November 3, 2025

News and notes

Día de los Muertos, Day of the Dead
Credit: 5chw4r7z, Creative Commons Attribution-Share Alike 2.0 Generic license

Now that my computer is working again, can publish this week's blog. From now on I will publish Monday afternoons rather than Sunday night/Monday morning.

This past week saw both Halloween and the Day of the Dead, so that makes it a perfect time to discuss the geology and mineral resources of Mexico, where the Day of the Dead is a national celebration. However, before going on to that, we will first look at some news items I thought were interesting. If you enjoy my blogs, bookmark the site, and check Monday afternoon rather than relying on social media postings which can get lost in the shuffle.

Comments

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

Geopolitics

- Six Months Since the U.S.-Ukraine Minerals Deal Was Signed—What Now? Summary from Rare Earth Exchanges here.
- A geoscientist shortage could undermine U.S.-Australian deal on critical minerals.
- Canada to work with G7 partners to secure critical mineral supply deals, minister says.

Research and News

- Manitoba Geological Survey, Report of Activities 2025.
- From France's BRGM: Making the invisible visible: a series of videos on BRGM's 3D models.
- GSA Today, November 2025.
- Characterization of Diffusion-Creep Olivine Fabric and Its Identification in Natural Peridotite: Repeated Pure Shear and Equal-Channeling Angular Pressing Tests.
- Coupled strontium-calcium isotopes in Archean anorthosites reveal a late start for mantle depletion.
- Characterisation of clay-hosted rare-earth element deposits in Australia: mineralogy, geochemistry and metallurgy.
- Interplay Between Salt Tectonics and a Large Igneous Province in the Espírito Santo Basin (Brazil).
- Contemporaneous magnesian (I-type) and ferroan (A-type) magmatism in the Great Proterozoic Accretionary Orogen: Insights from the Julianehåb Igneous Complex, Greenland, and the Adlavik Domain, Labrador, Canada.

Geochemistry

- Rare earth elements and U uptake by fish remains in seawater: how fast?
- The stable carbon isotope fractionation of methanogenesis products at complete carbon consumption.
- Magnesium and silicon isotope fractionation during sepiolite precipitation at 25 °C.
- Expanding time-temperature chronometry for arc magmas with MgO diffusion in hydrous melts.

Plate Tectonics

- Basal mantle structure regenerated through supercontinents.

- Terrane accretion, contractional deformation, almost continuous magmatism and mineralisation in the New Guinea Orogen.
- Evidence for Caribbean Plate Subduction Beneath the Isthmus of Panama and Implications for Subduction Initiation and the Closure of the Central American Isthmus During the Miocene.
- GNSS and InSAR Integration for 3-D Crustal Deformation in California and Western Nevada.
- Changes in Motion of the Nazca/Farallon Plate Over the Last 34 Million Years: Implications for Flat-Slab Subduction and the Propagation of Plate Kinematic Changes.
- Remagnetization of Lower Cretaceous Limestones in the Western Tethyan Himalaya and Its Tectonic Implications for the India-Asia Collision.
- Iron isotopic evidence for growth of continental crust at convergent margins.
- Kinematic Evolution of the Cephalonia-Lefkada Transform Fault Zone: Strain Partitioning in Response to Subduction Margin Dynamics.
- Active faulting in the upper plate of the Himalayas: Paleoseismic insights from the Western Nepal fault system.

Paleontology

- First Record of *Bramatherium* Falconer, 1845 (Mammalia: Giraffidae) from the Late Miocene of Greece and the *Helladotherium-Bramatherium* Debate.
- From trace to trace maker: Oligocene–Miocene coprolites of southern Poland and their potential producers.
- Hunted hunters – prey of *Aspidorhynchus* (Actinopterygii) within isolated gastrointestinal tracts from the late Jurassic of the Solnhofen Archipelago.
- TED (Turtle Evolution Database), an online database of fossil turtles from Czechia and Poland with images and 3D models.
- Mid-Cenozoic rhinocerotid dispersal via the North Atlantic; behind a paywall, Phys.org summary here.
- Not crying crocodylomorph tears: New dwarf crocodylomorph from the Upper Jurassic of Portugal and the first neuroanatomical data for Atoposauridae.
- The middle Eocene podocnemidid turtles from the eastern Duero Basin (Soria Province, central Spain).
- An early dyrosaurid (*Wadisuchus kassabi* gen. et sp. nov.) from the Campanian of Egypt sheds light on the origin and biogeography of Dyrosauridae; SciNews summary here.

Mining and Energy

- Kodal Minerals keeps Mali lithium mine running amid unrest.

- Cause of deadly Polymetals explosion remains unknown.
- Pakistan: Gov't awards 23 offshore oil exploration blocks after 18 years.
- US oil and gas production hit fresh record high in August, EIA data shows.
- Canada backs 25 critical minerals projects in G-7 initiative.
- Canada's heavy oil finds new fans as global demand rises.
- Mali revokes over 90 mining exploration permits.10/28 Germany: Eavor is about to bring its first-of-a-kind geothermal project online.
- Visualizing How Much Gold Is Left to Mine on Earth.

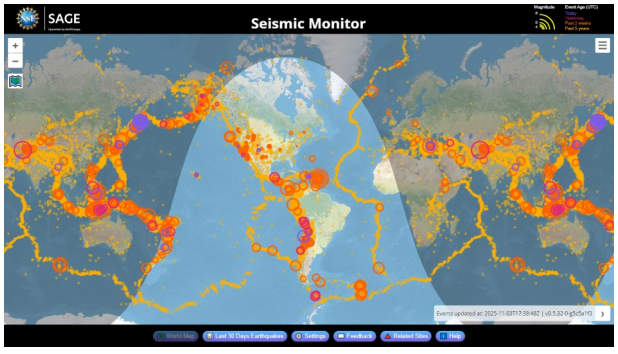
Environmental Geology and Hydrogeology

- Abandoned coal mine drainage identified as a significant source of carbon emissions.
- US approves first cleanup of abandoned, contaminated uranium mines.
- Toxic wastewater from oil fields keeps pouring out of the ground. Oklahoma regulators failed to stop it.
- Growing Season Precipitation Percolates to Groundwater Past Older Water in Storage Across a Temperate Agricultural Catchment; Phys.org summary here.

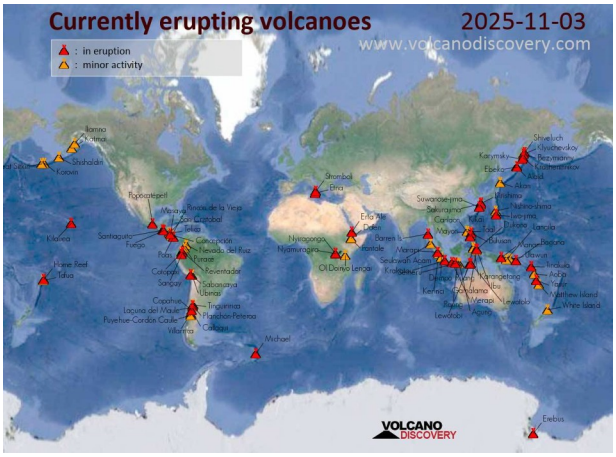
Glaciers and Climate Change

- Antarctic glacier shows fastest retreat in modern history.
- Seasonal variability of ocean heat transport and ice-shelf basal melt around Antarctica; Phys.org summary here.

Volcanoes, Earthquakes and Geohazards



Seismic Monitor



Active Volcano Map

Volcanoes

- Smithsonian / USGS Weekly Volcanic Activity Report.
- The United States Geological Survey (USGS) Volcano Observatories are not reporting because of the US government shutdown; however, there is the Cascades Volcano Observatory Weekly Update.
- Izu-Oshima volcano: Decadal Monitoring of Seismic Velocity Changes Beneath Izu-Oshima, Central Japan, Using Ambient Seismic Noise Records.
- Rupture of the 1949 Khait Earthquake on a Cryptic Fault: Implications for Earthquake Hazard.
- Axial Seamount: It's starting to feel like our latest eruption forecast is running out of time.

Earthquakes

- Euro-Mediterranean Seismological Centre (EMSC).
- Earthquakes Monitoring Live Worldwide.
- Afghan govt says quake kills 20, injures over 500; USGS summary here.
- Near-Fault Strong-Motion of the 2023 Mw7.8 Kahramanmaraş Earthquake: Insights Into High-Frequency Radiation Mechanisms.
- Birth and growth of a volcanotectonic fault during the current volcanic unrest at Campi Flegrei caldera (Italy); related Citizens' smartphones unravel earthquake shaking in urban areas.
- Supershear rupture sustained through a thick fault zone in the 2025 Mw 7.8 Mandalay earthquake; commentary on this paper from Kyle Bradley and Judith A Hubbard here.
- Alaska Earthquake Center: A Mid-Morning Quake Between Seward and Homer; USGS summary here.
- M6.0 earthquake shakes western Türkiye; USGS summary here.
- Seismoacoustic monitoring of eastern mediterranean earthquakes toward a tsunami early warning system for Egypt.
- Frictional healing and induced earthquakes on conventionally stable faults; Phys.org summary here.

Geohazards

- A gigantic Miocene landslide in the Wasatch Range, Utah, USA.
- Image: Hurricane Melissa barrels through the Caribbean.
- Hurricane Melissa live updates: Category 2 storm slams into Cuba after devastating Jamaica.

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; also they now have a Free Online Learning Module: Pumping Test Analysis.
- 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.
- From the Mineralogical Society of America: Handbook of Mineralogy.

Upcoming Events

- 5th International Professional Geology Conference (IPGC), November 5 to 7, 2025, Zaragoza, Spain.
- Saskatchewan Geological Open House, December 1 to 3, 2025, Delta Bessborough Hotel, Saskatoon; Registration for the 2025 Conference now open.
- Groundwater Week 2025, December 9-11, 2025 in New Orleans.
- Feb. 16-18, 2026, Inaugural Mineralogical Society of America Annual Meeting, Tuscon AZ
- GAC-MAC 2026 St. John's NL, St. John's Convention Center, May 25-28, 2026.
- 14-18 September 2026 , IAH 2026, 53rd Congress of the International Association of Hydrogeologists; Budapest Congress Center.
- Society of Petroleum Engineers Distinguished Lecturer Schedule.
- American Geophysical Union List of Upcoming Meetings.
- The Geological Society: Events & Courses.
- International Union of Geological Sciences calendar of geoscience events.
- "Geology Hour" Online, evenings on the 3rd Monday of the Month from the Geological Society of the Oregon Country.
- Canadian Energy Geoscience Association Upcoming Events.

November 3, 2025

Geology and Mineral Resources – Mexico

Introduction

Figure 1 – Mexico
Credit: CIA World Factbook, public domain

Mexico, officially called the Estados Unidos Mexicanos, is a country of 130,739,927 people that is the bridge between North America and Central America. Culturally, Mexico is the northernmost country in Latin America.

Mexico has an area of 1,964,375 square kilometres and borders on the United States, to the north and Guatemala and Belize, to the south. Also, to the west of Mexico is the Pacific Ocean, to the northeast is the Golfo de Mexico (a.k.a the Gulf of America), and to the southeast is the Caribbean Sea. Other significant oceanic seas are the Mar de Cortes (Gulf of California), and the Golfo de Tehuantepec in the Pacific, and the Bahia de Campeche in the Gulf of Mexico.

Mexico is a moderately prosperous country with a per capita GDP (PPP) of $25,463 and a high Human Development Index of 0.789.

For more details on the country, check out the CIA World Factbook on Mexico as well as the Wikipedia and Grokipedia articles on the country.

Geology

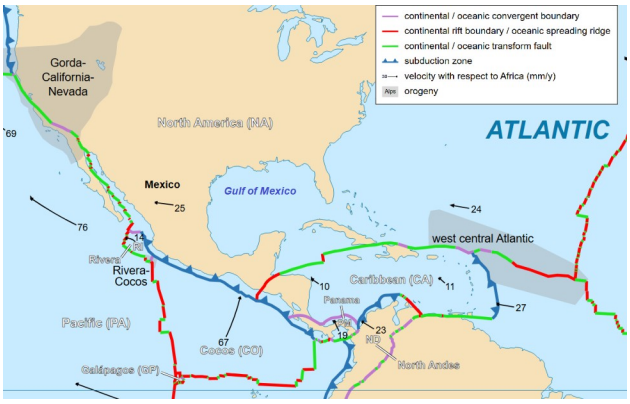


Figure 2 – Tectonic Framework of Mexico
Credit, extract: Eric Gaba (Sting – fr:Sting), Creative Commons Attribution-Share Alike 2.5 Generic license

Tectonically, Mexico sits on the North American Plate. Significant boundaries with neighbouring plates include:

- A transform fault and rift boundary with the Caribbean Plate.
- A transform fault with the Pacific Plate;
- A subduction zone where the Cocos and Rivera plates are moving under the Pacific Plate; some people include the Orozco Plate (also called the Orozco Fracture Zone) between the Cocos and Rivera plates.

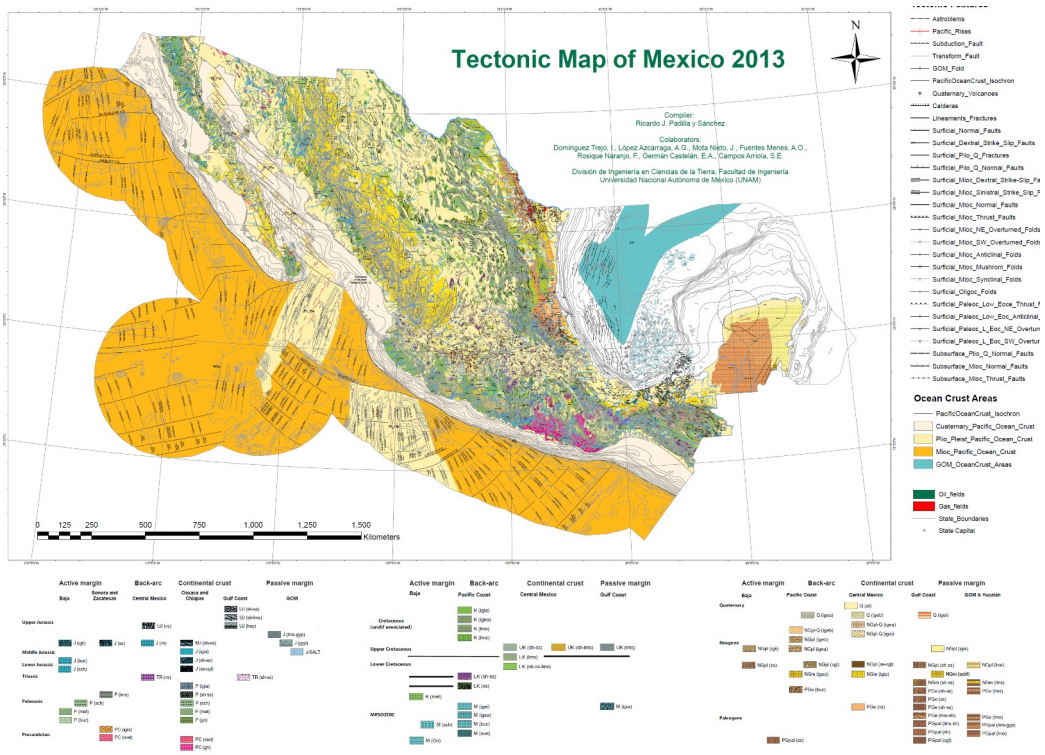


Figure 3 – Tectonic Map of Mexico
Credit: Padilla y Sánchez *et al*, AAPG Open File Series

The tectonic history of Mexico goes back to the Precambrian and continues to the present day Quaternary. This almost continuous tectonic activity assembled the mosaic of tectonic terranes that makes up modern day Mexico. These terranes reflect a complex interaction between Laurentia, Gondwana, and the ancient versions of the Pacific Plate that took place during the Paleozoic, Mesozoic, and present-day Cenozoic eras. To get an idea of the complexity of this tectonic history, study the Tectonic Map of Mexico shown in Figure 3 for an hour or so to give it the study it deserves.

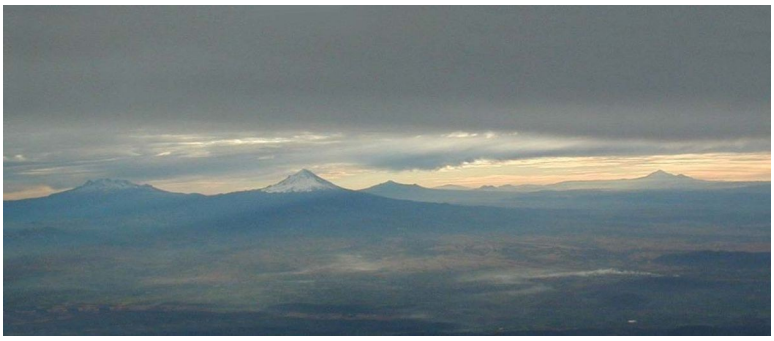


Figure 4 – Six Volcanoes in Mexico, From left to right: Iztaccíhuatl, Popocatépetl, Matlalcueitl, Nauhcampatépetl (most distant), Citlaltépetl, and Sierra Negra
Credit: David Tuggy, Creative Commons Attribution-Share Alike 2.5 Generic license

If you think that all this tectonic activity leads to widespread volcanism and earthquakes in Mexico, you'd be right. The six volcanoes in Figure 4 are part of the Trans-Mexican Volcanic Belt. Volcano Discovery lists 150 active volcanoes in Mexico. Earthquakes are a daily occurrence somewhere in Mexico, here is a link to the latest ones.

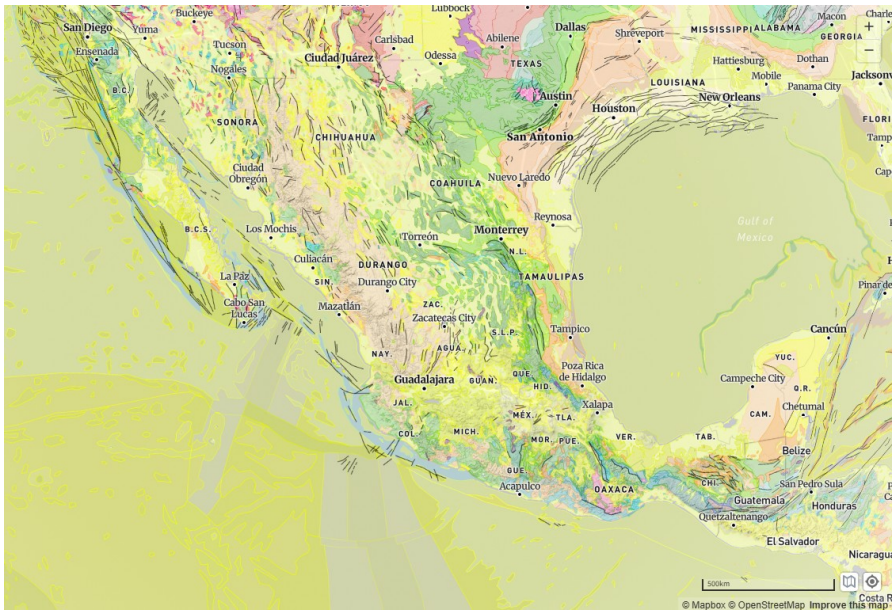


Figure 5 – Interactive Geologic Map of Mexico
Credit: Macrostrat, Creative Commons Attribution-Share Alike 4.0 International license

Figure 5, above, links to an interactive geologic map of Mexico, this is another map that can occupy a lot of your time if you want to study it.

Mineral Resources

Figure 6 - Native silver bisecting bornite, from the San Martín Mine, Zacatecas, Credit: Robert M. Lavinsky, Creative Commons Attribution-Share Alike 3.0 Unported license

The USGS Minerals Yearbook on Mexico indicates that the country has a huge natural endowment of metallic minerals, energy minerals and industrial minerals. The USGS site The Diggings lists 2,012 records of mines in Mexico. Metallic minerals minerals mined in Mexico include: antimony, cadmium, cobalt, copper, gold, iron, lead, manganese, mercury, molybdenum, mine, silver, and zinc. Industrial minerals produced in Mexico include: barite, celestite, cement, various kinds of clay (bentonite, common clay, fullers earth, kaolin, diatomaceous earth), feldspar, fluorspar, graphite, gypsum & anhydrite, magnesite, mica, ammonia nitrogen, perlite, phosphate rock, salt, construction stone, sand & gravel, quartz & quartzite, sulfur, talc, vermiculite, and wollastonite. The latest production statistics can be found here.

Figure 7 – 8 Reales Coin of Carlos III
Credit: Heritage Auctions, Creative Commons Attribution-Share Alike 4.0 International license

Silver production from Mexico and Peru funded the Spanish empire in the 16th and 17th centuries. This silver mining, had a huge effect on Mexico and the whole world economy. Spanish silver dollars, the famous Pieces of Eight, became the world currency. In the end, the Spanish overextended themselves; no amount of silver could match their ambitions, and Spain slid into second-rate status. However, they still mine the silver to this day.

Figure 8 – Offshore Oil Platform near Ciudad del Carmen,
Credit: Chad Teer, Creative Commons Attribution 2.0 Generic license

Fuel mineral production in Mexico includes coal, natural gas and petroleum. There are approximately 48 coal mining centres in Mexico, most of which are located in Coahuila State.

For petroleum and natural gas, Mexico is the eleventh largest producer of oil in the world, the thirteenth largest in terms of net exports and has the seventeenth largest oil reserves in the world. Much of the oil production in Mexico comes from the Bahia de Campeche in the Gulf of Mexico. The latest statistics on production from the USGS can be found here. The USGS also recently released Assessment of undiscovered conventional oil and gas resources in Mexico, Belize, and Guatemala, 2024.

I worked in Mexico 1980-81 and part of my work was in oil fields in the Bahia de Campeche. The geology of the Campeche Bay includes Jurassic and Cretaceous aged carbonate rocks deposited in an oceanic rift basin formed during the breakup of the supercontinent Pangaea in the Late Triassic period. These carbonate rocks are generally fractured, probably a buried karst topography. Overlying these carbonate rocks are Paleogene and Neogene clastic deposits, mostly shales and mudstones. This situation is the perfect one for creating dangerous overpressures in the subsurface and the danger of lost circulation. In Campeche, these conditions lay behind the Ixtoc disaster of 1979.

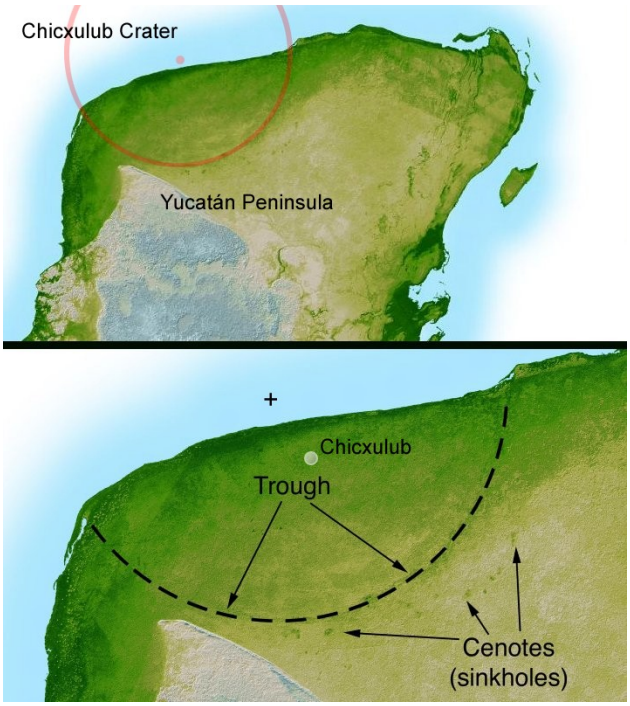


Figure 9 - Chicxulub Impact Structure
Credit: NASA/JPL-Caltech, public domain

Another, related, feature of the geology of Campeche is the Chicxulub Impact Structure. The cause of this structure is an asteroid impact that occurred approximately 66 million years ago, an event that led to the K/Pg Extinction Event, an hypotheses first proposed by Luis and Walter Alvarez in 1980. An interesting connection between the oil resources and the Chicxulub Impact Structure is that the geology suggesting the presence of an impact structure had been uncovered during petroleum exploration activities, it wasn't until Alvarez *père et fils* looked at the previously hidden drill core that the recognized that an impact had taken place. So, don't throw out your rock collection. Here is a link to a recent paper on the Chicxulub crater.

Summary

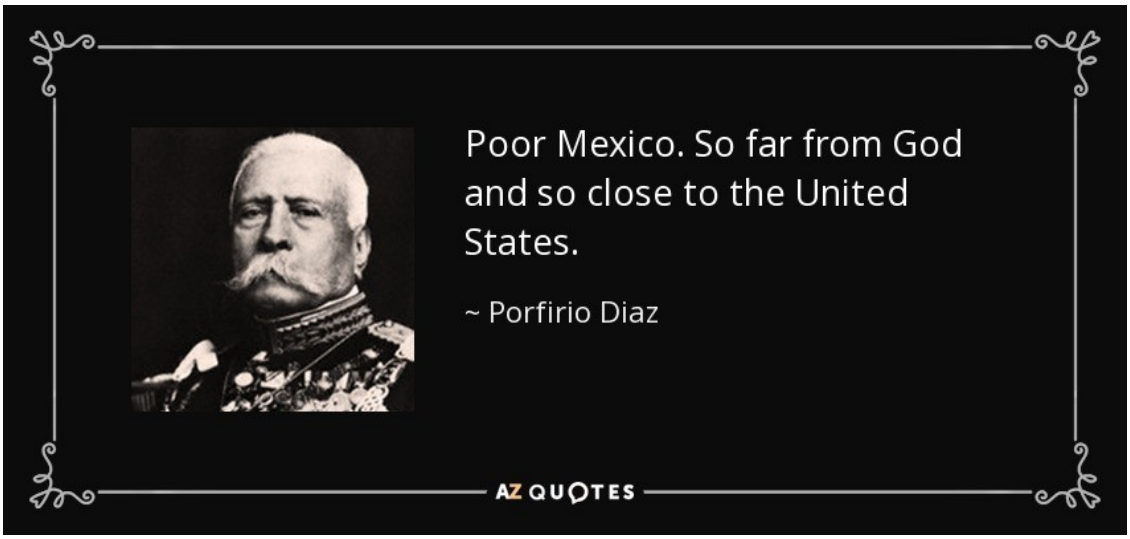


Figure 10 – Quote Attributed to Porfirio Díaz, 33rd President of Mexico
Credit: AZ Quotes

That winds up this short look at Mexico. It is a beautiful place with great potential for future mineral development, especially in the offshore petroleum industry. The main problem they face is resolution of the ongoing conflict between the narcotics trafficking cartels and the government. The Jalisco Cartel New Generation (CJNG) are a typical example of these cartels. This resolution could be difficult, as in this story:

- Public Assassination of Anti-Cartel Mayor in Michoacán Prompts U.S. Offer to Intervene Against Cartels.

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.