

[April 28, 2025](#)

Comments

A reader, Marcus S., pointed out that last week's posting on [Jamaica](#) did not include a reference to gold mining exploration on the island. [C3 Metals](#) has [projects](#) at [Bellas Gate](#), [Super Block](#), and [Hungry Gully](#). The latest press release, from February 2025, on the Bellas Gate Project is [here](#).

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.

News and notes

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

Geopolitics



Ukrainian Oblasts that the Kremlin Define as "Novarossiia"

[Credit: The Institute for the Study of War](#)

- The [Canadian Federal Election](#) is on April 28th; this blog goes out before the voting even starts; I expect surprises.
- [Russia and Iran Deepen Energy Cooperation](#).
- Whiskey's for drinking, water's for fighting: [Kashmir attack: Does India's Indus Waters Treaty freeze threaten Pakistan?](#)
- [US Can Produce Rare Earths If China Stops Exports But There's a Catch](#).
- [US Propane Tanker Diverts Chinese Port Call In Latest Warning Sign For China's Plastic Factories](#).

- Critical minerals: [China Set to End One of Its Last US Dependencies Thanks to 35 Million Tons of High-Purity Quartz Deposit Worth 1.4 Billion Euros](#).
- Monitoring nuclear testing: [The Reduced Detection Rate of Signals That Are Hidden by Earthquakes: Case Studies with Spotlight Detectors That Operate at Seismic Arrays](#); Phys.org summary [here](#).

Research and News

- [Pore Fluid Origins, Circulation, and Links With Methane Hydrate on the South-Central Chilean Margin](#).
- [Mineralogical characteristics and color genesis of black quartzite jade from Linwu, Hunan, China](#).
- [Transport and Depositional Processes of Neogene Pumice Fragments in a Distal Fluvial System of the Northern Patagonian Foreland \(Argentina\)](#).
- [Stable chromium isotope fractionation during melt percolation: Implications for chromium isotopic heterogeneity in the mantle](#).
- [A continental review of Australia's Cenozoic megafans and associated large accretionary fluvial systems](#).
- [Holocene sea-level changes and the influence of storms on beach ridge formation in the Lower Gulf of Thailand](#).
- Geology education: [Earth science is critical to national resilience – so why is it being gutted?](#)
- [Magnetization of Ultramafic Rocks in the Troodos Ophiolite: Implications for Ridge Axis Serpentinization and Ophiolite Emplacement](#).
- Geophysics: [Laboratory Measurement of Sonic \(1–20 kHz\) P-Wave Velocity and Attenuation During Melting of Ice-Bearing Sand](#).
- [Using detrital zircon to reconstruct Neoproterozoic crustal thickness variation in the northwestern margin of the Yangtze Block](#).
- Record of Quaternary geomagnetic instability: [A Continuous 150-kyr Record of Geomagnetic Field Variations From Lake Chala, Eastern Equatorial Africa](#).
- [Hydrogen isotopic evidence for a core component in Baffin Island lavas](#).
- [Metasomatism of the carbonate rocks of the contact zone with the basalt](#).
- In the April 2025 issue of *New Mexico Geology*: [Petrogenesis of the Railroad Mountain Alkali Olivine Diabase Dike: Intrusion at the Edge of the Stable Craton in Eastern New Mexico](#).

Plate Tectonics

- Eclogites: [Quantitative Microstructural Analysis of Exhumed Epidote-Amphibolites and Plate Interface Rheology in Warm Subduction Zones](#).
- [Growth of continental crust and lithosphere subduction in the Hadean revealed by geochemistry and geodynamics](#).
- [Terrane accretion explains thin and hot ocean-continent back-arcs](#).
- [Subducted Slab Slipping Underneath the Northern Edge of the Pacific Large Low-Shear-Velocity Province in D''](#)
- [Remagnetization of Serpentinite During Deformation: Evidence From a Fossil Oceanic Transform Fault Zone of the Troodos Ophiolite](#).
- Plate tectonics and glaciation: [Effects of glacial forcing on lithospheric motion and ridge spreading](#); Phys.org summary [here](#).
- [Heavy boron isotopes in intraplate basalts reveal recycled carbonate in the mantle](#).
- [The geomorphic evolution of the Tasmanid Seamount Chain](#).
- [Recycling Subducted Organic Carbon as Diamonds: An Example From the New Caledonia Forearc Ophiolite](#).
- [Control of inherited structures on deformation and surface uplift: Crustal-scale analogue modelling with implications for the European eastern Southern Alps](#).

Paleontology

- [Reconciling Divergent Ages for the Oldest Recorded Air-Breathing Land Animal, the Millipede, *Pneumodesmus newmani* Wilson & Anderson, 2004: A Review of the Geology and Ages of the Basal Old Red Sandstone Stonehaven Group \(Silurian–Early Devonian\), Aberdeenshire, Scotland](#)
- Fossil titanosaur nesting area: [A unique association of fusiolithid dinosaur eggs from the Upper Cretaceous of Spain \(Poyos, central system\)](#).
- [From head to tail: 3D imaging the whole-body morphology of the stem gnathostome *Anglaspis heintzi*](#).
- [Giant 'sea dragon' fossil could be largest mosasaur ever discovered in Mississippi](#).
- [Pathological vertebrae in the holotype of *Paludidraco multidentatus* \(Sauropterygia, Simosauridae\) from the Upper Triassic of El Atance \(Central Spain\)](#).
- [A revised turtle assemblage from the Upper Cretaceous Menefee Formation \(New Mexico, North America\) with evolutionary and paleobiostratigraphic implications](#).
- [Established and Proposed Geosites of Visean \(Carboniferous\) Plants from the Moscow Basin](#).

- [Expanded phylogeny elucidates *Deinosuchus* relationships, crocodylian osmoregulation and body-size evolution](#); Smithsonian Magazine summary [here](#).
- [Sulross geology students collect vertebra from *Alamosaurus* in Big Bend National Park](#)

Mining and Energy

- [Gates, Bezos-backed critical minerals explorer to 'go big' on Congo – report](#).
- [Lyondell Houston refinery ceased operations in February, company says](#).
- [Trump Admin Tweaks Offshore Drilling Rules to Boost Production](#).
- Geology of geothermal energy: [The Effect of Hydrothermal Alteration and Microcracks on Hydraulic Properties and Poroelastic Deformation: A Case Study of the Blue Mountain Geothermal Field](#).
- [Trump Eyes Sovereign Wealth Fund to Back U.S. Mining](#).
- Petroleum geology: [Petrography and Fluid Inclusions for Petroleum System Analysis of Pre-Salt Reservoirs in the Santos Basin, Eastern Brazilian Margin](#).
- REE Ore geology: [Paleozoic carbonatites controlled rare-earth-elements mineralization at Bayan Obo](#).
- [Hemlo gold mine: Barrick gold seeks buyers for its last mine in Canada](#); this [guy](#) says to buy gold.
- [Chevron Starts Oil Production From Ballymore Project in Gulf of America](#).
- [Saudi Aramco signs development deal with China's EV giant BYD](#).
- [By Chance, He Discovers a Gold Deposit in Auvergne, Valued at 4 Billion Euros, but the French Government Blocks Its Exploitation](#).
- Nuclear battery [using ¹⁴C: A battery that lasts 5,700 years without recharging has been created in the UK](#).
- [China has world's first operational thorium nuclear reactor thanks to 'strategic stamina'](#).
- Processing technology: [Pathways to Electrochemical Ironmaking at Scale Via the Direct Reduction of Fe₂O₃](#); SciTechDaily summary [here](#); no more need for [metallurgical coal](#).

Environmental Geology and Hydrogeology

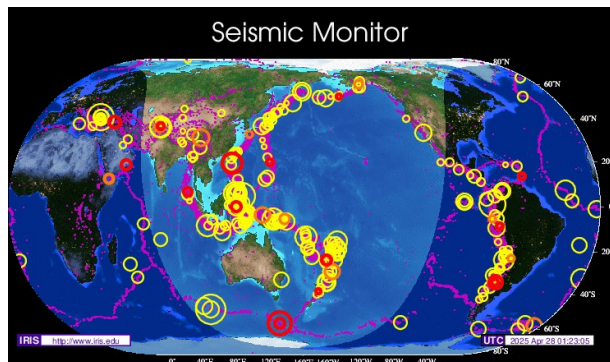
- [Hydrological Characteristics of Columnar Basalt Aquifers: Measuring and Modeling Skaftafellsheiði, Iceland](#).
- Vadose zone hydrogeology: [Monitoring water percolation in a laboratory compacted soil dam using time-lapse electrical resistivity tomography](#).

- Biosolids application gone wrong: [Tainted fertilizer spread across 10,000 acres may trigger first Superfund designation for farmland.](#)
- [Five decades after the Clean Air Act, legacy metal contaminants in Northeast U.S. surface waters document full recovery for the first time](#); Phys.org summary [here](#).

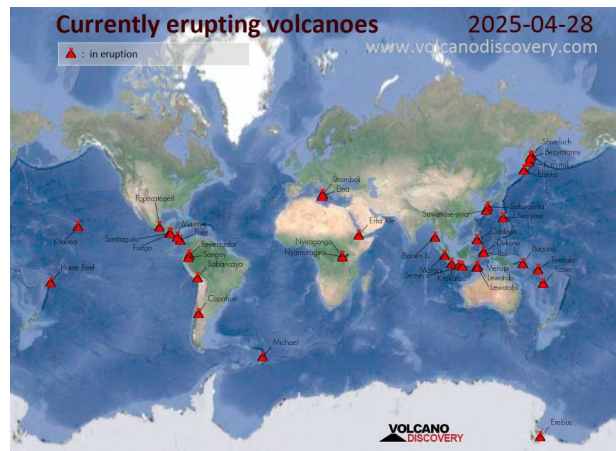
Glaciers and Climate Change

- Deglaciation: [Bølling-Allerød Productivity in the Subarctic Pacific Driven by Seasonal Upwelling.](#)
- [Arctic fjord ecosystem adaptation to cryosphere meltdown over the past 14,000 years](#); Phys.org summary [here](#).
- [Obliquity disruption and Antarctic ice sheet dynamics over a 2.4-Myr astronomical grand cycle.](#)
- [Sea-Ice Retreat From the Northeast Greenland Continental Shelf Triggers a Marine Trophic Cascade](#); Phys.org summary [here](#).
- [Poleward shift of subtropical highs drives Patagonian glacier mass loss](#); Phys.org summary [here](#).
- [A 430 kyr record of ice-sheet dynamics and organic-carbon burial in the central Eurasian Arctic Ocean.](#)
- What could go wrong? [Britain to approve £50m Sun-dimming experiments in bid to prevent runaway climate change.](#)
- [Four-million-year Marinoan snowball shows multiple routes to deglaciation.](#)
- [No glaciers left: this country just made climate history.](#)
- [Antarctica's melting surprises researchers.](#)

Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

Volcanoes

- [Smithsonian / USGS Weekly Volcanic Activity Report](#).
- United States Geological Survey (USGS) Volcano Observatories:
 - [Tilt, Tremor, and Lava: Remembering Mauna Loa's 2022 Eruption Onset](#).
 - [Thinking outside the caldera: Understanding basaltic eruptions at Yellowstone](#).
- Volcano research: [Seismic Structure of the Mid to Upper Crust at the Santorini-Kolumbo Magma System From Joint Earthquake and Active Source Vp-Vs Tomography](#).
- Magma movement research: [The Influence of Variable Host Rock Cohesion and Magma Viscosity on Intrusion-Fault Interaction: Insights From Laboratory Models](#).
- Volcano monitoring research: [Minute-scale dynamics of recurrent dike intrusions in Iceland with fiber-optic geodesy](#); Phys.org summary [here](#).
- [Pair of 'glowing' lava lakes spotted on Africa's most active volcanoes as they erupt simultaneously – Earth from space](#).
- [UH: Kīlauea volcano ash prompts largest open ocean phytoplankton bloom](#).
- [Arctic haze induced by an Icelandic volcanic eruption: Evidence from China's highest-resolution trace gas monitoring](#); SciTechDaily summary [here](#).

Earthquakes

- [Euro-Mediterranean Seismological Centre \(EMSC\)](#).
- [Earthquakes Monitoring Live Worldwide](#).
- [Cascading Earthquake Swarms in the Northern Taupō Volcanic Zone, New Zealand](#).
- [Frictional and microstructural evidence for a weak Wasatch fault zone](#).
- [Special issue “active tectonics and seismic hazards in the Himalayan region](#).
- Related to today's post: [Source rupture process of the MW 6.2 earthquake in the Noto Peninsula, central Japan, on May 5, 2023](#).
- [M6.2 earthquake shakes Istanbul](#); USGS summary [here](#).

Tsunami

- [Detection of Landslide-Generated Tsunami by Shipborne GNSS Precise Point Positioning](#).

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.
- 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>.
- Brett Davis’ book on veins in a deforming rock mass: “[The Veining Bible](#)”; also at [this site](#).

Upcoming Events

- [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.](#)
- [GeoConvention 2025, Calgary Telus Convention Center May 12 – 14, 2025.](#)
- [May 15, 2025: NGWA’s Problematic Contaminant Webinar Series: Limiting Metals Mobilization During Managed Aquifer Recharge.](#)
- [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 \[here\]\(#\).](#)
- [GeoManitoba 2025 78th Annual Canadian Geotechnical Society Conference & 9th Canadian Permafrost Conference, RBC Convention Centre, Winnipeg, Manitoba, September 21 – 24, 2025.](#)
- [29 September – 1 October 2025, Stuttgart, Germany, Nature Conference on Advancing Perovskite-Based Photovoltaics.](#)
- [November 3 – 4, 2025 Central Canada Mineral Exploration Convention 2025 Victoria Inn Hotel & Convention Centre, 1808 Wellington Avenue, Winnipeg, Manitoba R3H 0G3, Canada.](#)
- [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](#).

April 28, 2025

Geology and the Fate of Societies – Japan



Figure 1a – Japan

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



Figure 1b – Location of Japan

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

Located in the [Pacific Ocean](#) offshore of [East Asia](#) is the island nation of [Japan](#). North and east across the [Sea of Japan](#) are [Russia](#), [North Korea](#), and [South Korea](#). East and south, across the [East China Sea](#) are [China](#) and [Taiwan](#). Japan consists of four main islands, [Hokkaido](#), [Honshu](#), [Shikoku](#), and [Kyushu](#) and [thousands of smaller islands](#) including the [Bonin Islands](#) (Ogasawara-gunto), [Daito-shoto Islands](#), [Minami-jima](#), [Okino-tori-shima](#), [Ryukyu Islands](#) (Nansei-shoto), and the [Volcano Islands](#) (Kazan-retto).

Japan is a unitary [parliamentary constitutional monarchy](#). The Head of State is [Emperor Naruhito](#), his Prime Minister is [Shigeru Ishiba](#). The Legislature of Japan, [the Kokkai](#), usually translated at the National Diet, consists of an upper house, the [House of Councillors](#), and a lower house, [House of Representatives](#). The Capital and largest city in Japan is [Tokyo](#) (pop. ~41,000,000 in the metropolitan area).

According to the Central Intelligence Agency ([CIA](#)) [World Factbook](#) on Japan, the total area of Japan is 377,915 square kilometres (km²); of which 364,485 km² is land and 13,430 km² is water. Also according to the CIA, 123,201,945 people live in Japan, 92% of whom live in urban areas. Of that ~123 million people, almost all, 97.5%, are [ethnic Japanese](#). Minority populations in Japan include: [Chinese](#), [Vietnamese](#), [Korean](#), [Filipino](#), [Brazilian](#) (often of Japanese descent), [Nepalese](#), [Indonesian](#), [American](#), and [Taiwanese](#).

[Japanese](#) is the official language; the [Ainu Language](#) is spoken among some elderly people on Hokkaido; [Ryukyuan languages](#) (in the [Japonic language family](#)) are spoken on the Ryukyu Islands; and the Hachijō language (another Japonic language) is spoken on the [Southern Izu](#) and Daito-shoto islands. In terms of religion, [Shintoism](#) (48.6%), and [Buddhism](#) (46.4%) are the most common faiths. Among the remainder,

1.1% are [Christian](#) and 4% are something other. The Japanese [are well educated](#) and can expect to spend 15 years in school.

Economically, the per capita [GDP \(PPP\)](#) in Japan is \$54,678; the [Gini](#) coefficient is 33.4, indicating medium inequality; and the [Human Development Index](#) is very high at 0.920. [The top exports](#) of Japan were cars (¥1.19t), [commodities not elsewhere specified](#) (¥747B), integrated circuits (¥356B), gold (¥300B), and [machines and apparatus of a kind used solely or principally for the manufacture of semiconductor boules or wafers, semiconductor devices, electronic integrated circuits or flat panel displays](#) (¥288B). The [top imports](#) of Japan were crude petroleum (¥981B), petroleum gas (¥764B), telephones (¥485B), coal briquettes (¥385B), and computers (¥344B). In January 2025, Japan [exported](#) mostly to United States (¥1.54T), China (¥1.17T), South Korea (¥552B), Chinese Taipei (¥525B), and Hong Kong (¥398B), and [imported](#) mostly from China (¥2.62T), United States (¥1.06T), Australia (¥724B), United Arab Emirates (¥476B), and Vietnam (¥441B).

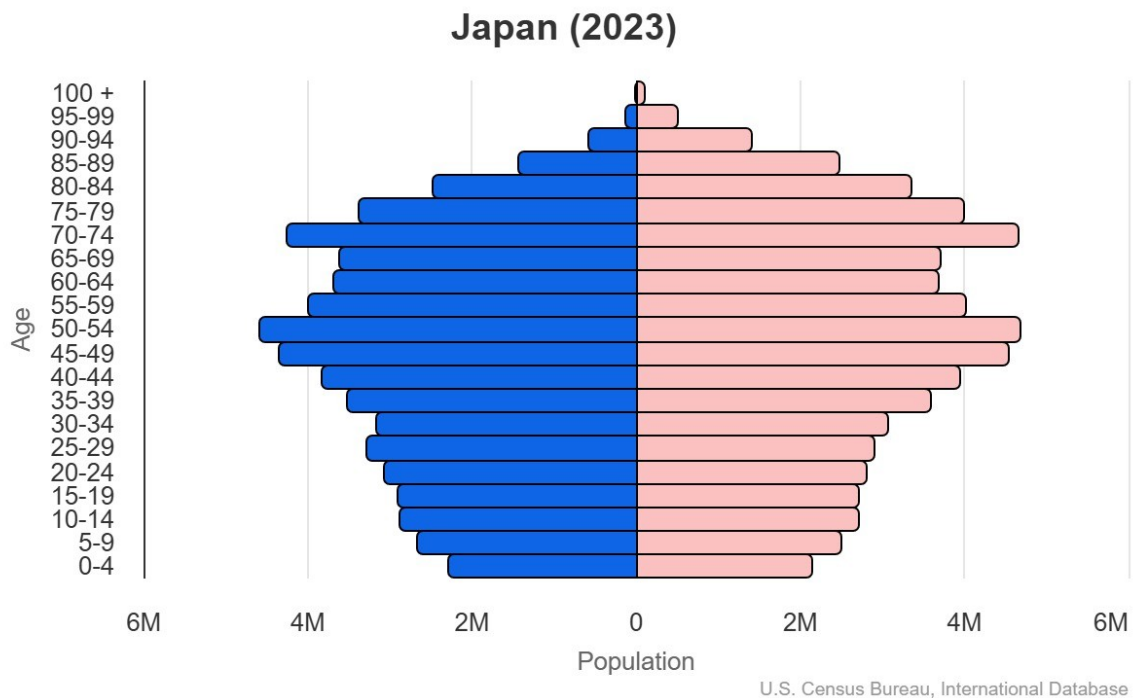


Figure 2 – Japanese Demographics
Credit: U.S. Census Bureau, International Database, public domain

[Japanese demographics](#) show an aging, with the population shrinking at 0.41% per year. Last year saw a [record drop in population](#). The median age is 49.9 years old; only 12.1% of the population is under 15 years of age while 29.5% of the population is over 65. The total fertility rate is 1.39 births per woman, well below the replacement rate of 2.1. Life expectancy at birth, for both sexes, is 85.0 years.

Geology

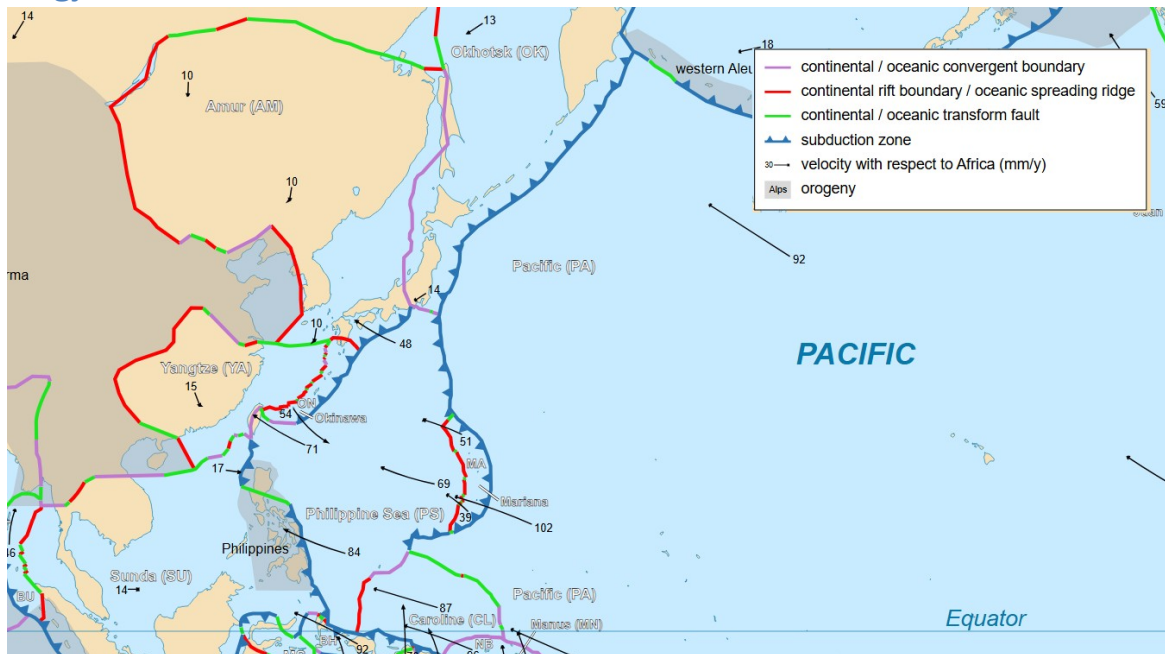


Figure 3 – Tectonic Setting of Japan

Credit: Eric Gaba ([Sting](#) – [fr: Sting](#)); [Creative Commons Attribution-Share Alike 2.5 Generic](#) license

Tectonically, Japan sits off of the east edge of the [Eurasian Plate](#) having [subduction](#) boundaries with the [Pacific Plate](#) and the [Philippine Sea Plate](#). The Eurasian Plate is also divided into smaller regional tectonic plates: northeast Japan is part of the [Okhotsk Plate](#); south central Japan is part of the [Amur Plate](#); and southwestern Japan, Okinawa and the Ryukyu Islands are on the [Okinawa Plate](#). To the west of the Okinawa Plate is an ocean spreading ridge bordering on the [Yangtze Plate](#).

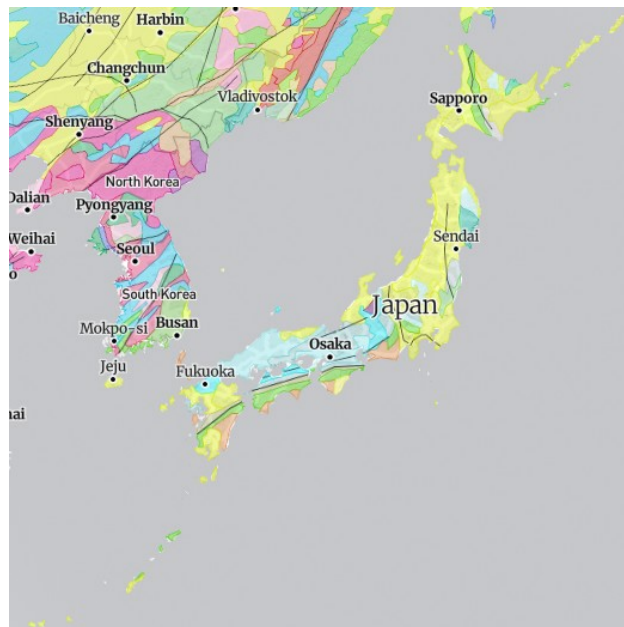


Figure 4 – Macrostrat Interactive Geology Map of Japan, Credit: [Macrostrat](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license

Figure 4, above, links to an [interactive](#) geological map of Japan. To get the details of the lithology, click on Figure 4 and open the [Macrostrat map](#) then move the cursor over the area of interest and click to open the lithological description.

The tectonic setting of Japan is reflected in the three major geological domains of the country:

Northeastern Japan north of the [Tanakura Fault](#) including the:

- [Idosawa Fault](#);
- [Senya Fault](#);
- [Hidaka Mountains](#);
- [Kitakami Mountains](#); and the
- [Ōu Mountains](#).

Central Japan, between the Tanakura Fault and the [Itoigawa-Shizuoka Tectonic Line](#), including the:

- [Fossa Magna Graben](#);
- [Tanna Fault](#); and the
- [Bōsō Hill Range](#).

Southwestern Japan, south of the Itoigawa-Shizuoka Tectonic Line which is further divided into several metamorphic belts along the [Japan Median Tectonic Line](#) (JMTL). North of the JMTL are granitoid intrusions ranging from age from the [Paleogene Period](#) to the [Cretaceous Period](#). South of the JMTL are [accretionary complexes](#) ranging in age from [Jurassic Period](#) to younger. Important structural units in southwestern Japan include the:

- [Urasoko fault](#);
- [Fukoju Fault](#);
- [Neodani Fault](#);
- [Nojima Fault](#);
- Hida Orogenic Belt ([Hida Mountains](#) and [Ryōhaku Mountains](#));
- [Sangun Orogenic Belt](#);
- [Maizuru Orogenic Belt](#);
- [Tanba-mino Orogenic Belt](#);
- [Ryoke Orogenic Belt](#);
- [Shimanto Orogenic Belt](#);

- [Sambagawa Orogenic Belt](#);
- [Chichibu Orogenic Belt](#);
- [Sambosan Orogenic Belt](#); and the
- [Beppu–Shimabara Graben](#).



Figure 5 – The Great Wave off Kanagawa
Credit: [Katsushika Hokusai](#) (1760–1849), [public domain](#)

As you might already know, or guess after reading through this summary of Japanese geology, the country is very active tectonically. There are over [100 active volcanoes](#) in Japan and in the [history of Japanese earthquakes](#) there have been [many, many earthquakes](#). These earthquakes have often led to the phenomena called tidal waves or [tsunami](#) (a Japanese word borrowed into English). There have [been a total of 143 recorded tsunami](#) since 684 AD including the one commemorated by [Katsushika Hokusai](#) in his famous work [The Great Wave off Kanagawa](#). The recorded death toll from tsunami in Japan since 684 AD is approximately 130,974 people. The Japanese also place [markers](#) for the high-water marks of tsunami, as a warning to the future.

For more information, check out the [Geological Survey of Japan](#) together with these links:

- Koji Wakita, 2013, *Geology and tectonics of Japanese islands: A review – The key to understanding the geology of Asia*, *Journal of Asian Earth Sciences*, Volume 72, 10, Pages 75-87, <https://doi.org/10.1016/j.jseaes.2012.04.014>.

- *The Geology of Japan*, 2016, Editors Teresa Moreno; Simon Wallis; Tomoko Kojima; Wes Gibbons, The Geological Society of London, <https://doi.org/10.1144/GOJ>; also at <https://www.lyellcollection.org/doi/book/10.1144/GOJ>.

Resources

Agriculture



Figure 5 – Terraced Rice Fields, Asahi, Yamagata Prefecture

Credit: [Syuzo Tsushima](#), [Creative Commons Attribution 2.0 Generic](#) license

According to the CIA World Factbook, agriculture accounts for 1% of Japan's GDP and uses 12.7% of the land (11.2% arable land, 0.7% permanent crops, 0.9% permanent pasture). 15,730 km² of the land is irrigated. Of the rest, 68.4% is forest and 18.9% has other uses, including urban areas.

Also according to the CIA, the top ten agricultural products in 2023, based on tonnage, are rice, milk, sugar beets, vegetables, eggs, chicken, potatoes, onions, cabbages, and pork. Statistics on agricultural production from the [United Nations Food and Agriculture Organization](#) (FAO) can be found [here](#). The FAO indicates that from 2021 to 2023 [about 5.5% of the population](#) suffered from moderate to severe food insecurity.

Rice is the major agricultural product of Japan; in 2023, they produced 10,136,000 tonnes. Rice cultivation is also a major part of [traditional Japanese rural culture](#). The rhythm of springtime planting of the rice seedlings, summer ripening of the crop, and harvest in the fall continued from year to year. This rhythm of agriculture continued regardless of natural and political events.



Figure 7 – Squid fishing boats at Kōchi, Japan

Credit: [Takanobu Shuji](#), [Creative Commons Attribution 2.0 Generic](#) license

Fishing has been another long time practice of the Japanese, providing an important source of food to an island nation. The [Japanese fishing industry](#) includes [edible seaweed](#), [wild-caught fish](#), [whaling](#), and [aquaculture](#). About 66% of the seafood consumed in Japan is caught by Japanese fishermen, the rest is imported from other countries. The Japanese fishing industry is the largest in the world, based upon the size of landed catch, and they [believe that the catch is sustainable](#). Statistics on Japanese fishing production from the FAO can be found [here](#).



Figure 8 – Pet Koi in Ojiya, Niigata Prefecture

Credit: [Asturio Cantabrio](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license

While not strictly food fish, the Japanese are also famous for [raising ornamental fish](#), such as the [Koi](#) in Figure 8. For more information, check out the [Japan Ornamental Fish Association website](#) and this [website](#) on the cultural significance of raising Koi.

Forestry



Figure 9 – Kabutoyama Forest Park in Nishinomiya, Hyogo Prefecture
Credit: [663highland](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

68.4% of the land area of Japan is forest. There are a wide variety of [ecological biomes in Japan](#); resulting in a wide variety tree species. The [varieties of trees](#) in the various biomes include:

- [Evergreen forests](#) that grow in warm-temperate regions, mainly containing shii (Japanese chinquapin, *Castanopsis sieboldii*) and tabu (Japanese bay tree, *Machilus thunbergii*);
- [Deciduous forests](#) that form in mountainous and cool-temperature regions, mainly containing beech (*Fagus crenata*) and oaks (*Quercus spp.*); and in
- [Conifer forests](#) that form in the mountainous areas of low-temperature regions, mainly containing fir (*Abies spp.*) and spruce (*Picea spp.*).

Statistics on forestry production in Japan from the FAO can be found [here](#).

No discussion on Japanese forests would be complete without a mention of [Aokigahara](#), the suicide forest. A quiet, serene place, [Aokigahara](#) is the perfect place to leave this life if you so wish to and about 150 people per year exercise that option. We should note that suicide has a [complicated history in Japan](#) and it's [all-too-common occurrence](#) is a great worry to some people.

Mineral Resources



**Figure 10 – Gold Ore from the [Toi Gold Mine](#) in Izu City, Shizuoka Prefecture
Credit: [PHGCOM](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license**

According to the [USGS Minerals Yearbook](#) on Japan, the country imports almost all of its important mineral resources, i.e. petroleum, natural gas (as LNG), iron, copper, etc. Domestic mineral production is restricted to industrial minerals such as lime, limestone, cement, and [iodine](#) together with one active mine, the [Hishikari Gold & Silver Mine](#) in Kagoshima Prefecture.

An [epithermal vein-type deposit](#) (check out Brett Davis' book "[The Veining Bible](#)"), [Sumitomo Metal Mining Co., Ltd.](#) reports that the grades at Hishikari are 20 grams of gold per tonne. According to the [USGS](#), the Hishikari mine produced 4,400 kg of gold and 2,400 kg of silver in 2022.

Former Japanese mining operations include:

- The [Toi Gold Mine](#), in Izu City, Shizuoka Prefecture operated from ca. 1370 AD to the mid 20th Century. A Canadian company.;
- The [Ashio Copper Mine](#), Ashio, Nikko City, Tochigi Prefecture operated from ca. 1610 to 1973; and
- The [Fukoku Mine](#), Fukuchiyama City, Kyoto Prefecture formerly produced copper and tin;
- The [Akenobe Mine](#), Oya-cho, Yabu City, Hyogo Prefecture, formerly produced copper, zinc, tin, tungsten, and arsenic;
- The [Tada Mine](#), Inagawa-cho, Kawabe District, Hyogo Prefecture, produced copper, tin, and silver mine, from 1211 to 1973; and
- Two former coal mines, at [Takashima](#) and [Hashima](#), both in Nagasaki Prefecture, operated in the late 19th and early 20th Centuries; both of which are [alleged to have used slave labour from Korea](#).

A Canadian company, [Japan Gold](#), is currently exploring for gold in Japan. Figure 11, links to an interactive map of mineral occurrences in Japan.

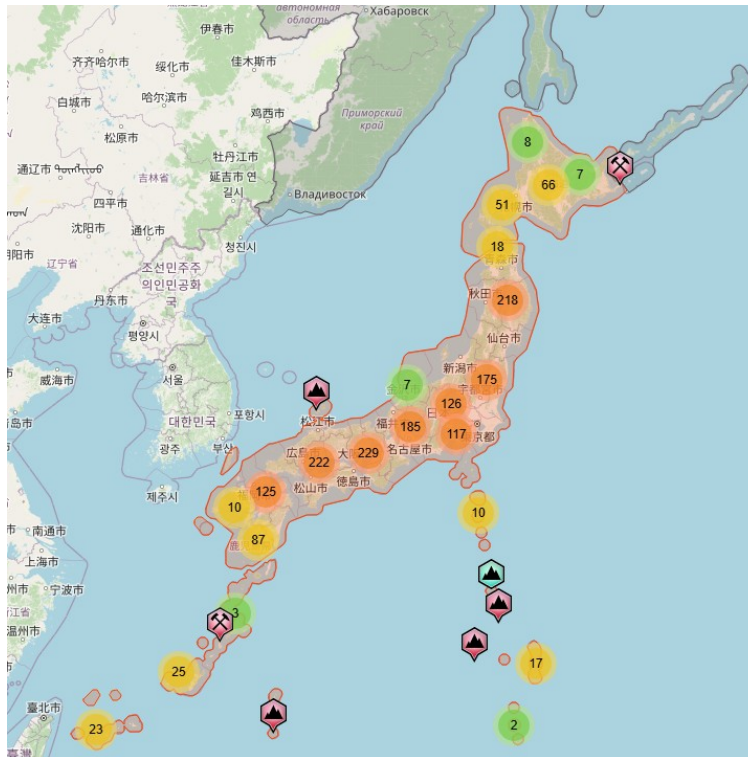
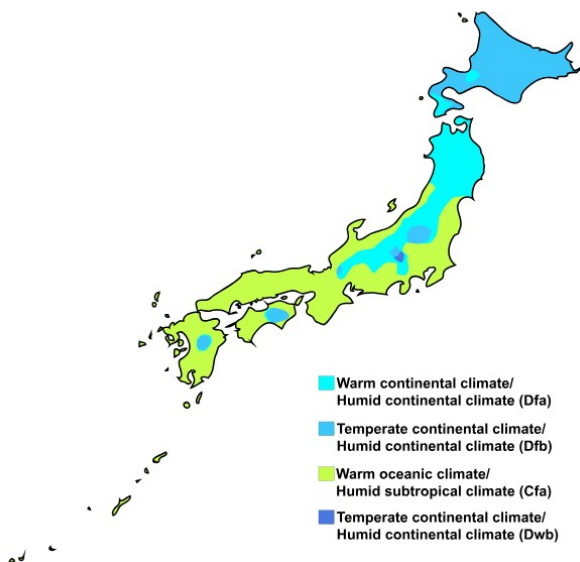


Figure 11 – Interactive Mineral Occurrences Map of Japan
 Credit: ©Mindat.org

Climate

Japan map of Köppen climate classification



The climate of Japan varies from near tropical in the Ryukyu Islands, to cool temperate in the north. The main climate zones are:

- Warm continental/Humid continental ([Dfa](#));
- Temperate continental/Humid continental ([Dfb](#));
- Warm oceanic/Humid subtropical ([Cfa](#)); and
- Temperate continental/Humid continental ([Dwb](#)).

Figure 12 – Köppen Climate Zones, Japan
 Credit: [Ali Zifan](#), [Creative Commons Attribution-Share Alike 4.0 International license](#)

Japan look like a pleasant place to visit. A modern industrial country with a [low crime rate](#), the main drawback is probably the crowds in large megalopolis like Tokyo (said to be the [safest city in the world](#)). If you go, check out the travel advisories ([here](#), [here](#) and [here](#)). The main issues with visiting Japan are

the tectonic risks mentioned above. You could also check out [Climates to Travel](#) and [Lonely Planet](#) before you go.

History and Geopolitics

History

The [history of Japan](#) is fairly complex, and interesting. If you are interested in the details check out these links [here](#) and [here](#). I thought that I would summarize the history by breaking it down into a few convenient categories:

1. Prehistory

Japan was settled by hunter/gatherers during the [Paleolithic](#) who developed the [Jōmon culture](#). Rice cultivation was brought to Japan by people that archaeologists call the [Yayoi people](#). The Yayoi period led to early state formation during the [Kofun period](#) (c. 250–538) when most of southern Japan came under the nominal rule of an emperor.

2. Classical Period

The Kofun period was succeeded by the [Asuka period](#) (538–710), a period marked by the [introduction of Buddhism to Japan](#) from Korea. The [Nara period \(710–794\)](#) succeeded the Asuka period and was marked by large scale borrowing of Chinese culture. For example, the new capital at [Heijō-kyō](#) (modern [Nara](#)) was modeled on [Chang'an](#), the capital of the contemporary [Chinese Tang dynasty](#). It was also during this time that increasing contacts with the rest of Asia brought [smallpox, the epidemic of which in 735 to 737](#) killed about 1/4 of the population.

3. Literature and Feudalism

It was during the [Heian period](#) (794–1185) that Japan steps into the world of literature. During the Heian times, the imperial court became increasingly decadent and generally unimportant. Two fruits of this decadent period were two early masterpieces of Japanese literature: [Sei Shōnagon's The Pillow Book](#), and [Murasaki Shikibu's Tale of Genji](#). It was during the Heian period that the Buddhist priest [Kūkai](#) is credited with developing the [kana](#) script.

The [Kamakura period](#) (1185–1333) began when [Minamoto no Yoritomo](#) took effective control of Japan as [Shogun](#), but leaving the Emperor with his title but little other power. It was during this time that Japanese [samurai](#) warriors defeated two invasions by the [Mongols in 1274 and 1281](#). Also, during this time there were attempts to restore the Emperor's power in the [Jōkyū War](#) and the [Kenmu Restoration](#).

The samurai who opposed the Kenmu Restoration succeeded in installing [Ashikaga Takauji](#) as the new Shogun in 1333, leading to the [Muromachi period](#) (1333–1568). The Shogunate of Ashikaga Takauji and his successors was considered a flourishing of Japanese culture known as the [Higashiyama period](#). The cultural developments of the Higashiyama period included the formalization of the [tea ceremony](#), the growth in artistic [Japanese gardening](#) including [bonsai](#), and the invention of [Noh theatre](#).

The Muromachi feudal system became increasingly anarchic, leading into a period called the [Sengoku period](#). The Sengoku period in turn evolved into an even bloodier contest among the [daimyo](#) and their samurai retainers during the subsequent [Azuchi–Momoyama period](#). The winners in this anarchic contest were, in turn: [Oda Nobunaga](#), [Toyotomi Hideyoshi](#), and, finally [Tokugawa Ieyasu](#).

4. The Tokugawa Shogunate (1600–1868)



Figure 13 - Portrait of Tokugawa Ieyasu, founder of the Tokugawa Shogunate
Credit: [Kanō Tan'yū \(1602–1674\)](#), [public domain](#)

Also called the [Edo period](#), after the old name for Tokyo, the rule of the Tokugawa clan was a period of strictly enforced internal peace and isolation from the outside world. It is almost as if, at the end of the bloody wars among the Japanese daimyo and their samurai retainers, Tokugawa Ieyasu said “enough of this slaughter, let’s have some peace and harmony”. It didn’t come easy. First, the Shogun issued laws [to put rival daimyo](#) into their place. Besides dealing with his political rivals, ordinary criminals were subject to [draconian punishments](#) such as beheading, crucifixion (something they learned about from [Christian missionaries](#)), and even boiling alive. [Foreign trade](#) was strictly controlled, and Christianity was suppressed due to the Catholic’s allegiance to the [Bishop of Rome](#). They even instituted effective gun control by gradually restricting the production of guns to a small handful of old master craftsmen.

Under the Meiji Restoration, Japan embarked on a wholesale adoption of modern industrial social organization. They modelled their new legislature after the European diet of Germany. They modelled their new army after the [Prussian Army](#). The organization of their new navy was copied from the [British Royal Navy](#). While keeping the meritocratic aspects of Confucian education, they introduced modern science and knowledge to the Japanese education system.

The results were not long in coming. In 1874 Japan launched a [punitive expedition](#) to Taiwan against pirates and ended up keeping the place. They then [incorporated the Ryukyu Islands](#) into the imperial realm. Japan defeated China in the [First Sino-Japanese War](#) (1894–1895), a move that led to the [conquest of Korea](#). The Japanese then ran up against the Russians, whom they defeated in the [Russo-Japanese War of 1905](#). It got better for the Japanese, in 1914 they joined the allies against [Germany in the First World War](#), mainly with the aim of snagging German possessions in the Pacific.

Internally, during this time, Japan was struggling with the development of representative government. As the result of mass protests and riots during the [Taishō political crisis](#) and the [rice riots of 1918](#), political power shifted from the oligarchy of leading men to the new political parties. In 1925, universal male suffrage was introduced. Unfortunately for the Japanese, during the 1920's and 30's, the military leadership began to take an increasing role in directing Japanese politics. This development ultimately led to disastrous results.

Japan's conquest of Korea led to [further expansion into Manchuria](#), at the expense of China. The spur for this imperialist expansion was the harsh reality that while Japan had developed a strong industrial economy, they had few domestic resources such as iron and coal. The military solution was to simply take what they needed in Korea and Manchuria. Eventually, the dispute with China led to the beginning of the [Second Sino-Japanese War](#), a war marked by brutality against the Chinese, as in the notorious [Rape of Nanjing](#).

The United States was none-too-happy with Japanese behavior in China and [instituted trade sanctions against Japan](#). In response, the Japan elected to go to [war with the United States](#), beginning with a strike against the [American Fleet at Pearl Harbour in Hawai'i](#). This proved to be a tragic mistake for Japan. A mistake that ended with the [firebombing of major Japanese cities](#), the atomic destruction of [Hiroshima](#) and [Nagasaki](#), the destruction of the [Japanese army in China and Manchuria by the Soviet Union](#), and the [utter defeat of Japan](#).

6. Modern Japan

Despite their defeat in World War II, the Japanese had one major asset to call on – their people. The Japanese recovery from the war [amazed the world](#) and can be credited mostly to the hard-working Japanese people. [Postwar Japan](#) has become the model of prosperous economic and social development, especially in its investment in the education of its people, an investment that paid off handsomely. Rather than having to conquer territories to secure resources, the sale of Japanese goods has enabled them to simply buy what they needed. It's been quite a ride for the Japanese.

Geopolitics – The Problems of Success



Figure 14 – Shinjuku, Tokyo with Mt. Fuji in the Background

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

Modern Japan appears to have it all. Prosperous, peaceful, with plenty of room for individual expression through its many [wacky subcultures](#). You would think that the main problem would be to keep a good thing going, right? To a certain extent, that is true.

And yet; something is terribly wrong in their country. One piece of evidence is their declining birth rate. A happy people should be happy to replace themselves, family being one of the main features of a happy life. Now, the Japanese are not alone in their declining population – it seems to be a [common issue in much of the industrial world](#). But identifying it as common doesn't address its causes. Realistically, it has many causes, including the ultimate one of the difficulty in building a family in the industrial world.

Another sign of stress within Japan is the common practice of suicide, [especially among young people](#). What drives young people, with their whole life ahead of them, to take such drastic steps? Certainly, there is the pressure to succeed within the competitive [meritocratic education system](#) and shame if you fail to live up to expectations. Or is their something more, what despair drives people to go to Aokigahara Forest, and never return? I don't have the answers, but the people of Japan have to find those answers. With a shrinking population they need every Japanese they can get.

Another internal issue of Japan is one that will never go away – the tectonic dangers of their beautiful land. Geohazards are a serious issue in Japan, for example, they are world leaders in [earthquake preparedness](#) and [research](#). In this respect, Japan's strong social cohesion gives them an advantage in dealing with the next big one. You don't have to be a seer like [Ryō Tatsuki](#) to know that predicting tectonic catastrophes for Japan is a pretty safe game, even if most of us won't risk predicting their exact date. However, should their social cohesion fail, the Japanese may not be able to bounce back from the inevitable catastrophes that their angry Shinto nature gods throw their way.

[Some people](#) suggest that “the solution” to Japan’s demographic problem is immigration. While Japan could bring in people from places like the Philippines that have surplus population, there is no guarantee that such immigrants would easily assimilate in the Japanese people. The social cohesion of Japan would be put at risk by the presence of many non-Japanese. I don’t see the Japanese taking that chance, there is too much at stake. So Japan will have to manage an aging, declining population as best they can and not build their future with other people’s children.

Japan’s relations with other countries in East Asia are not the best. The [South Koreans](#) and [Chinese](#) haven’t forgotten Japan’s behavior in the 20th Century. Nor are they willing to forgive it even though no living Japanese can be held responsible for the past wrongs done in East Asia. It’s complicated by the fact that both China and South Koreans frankly admire what Japan has done and seek to replicate the Japanese economic miracle in their own countries. To a certain extent they both have done so.

Another country in East Asia that Japan is not in the best relations with is Russia. Going back to the 1905 Russo-Japanese War, one of the issues was a dispute over [Sakhalin Island](#), which both Japan and Russia had interests in. In the settlement of the 1905 War, Russia and Japan split the island, with Japanese occupying the southern half. During the 1945 [Manchurian campaign](#), the [Soviet Union](#) (successor state to the [Russian Empire](#)) seized all of Sakhalin Island and occupied the Japanese [Kuril Islands](#) to boot. The modern Russian Republic continues to occupy the Kuril Islands, a situation that the Japanese hope to fix some day. This is worth keeping an eye on.

An important player in Japan’s geopolitics is [the United States](#). Since the end of World War II, the USA have essentially acted as guarantor of Japan’s security. That may change and [Japan might have to look to their own defence more seriously](#). This will become increasingly more important as [China seeks to re-establish their historical hegemony](#) of East Asia. Things could get dangerous in that part of the world and the Japanese will have to be prepared.

That kind of wraps up this look at Japan. I am guardedly optimistic for the Japanese people. They are a cultured, disciplined, and diligent people with superb social cohesion. They have great challenges, but are also great at meeting those challenges. The Shinto nature gods that threaten to destroy their country are also the agents of its creation. I think that the Japanese understand that.

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.