December 22, 2025

News and notes

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

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

Pump Jack in Venezuela
Credit: Rjcastillo, Creative Commons Attribution-Share Alike 3.0 Unported license

- Venezuela:
  - China Condemns U.S. Seizing of Venezuela Oil Tankers. Because their carrying oil for China.
  - Trump says he is not ruling out war with Venezuela, NBC News reports.
  - Commentary: The Venezuelan Drone Crisis.
- Ukraine Hits Russian Shadow Tanker in Mediterranean for First Time.
- Exclusive - Patriots of the Caribbean: Sen. Mike Lee Bill Authorizes Privateers to Combat Cartels Outside U.S. Borders; reference Mark Knopfler.
- As the geopolitical landscape shifts, oil and natural gas remain key to everything.
- National Security Strategy of the U.S.A. – November 2025.

Research and News

- Extending the western Hudson Bay Lowland Quaternary stratigraphy, in Manitoba Canada, to at least Marine Isotope Stage 10.

- A Dual-Geochronologic and Thermochronologic Detrital Approach to Identify the Focus of Erosion in the Kosi Basin, Nepal.
- Silver isotope fractionation by chemical diffusion in granitic melt.
- January 2026 issue of Sedimentology: Volume 73, Issue 1, Pages: 1-292.
- From bacterial to thermochemical sulfate reduction: Sulfur isotope constraints on the genesis of hyper-enriched black shales.
- The predominance of SiO_5 species in $MgSiO_3$ melt at transition zone pressures from a dynamics point of view.
- Provenance Reassessment of Eocene Turbidites, New Caledonia: Inferences for Obduction Models.
- Time-resolved X-ray diffraction of silicate melt and glass under shear.
- Mineral alteration: Impact of coating structure on the rates of coupled dissolution-precipitation reactions.
- In-situ U-Pb dating of early marine carbonate cements constrains the age of the late Ediacaran lower Nama Group, Namibia.
- Facies Characterization and Volcanic Source Assignment of Marine Tephra Deposits Around São Miguel Island, Azores Archipelago.
- Sediment provenance and transport pathways along the Atlantic Iberian Margin.
- China is drilling a hole that will reach six miles deep into the Earth.
- Coral reef terrace age deduced from retreating knickpoints.
- New mineral discovered in South China is named Jinxiuite, or nickel-bismuth-antimony-arsenic sulfide.
- Local low-symmetry structure in iridescent garnet detected via spatially resolved electron diffractometry.
- Spilling into confinement: Submarine canyon-confined overbank processes and architecture.
- A digital framework for estuarine stratigraphy: an example of a machine learning approach to paleo-environmental classification and coastal evolution.
- Testing a northern Appalachian source for the Catskill-Pocono clastic wedge: Reconstructing Devonian–Mississippian sediment routing using detrital zircon and monazite geo-thermochronology.
- Neoarchean-Paleoproterozoic structural evolution of the Little Elk domain, Black Hills, South Dakota.

From Out of this World

- Isotope effects (Cl, O, C) of heterogeneous electrochemistry induced by Martian dust activities.
- Colomeraite, $NaTi_3+Si_2O_6$, a new clinopyroxene mineral from the Colomera iron meteorite.
- 12/16: Diagenetic, Nonevaporative Origin for Calcium Sulfate Salts at Gale Crater.
- Explosive lunar fission above a large low-velocity province; Phys.org summary here.

Plate Tectonics

- Continental crust had fully emerged by the end of the Paleoproterozoic.
- Stratigraphic and provenance analysis of the Alamor–Lancones Basin: Implications for the Cretaceous–Paleocene tectono–magmatic evolution of the northern Andean forearc system.
- Review: A Tectonic History of the Earth.
- Tectonics and Surface Processes During Collisional Orogenesis—Exploring the Parameter Space of the Beaumont Number.
- Changing volatile emissions and sources along the Ethiopian Rift.
- Miocene provenance and drainage evolution of the northern Calabrian forearc basins, Southern Italy.
- Trench-Parallel Fluid Migration and Its Transient Discharge in a Cold Subduction Zone Decoded by Geochemistry of Subducted Cherts.
- Epidote emerges as a pivotal player in the hydration dynamics of the mantle transition zone.
- 12/17 Tomographic Constraints on a Mid-Crustal High-Velocity Body Beneath West-Central Taiwan: Implications for Passive-Margin Mafic Additions.
- Bimodal Structural Evolution of the Mantle Lithosphere and Crust During Continental Shortening: Development of the Eurekan Orogen.
- Thick Underplating and Buoyancy of the Bermuda Swell; IFLScience summary here.

Paleontology

- The first occurrence of *Cainochoerus* (Mammalia, Artiodactyla, Suidae) from the Late Miocene Lemudong'o Formation, Kenya.
- Microbial taphonomy of Ginkgo leaves in fine-grained substrates: how sediment type facilitates preservation.
- Trace fossils within mammal remains reveal novel bee nesting behaviour.
- The best dinosaur discoveries of 2025.

Mining and Energy

- Copper’s tight supply and tariff risks set for a volatile 2026.
- How 2026 will reshape the US critical mineral resilience.
- Beetles block mining of Europe's biggest rare earths deposit.
- Mali: Canadian mining giant, Barrick Gold resumes control at one of Africa’s largest gold mines after $430m settlement.
- $60 Oil Is No Longer a Floor.
- Why Canada’s hottest shale play is catching the eye of US producers.
- Mass layoffs cast shadow over Guinea’s Simandou mega-mine as output begins.
- USGS releases assessment of undiscovered gas resources in Gulf Coast Haynesville Formation.
- Global coal demand has reached a plateau and may well decline slightly by 2030.
- Nuclear startup Last Energy raises $100M for its steel-encased micro reactor.
- U.S. Shale Turns From Drilling Faster to Recovering More Oil.

Environmental Geology and Hydrogeology

- Twenty Years Into Fracking, Pennsylvania Has Yet to Reckon With Its Radioactive Waste.
- Environmental Monitoring of Total Hydrocarbon Contents in Fjords of Svalbard, Grönfjord.
- How natural are the sediments on our beaches? Characterising urban anthropogenic mixed beaches in Scotland.
- How the myth of ‘aqua nullius’ still guides Australia’s approach to groundwater.
- Identification of Aquifer Systems in Weathered and Fractured Sandstone Based on 3D Geological Modeling in the Mesa de Los Santos (Santander, Colombia).

Glaciers and Climate Change

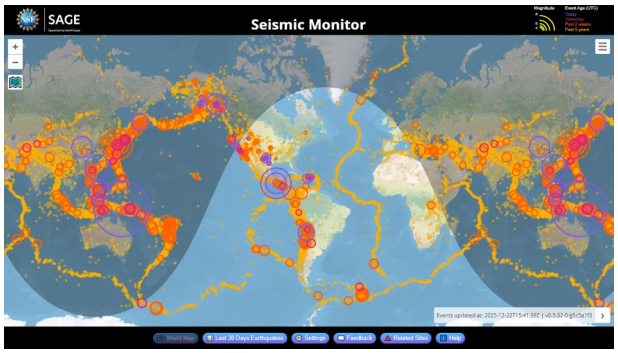
- Holocene climate oscillations, seismotectonic events and human–environmental interactions reconstructed from the Giannades palaeolake on Corfu (Eastern Mediterranean, Greece).
- Retreat and volume loss of two rapidly vanishing Svalbard glaciers since 1938: Elsabreen and Ferdinandbreen, Petuniabukta.
- Periglacial environment: Thermal diffusivity of mountain permafrost derived from borehole temperature data in the Swiss Alps; Phys.org interview with author here.
- Glacial meltwater: High magnesium isotope ratios in subglacial Icelandic waters: impacts of carbonate precipitation and implications for CO_2 sequestration.

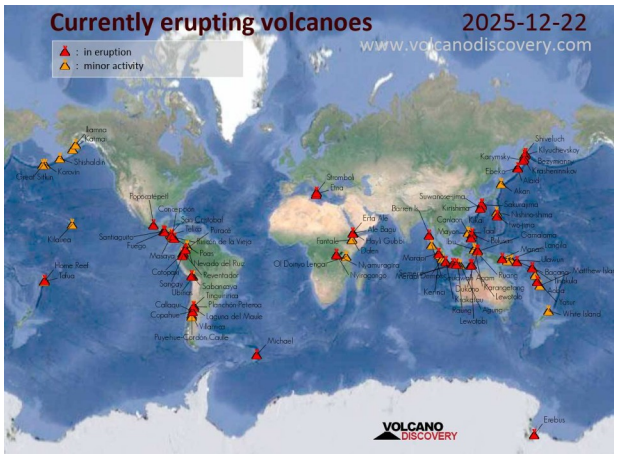
- Dendrochronology and climate change: Researchers find trees could spruce up future water conservation efforts.
- Peak glacier extinction in the mid-twenty-first century.

Bad Science

- Slaying the undead: How long does it take to kill zombie papers?
- Book review: A Much-Needed Exposé of Academic Fraud.

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: The story of the Gallatin Range - magnificent mountains northwest of Yellowstone Caldera.
  - Cascades Volcano Observatory Weekly Update.
  - Volcano Watch – One year of Kīlauea's episodic summit fountaining: highlighting the hazards.
- Muddy eruption at Yellowstone's Black Diamond Pool captured on video.
- Satellite Geodesy Reveals Shallow, Transient Magma Intrusions at Sotará Volcano, Colombia.
- Eifel volcanoes mapped in detail: Surprising new insights from Germany's largest seismological experiment; referenced papers here, here, and here.

- Magmatic Volatile Flux Drives Non-Eruptive Volcano-Tectonic Seismicity at Mount St. Helens, USA From 2008–2024.

Earthquakes

- Euro-Mediterranean Seismological Centre (EMSC).
- Earthquakes Monitoring Live Worldwide.
- Extreme plate boundary localization promotes shallow earthquake slip at the Japan Trench; Phys.org summary here.
- Reconstruction of Clipped Time-History Records, with Application to Ground Motions from the 1992 M_L 5.8 Roermond, Netherlands, Earthquake.
- A Large Magma Intrusion Caused Greece's Seismic Crisis in Early 2025.

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 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

- January 14, 2026 from 9am to 4:30pm GMT, IAH (Irish Group) CPD Course: Groundwater, Hydrology and Climate Change.
- 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.
- 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.

December 22, 2025

Geology and Mineral Resources – Montenegro

Introduction

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

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

A successor state to the former Yugoslavia, Montenegro is a country of 623,327 people on the Balkan Peninsula of Southeast Europe. The country has an area of 13,812 square kilometres and borders on: Bosnia & Herzegovina, Serbia, Kosovo, and Albania. To the west is the Adriatic Sea.

The basics of the Montenegro economy are as follows:

- Montenegrins are moderately well off with a per capita GDP (PPP) of $34,410 and a very high Human Development Index of 0.862.
- Montenegro is a member of the European Union and the Euro the main currency.
- The economy of Montenegro includes large tourism, energy, manufacturing, and agriculture sectors.

For more details on the country, check out the CIA World Factbook on Montenegro as well as the Wikipedia article.

Geology

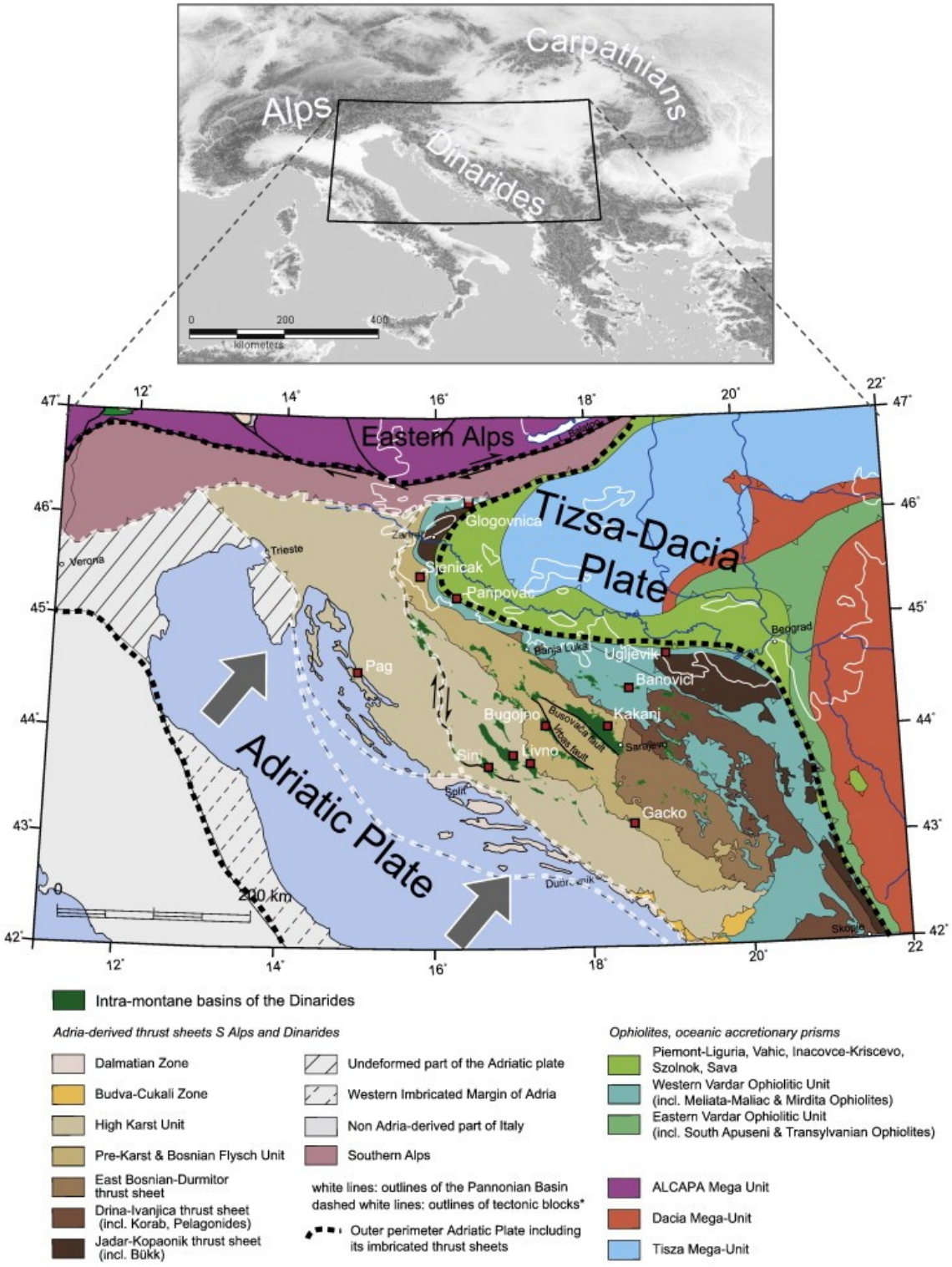


Figure 2 - Plate Tectonic and Geologic Setting of the Dinarides

Montenegro is found within the Dinarides or Dinaric Alps. Tectonically, the Dinarides are sandwiched between the Adriatic Plate, to the southwest, the Tizsa-Dacia Plate, to the northeast, and the Eastern Alps, to the northwest. The Dinarides were formed during the Alpine Orogeny curing the Cenozoic Era. The detailed evolution of the Dinarides is fairly complex and if you would like to dive into this subject, here are a few references:

- November 2022, F. Šumanovac, *Lithosphere Structure of the Southern Dinarides and Continuity of the Adriatic Lithosphere Slab Beneath the Northern Dinarides Unravelled by Seismic Modelling*, MDPI Geosciences, https://doi.org/10.3390/geosciences12120439
- January 2021, P. Balling, C. Grützner, B. Tomljenović, W. Spakman, K. Ustaszewski, *Post-collisional mantle delamination in the Dinarides implied from staircases of Oligo-Miocene uplifted marine terraces*, Sci Rep 11, 2685 (2021). https://doi.org/10.1038/s41598-021-81561-5
- November 2018, M. van Unen, L. Matenco, F. H. Nader, R. Darnault, O. Mandic, V. Demir, *Kinematics of Foreland-Vergent Crustal Accretion: Inferences From the Dinarides Evolution*, Tectonics, Volume38, Issue1, January 2019, Pages 49-76, https://doi.org/10.1029/2018TC005066
- January 2018, A. Argnani,, *Subduction Evolution of the Dinarides and the Cretaceous Orogeny in the Eastern Alps: Hints From a New Paleotectonic Interpretation,* Tectonics, Volume37, Issue2, February 2018, Pages 621-635, https://doi.org/10.1002/2017TC004632
- September 1997, J. Pamić, & I. Gušić, V. Jelaska, *Geodynamic evolution of the Central Dinarides*, Tectonophysics, Volume 297, Issues 1–4, 20 November 1998, Pages 251-268, https://doi.org/10.1016/S0040-1951(98)00171-1

The geology of Montenegro can be divided into four regional tectonic units:

1. The Durmitor tectonic unit which is made up of Devonian to Carboniferous aged clastic sedimentary rocks, Carboniferous flysch sediments and Permian aged clastic sediments;
2. The Permian to Mesozoic aged carbonate and clastic rocks of the Budva–Cukali zone;
3. The Mesozoic aged carbonate and clastic rocks rocks of the Adriatic–Ionian zone; and
4. The carbonate rocks High Karst zone, also Mesozoic aged.

A significant part of the geology of Montenegro has been the development of karst topography in the carbonate rocks of the country, predominately limestones and dolomites (or dolostone). Karst topography develops when rainwater, made mildly acidic by the dissolution of carbon dioxide, percolates into carbonate and dissolves the rock. Over time, the result is a topography made up of sinkholes, caves, and other solution features. Tourists travel to Montenegro to visit the caves found in the karst topography of the country and much of the aesthetic appeal of the landscape in Montenegro is due to the karst topography.

Figure 3, below, summarizes the features in karst topography.

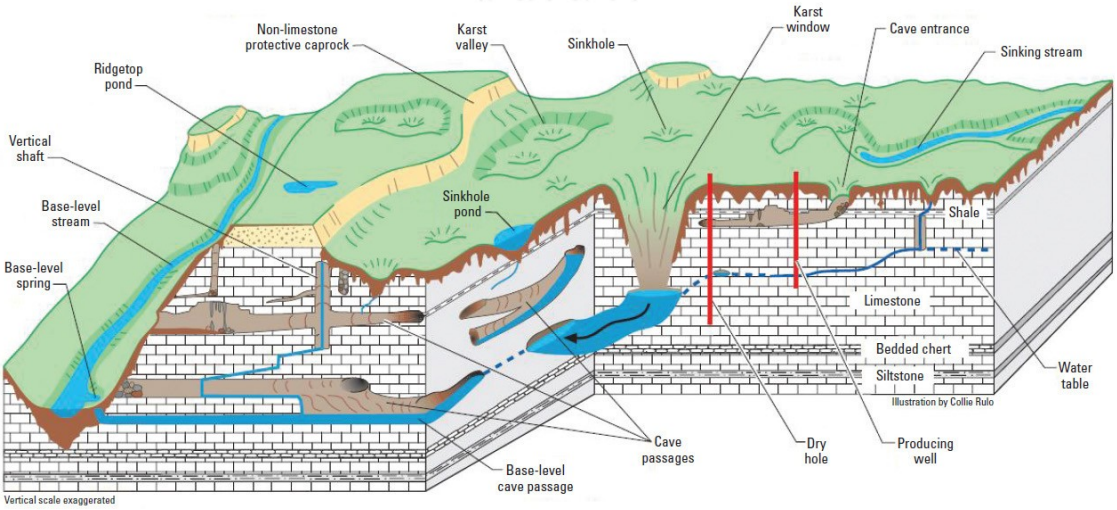


Figure 3 – Summary of Karst Features
Credit: Fig. 1 in Taylor & Greene, 2008, Ch. 3 in USGS Report TM 4–D2, public domain

Figure 4 links to an interactive geology map of Montenegro from Macrostrat.

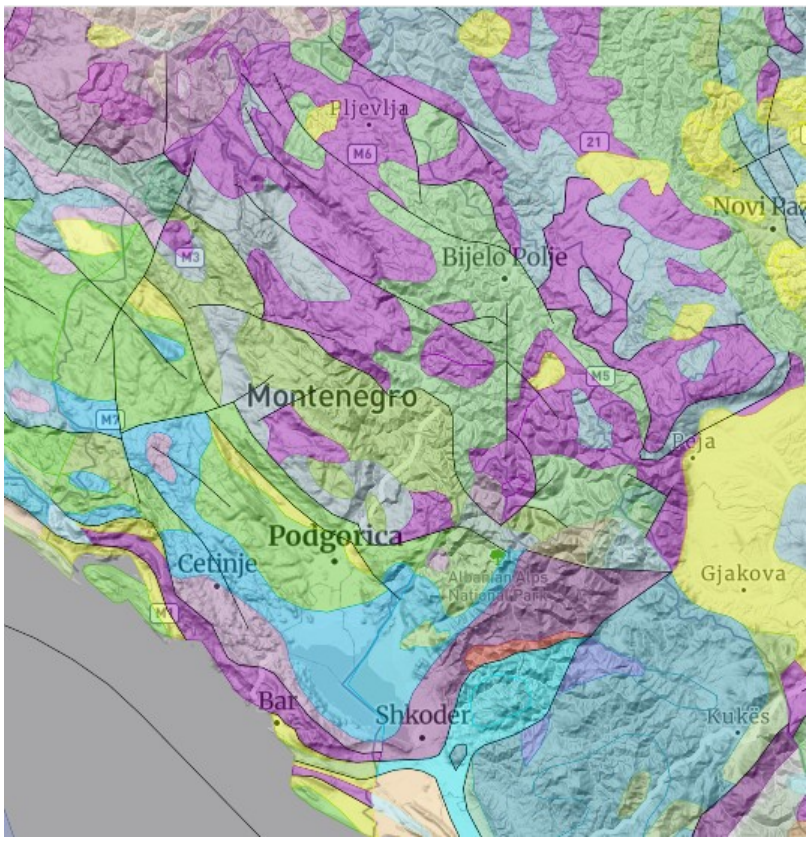


Figure 4 – Interactive Geology Map of Montenegro
Credit: Macrostrat, Creative Commons Attribution-Share Alike 4.0 International license

Mineral Resources

Figure 5 - Lignite open-cast mine near Pljevlja in northern Montenegro
Credit: Julian Nyča, Creative Commons Attribution 3.0 Unported license

According to the USGS Minerals Yearbook, Montenegro's mine production included bauxite, coal (mostly lignite), construction materials, lead, and zinc. The USGS yearbook lists the following mines in Montenegro:

- Bauxite is mined at the Niksic Mine, near Niksic.
- The largest lignite mine in Montenegro is the Pljevlja Mine operated by Rudnik uglja Pljevlja; their concession to mine lignite at Pljevlja was recently extended to 2050.
- Lignite was mined at the Berane Mine, Berane, the enterprise went bankrupt but a new firm incorporated December 19, 2025 to operate the mine.
- Lead and zinc were mined by ZGH Boleslav at the Suplja Stijena Mine. However, this past summer the operation was suspended after toxic mine waste drained into a sinkhole and into the local Cehotina River.

Industrial minerals quarried in Montenegro are construction materials: sand, gravel, crushed rock, and dimension stone, including marble. The most recent mineral production statistics from the USGS for Montenegro was from 2022 and can be found here. Figure 6 links to an interactive mineral occurrence map for Montenegro.

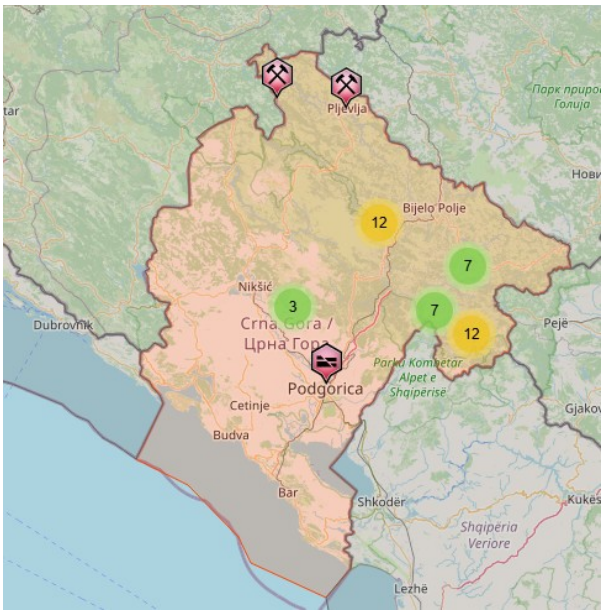


Figure 6 - Interactive Mineral Occurrence Map for Montenegro, [Credit: ©Mindat.org]

Summary

Figure 7 - Bijela, Montenegro
[Credit]: [Sharon Hahn Darlin], [Creative Commons] [Attribution-Share Alike 4.0 International] license

Montenegro looks like a pleasant place to visit; just don't call them Serbians as Montenegrins consider themselves a separate ethnic group. For geologists, the USGS informs us that Montenegro's undeveloped mineral resources includes metallic ores for chromium, copper, iron, and titanium; industrial minerals of chert, dolomite, and gypsum; and mineral fuels of crude petroleum, natural gas, and peat. So there is plenty of opportunity for exploration activity.

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.