

August 18, 2025

News and notes



Hollyhocks (*Alcea sp.*) in my garden, August 15, 2025

This week, before going on to discuss the geology and mineral resources of Madagascar, we will first look at some news items that I thought were interesting.

Comments

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

Geopolitics

- [Top British Army Officer Predicts Civil War as ‘Rabbit in Headlights’ Leaders Incapable of Political Solutions.](#)
- [Bolivia election and lithium: What you need to know.](#)
- [One of Russia’s Largest Oil Refineries Halts Crude Intake](#); related: [Explosions Rock Russia’s Volgograd, Lukoil Refinery Hit Overnight.](#)
- [Infographic: China’s grip on global antimony refining.](#)

Research and News

- Geologists understand this: [Stone Age humans travelled for miles to find the perfect rocks](#); peer reviewed paper [here](#).
- [Preservation of Primary Si Isotope Signatures in Devonian Lahn-Dill-Type Iron Ores as Revealed by Femtosecond Laser Ablation](#).
- [The ejection pattern of sand particles in steady-state aeolian transport](#).
- Sedimentary deposits from volcanic ash: [Submarine ash megabeds fed by far-traveled, shoreline-crossing pyroclastic currents from a large explosive volcanic eruption](#).
- Carbon cycle research: [The geologic history of marine dissolved organic carbon from iron oxides](#).
- Mineralogy: [Conversion of titanite to rutile during the albitization of granitoids from the Sakar Batholith, SE Bulgaria: experimental studies](#).
- AI and geology: [Using Machine Learning for automatic rock classification](#).
- [How do fluids control beryllium mineralization in a magmatic-hydrothermal system: Evidence from mica geochemistry and quartz-beryl O isotopes](#).
- Geophysics: [An Analysis of Dense Seismoacoustic Signals from an Accidental Chemical Explosion in South Korea on 4 March 2020](#).
- [Earth-shattering kabooms: Disentangling Impact Ejecta Dynamics Using Micro-X-Ray Fluorescence \(\$\mu\$ -XRF\): A Case Study From the Terrestrial Cretaceous-Paleogene \(K-Pg\) Boundary](#).
- Structural geology: [Differential subsidence and gravity collapse of the eastern and western Niger Delta lobes: Evidence from 2-D kinematic structural modelling](#).
- [Petrology and origin of a Devonian volcanic complex on Arthurs Seat, Mornington Peninsula, Victoria, Australia: *multum in parvo*](#).
- Good news: [Placing the Near-Earth Object Impact Probability in Context](#); Phys.org summary [here](#).

Plate Tectonics

- [Rapid crustal transit of magmas beneath the Main Ethiopian Rift](#).
- [Crust-Mantle Interaction During Continental Deep Subduction: Evidence From Light Mo Isotopes in Post-Collisional Mafic Igneous Rocks From the East Kunlun Orogen](#).
- [Structure of the NE Oman Mountains: A Review of Robust Geochronological Constraints for Tectonic Models of Ophiolite Obduction and Continental Subduction](#).
- [Insights into Extensional Tectonics from a Large Deep Learning Focal Mechanism Catalog](#).

- [Transform Faulting in the Northern Red Sea Revealed by Ocean Bottom Seismometers Deployed in the Zabargad Fracture Zone.](#)
- Mineralogy and plate tectonics: [Behavior of Thallium during HP/UHP Subduction-Zone Devolatilization in Western Alps HP/UHP Metasedimentary Rocks: The Role of Phengite.](#)
- [Slab break-off and subduction polarity reversal after collision can be very fast.](#)
- [Properties and Dispersal of a Hydrothermal Plume in a Weakly Stratified Under-Ice Environment.](#)
- [Rotation of crustal extension and narrowing of rift faulting in the southern Rio Grande rift, Trans-Pecos Texas.](#)

Paleontology

- [Reversing the Trend: The Evolution of Cranial Akinesis in the Terror Birds \(Cariamiformes, Phorusrhacidae\).](#)
- [115 million-year-old dinosaur tracks unearthed in Texas after devastating floods.](#)
- [The role of amorphous silica coating on apatite nanocrystals in the exceptional preservation of phosphatized embryo-like microfossils from the Ediacaran Doushantuo Formation.](#)
- [Multiple exceptionally preserved fossils from the Paleocene Waipara Greensand inform the diversity of the oldest stem group Sphenisciformes and the formation of their diving adaptations; Phys.org summary \[here\]\(#\).](#)
- [A new species of the genus *Caturus* \(Caturidae, Amiiiformes\) from the Upper Jurassic of the Solnhofen Archipelago \(Germany\).](#)
- [An immature toothed mysticete from the Oligocene of Australia and insights into mammalodontid \(Cetacea: Mysticeti\) morphology, systematics, and ontogeny.](#)
- [I'm a physicist who studies fossils, and I recently discovered preserved blood vessels in the world's largest T. rex.](#)
- [First study of a shell pathology in the lineage of basal turtles Helochelydridae.](#)
- [Mammutid proboscideans \(Mammalia, Proboscidea, Mammutidae\) from the Upper Miocene of Hayranli-Haliminhani, Sivas Basin, Türkiye.](#)
- University of Utah: [South African caves filled with fossil clues to Pleistocene Epoch.](#)
- [A subantarctic reigitheriid and the evolution of crushing teeth in these enigmatic Mesozoic mammals; Phys.org summary \[here\]\(#\).](#)

Mining and Energy

- [Papum Pare to Singrauli: India maps fresh hotspots for rare earth metals amid China concerns.](#)

- [Uganda targets higher exports with first large-scale gold mine.](#)
- [US startup makes thorium breakthrough at Department of Energy's Idaho National Lab.](#)
- [India Launches Deepwater Oil and Gas Exploration Mission.](#)
- Changing prices: [Explaining the iron ore grade shift.](#)
- [China's Coal Production Drops in July.](#)
- Ore deposit geology: [Contrasting timescales of metal fluxes in porphyry copper systems from coupled physicochemical processes of magmas, rocks and fluids.](#)
- [One of the largest gold, silver, and copper deposits has just been discovered in Chile, and it's expected to be worth several billions.](#)
- [How Canada's Oil Sands Producers Pump More Crude from the Same Assets.](#)
- Natural resource development: [Canada and the world can have a decent future if we do the right things.](#)
- Ore deposit mineralogy: [Genesis of jordanite-geocronite solid solution series in the Huize Pb-Zn deposit, SW China: Implications for fluid evolution in the late mineralization stage.](#)
- Petroleum deposit geology: [Detailed petrophysical analysis and insights into the Alam El Bueib 3E reservoir from the Berenice field, Western desert, Egypt.](#)
- [De Beers strikes first kimberlite field in 30 years.](#)
- New Zealand: [Pay cheques soar as miners flood to West Coast for biggest opportunity in a generation.](#)
- Critical minerals: [Canada invests in Northcliff's New Brunswick tungsten project.](#)

Environmental Geology and Hydrogeology

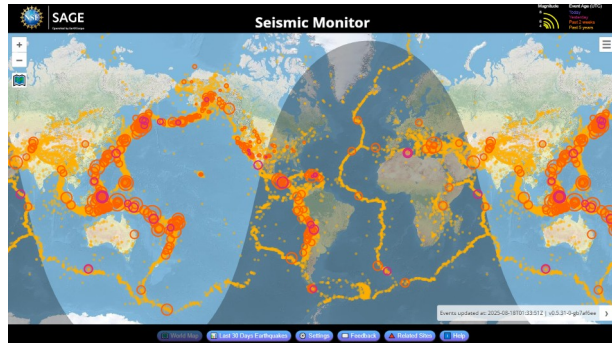
- [Long-term analysis of land cover changes resulting from mining activities: Strzelin case study \(S-W Poland\).](#)
- Light contamination from tourism in caves: [Substrate type and light intensity determine *lampenflora* concentration on paleontological remains in show caves.](#)
- [A global humidity index with lateral hydrologic flows; Phys.org summary \[here\]\(#\).](#)

Glaciers and Climate Change

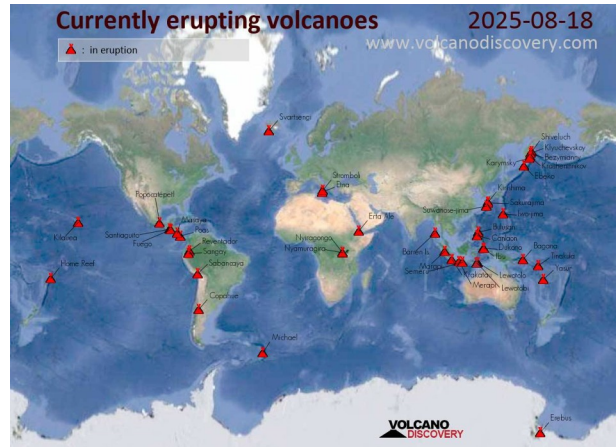
- [Insights into supraglacial lake drainage dynamics: triangular fracture formation, reactivation and long-lasting englacial features; Phys.org summary \[here\]\(#\).](#)
- [Glacial flooding measured in real time at Juneau, Alaska.](#)
- [Calving-driven fjord dynamics resolved by seafloor fibre sensing.](#)

- [Paleocene-Eocene Thermal Maximum: 56 million years ago, Earth underwent rapid global warming. Here's what it did to pollinators.](#)

Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

Volcanoes

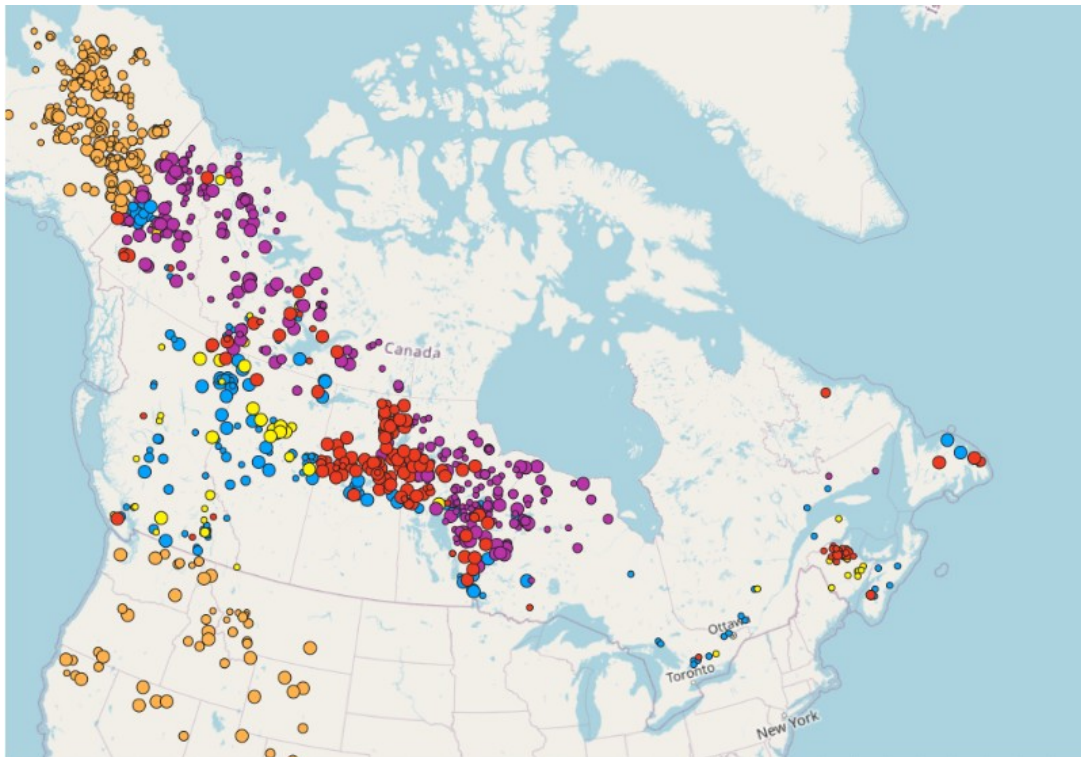
- [Smithsonian / USGS Weekly Volcanic Activity Report.](#)
- United States Geological Survey (USGS) Volcano Observatories:
 - [Cascades Volcano Observatory Weekly Update.](#)
 - Fun, fun, fun: [Halema'uma'u fissure sampling on August 13, 2025.](#)
 - [Volcano Watch - Water in Kīlauea, and its role in its eruptions.](#)
 - [The many types of fluids that flow in Yellowstone.](#)
- Video: [Aug 13, 2025: Fuego Volcano Wakes Up.](#)
- [Blue Lava And Battery Acid Lakes Adorn The Ijen Volcano of Indonesia.](#)
- From the NASA Earth Observatory: [Ash Streams from Klyuchevskaya Sopka.](#)

Earthquakes

- [Euro-Mediterranean Seismological Centre \(EMSC\).](#)
- [Earthquakes Monitoring Live Worldwide.](#)
- [Detection and Analysis of Aleutian Arc Seismicity \(2022–2023\) Using an Autonomous Hydrophone Array.](#)
- Research: [Modeling Seismic Intensity Envelopes for Earthquake Early Warning Applications.](#)

- [Magnitude, Depth, and Methodological Variations of Spectral Stress Drop Within the SCEC/USGS Community Stress Drop Validation Study Using the 2019 Ridgecrest Earthquake Sequence.](#)
- [Systematic Estimation of Earthquake Source Parameters for Continental Australia: Attenuation and Stress Drop.](#)
- [Supershear Rupture Along the Sagaing Fault Seismic Gap: The 2025 Myanmar Earthquake; Phys.org summary \[here\]\(#\).](#)
- [Heterogeneous strong asperities and tectonic complexity control irregular cascading ruptures.](#)

Wildfires and Other Geohazards



Interactive Wildfire Map August 17, 2025
Credit: ©Canadian Wildland Fire Information System

- [Iberian wildfires: Spain fighting to control 20 fires while eight blazes rage in Portugal.](#)
- [Fast-Moving Hawk Fire in Los Angeles County Prompts Evacuation.](#)
- [470 'out of control' wildfires burning across Canada: Striking visuals from across the country.](#)
- [Landsliding follows signatures of wildfire history and vegetation regrowth in a steep coastal shrubland.](#)

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

- [Copper to the World Conference, Tuesday 26 – Wednesday 27 August 2025](#), in Adelaide, Australia; report on 2024 conference [here](#).
- [The 52nd Congress of the International Association of Hydrogeologists, 15-19 September 2025, Melbourne Australia](#).
- [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](#).
- Australia: [12–18 October 2025, Earth Science Week](#).
- [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](#).
- [Saskatchewan Geological Open House, December 1 to 3, 2025, Delta Bessborough Hotel, Saskatoon](#); Registration for the 2025 Conference will be opening on August 6.
- 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](#).
- [“Geology Hour” Online](#), evenings on the 3rd Monday of the Month from the Geological Society of the Oregon Country; next one August 18.

August 18, 2025

Geology and Mineral Resources – Madagascar

Introduction



Figure 1a – Madagascar

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



Figure 1b – Location of Madagascar

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

The [Republic of Madagascar](#) is an island country of 29,452,714 people on the [island of Madagascar](#) off the east coast of [Africa](#) in the [Indian Ocean](#). Between Mozambique and Africa is the [Mozambique Channel](#). The country has an area of 587,041 square kilometres (km²) of which 581,540 km² is land and 5,501 km² is water. For more details on the country, check out the [CIA World Factbook on Mozambique](#) as well as the [Wikipedia article](#).

Geology

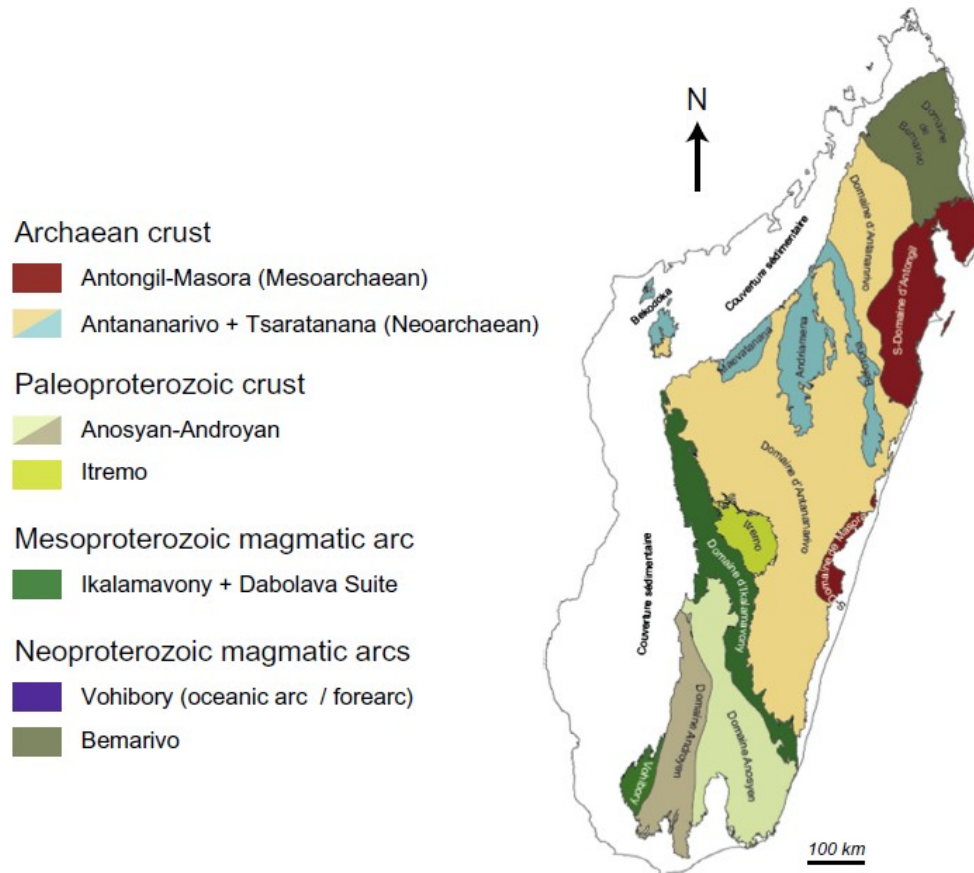


Figure 2 – Precambrian Rocks of Madagascar
Credit: Figure 3 in [Moine & Nedelec, 2014](#)

The [basement rocks in Madagascar](#) are [Precambrian](#) in age (i.e. the first 4 billion years of the Earth's history). These are mostly metamorphic rocks whose age reflects the [orogenies](#) that brought them together. The oldest of these deposits are the [Mesoarchean](#) aged [gneiss](#) and [granitic](#) intrusions of the [Antongil- Masora Terrane](#).

The next oldest are the [Neoarchean](#) aged [Antananarivo](#) and [Tsaratanana terranes](#). The Antananarivo terrane consists largely of [felsic orthogneisses](#). The Tsaratanana terrane is made up of mostly [mafic](#) gneiss, [tonalite](#), [chromite](#)-bearing [ultramafic](#) rocks, and [paragneiss](#).

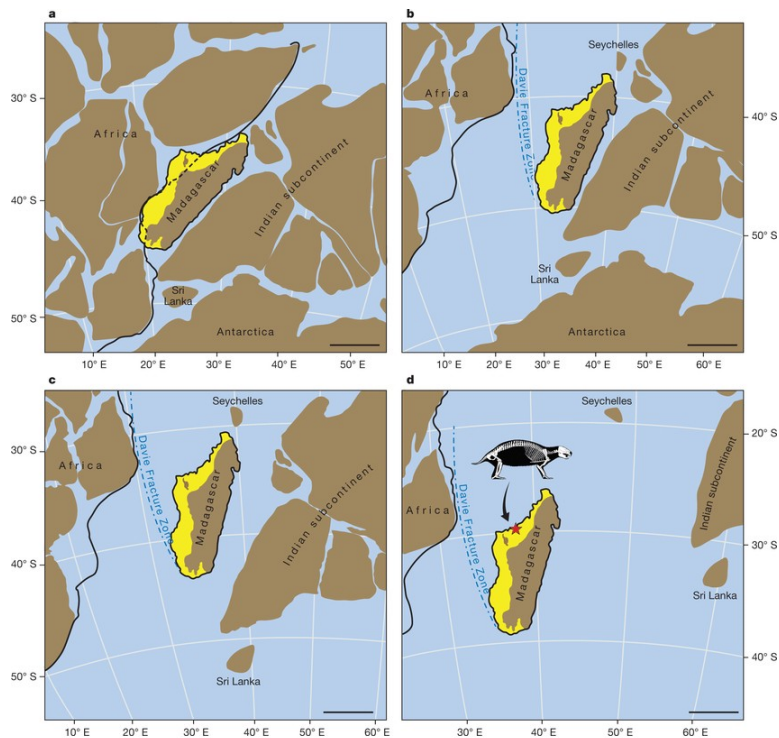
Next in age are the [Paleoproterozoic](#) aged [Anosyen-Androyen](#) and [Itremo](#) terranes. The Anosyen-Androyen terrane is predominantly made up of [metasediments](#) and felsic [metavolcanics](#) (“[leptynite](#)”).

The Itremo terrane is a sequence of low-grade shallow water sedimentary rocks including [quartzite](#), [micaceous schist](#), and [marble](#). Intruding the Itremo terrane are granite and [gabbro](#).

The [Mesoproterozoic](#) aged [Ikalamavony](#) and [Dabolava](#) sequences are next in age. The Ikalamavony sequence consists of mostly [intermediate](#) to mafic orthogneiss, [pelitic](#) and [calc-silicate](#) gneiss, marbles and quartzites intruded by [granodiorite](#). The Dabolava sequence is made up of intrusive igneous rocks.

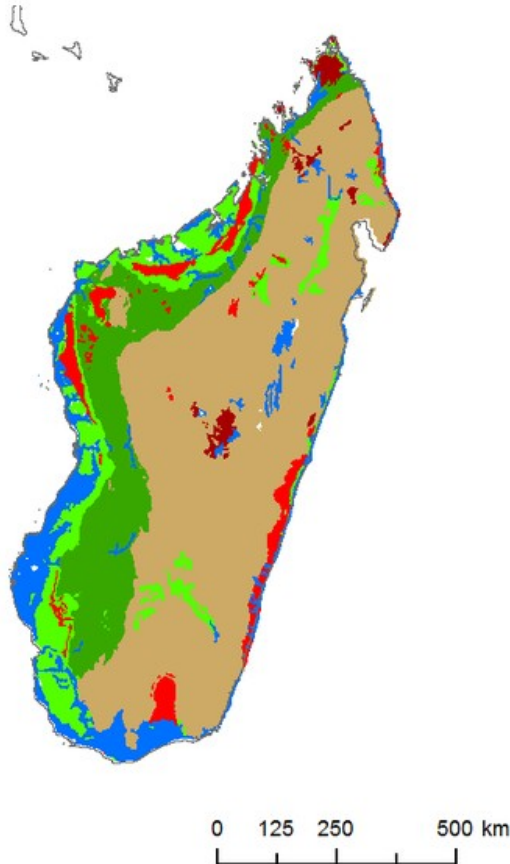
The youngest Precambrian rocks in Madagascar are in the [Neoproterozoic](#) aged [Vohibory](#) and [Bemarivo](#) terranes. The Vohibory Domain is made up of by mafic and felsic [meta-igneous rock](#) with interbedded paragneisses and marble layers. The Bemarivo terrane consists of [metagranite](#), granite, and stratified [volcanic rock](#) with interbedded metasediment.

The [assembly](#) of the supercontinent [Gondwana](#), of which Madagascar was a part, was largely complete by the end of the Neoproterozoic and the beginning of the [Paleozoic Era](#). Eventually, however, [Gondwana](#) [broke up in the Late Triassic](#), and Madagascar with it, as shown in Figure 3.



Key stages in plate tectonic history of Madagascar a, Position of Madagascar before rifting between West Gondwana (South America and Africa) and East Gondwana (Madagascar, Seychelles, Indian subcontinent, Sri Lanka, Antarctica and Australia) at 183 Myr ago (Early Jurassic epoch). b, Separation of Indo-Madagascar from Antarctica and Australia at 124 Myr ago (mid-Early Cretaceous epoch). c, Separation of Indian subcontinent from Madagascar at 88 Myr ago (mid-Late Cretaceous epoch). d, Approximate time of deposition of Maevarano Formation at 66 Myr ago (latest Cretaceous period). Solid black lines indicate current coastlines of Madagascar and east Africa; brown represents Precambrian terranes; and yellow indicates sedimentary basins along west coast of Madagascar. The discovery site of UA 9030 is indicated by red star in d. Scale bars, 500 km. Maps adapted from Earthworks (www.reeves.nl/gond.com).

Figure 3 – Key Stages in the Tectonic History of Madagascar
Credit: From Krause et al, 2020



Madagascar - Geology

	Quaternary Unconsolidated Sediments
	Tertiary-Quaternary Volcanic
	Cretaceous Volcanic
	Cretaceous-Tertiary Sedimentary
	Carboniferous-Jurassic Sedimentary
	Precambrian Basement undifferentiated

Figure 4 – General Geology of Madagascar

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

The [Phanerozoic](#) formations of Madagascar deposited following the assembly and [breakup of Gondwana](#) are best understood by the reference to the various sedimentary basins in the country.

The Western Basin, which extends almost the whole length of the island; includes, from oldest to youngest:

- The [Upper Carboniferous](#) to [Middle Jurassic](#) aged [Karoo System](#), various continental and marine deposits including [marl](#), [limestone](#), [sandstone](#), [shale](#), and [tillite](#).
- Other [Jurassic](#) aged [limestones](#), [marls](#), and [sandstones](#).
- [Cretaceous](#) aged sandstone, marl, limestone, and clay.
- [Paleogene](#) aged limestones with calcareous [dolomite](#), marl, calcareous marl and marly limestones.
- [Neogene](#) continental soft sandstone with sandy clay.
- [Quaternary](#) alluvial and mangrove swamp deposits.

The Diego-Suarez Basin in the extreme north consists of:

- [Permian](#) aged continental clayey sandstone and shale.
- Jurassic aged marl, limestone, and dolomitic limestone.
- Cretaceous aged sandstone, [chalk](#), marl and clay.
- Paleogene, [Eocene](#), aged [dolomitic limestone](#) and [karstic](#) limestone.

- Neogene marine sequence of alternating limestones, sandstones and basaltic [tuff](#), covered by [basaltic](#) flows.
- Quaternary aged coral reef deposits and sand dunes.

The East Coast (Côte Est) Basin is made up of:

- Cretaceous, [Maastrichtian](#), aged marls and limestones with some [Upper Cretaceous](#) volcanic basalts.
- Neogene aged continental sandstones interbedded with clays and basaltic flows together with [Pliocene](#) shale.
- Quaternary aged sand dunes and [alluvium](#).

The South Basin:

- Neogene aged continental clay, [argillite](#), sand, clayey sand and clayey sandstone.
- Quaternary aged lithified sand dunes together with alluvial deposits in the valleys.

Mineral Resources

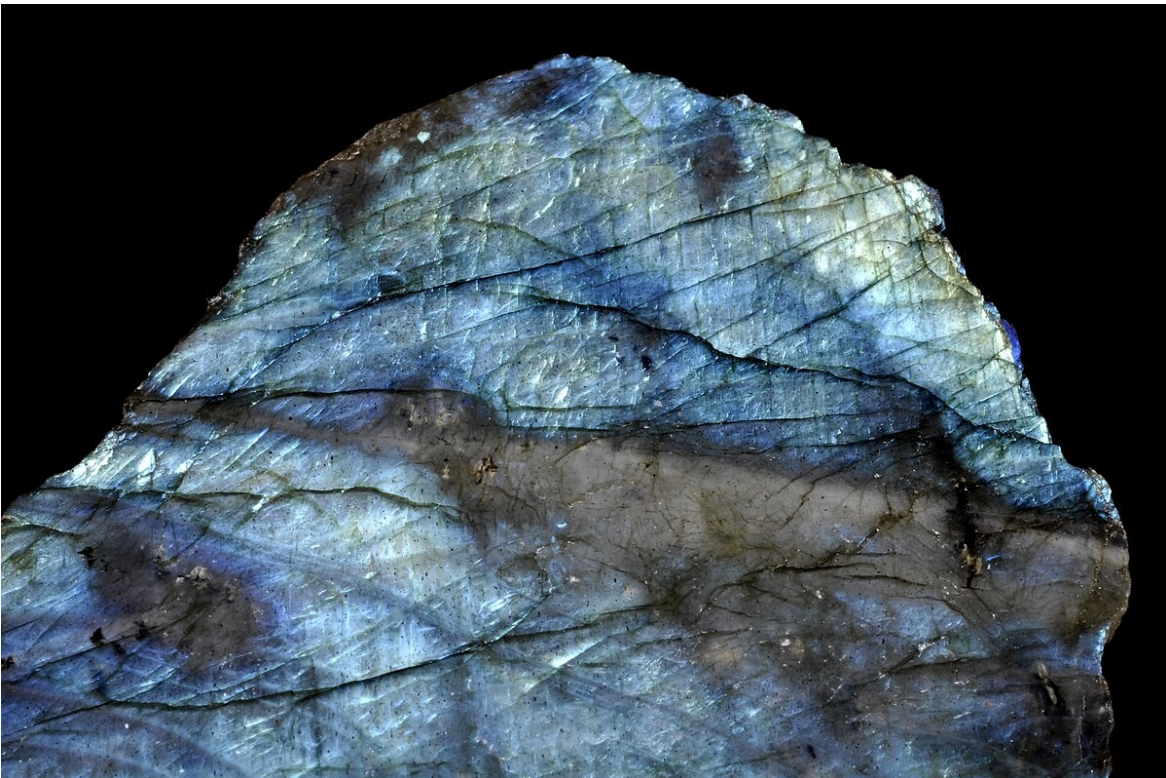


Figure 5 – Labradorite from Madagascar
[Credit: Parent Géry, public domain](#)

The mineral industry of Madagascar includes a variety of metallic minerals and industrial minerals, especially gemstones. Madagascar also has a single oil field, at [Tsimiroro](#), which is expected to come online this year, and a [coal deposit at Imaloto](#) currently under development.

Industrial minerals production (excluding gemstones) includes production of cement, clay, [graphite](#), [gypsum](#), and [pozzolan](#) volcanic ash. [Titanium oxide](#) and [rare earth elements](#) are mined at the [Mandena](#) mine.

Metallic mineral mines in Madagascar include: a [chromium mine at Ankarabo](#), not currently [in operation](#); the [Ambatovy cobalt and nickel mine](#); and gold that is mined in small [artisanal operations](#).



Figure 6 – Artisanal Sapphire Production, October 2016

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

Gemstones mined in Madagascar include:

- [Aquamarine](#), [emerald](#), [garnet](#), [quartz](#), [ruby](#), [sapphire](#), and [tourmaline](#) are mined by artisanal and small-scale miners.
- [Amazonite](#), [amethyst](#), [labradorite](#), and quartz are mined by the [Norcross Madagascar Group](#).
- Labradorite is also mined by [Red Graniti Madagascar SARL](#) and [SQNY International](#).

The most recent mineral production statistics for Madagascar from the USGS can be found [here](#). Figure 7 links to an interactive mineral occurrence map for Madagascar from [Mindat.org](#).

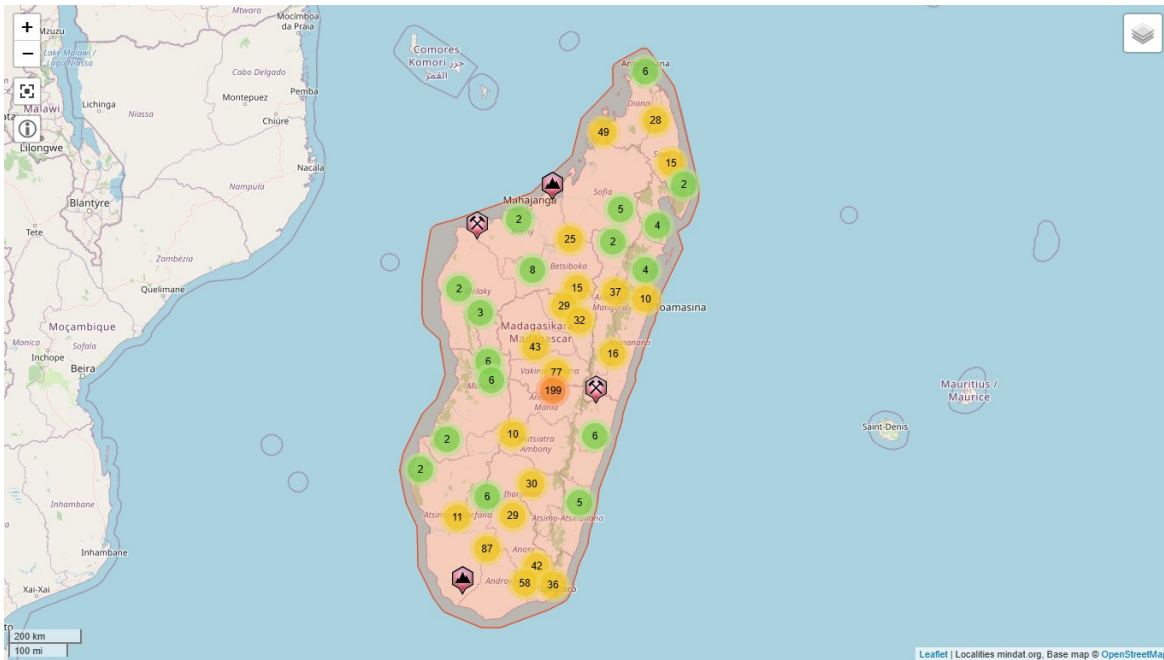


Figure 7 - Mineral Occurrence Map for Madagascar
 Credit: [©Mindat.org](https://www.mindat.org)

Summary

A shard of ancient Gondwana, Madagascar has interesting geology and mineral resources. It's a great place to go if you like pretty, shiny things ([ooh, shiny](#)). Like many places with a Precambrian shield type basement, there should be many opportunities for further mineral development.

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.