February 2, 2026

News and notes

Groundhog Day
Credit: Cephas, Creative Commons Attribution-Share Alike 3.0 Unported license

This week, before going on to discuss the cautionary tale of the island of Nauru, we will first look at some news items I thought were interesting. The picture above is in honour of the folk celebration of Groundhog Day in North America; apparently we have six more weeks of winter here.

If you enjoy my blogs, bookmark the site and check on Mondays rather than relying on social media postings which can get lost in the shuffle. For my news items, I try to stick to open access papers.

Comments

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

Geopolitics

- Trump launches $12B minerals vault to cut China reliance.
- Geopolitics loom large over Big Oil earnings as investors seek Venezuela details.
- How to Start World War III and Spike Oil Prices: Iran Decides to Close the Strait of Hormuz.

Research and News

- Petrogenesis and geodynamic implications of garnet-bearing dacitic volcanic rocks associated with Fuchuan ophiolite complex, Southeast China.
- Density of Sodium Aluminosilicate Melts Along the NaAlSiO4-NaAlSi3O8 Join at High Pressure: In-Situ Measurements and Re-Calibration of a Modified Hard-Sphere Equation of State For Silicate Melts.
- Prolonged cooling of andesitic-dacitic lava flows produces optimal groundmass material for $^{40}Ar/^{39}Ar$ dating.
- Seismic wide-angle constraints on crustal thickness and structure at Ocean Drilling Program Site 1256: How typical are its features for oceanic crust?
- Eccentricity rhythms in the Oligocene-Miocene carbon cycle regulated by weathering and carbonate burial.
- Mud volcanoes and synsedimentary deformation structures in Miocene lacustrine deposits over evaporites: Evidence of seismite interpretation.
- The Influence of Elevated Temperature on Time-Dependent Compaction Creep in Bleursville Sandstone.
- Fracture-Assisted Pressure Solution Creep of Granite: An Example From the Mont Blanc Massif, Western Alps.
- Si Isotope Fractionation in Metamorphic Rocks From Cryogenic Temperature Crystallographic Data and Quantum Phonon Model.
- New issue of New Mexico Earth Matters, from the New Mexico Bureau of Geology & Mineral Resources.
- Planetary geology: Spectral evidence for magmatic differentiation within a martian plumbing system.
- Establishing Mineral Chemical Vectors Toward Metamorphosed Volcanic-Hosted Massive Sulfide Deposits: New Insights from Chlorite, White Mica, and Garnet.
- Upper Cretaceous Seismic Stratigraphy and Magma-Enhanced Petroleum System of the Offshore Indus Basin.
- Absence of dehydration due to superionic transition at Earth's core-mantle boundary.
- Columbia supercontinent remnants in the Tuareg Shield (Iforas, Mali).
- Characteristics of Pennsylvanian Sandstones from Southwest Indiana-Implications for Distinguishing the Caseyville from the Tradewater Formation in Indiana.

Plate Tectonics

- Modeling Geoid and Dynamic Topography From Tomography-Based Thermo-Chemical Mantle Convection.
- Tectonic Structures and Their Consequential Nontectonic Deformations-The Case of the Friable Lower Cretaceous Sandstones in Jordan.
- Long-lived topography along rifted margins: Insights from Aparados da Serra escarpment, Southeast Brazil.
- Basin development and provenance of the Lower to Middle Jurassic Ban Don Group in Indochina: Implications for the Jurassic Palaeo-Pacific subduction and drainage patterns.
- Evidence of Subduction, Collision, and Extension in Northern Borneo: Constraints From Receiver Functions.
- Interplay of caldera and tectonic subsidence in an inverted Late Carboniferous–Permian basin (Central Pyrenees).

Paleontology

- Earliest Australian dinosaur: ichnofossils from the Carnian Aspley Formation of Brisbane, Queensland, Australia.
- The Earliest Known Vertebrates Had Four Eyes—and They Worked a Lot Like Ours Do, New Research Suggests.
- *Hadronomas* and the case of the missing fifth digit: a study of fifth digit proportions in extant and extinct kangaroos.
- Identifying variation in dinosaur footprints and classifying problematic specimens via unbiased unsupervised machine learning.
- Discovery of Goethe's amber ant: its phylogenetic and evolutionary implications; Phys.org summary here.

Mining and Energy

- Europe's Russian Gas Ban Is Set to Trigger a New Wave of LNG Tanker Demand.
- Graphite: How one Quebec company could help boost Canadian self-reliance.
- CME raises gold, silver margins after historic price plunge; related: CHART: Friday massacre for mining stocks but copper price pulls out of nosedive.
- Geothermal energy could beat nuclear, coal to meet AI power, cut fossil fuel costs by 60%.
- More than 200 killed in mine collapse in DR Congo.
- Glut To Trump Geopolitics to Keep Oil Price around $60 This Year.

- Transportable nuclear power plant advances microreactor deployment in remote regions.
- New transmission line connecting Hydro-Quebec to ISO-NE begins commercial operations.
- Reserves of critical minerals driving mining interest in South Dakota.
- Geothermal: 'The LED of heating': cheap geothermal energy system makes US comeback.
- PEA Report Confirms World Leading Alumina Resource in Saskatchewan.
- Canadian mining company confirms mass kidnapping of employees in Concordia, Sinaloa.
- Groningen closure debate reignites as Shell brings fresh arbitration; related: The American LNG Bazooka and the Quiet Rethink of Europe's Largest Gas Field.
- Antimony: The Metal Nobody's Heard Of (and the Pentagon Is Desperate For).
- Bolivia's lithium gamble tests US realignment in Latin America.
- Natural gas and coal kept Saskatchewan's lights on during frigid weather.
- Designing an effective strategic stockpiling system for critical minerals.
- Exploration: 2025 Western Canada Sedimentary Basin - Year in Review.
- Power Diverted From Data Centers To Households Across PJM Network Amid Historic Freeze.
- Drill baby, drill: Trump administration takes first step toward offering new offshore oil drilling leases in California.
- Research vessel reaches Jamaica to confirm massive oil find.
- Tests confirm battery-grade cobalt sulphate at NICO project in Northwest Territories.

Environmental Geology and Hydrogeology

- Assessing groundwater sustainability across high mountain Asia using remote sensing: Phys.org summary here.
- New Lawsuit Claims 'Catastrophic Impacts' From Permian Basin Injection Wells.
- Why too much phosphorus in America's farmland is polluting the country's water.
- Developmental low-dose bisphenol A exposure leads to extensive transcriptome female masculinization and male feminization later in life; SciTechDaily summary here.

Glaciers and Climate Change

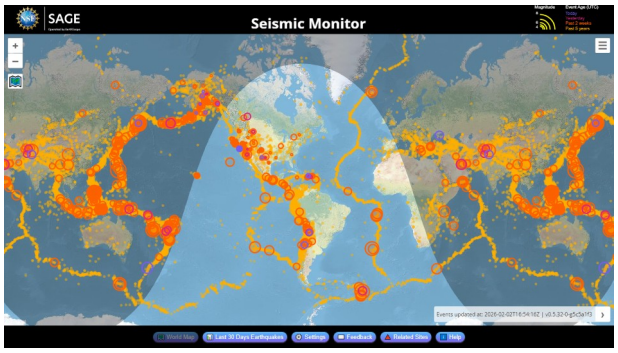
- Quantifying temperature-sliding inconsistency in thermomechanical coupling: a comparative analysis of geothermal heat flux datasets at Totten Glacier.
- South Pacific carbon uptake controlled by West Antarctic Ice Sheet dynamics.

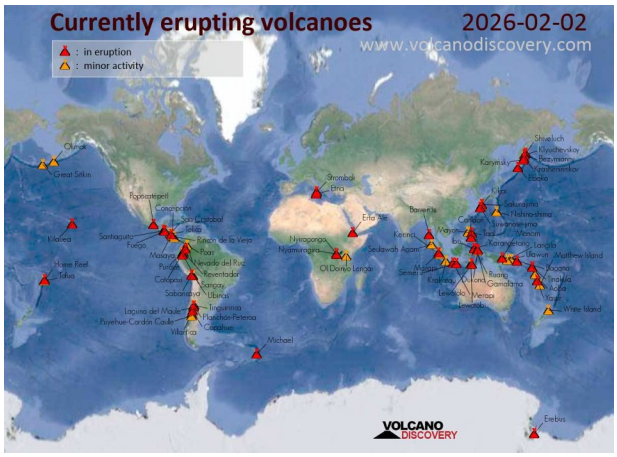
- Satellite telemetry of surface ablation to inform spatial melt modelling and event-scale monitoring, Place Glacier, Canada.
- Progressive Structural Weakening of the Northern Pine Island Ice Shelf, West Antarctica.
- Zonally asymmetric changes in the Antarctic Circumpolar Current strength over the past million years.

Bad Science

- Guest post: Forget pickles and ice cream. I published a fake paper on pregnancy cravings for prime numbers.
- The results of bad education: Two Memphis leaders question whether snow was man-made.
- ASTM Journal retracts nearly 150 articles for compromised peer review.
- Study is stolen, sold, published. Now the victim is accused of plagiarism.

Volcanoes, Earthquakes and Geohazards





Seismic Monitor **Active Volcano Map**

Volcanoes

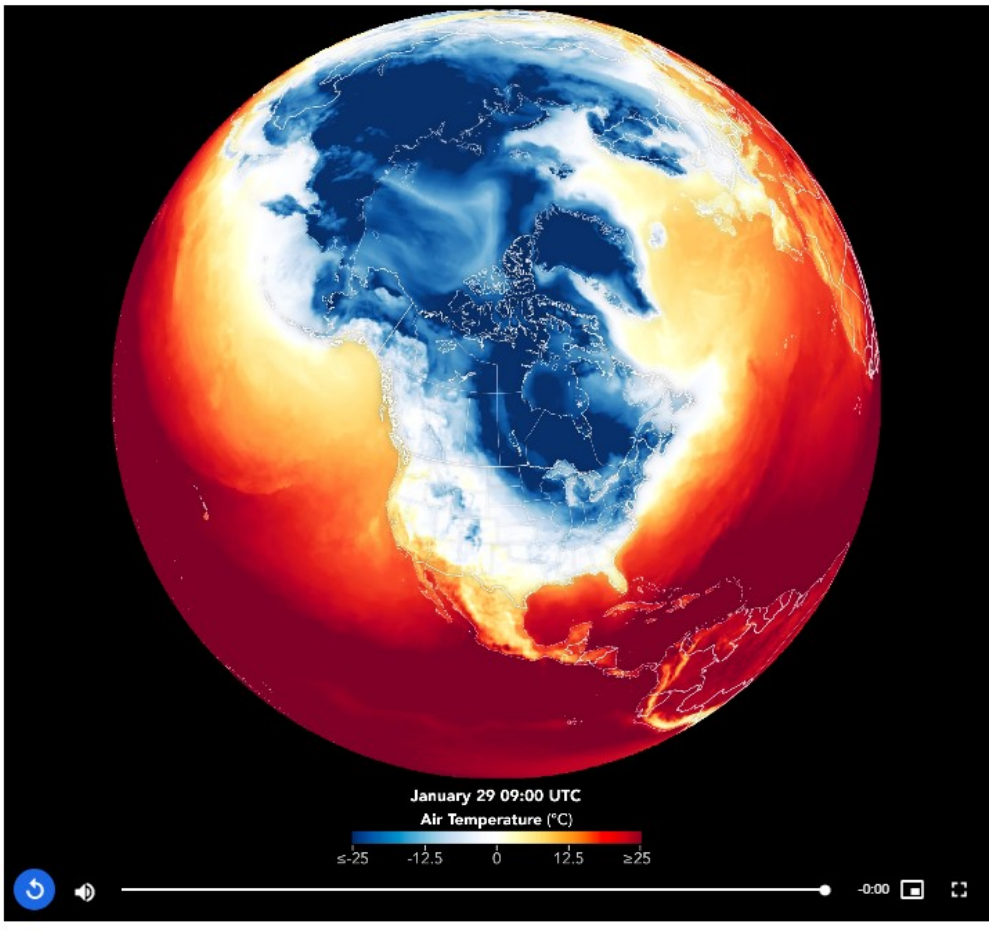
- Smithsonian / USGS Weekly Volcanic Activity Report.
- United States Geological Survey (USGS) Volcano Observatories:
  - Yellowstone Caldera Chronicles: Yellowstone earthquakes that are related to ground deformation.
  - Cascades Volcano Observatory Weekly Update.
  - Volcano Watch –When it rained rocks: tephra fall during Kīlauea's episode 41.

- Geophysics and the Hawaiian volcanoes: Seismic and mineralogical evidence for an iron-rich mega–ultralow-velocity zone beneath Hawai'i.

Earthquakes

- Euro-Mediterranean Seismological Centre (EMSC).
- Earthquakes Monitoring Live Worldwide.
- Pulsed swarm of seismicity offshore Mindanao, Philippines.
- Characteristics of Far-Field Surface Ruptures Caused by Two Recent Strike-Slip Earthquakes: Insights into Fault Displacement Prediction .
- M4.1 earthquake shakes Toronto; Earthquakes Canada called it a M3.7.
- New Zealand: Magnitude 4.6, Tue Jan 27 2026 1:53 PM.

Geohazards



January 21-29, 2026

Video of Extreme January Cold
Credit: NASA Image of the Day for January 30, 2026, public domain

Free Geology Books and Other Stuff

Free geology books can be downloaded from these sites:

- OreZone Readers and Experts Telegram Channel; the Ore Zone channel also shows employment opportunities for geologists.
- The Groundwater Project has many groundwater geology books for free download together with free online courses, listed here.
- Free Groundwater Modeling Courses from the HydroGeoCenter.
- From Western Australia: Carbonatite, lamprophyre and host rocks in the northern Aileron Province.
- The Geology of Indonesia: Volume 1 and Volume 2.
- Brett Davis' book on veins in a deforming rock mass: "The Veining Bible"; also at this site.
- From the Mineralogical Society of America: Handbook of Mineralogy.
- Systematic geochemical classification of felsic igneous rocks of the Yilgarn Craton.

Upcoming Events

- Free webinar: The challenges of investigating fuel stations, 10 February 2026, 12:30 - 13:15 GMT.
- 2026 AAAS Annual Meeting, Phoenix, AZ, February 12-14.
- Feb. 16-18, 2026, Inaugural Mineralogical Society of America Annual Meeting, Tuscon AZ.
- March 15-21, 2026, Provincial Engineering and Geoscience Week, Manitoba.
- AGS Annual Conference 2026, 19th Mar 2026, One Great George Street, London, U.K.
- GAC-MAC 2026 St. John's NL, St. John's Convention Center, May 25-28, 2026.
- PEG2026: 11th International Symposium on Granitic Pegmatites; 16th–19th August 2026, in Perth, Western Australia.
- 14-18 September 2026 , IAH 2026, 53rd Congress of the International Association of Hydrogeologists; Budapest Congress Center.
- Society of Petroleum Engineers Distinguished Lecturer Schedule.
- American Geophysical Union List of Upcoming Meetings.
- The Geological Society: Events & Courses.

February 2, 2026

Nauru, Phosphate Mining and the Consequences

Introduction

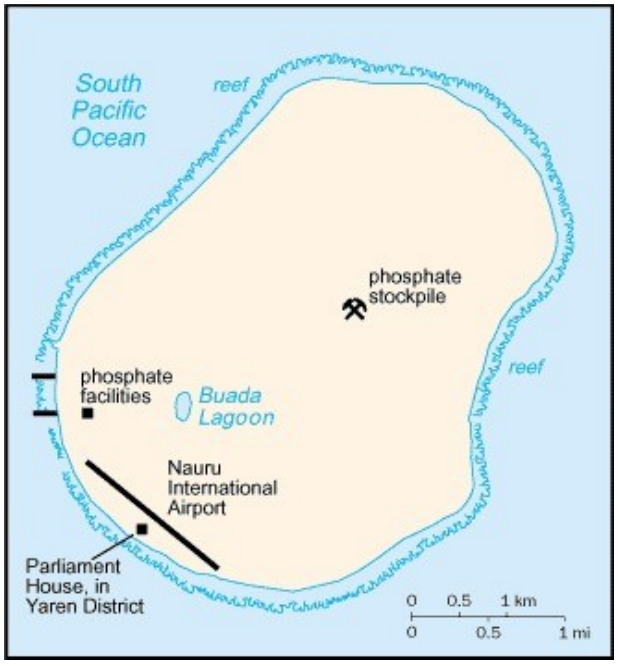


Figure 1a – Nauru
Credit: CIA World Factbook, public domain

Figure 1b – Location of Nauru
Credit: CIA World Factbook, public domain

The Republic of Nauru is an tiny island country of 9,930 people in the South Pacific Ocean. The country has an area of 21 square kilometres and its nearest neighbour is Kiribati, about 300 kilometres to the east.

Since the collapse of the phosphate mining industry (more below) Nauru is now a relatively poor country with a per capita GDP (PPP) of $9,995 and a high Human Development Index of 0.703.

Nauru primarily imports refined petroleum, construction vehicles, and food, with major partners being Taiwan and Australia. Its exports mainly consist of fish and phosphate, with Thailand and Australia being significant markets.

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

Geology and Phosphate Mining

Figure 2 - Satellite Picture of Nauru
Credit: Atmospheric Radiation Measurement Program, public domain

The geology of Nauru is that of a coral atoll sitting on top of a submarine volcano. Tectonically, Nauru sits within the Nauru Basin of the Pacific Ocean, on a part of the Pacific Plate that formed at a mid oceanic ridge, beginning approximately 132 million years ago (Mya).

The submarine volcano on which the Nauru coral atoll grew grew from mid Eocene (35 Mya) until the Oligocene over a tectonic hotspot. The volcano is made up of basalt and formed a seamount that rose over 4000 m above the ocean floor.

Following the end of volcanic activity, erosion levelled the volcano to below sea level and a coral atoll, approximately 500 metres thick, grew on to of the volcanic rock. Originally deposited as limestone, the diagenetic processes of dolomitization caused the limestone to largely become dolomite. Sea level change during the Quaternary raised the island about 30 metres above sea level and subsequent erosion resulted in a karst landscape of cavities, sinkholes and caves.

Finally, beginning in the Pleistocene and continuing until the arrival of humans during the Holocene (ca. 1000 BC), the island became the haunt of seabirds. Droppings from these seabirds accumulated into huge deposits of phosphorite.

Figure 3 - The site of secondary mining of phosphate rock in Nauru, 2007
Credit: Lorrie Graham/AusAID, Creative Commons Attribution 2.0 Generic license

When first discovered by the English explorer John Fearn 1798, Nauru was called "Pleasant Island". After the Germans incorporated Nauru into their "place in the sun", phosphate deposits were identified o the island. Then as now, phosphate is a critical component of fertilizer and demand can easily exceed supply. Mining of phosphate rock began in 1905 and by the 1920's the island was exporting around 200,000 tonnes of phosphate a year. During World War 1, Australian forces occupied the German colony of Nauru and after the war it formally became part of the British Empire under Australian, British, and New Zealand administration. Japan forcibly occupied Nauru during WWII, after which Australia administered the island until it was granted independence in 1968.

Throughout this time, phosphate mining continued and the new government of Nauru became dependent on income from royalties on the mining. As a result of the income from phosphates, Nauru became a wealthy country.

And then the money ran out.

Although there was a serious attempt to set up a sovereign wealth fund to save for the future, malinvestment and outright corruption sapped the potential for a steady cash flow. In fact, the fund ended up in debt. Although Nauru's economy has recovered since the end of major mining in the 2000's, much of that has been due to revenue from housing refugees for Australia as well as allowing Nauru to be the home of questionable banking practices. Phosphate mining continues in Nauru, in 2022 some 250,000 of phosphate rock was recovered.

Meanwhile, approximately 80% of the land surface of Nauru has been strip mined and the land has not been restored. Interestingly, the removal of the phosphate rock exposed the underlying karst topography. In 1989, Nauru took legal action against Australia in the International Court of Justice over Australia's failure to remedy the environmental damage caused by phosphate mining. Australia and Nauru agreed to an out-of-court settlement to rehabilitate the mined-out areas of Nauru. Although the rehabilitation is underway, the damage has been done.

Summary

Finding a hugely valuable natural resource on your property of in your country can be like winning a large sum of money on the lottery – now what? Just like people who beat the odds and win big on the lottery, nations that come into huge amounts of money from natural resources face many choices. Make no mistake – these choices matter.

Where do we invest the money? This is the big one and depends entirely upon how much you trust the financial system. No system is entirely safe. Assuming that you are able to keep control of the productive asset (also not guaranteed) you then have to pick good investments for it. Unfortunately, the history of financial markets does not lead to long term confidence.

Who do you entrust with the management of the money. This is also problematic. Who do you trust? Sovereign wealth funds tend to be managed by professional economists and bankers, while not perfect it is probably the best choice available. However, any large sum becomes a temptation and sociopathic personalities gravitate to situations where they can acquire the most lucre. A system of close supervision seems wise, but the temptation of a large money pot is itself huge.

Many of the commentaries on the history of Nauru seem to say "see what these unsophisticated South Sea Islanders did". As if these people are unique in their financial naivete. Financial scandals in so-called advanced Western societies go back in time and include such events as the Tulip Bubble, the South Sea Bubble and the Mississippi Bubble. More recently we saw people invest heavily in mortgage backed securities, until that collapsed in 2009. Current obsessions with artificial intelligence (AI) and cryptocurrency also have the makings of financial bubbles. In terms of wishful thinking and making bad decisions, the people and leadership of Nauru are not unique, not by any means.

Some people like to invoke the so-called "Dutch Disease", based on the experience of the Netherlands with the mineral wealth from the Groningen gas field, for the troubles that places like Nauru experience when they get rich from natural resources. The narrative is that the easy money to be made in the natural resource exploitation attracts capital investment from other sectors of the economy, impoverishing those other sectors. There almost seems to be a puritanical judgment that easy money leads to moral turpitude.

While open to debate, I don't think that natural resource development automatically impoverishes other sectors of the economy. Again, what choices did you make?

One other big choice that needs to be made when developing natural resources is environmental, and in Nauru many bad choices were made. Mining can be done in such a way so as to restore the land after the resource is extracted. Or you can just take the money and run, as appears to be the case in Nauru. As a result, Nauru is faced with many years of hard work to restore the 80% of their land area that has been left unusable due to mining. It didn't have to be that way.

If I have one take away from the story of Nauru it is this one – choices matter. Within the constraints of financial risk, it really matters how you manage these sovereign wealth funds, who you choose to run them, and what institutional controls you put in place. It also matters for the long term how you manage the inevitable environmental consequences of resource extraction?

The lessons are there to learned.

Standard Caveat