the Indonesian islands during the [Paleolithic](#) with [Homo erectus](#) arriving there around 1.6 million years ago. A hominid believed to have evolved from *H. erectus*, called [Homo floresiensis](#), lived on the island of [Flores](#) from about 700,000 years ago, until about 60–50,000 years ago. Modern human beings, [Homo sapiens](#), are thought to have arrived on the islands around 45,000 years ago. There may be a connection between the arrival of modern humans and the demise of *H. floresiensis*.

[Neolithic](#) cultures created megalithic monuments in the [Bada valley of Sulawesi](#), possibly as long as 5,000 years ago. The [Bronze Age Dong Son culture](#) spread to Indonesia from present day Vietnam during the beginning of the [Christian Era](#), bringing techniques of [bronze casting](#), [wet-field rice cultivation](#), ritual buffalo sacrifice, and [ikat](#) weaving methods.

### Hindu-Buddhist Kingdoms

The Hindu and Buddhist kingdoms were the earliest states in the history of Indonesia and included a large number of independent polities. All were strongly influenced by the Hindu and Buddhist cultures in India (as noted in [last month's posting](#) that noted India's influence on the Hindu and Buddhist cultures of [Greater India](#)). Among the notable states were:

- The Hindu [Yawadvipa](#) on Java, ca. 200 B.C.
- [Tarumanagara Kingdom](#) on West Java between 358 and 669 AD followed by the [Sunda Kingdom](#) that lasted on West Java till 1579.

- The [Kalingga Kingdom](#) in Central Java from 501 to 700 AD.
- The [Mataram Kingdom](#) in Central Java between the 8th and 10th centuries.
- The [Srivijaya](#) Kingdom on Sumatra during the 7<sup>th</sup> Century AD.
- [Singhasari](#) and [Majapahit](#) empires in the 13<sup>th</sup> and 14<sup>th</sup> Centuries

### **[Islamic Sultanates](#)**

[Islam arrived](#) in the Indonesian islands beginning in the 13<sup>th</sup> Century. Notable Islamic states included:

- The [Sultanate of Mataram](#) on Java from around 1570 to 1646, and
- [The Sultanate of Banten](#) on West Java and Sumatra from 1526 to 1813.

### **European colonization**

[Portuguese](#), Spanish, [French](#), [English](#), and [Dutch](#) adventurers began to arrive in the Indonesian islands during the 16th Century. It was the Dutch who eventually seized all of modern Indonesia, ruling it through the [Dutch East India Company](#), beginning in 1602, and directly by the Dutch state after 1800. Dutch rule of the Indonesia was interrupted by [British and French](#) forces during the [Napoleonic Wars](#).

Dutch rule in what was called the [Dutch East Indies](#) was not humane. Dutch policy was to extract as much wealth out of the country as was possible with little concern for the well being of the native population. In addition to the spice trade, the Dutch developed the mineral resources of the islands, especially [petroleum deposits](#). Naturally, the native population resented their treatment and, beginning in 1908, [a nationalist movement was formed](#) with the aim of achieving Indonesian independence. The Dutch authorities suppressed the movement as thoroughly as they could, engendering more resentment.

In 1941, the [Japanese invaded](#) and [occupied the Dutch East Indies](#) until the end of the war in 1945. The Japanese were interested in Indonesian oil supplies and sought the cooperation of Indonesian nationalists in their rule of the country. With the defeat of Japan in August 1945, nationalists attempted to seize control of the country in the [Indonesian National Revolution](#). The Dutch attempted to reassert their authority over the islands, [sending Dutch forces to re-occupy the islands](#). In the [civil war](#) that followed about 3,500 Europeans were killed and 20,000 went missing. In 1949, the Dutch were driven out and the Republic of Indonesia was established in 1949.

### **Independent Indonesia**

Following independence, Indonesia went through a [period of liberal democracy](#) that lasted till 1956. It was a time marked by uprisings and civil unrest. Under [President Sukarno](#), the country went through a period of what was euphemistically called [guided democracy](#), a period of authoritarian rule that lasted until the [ouster of Sukarno in 1965](#). His successor, [President Suharto](#) continued the policy of [authoritarian rule](#).

The period of authoritarian rule from 1956 till 1999, under both Sukarno and Suharto was marked by many violent events:

- An attempted [coup d'état in 1958](#) (instigated by the CIA);
- The [ouster of President Sukarno](#) (with CIA help) and the [Indonesian mass killings of 1965–66](#) (the background of the [Year of Living Dangerously](#));
- The [dispute over Western New Guinea](#) and the [subsequent annexation](#) of the territory; and
- The attempted annexation of Timor Leste and the brutal [occupation of the territory by Indonesian forces](#).

Other notable events during this time included massive forest fires in [1997](#), and, of interest to geologists, [the Bre-X scandal of 1997](#) involving claims of gold deposits that turned out to be non-existent.

In 1998, the people of Indonesia [had enough of Suharto](#) and [forced his resignation](#) in the wake of the [1997 Asian financial crisis](#). Since 1999 Indonesia has embarked on another [experiment with democracy](#). Unfortunately, inter-ethnic disputes in [Aceh](#), the [Maluku Islands](#), and [West Papua](#) together with outbreaks of [terrorism](#) have resulted in a period of [low intensity conflict](#). Also, since 1999, Indonesia also suffered the effects of [2004 earthquake and tsunami](#) and further wildfires in [2015](#).

### Geopolitics

Major crude oil trade flows in the South China Sea (2011)  
million barrels per day

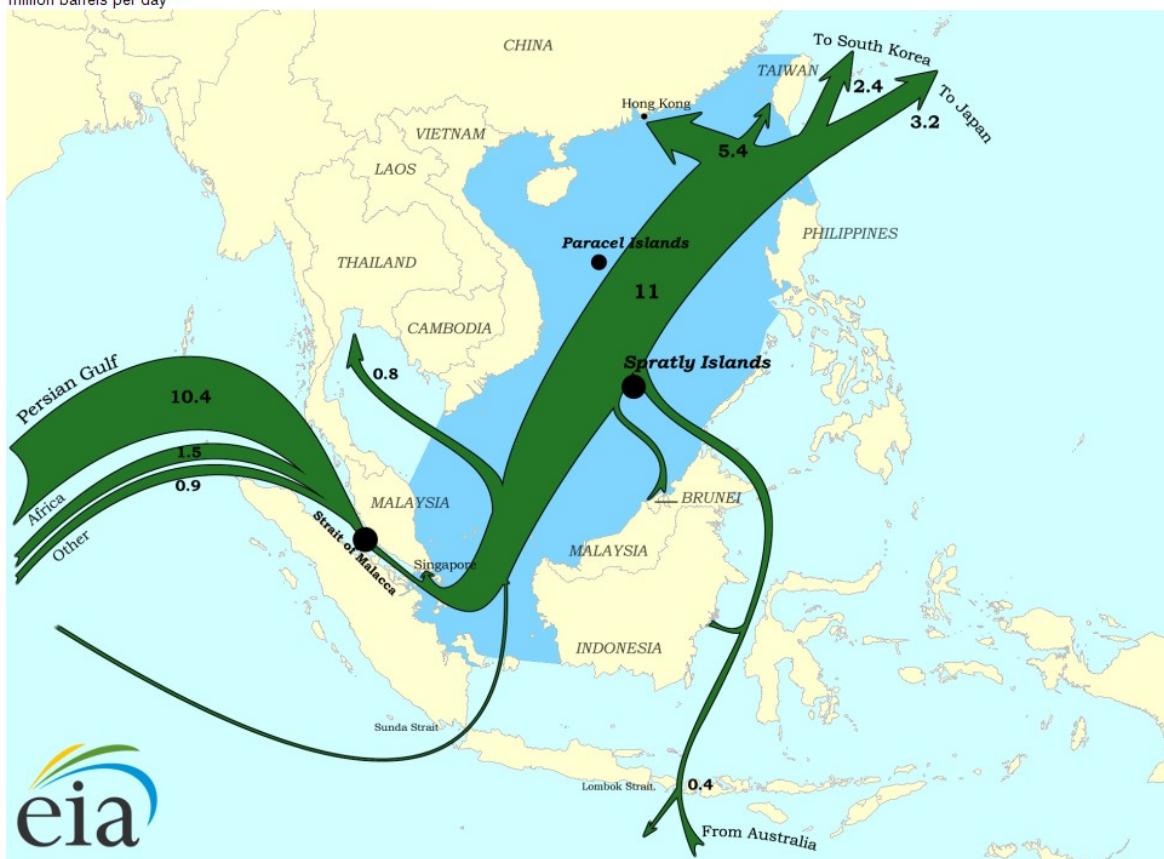


Figure 14 – Major Oil Shipments through the Malacca Strait  
Credit: [U.S. Energy Information Agency, public domain](#)

Indonesia's internal issues are difficult and may never have a satisfactory conclusion for the various parties. In addition to the ethnic divisions there has been an awakening of [militant Islam](#) in the last few years. There are reasons why the Sukarno and Suharto regimes implemented harsh measures to maintain power and the current government may also have to make similar choices. It remains to be seen if the current government has the wisdom and courage to successfully navigate the difficult inter-ethnic conflicts that history and fate have dealt them.

Indonesia's [geopolitical situation](#) is interesting, to say the least. A large, populous country, they have made it a point of being [not aligned with any of the Great Powers](#). However the [current government aligns itself diplomatically](#), it is a geopolitical fact-of-life that Indonesia sits at confluence of a major trade route and in any Great Power conflict between the USA and China, the [Strait of Malacca](#) will be a key choke point, especially for the flow of oil. Indonesia will have to choose wisely where they sit in any such conflict.

That winds up this fairly short look at Indonesia. This is another place with an uncertain future, so I won't even try to make any predictions. Follow up on the links if any of this interests you.

## **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.