

March 17, 2025

## St. Patrick's Day



March 17<sup>th</sup> is [St. Patrick's Day](#), here is a [link to the geological study](#) of St. Patrick's Mountain ([Croagh Patrick](#)) in [County Mayo, Ireland](#).

**Croagh Patrick, County Mayo, Ireland**

**Credit: [Bob Shires, Creative Commons](#)**

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## News and notes

Before going on to discuss the geology and geopolitics of [Iran](#), here are some news items I thought were interesting.

### Geopolitics

- [U.S. and Vietnam Sign \\$4-Billion Energy and Minerals Deals.](#)
- [Russia Switches to Crypto in Oil Trade.](#)
- [Putin agrees in principle with Ukraine ceasefire proposal but says more discussions needed; after American pressure](#) on oil sales.
- [Canada's Energy Minister Threatens the U.S. With Oil Export Cuts.](#)
- [What's so special about Ukraine's minerals? A geologist explains.](#)
- [Why Argentina's military is deploying to surveil hundreds of Chinese fishing boats off its coast.](#)
- 02/13 Demographics is destiny: [Mapped: Europe's Population Crash \(2025-2100P\).](#)

### Research and News

- [Hydrogen Generation and Serpentinization of Olivine Under Flow Conditions.](#)
- [The emplacement model of the Qitianling pluton in southern Hunan, China: New insights from 3-D magnetotelluric imaging.](#)
- Geophysics: [Evidence of High-Shear-Velocity Anomalies Inside the Pacific LLSVP.](#)
- Sedimentary geology: [Multi-year observations of near-bed hydrodynamics and suspended sediment at the core of the estuarine turbidity maximum of the Changjiang Estuary.](#)
- [Reappraisal of the carbonate microfacies, depositional environments and biostratigraphy of the lower Cambrian Second Plain Creek Member, Mernmerna Formation, Flinders Ranges, South Australia.](#)

- [Geological reassessment of syn-rift extensional sequences in the Shine Usny Tolgod and Dzun Shakhai fossil localities, Eastern Gobi Basin, Mongolia.](#)
- [Bedmap3 updated ice bed, surface and thickness gridded datasets for Antarctica](#); Phys.org summary [here](#).
- Geochemical cycles: [Modeling the global oceanic barium cycle and implications for paleoceanographic proxies.](#)

## Mineralogy

- [Crystal Chemistry, High-Pressure Behavior, Water Content, and Thermal Stability of Natural Spodumene.](#)
- [Zircon Solubility, Metamict ZrSiO<sub>4</sub> Replacement, and Hydrothermal Zircon Formation at Upper Crustal Pressures.](#)

## Plate Tectonics

- [Unusually fracture-free seafloor in the southern North Atlantic between Newfoundland and Iberia explained through compounding tectonic inheritance since the Paleoproterozoic.](#)
- [Hydrous Regions of the Mantle Transition Zone Lie Beneath Areas of Continental Intraplate Volcanism.](#)
- [Link between crustal thickness and Moho transition zone at 9°N East Pacific Rise](#)
- [Tracking a common mantle source: From southwest Iberia to the Madeira-Canarias Islands.](#)
- [Combining 3-D Probabilistic Kinematic Modeling With Thermal Resetting Measurements: An Approach to Reduce Uncertainty in Exhumation Histories.](#)
- Early Cretaceous opening of the South Atlantic Ocean: [Breakup Magmatism in the South Atlantic: Mechanisms and Implications.](#)
- [Eclogite formation: Reactive thermodynamics of crustal eclogitization and foundering.](#)

## Paleontology

- The “spark of life” for the early evolution of organisms: [Spraying of water microdroplets forms luminescence and causes chemical reactions in surrounding gas](#); Phys.org summary [here](#).
- [New Ornithopod Remains from the Upper Barremian \(Lower Cretaceous\) of Vadillos-1 \(Cuenca, Spain\).](#)
- [Mesozoic mammaliaforms illuminate the origins of pelage coloration](#); behind a paywall, summary [here](#).
- [Jehol biota: The re-description of \*Liaoningotitan sinensis\* Zhou et al., 2018.](#)
- [Novel record of placodont remains including a \*Henodus\* cranium from the Upper Triassic Silves Group of the Algarve, southern Portugal.](#)

- [Dinosaur footprints from the Lower Jurassic \(Hettangian–Sinemurian\) Precipice Sandstone of the Callide Basin, Queensland, Australia](#): Phys.org summary [here](#).
- [Triassic terrestrial tetrapod faunas of the Central European Basin, their stratigraphical distribution, and their palaeoenvironments](#); Phys.org summary [here](#).

## Ore Deposit and Petroleum Geology

- [Kinetic Analysis of Carpathian Source Rock Pyrolysis Under Dynamic Conditions](#).
- [Study on the Key Factors Controlling Oil Accumulation in a Multi-Source System: A Case Study of the Chang 9 Reservoir in the Triassic Yanchang Formation, Dingbian Area, Ordos Basin, China](#).
- [Hydraulic and thermal controls on gas production from methane hydrate reservoirs](#).
- [Laser ablation inductively coupled plasma tandem mass spectrometry \(LA-ICP-MS/MS\) Rb-Sr sericite geochronology in orogenic gold deposits: Strategies and significance](#).
- [Tourmaline compositions trace the sources of metals in the Tangziwa Sn-Cu deposit, Gejiu ore district, China](#).
- [Transient non-soluble noble metal transport in hydrothermal ore systems](#).
- [Greisen-Hosted Lithium Resources of the Erzgebirge/Krušné Hory Province \(Germany and Czech Republic\)](#).
- Copper exploration: [Machine Learning-Based Spatio-Temporal Prospectivity Modeling of Porphyry Systems in the New Guinea and Solomon Islands Region](#).
- Reservoir geology: [Controls on storage capacity in mudstones. Cementation before sediment compaction and preservation of porosity in lithified rock](#).
- [Lithium Pegmatites in Africa: A Review](#).
- [Origin of the Jadar Volcano-Sedimentary Li-B Deposit, Serbia](#).
- [Hydrocarbon generation potential and geochemical characteristics comparison of source rocks in the Southwestern Qaidam basin, China](#).

## Mining and Energy

- [Gold price makes history with \\$3,000 milestone](#).
- [Research on the disaster mechanism and control technology of large section high waste dump slope in open pit mines](#).
- [China Uncovers a Massive 20M-Tonne Copper Deposit in the Qinghai-Tibet Plateau—A Danger to Chile's Global Dominance](#).
- [USGS releases assessment of undiscovered oil and gas resources in Wyoming, southern Montana](#).

- [Ex-Pioneer CEO: Shale Can't Thrive at \\$50 Oil.](#)
- [Accidents at giant Simandou iron ore project kill more than a dozen workers, prompting inquiry.](#)
- [US agency slashes estimate of Vietnam's rare earth reserves in major revision](#); see page 145 of the [USGS report](#).
- [Vietnam's former deputy environment minister indicted for facilitating illegal rare earth mining for sale to China.](#)
- Latin America: [Map Shows Rare Earth Treasure Trove Hidden in America's Backyard.](#)
- [Cobalt prices spike as Congo export halt rattles supply chain.](#)
- [USGS projects world production capacity for 7 critical minerals and helium 2025 to 2029.](#)
- [Trump administration aims to cancel oil reserve sales, support small nuclear power.](#)
- [Wyoming slashes taxes for coal, sets up a CO<sub>2</sub> fund to boost oil and gas.](#)
- [Egypt's Ambitious Oil and Gas Plans.](#)

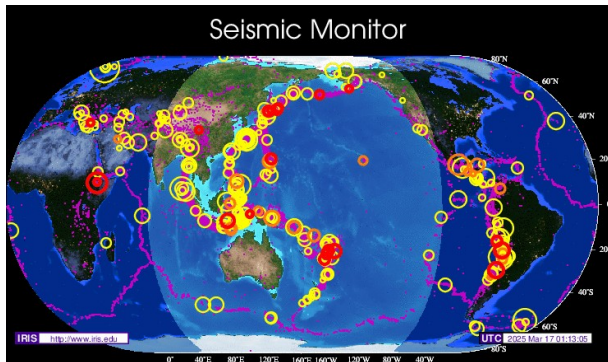
### **Environmental Geology and Hydrogeology**

- [Review of sediment connectivity: Conceptual connotations, characterization indicators, and their relationships with soil erosion and sediment yield.](#)
- [EPA Launches Biggest Deregulatory Action in U.S. History.](#)
- [A river 'died' overnight in Zambia after an acidic waste spill at a Chinese-owned mine.](#)
- [Groundwater quality evolution across China.](#)
- [Mining company fined \\$114K for polluting B.C. river with high cobalt levels.](#)
- Whiskey's for drinking, water's for fighting: [Geological resource production constrained by regional water availability](#); Phys.org summary [here](#).
- [A New Perspective on the Deepwater Horizon Oil Spill: What Can Benthic Foraminifera Tell Us 14 Years After the Spill?](#)
- [Company wants to inject oil sands mine water into underground reservoir.](#)

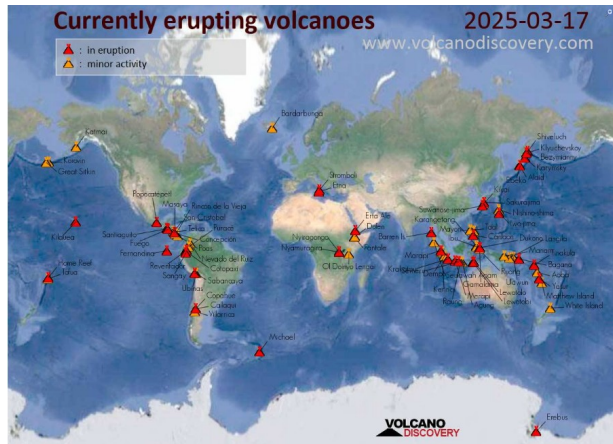
### **Glaciers and Climate Change**

- [Temperature rising.](#)
- [Amazon forest felled to build road for climate summit.](#)
- [NZ's glaciers have already lost nearly a third of their ice – as more vanishes, landscapes and lives change.](#)

## Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

### Volcanoes

- United States Geological Survey (USGS) Volcano Observatories:
  - Volcano Watch – [All in a Day's Work: Determining magma storage depths at Kilauea.](#)
  - [Slow as a Sloth or Swift as a Sprinter? Clocking the Speed of Yellowstone's Magma.](#)
- [Smithsonian / USGS Weekly Volcanic Activity Report.](#)
- Guatemala: [Refining the Eruption Chronology of Atilán Caldera Through Zircon Double-Dating.](#)
- Mount Spurr: [Scientists warn massive US volcano could erupt in WEEKS.](#)
- [Guatemala Residents Flee as Fuego Volcano Unleashes Lava and Ash](#)

### Earthquakes

- [Euro-Mediterranean Seismological Centre \(EMSC\).](#)
- [Earthquakes Monitoring Live Worldwide.](#)
- [Earthquake sequence between Santorini Amorgos Islands since January the 27th 2025.](#)
- Iceland: [Seismic activity increases in the Sundhnúkgígur crater row.](#)
- [M6.5 earthquake strikes remote Norwegian island](#); USGS summary [here](#).

### 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.
- 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>.

## 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](#).
- [ISMAR 2025](#) – International Symposium on Controlled Aquifer Recharge April 28 – May 2, 2025 – Stellenbosch, South Africa
- [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 17, 2024

## Geology and the Fate of Societies – Iran



**Figure 1a – Iran**

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



**Figure 1b – Location of Iran**

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

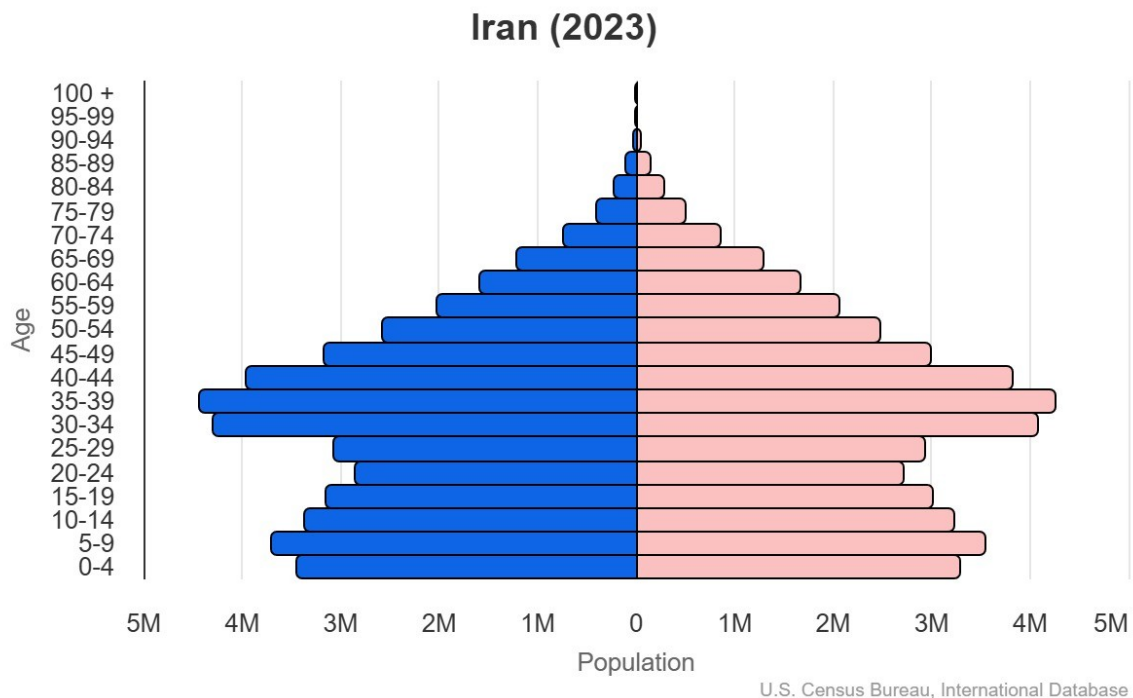
Formerly called [Persia](#), the [Islamic Republic of Iran](#) is found in [West Asia](#). Iran shares land borders with: [Iraq](#) and [Turkey](#), to the west; with [Azerbaijan](#), [Armenia](#), and [Turkmenistan](#), to the north; and, [Afghanistan](#) and [Pakistan](#), to the east. It has also borders on the [Caspian Sea](#), to the north; and the [Gulf of Oman](#) and the [Persian Gulf](#) to the south. Across the Persian Gulf from Iran are: [Kuwait](#), [Saudi Arabia](#), [Bahrain](#), [Qatar](#), and the [United Arab Emirates](#); and across the Gulf of Oman is [Oman](#).

Iran is a unitary presidential theocratic [Islamic republic](#). The chief of state is the Supreme Leader, [Ali Khamenei](#); the head of the government is the President, [Masoud Pezeshkian](#); the Vice President is [Mohammad Reza Aref](#); and the Legislature is the [Islamic Consultative Assembly](#). The Capital City, and largest city is [Tehran](#) (pop. 14,425,000 in the metropolitan area).

According to the [Central Intelligence Agency](#)'s (CIA) [World Factbook on Iran](#), the total area of Iran is 1,648,195 square kilometres (km<sup>2</sup>) of which 1,531,595 km<sup>2</sup> is land and 116,600 km<sup>2</sup> is water. Also according to the CIA, 88,386,937 people live in Iran, about 77.3% of whom live in urban areas. [Ethnic groups in Iran](#) include [Persian](#), [Azeri](#), [Kurd](#), [Lur](#), [Baloch](#), [Arab](#), [Turkmen](#), and [Turkic tribes](#). The official language in Iran is [Farsi](#) (Persian), but [Azeri](#), assorted [Turkic dialects](#), [Kurdish](#), [Gilaki](#), [Mazandarani](#), [Luri](#), [Balochi](#), and [Arabic](#) are also spoken.

[Islam](#) is the official religion of Iran, followed by 98.5% of the population, with [Shia Islam](#) as the most common form of the [Prophet's](#) faith. Other religions followed in Iran include [Christian](#) (0.7%), [Baha'i](#) (0.3%), and others such as [Zoroastrian](#), [Jewish](#), and [Hindu](#) (0.2%). About 0.3% of Iranian describe themselves as agnostic (bravely so, since the [penalty for apostasy is death](#)). In terms of education, 88.7% of Iranians age 15 and over can read and write; people can expect to be in school for around 15 years.

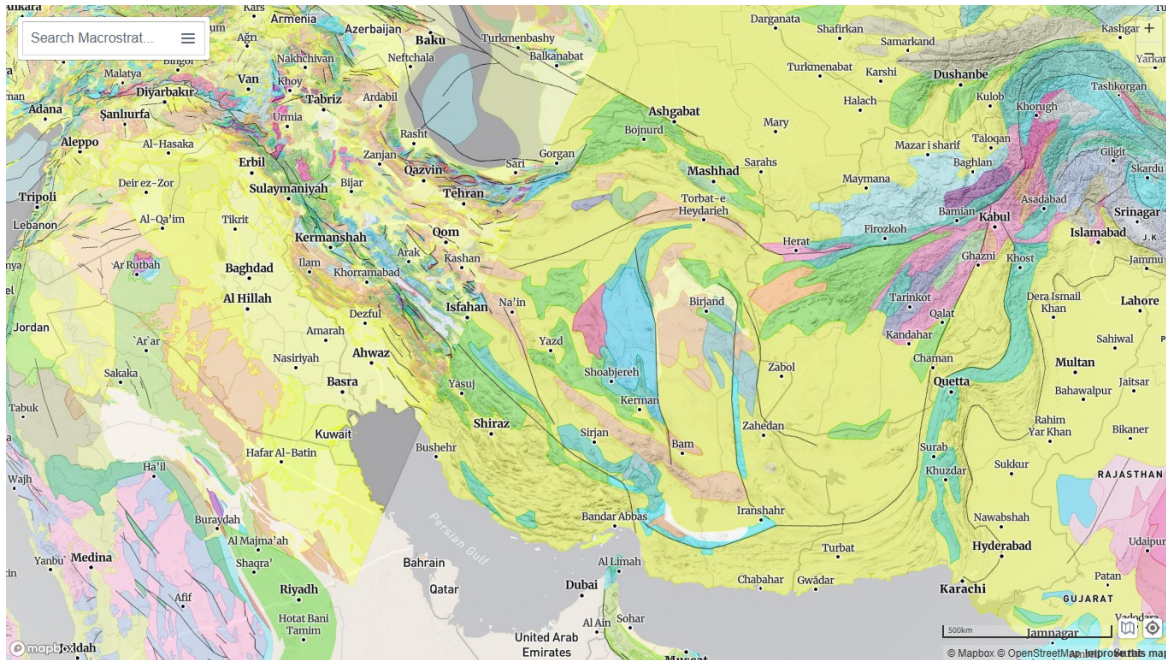
Iran is [developing](#) a modern industrial economy. The per capita [GDP \(PPP\)](#) is \$19,607; the [Gini](#) coefficient is 34.8 indicating medium inequality, and the [Human Development Index](#) is high at 0.780. The [top exports of Iran](#) are ethylene polymers (\$1.85b), iron ore (\$1.3b), acyclic alcohol derivatives (halogenated, sulphonated, nitrated) (\$871m), petroleum gas (\$631m), and refined copper (\$560m), exporting mostly to China (\$4.59B), Turkey (\$2.18B), India (\$1.02B), Pakistan (\$943M), and Armenia (\$597M). The [top imports of Iran](#) are broadcasting equipment (\$3.24b), motor vehicles; parts and accessories (8701 to 8705) (\$1.27b), corn (\$1.27b), soybeans (\$1.24b), and vehicle bodies (including cabs) for the motor vehicles (8701 to 8705) (\$1B), importing mostly from China (\$10B), United Arab Emirates (\$5.78B), Turkey (\$3.06B), Brazil (\$2.3B), and Germany (\$1.26B).



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

The demographic profile of Iran shows a young to middle aged population with a slightly declining population. The median age is 33.8 years; 23.3% are under the age of 15; and 69.8% of the population is between 15 and 64 years of age. The total fertility rate is 1.92 births per woman (below replacement rate of 2.1); the net migration rate is -0.3 migrants/1,000 population; and the resulting annual growth rate for the population is 0.93%. As long as they don't run [afoul of the authorities](#), Iranians can expect a long life, the life expectancy at birth for both sexes is 75.4 years.

## Geology



**Figure 3 – Interactive Geological Map of Iran**

**Credit: Macrostrat, Creative Commons Attribution-Share Alike 4.0 International license**

To identify the lithologic units in Figure 3, open the [Macrostrat map](#) by clicking on the figure and then click on the unit of interest. As you can see, [the geology of Iran](#) is fairly complex. One way to understand it is to look at the [orogenies](#) (mountain building episodes) that formed the rocks. These orogenies include:

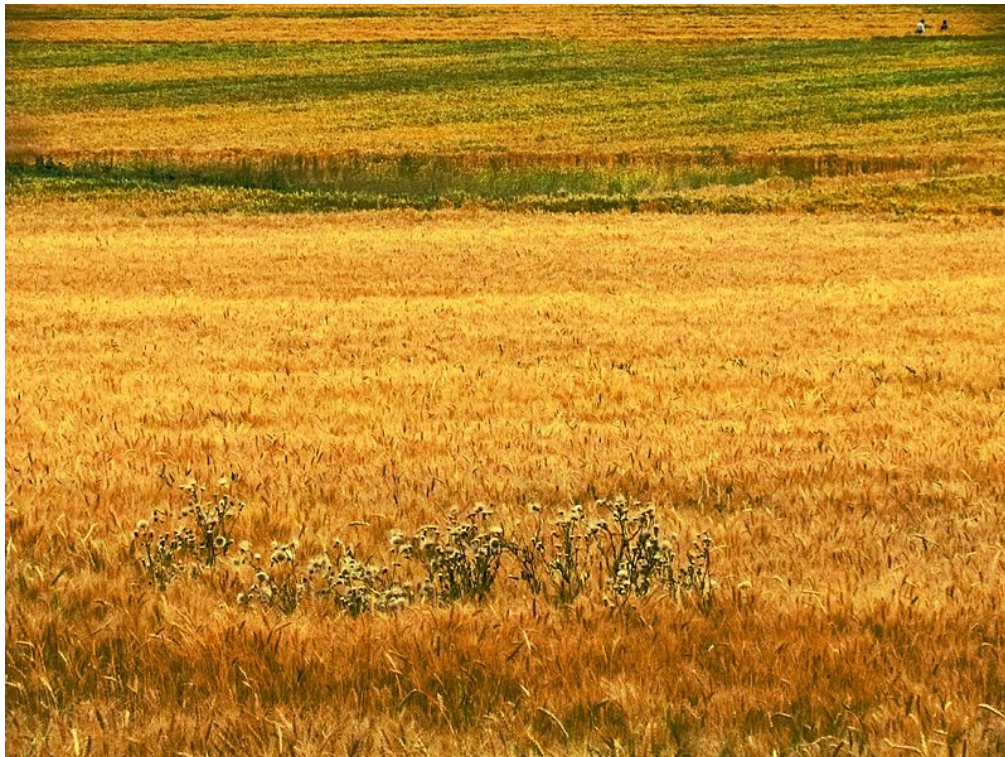
- The [Pan-African Orogeny](#) that formed the [Proterozoic](#) to the [Early Cambrian](#) aged rocks in Iran. This tectonic phase started with [tension or extension](#) leading to the formation of [rifts](#) and generation of [oceanic crust](#) and ended with folding, closure, metamorphism, growth of the [continental crust](#), and development of regional faults.
- During the time of the [Caledonian orogeny](#) in Iran, [sedimentary basins](#) were filled in showing [facies change](#), [hiatuses](#) or cessation of sedimentation, and [epeirogenic movements](#). Beginning in the [Late Cambrian](#), the [marine facies](#) of [Barut](#) and Zaigoon Formations changed into the [continental facies](#) of [Lalun Formation](#), and continued on to [Late Devonian](#).
- During the time of the [Hercynian orogeny](#) in Iran, the [Neo-Tethys Ocean](#) opened up as the Iranian [microplates](#) east and northeast of the Zagros Mountains were detached from [Gondwana](#) during the [Carboniferous](#).
- The [Cimmerian Orogeny](#) in Iran was marked by the closure of the [Paleotethys Sea](#) during the [Late Triassic](#), as shown in the rocks south and southwest of the Caspian Sea. Also during the Late Triassic, the Iranian microplates that previously separated from Gondwana collided with [Laurasia](#). During the later part of the Cimmerian Orogeny, [Jurassic](#) aged granite formed in the [Kolah Ghazi](#), [Shir Kuh](#), and [Shah Kuh](#) regions.

- In Iran, the [Laramide Orogeny](#), [Late Cretaceous](#) to [Paleocene](#), involved compressional and extensional tectonic events. Oceanic crust became emplaced upon continental margins, depositing [ophiolite assemblages](#) and/or [coloured melanges](#) as seen in the suture zone between [Sanandaj–Sirjan](#) and Zagros, and alongside [Nehbandan fault](#) in the east of Iran. The Upper Cretaceous-Paleocene granite of [Mount Alvand](#) was also formed during the Laramide orogeny.
- The main mountain ranges of Iran, the [Zagros](#), [Alborz](#), and [Kopet-Dagh](#) mountains, were mainly formed during the [Alpine Orogeny](#). The [Sahand-Bazman volcanic arc](#) or belt was first formed during the [Eocene](#). Beginning in the Eocene and continuing on till the [Miocene](#), the [Arabian Plate](#) collided with the Eurasian Plate, raising up the mountains during the [Miocene](#).
- The latest orogeny affecting Iran, [the Pasadenian](#), began during the [Late Pliocene](#) and continued into the [Quaternary](#). The Pasadenian Orogeny can be seen as a continuation of the mountain building that began earlier during the Miocene. The [Sahand](#), [Sabalan](#), [Damavand](#), [Bazman](#) and [Taftan](#) volcanoes all erupted during this orogeny and are considered potentially active to this day.

For more information on the geology of Iran, followup on the links above or [check out this scholarly book](#) on the subject. There is a lot there for geology nerds.

## Resources

### *Agriculture and Food Production*

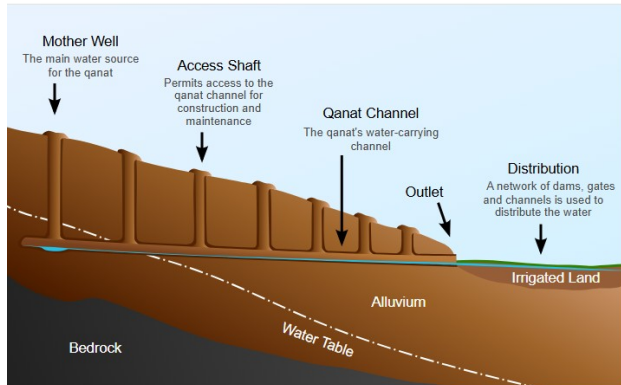


**Figure 4 – A Farm Field in Sarhad**

**Credit:** [Alireza Javaheri](#), [Creative Commons Attribution 3.0 Unported license](#)

According to the World Factbook, 30.1% of Iran's territory is agricultural land (10.8% arable land, 1.2% permanent crops, 18.1% permanent pasture). Of the remainder, forests cover 6.8% of the land and 63.1%

is something other: deserts, salt flats ("kavirs"), bare-rock mountains, and urban areas. Agricultural accounted for 12.8% of the GDP and employs a comparable proportion of the workforce. Most farms are small, less than 10 hectares. Many farms are not economically viable and may former farmers have migrated to the cities.



For a geologist with experience in groundwater issues, an interesting feature of agriculture in Iran is the use of [the qanāt](#). These are underground aqueducts / horizontal wells, originally dug by hand, that transfer water from water sources such as wells and aquifers, to farm fields. This technology was invented in [ancient Persia](#) and exported to Afghanistan, [Algeria](#), [China](#) (i.e., the [Turpan water system](#)), [Morocco](#), Oman, and Pakistan.

**Figure 5 – Cross-section of a Persian Qanāt**  
**Credit: Samuel Bailey, Creative Commons Attribution 3.0 Unported license**

According to the World Factbook, the top ten agricultural products in Iran, based on tonnage in 2023, were: wheat, sugarcane, milk, sugar beets, rice, tomatoes, barley, potatoes, oranges, and apples. Statistics on agriculture production in Iran, from the [United Nations Food and Agriculture Organization](#) (FAO) can be found [here](#). The FAO also [indicates](#) that 39.9% of the Iranian population suffers from moderate to severe food insecurity, the World Factbook indicates that 27.9% of household expenditures in Iran are for food. The FAO Country Brief ON Iran, indicating current conditions, can be found [here](#).



**Figure 6 – Traditional [Lenj ships](#) on [Qeshm Island](#), Southern Iran**  
**Credit: Okruz, Creative Commons Attribution-Share Alike 4.0 International license**

The Iranian fishing industry includes wild-caught commercial and artisanal fisheries in the Persian Gulf, Gulf of Oman, the [Indian Ocean](#) and the Caspian Sea as well as aquaculture. The industry employs 140,000 people using over [11,000 fishing vessels](#). 700,000 tons of fish were caught in 2020. Types of fish caught include tuna, sturgeon, and shrimp. [Aquaculture production in 2023](#) produced 328 tons of ornamental fish, 14,036 tons of carp, 10,765 tons of trout, 349 tons of [halva fish](#), and 5,672 tons of flounder. Statistics on Iranian fishery production from the FAO can be found [here](#).

For people with “refined tastes” (or a desire for [conspicuous consumption](#)) an important product of the [Iranian fisheries is caviar](#), the [preserved eggs of sturgeon](#). In 2017, Iran produced [4 tonnes of caviar](#), from both wild-caught fish and aquaculture. A 30 gram tin of [Iranian caviar sells for \\$229.00 in Canada](#).



**Figure 7 – Iranian Caviar**  
**Credit:** [The Ogre](#), [Creative Commons Attribution 3.0 Unported](#) license

### *Mineral Resources*



**Figure 8 – [Cerussite](#) ( $\text{PbCO}_3$ ) from the Nakhlak mine, [Isfahan, Iran](#)**  
**Credit:** [Ivar Leidus](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license

The [mineral industry in Iran](#) includes metallic mineral mining, industrial mineral production, and energy mineral extraction (coal, natural gas, petroleum, and uranium). Metallic minerals mined in Iran include:

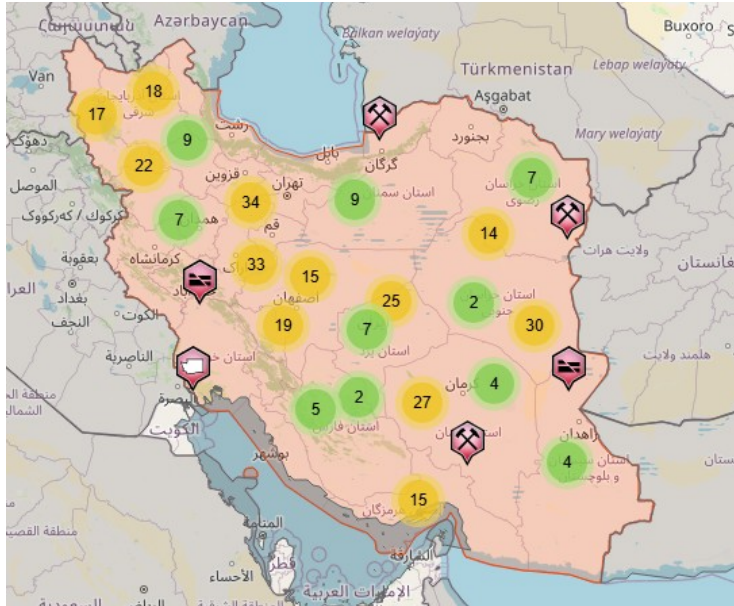
- Bauxite, from the [Jajarm Mine](#);
- Chromite from two mines, [Mirmahmud](#) and [Chesmehbidouh](#);
- Copper, from mines in [Alborz](#), [Ardebil](#), [Chahar Mahall and Bakhtiari](#);
- [Lead](#) mines in [Alborz](#), [Ardebil](#), and [East Azarbaijan](#);
- Gold mines in in [Ardebil](#), [East Azarbaijan](#), and [Kerman](#);
- Iron ore mines in in [Esfahan](#), [Fars](#), and [Golestan](#);
- Magnesite from a mine in [South Khorasan](#);
- Molybdenum, [numerous mines](#);
- Silver from mines in [East Azarbaijan](#), [Esfahan](#), and [Kerman](#);
- Titanium from mines in [Gilan](#) and [Kerman](#);
- Zinc from mines in [Ardebil](#), [East Azarbaijan](#), and [Esfahan](#).

Industrial minerals production in Iran includes [barite](#), cement (many facilities), [fluorspar](#), [gemstones](#), gypsum (about 12 quarries/mines), [phosphate rock](#), [potash](#), crushed stone, and dimension stone.



[Energy mineral production](#) in Iran includes a [uranium mine in Yazd](#), about a dozen [coal mines](#), and numerous [oil and gas](#) production facilities, as shown in Figure 9. In 2022 Iran produced 2,423 thousand tonnes of coal (150 bituminous, 2,273 metallurgical); 262,261 million cubic metres of natural gas; 1,395,030 thousand barrels of oil; and 71 tonnes of uranium. Iran is the 7<sup>th</sup> largest [oil producer](#) in the world.

Figure 9 – Iranian Oil and Gas Fields  
 Credit: Behrangaref, [Creative Commons Attribution 3.0 Unported license](#)



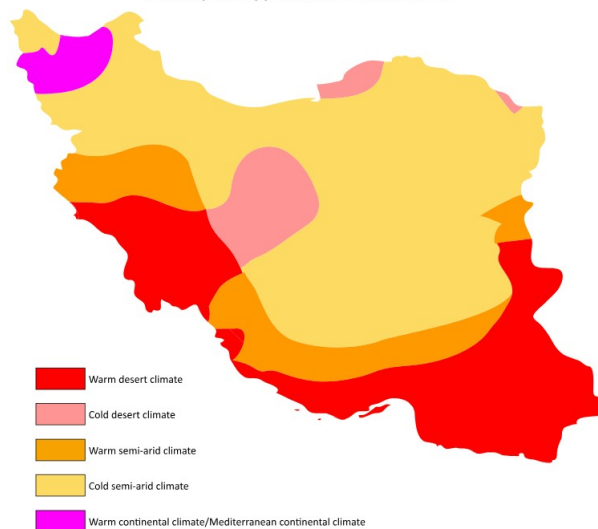
The USGS description of the [Mineral Industry in Iran](#) can be found [here](#).

Figure 10 links to an interactive map of mineral occurrences in Iran.

**Figure 10 – Interactive Mineral Occurrence Map of Iran**  
 Credit: ©Mindat.org

## Climate

Iran map of Köppen climate classification



**Figure 11 – Köppen Climate Classification of Iran**

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

Iran has mostly a dry climate, including: warm desert ([BWh](#)) climate; cold desert ([BWk](#)) climate; warm semi-arid ([BSh](#)) climate; cold semi-arid climate ([BSk](#)); and warm continental/Mediterranean continental ([Dsa](#)) climate.

Iran looks like an interesting place to visit, and one travel writer, [Rick Steves](#), [found it in interesting experience back in 2008](#). However, political tensions between Iran and the western world have resulted in these travel warnings, [here](#) and [here](#), that essentially say: don't go. Too bad; maybe when things calm

down, a trip to Iran might be worthwhile. If that interests you check out [Climates to Travel](#) and [Lonely Planet](#) who describe Iran as “the friendliest country on earth”.

## History and Geopolitics

### An Ancient Civilization



Figure 12 – The Achaemenid Empire at its Greatest Extent ca. 500 BC

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

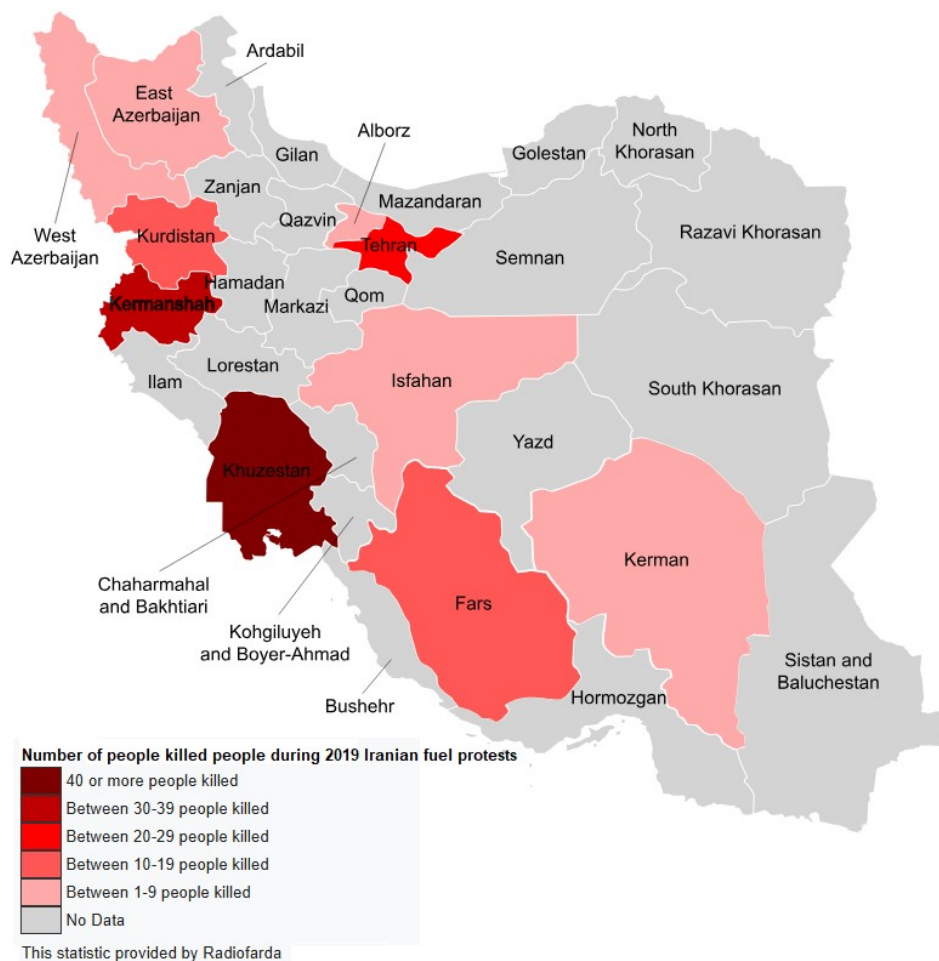
The [history of Iran](#) goes back a long way. People have been living there since [Paleolithic](#) times, including [Neanderthals](#). During the [Neolithic](#), farmers settled in southwest Iran at the eastern end of the [Fertile Crescent](#). Various [Bronze Age](#) and [Early Iron Age](#) arose and fell in Iran including [Elam](#) and the [Assyrians](#). Beginning in the mid-first millennium BC, [Medes](#), [Persians](#), and [Parthians](#) (a.k.a [Aryans](#)) moved to the Iranian plateau [from Central Asia](#). The major intervals in Iranian history include:

- The [Median kingdom](#), beginning around. 678 BC;
- The [Achaemenid Empire](#), beginning 500 BC;
- The [Parthian Empire](#), beginning 247 BC;
- The [Sasanian Empire](#), beginning 224 AD;
- The [Muslim conquest of Persia](#) in 624 to 634 AD;

- The first Iranian Muslim dynasties, the so-called [Persian Renaissance](#), beginning in 821 AD;
- The rule of the [Safavids](#) in Iran beginning in 1501;
- [Afsharid Iran](#), beginning in 1736;
- The [Constitutional Revolution](#) of December 12, 1905;
- The rule of the [Pahlavi Shahs](#) beginning December 15, 1905;
- The [overthrow of the Shah Reza Pahlavi](#) February 11, 1979;
- Iran under the [current constitution](#) including the [Iran-Iraq War 1980 to 1988](#) and the [2019–2020 Iranian protests](#)

Check out the links if any of these historical periods interest you. For the current geopolitics of Iran, the period since [1979 Revolution](#) is the most important.

### *Geopolitics – A Dangerous Place in the World*



**Figure 13 – Number of People Killed People during the 2019 Iranian Fuel Protests**  
 Credit: [Ali Zifan, Creative Commons Attribution-Share Alike 4.0 International license](#)

Internally, Iran has some of the problems that you might expect of a government founded by a revolutionary movement some 46 years ago. In many ways [Iran is not a normal state](#), but one driven by the hatreds and obsessions of its leaders. Today's leaders were the young men who made the 1979 revolution, they are old men now. What was revolutionary in 1979 is old news to the people of today, most of whom (the Iranian median age is 33.8) were born after the overthrow of the Shah. People are not happy, and while the government can [suppress dissent for a while](#), eventually Allah will call the old revolutionaries home to their final reward. Then a new generation will have to figure out how to live in a dangerous corner of the world. It won't be easy, Iran has serious issues with both its neighbours and more distant countries. In the meantime, the Iranian regime is pursuing the development of [nuclear weapons](#), perhaps to put the fear of God into their adversaries.

In terms of unstable neighbours, Afghanistan and Iraq come to mind. During the recent Afghan war, [some 3 million Afghans](#) fled to Iran. Some have stayed, and others have been sent back. This will remain an issue for many years to come.

As for Iraq, the Iranian government has, for years, [supported their Shiite coreligionists in Iraq](#); especially since the [destruction of the Saddam Hussein regime](#) and subsequent [American occupation of Iraq](#). The [relationship between Iranian and Iraqi Shiites](#) has not always gone well, and there are indications that the Iraqis would like [to free themselves](#) from Persian influence. The Shiites in Iraq are Arabs and the Iranians are Persians – [cultural differences](#) that cause friction in their relationship. This relationship is ongoing and developing.

Further afield, Iran and Saudi Arabia are fighting a [proxy war against each other in Yemen](#), where they support opposing sides. Neither the Saudis nor the Iranians have much love for one another, but they are engaged in [diplomatic talks](#). This past weekend, the [Americans have intervened](#) in the conflict, to stop the Houthis, the side supported by Iran, from attacking [shipping in the Red Sea](#). The [war in Yemen](#) will be a long source of trouble for Iran, Saudi Arabia, and a source of [unending misery for the people of Yemen](#). Another on-going issue is that the Saudis rightly fear Iranian influence among the [Shiites in Saudi Arabia](#), who live among the [major oil field of the Kingdom](#).

The Iranians also have a bone to pick with [Israel](#) (a.k.a. [The Little Satan](#)) over the [Israeli treatment of Palestinians](#), especially in the current [war in Gaza](#). To this end, the Iranians have supported a guerrilla war against Israel through their clients  [Hamas](#) and  [Hezbollah](#). The Iranians have even supported their clients via [direct missile attacks on Israel](#). This has all the makings of a widespread armed conflict – a World War if you wish – especially if/when [Israel makes a strike](#) against Iran's nuclear weapon development facilities. While we don't know for sure if Iran has actually succeeded in building nuclear weapons, we know that the [Israelis have](#), so this is definitely a very dangerous time for Iran and its neighbours.

As if they don't have problems with the country they call the Little Satan, the Iranian regime also has [bad relations with the United States](#), a.k.a. [The Great Satan](#). The Iranian government of the [Reza Shah Pahlavi](#) was [very close to the United States](#), too close for the likes of the revolutionaries who took over in 1979. It didn't help that the [American trained](#) Shah's security forces were [brutal in their treatment](#) of regime opponents, including the revolutionaries. The Americans are still ~~pissed-off~~ upset with the Iranian government over the [kidnapping of American diplomats in 1979](#). For their part, the Iranians have not forgotten the help that the [USA gave to the Iraqis during the 1980-88 war](#) nor have they forgotten

American involvement in the [Afghan War](#). Add to that, America's support for Israel and you have deep resentments among the leaders of Iran against the USA. Some have suggested that the [USA is preparing for a war with Iran](#) both to settle their own differences with the Iranian leaders and in support of American allies such as Israel and Saudi Arabia. If it happens, it [will not end well](#).

Currently, [Iran is helping Russia in its war in Ukraine](#), for example with the [provision of drones](#) and helping [Russia to evade Western sanctions](#) in the sale of Russian oil. Not all [Iranians are happy with this](#), but that matters little to the current leadership. Besides, their main customer, [China, is happy to take the oil](#) and the Iranians are happy to take the profits. Meanwhile, this weekend's news notes that [Trump Administration Slaps Fresh Sanctions on Iran's Oil Minister and 'Shadow Fleet' Ferrying Illicit Iranian Crude](#).

And so it goes on, inching towards a major conflict.

So, there we have it, oil, nuclear weapons (possibly) and age old hatreds. What could go wrong? Now, Iran could change when its leadership changes, but the geopolitical realities will require vigilance by whoever takes charge when the old guard passes away. There is no guarantee that younger leaders would be any less suspicious of Israel, the USA, and Saudi Arabia. They also have good reason to be guarded in their current alliance with Russia and China. It is a dangerous situation for Iran, its neighbours, and the rest of the world for that matter – interesting times for Iran.

## **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.