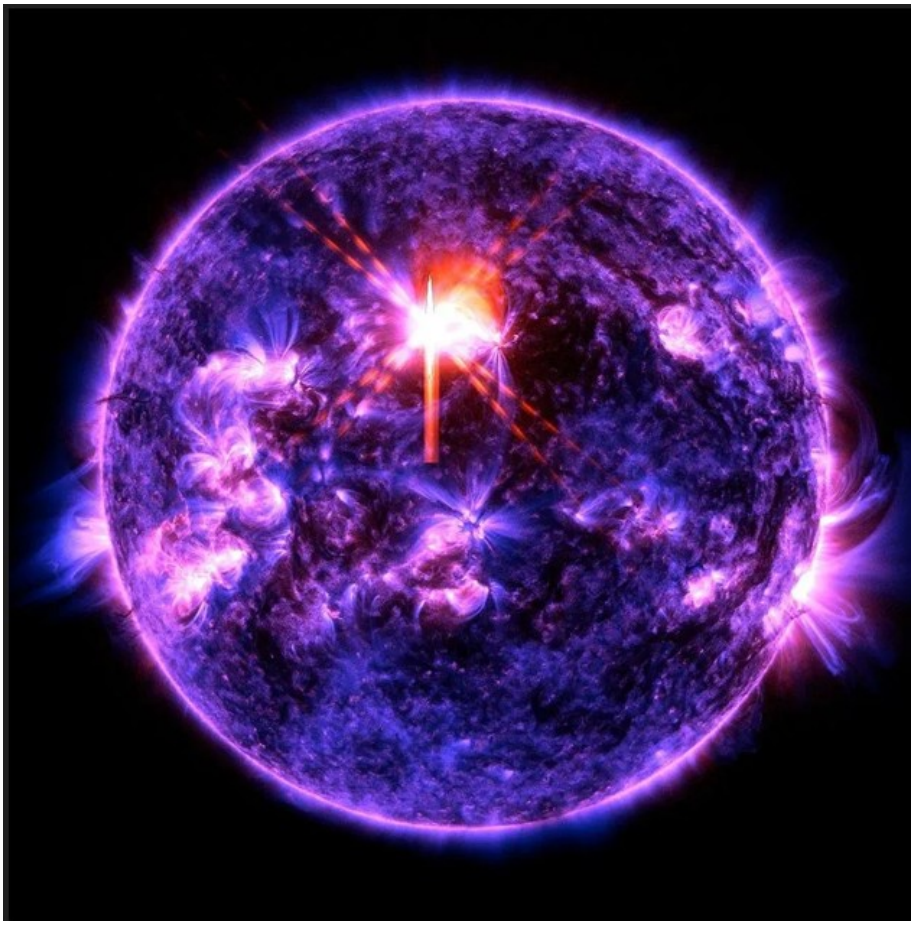
February 9, 2026

News and notes



Strong Solar Flare – February 4, 2026
Credit: NASA's Solar Dynamics Observatory, public domain

This week, before going on to discuss the geology and mineral resources of Nepal, we will first look at some news items I thought were interesting. The picture above is from NASA's Solar Dynamics Observatory.

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

- At Least 112 USAF C-17 Aircraft Headed To Middle East: 'Desert Storm Levels'.
- Whiskey's for drinking, water's for fighting: The water wars are coming.

- EU Escalates Oil Sanctions With Broad Ban on Shipping Services.
- U.S. asks American citizens to ‘leave Iran now’ ahead of high-stakes talks with Tehran.
- Drastic water shortages and air pollution are fuelling Iran’s protests.

Research and News

- Deconvolving the Effects of Fluvial Transit and Storage on Preservation of Sedimentary Source Signals Using Heavy Minerals and Terrestrial Biomarkers.
- Predicting instabilities in transient landforms and interconnected ecosystems; Phys.org summary here.
- Geophysics: P-wave seismic interferometric profile within the Granada Basin (Southern-Spain).
- Reconstructing Late Pleistocene to Prehistorical Holocene Geomagnetic Field Variations From La Palma Lava Flows (Canary Islands, Spain): Unraveling Viscous Components.
- Sound Velocities and Structural Transitions of Endmember and Fe, Al, Mg, Ti-Bearing $CaSiO_3$ Glasses Up to 23 GPa.
- Silicate and Carbonate Weathering Perturbation at the Eocene-Oligocene Transition Recorded by Mg Isotopes.
- Petrology, geochemistry, and chronology of anorogenic Cambrian-Ordovician intrusions of Idaho.
- Polymetallic nodules offshore NE Greenland: links to Fram Strait opening and local hydrothermal activity.
- Shear zone-hosted titanite, rutile, and quartz capture a detailed exhumation history of an ultrahigh-pressure terrane: Otrøya, Western Gneiss Region, Norway.
- Strength α-Quartz: New Results From High Pressure In Situ X-Ray Diffraction Experiments.
- From the BRGM in France: Mapping the bedrock: an essential step for our future.
- For people collecting geopolitical information: The CIA World Factbook has sunset.
- Nature of Si-Al disorder in natural and synthetic prehnite ($Ca_2Al_2Si_3O_{10}(OH)_2$) clarified by multi-nuclear NMR and first-principles calculation.
- Molecular Mechanisms of Magnesium Sulfate Crystallization: Bond Length Inversion and the Role of Hydration in Mineral Formation.
- New Insights into Antimony Isotopic Fractionation Mechanisms from Experimental Investigations.
- Growth twins in chalcopyrite.

- Variations in downslope activity and bottom current dynamics in a land-detached submarine channel system since the Last Glacial Maximum.
- Mantle heterogeneity influenced Earth's ancient magnetic field; Phys.org summary here.
- From the New Mexico Bureau of Geology & Mineral Resources, Issue 56 of Lite Geology – Crystals.
- Did an impact event contribute to North Atlantic igneous province flood basalt volcanism?
- February 2026 edition of GSA Today.
- The Coolest Rocks In Geology and the Fascinating Stories They Tell.

Planetary Geology

- Abundant hydrocarbons in a buried galactic nucleus with signs of carbonaceous grain and polycyclic aromatic hydrocarbon processing.
- Neutron Scans Reveal Hidden Water in Famous Martian Meteorite.
- Russia says 2.8-ton chunk of Aletai meteorite disguised as garden ornament found being smuggled to U.K.
- Lunar chronology model with the Chang'e-6 farside samples and implications for the early impact history.

Plate Tectonics

- Mild-to-wild plasticity of Earth's upper mantle.
- Multi-Method Geochronology and P–T Modeling Unravels the Thermo-Tectonic History of the Rudall Province, Western Australia.
- Heat and Tectonics of the Canadian Cordillera From the Seismically Constrained Inversion of Gravity Data.
- 2D gravity modelling in Central Italy: Clues for the seismogenesis in the Apennines.
- Imaging the mantle transition zone beneath East Asia using teleseismic receiver functions: implications for thermal and compositional heterogeneities.
- Complex Kinematics of Upper-Plate Faulting Along the Central Cascadia Forearc Inferred From the Lateral Displacement of Marine Terraces.
- Constraining the timing of ductile shearing in the western Idaho shear zone along the Salmon River canyon, Idaho, USA.
- Interplay Between Tectonics and Submarine Mass Transport Deposits in Cortes Basin: New High-Resolution Geophysics in the Outer California Borderland.

- Slab-Mantle Interaction During Subduction Initiation: Constraints From Trace Element and Sr-Nd-Pb Isotope Systematics of Boninite and Other Magmas and Metamorphic Sole in the Oman Ophiolite.
- Large-Scale Flow Toward Low-Velocity Anomalies Reconciles Seismic and Geodynamic Constraints in the Deepest Mantle Beneath Alaska.

Paleontology

- Revealing elasmobranch diversity across the Cretaceous-Paleogene boundary in the Central Tethys (Byala, Bulgaria).
- Cellular-level preservation of cutaneous spikes in an Early Cretaceous iguanodontian dinosaur; Phys.org summary here.
- The ant genus *Hypoponera* (Hymenoptera: Formicidae) in Dominican amber.
- An exceptionally well-preserved starfish fauna (Asteroidea, Echinodermata) from the Early Miocene of southeastern France.
- A morphometric approach to the taxonomic dilemma of *Zonozoe drabowiensis* Barrande, 1872 and *Zonoscutum solum* Chlupáč, 1999 (Upper Ordovician, Czech Republic).
- Palynological evidence for floristic turnover and rising diversity in the early Burdigalian of south-western Patagonia (Argentina).
- *Macromesodon* Blake, 1905 and *Apomesodon* Poyato-Ariza & Wenz, 2002 (Actinopterygii, Pycnodontiformes) from the Jurassic and lowermost Cretaceous of England, France, and Germany.
- *Pisinnocaris subconigera*—a valid species of early Cambrian fuxianhuiid.

Mining and Energy

- Ore Geology Reviews, Volume 190 available now with eight open source papers.
- Jamaica's offshore oil question.
- Chevron Slips into Smackover - Softly, but with Weight; USGS summary of the Smackover here.
- China central bank keeps buying gold as bull run hits brakes.
- Mineral exploration tool: HyperMinNet: A hypergraph-based framework incorporating high-order relationships for mineral prospectivity mapping.
- Proposed Elk Valley coal mine expansion faces scrutiny as water quality concerns continue.
- Value of US mineral production rose last year driven by precious metals prices; also released by the USGS: Mineral Commodity Summaries 2026.
- TotalEnergies Pushes Deeper Into Namibia's Offshore Oil Boom.

- Global electricity demand is set to grow strongly to 2030, underscoring need for investments in grids and flexibility.
- Alberta Plans New Crude Oil Pipeline to Ship Energy Exports to Asia.
- ConocoPhillips seeks Venezuela compensation before resuming drilling; related: Shell wants to export Venezuelan gas through Trinidad, CEO says.
- Here's the full meal deal on large nuclear reactors for Saskatchewan.
- Kenora, ON: Regional mining map continues to be an 'attraction tool'.
- Australia: Mineral potential assessment reveals new areas for likely unconformity-related rare earth element discoveries.
- Silver's 40% Crash Was the Most Predictable Disaster of 2026.
- Burkina Faso hits record 94 tonnes of gold output as mining reforms gain traction.

Environmental Geology and Hydrogeology

- Experimental insights into early cement development in carbonate aquifers: from diffusion to surface-controlled calcite growth.
- Biogeochemical processes in Baltic Sea sediments as a recorder of environmental change over the Holocene.
- Weight loss drugs and water pollution: Water-based coupling of amino acids for sustainable solid-phase peptide synthesis; Phys.org summary here.

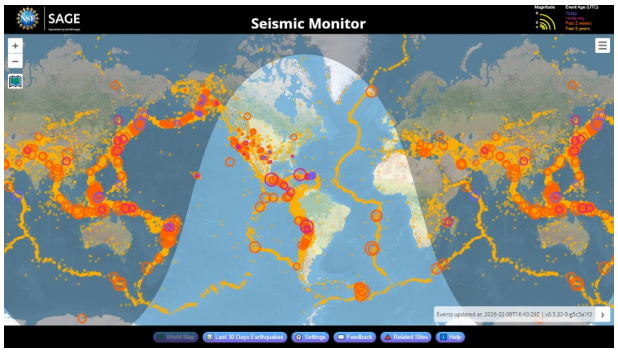
Glaciers and Climate Change

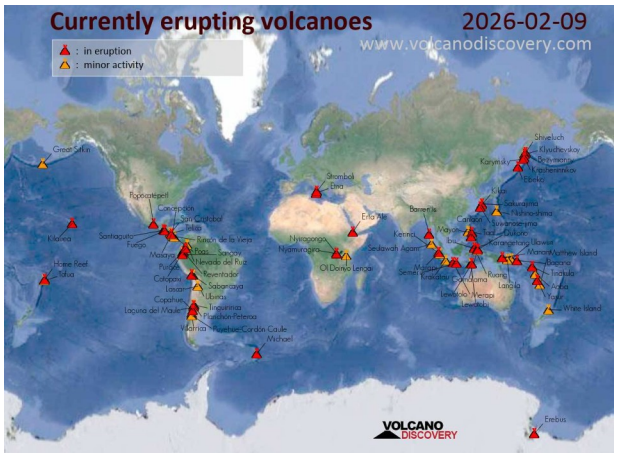
- Melting glaciers as symbols of tourism paradoxes; Phys.org summary here.
- Weakening ice shelf has caused crucial Antarctic glacier to accelerate.
- Antarctic ice sheet model comparison with uncurated geological constraints shows that higher spatial resolution improves deglacial reconstructions.
- Comparing calving laws at Greenland's three largest ice shelves.
- Amplified warming in tropical and subtropical cities under 2 °C climate change.

Bad Science

- Retraction of Research Article "Integrative phylogenomics positions sponges at the root of the animal tree".

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: Be my Valentine (Geyser).
  - Cascades Volcano Observatory Weekly Update.
  - Volcano Watch – New Hawaii citizen science tool: Is Tephra Falling?
- Crustal structure of Lanzarote and magma ascent path for the Timanfaya 1730 to 1736 eruption recorded by mineralogy and fluid inclusions of lower crustal xenoliths.

Earthquakes

- Euro-Mediterranean Seismological Centre (EMSC).
- Earthquakes Monitoring Live Worldwide.
- Reuters: Magnitude 5.5 earthquake strikes Cuba; USGS summary here.
- Stochastic poromechanical analysis forecasts a notable exceedance probability for the 2017 Pohang, South Korea, M_w 5.5 earthquake.
- How earthquakes organize stress.
- 02/05 Bipartite rupture in the 2025 Dingri earthquake indicates normal conjugate faulting during orogenic collapse.
- Stress Barriers and Their Impact on Rupture Propagation.
- New Zealand: Magnitude 4.4, Wed Feb 4 2026 12:35 PM.

- Low Aftershock Productivity and Fault Geometry of the 2017 Delaware Earthquake.
- San Ramon swarm sputters back to life with M3.8, M4.2 earthquakes.

Geohazards

- From the Alaska Earthquake Center: A surprise twist in the quest for landslide warning signs.

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.
- September 30 - October 3, 2026 SEG 2026 Conference Salt Lake City, United States.
- Society of Petroleum Engineers Distinguished Lecturer Schedule.
- American Geophysical Union List of Upcoming Meetings.
- The Geological Society: Events & Courses.

February 9, 2026

Geology and Mineral Resources – Nepal

Introduction

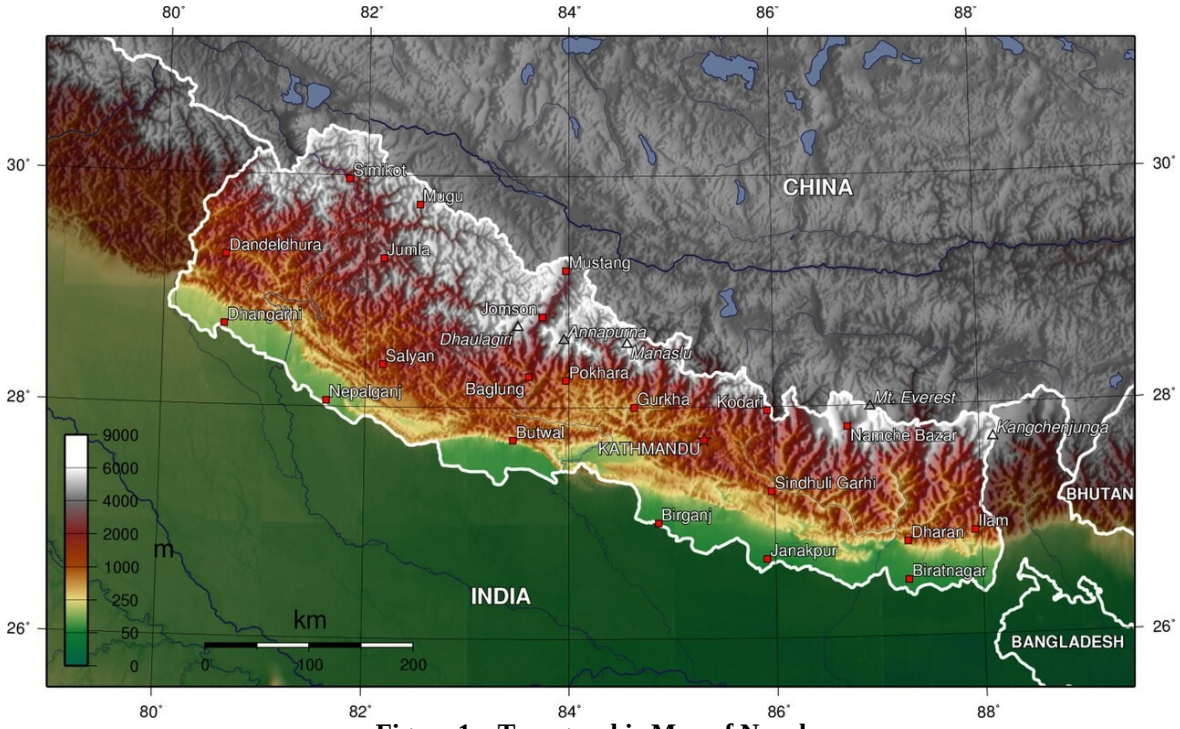


Figure 1 – Topographic Map of Nepal
Credit – Captain Blood, Creative Commons Attribution-Share Alike 3.0 Unported license

The Federal Democratic Republic of Nepal is a country of 31,122,387 people in South Asia. The country has an area of 147,516 square kilometres. Nepal borders on Tibet, to the north and India to the south. Across the the Siliguri Corridor, to the southeast, is Bangladesh and across the Indian state of Sikkim, to the east, is Bhutan. Nepal was most recently in the news with the internet enabled overthrow of the government in September 2025.

Nepal is a relatively poor country with a per capita GDP (PPP) of $5,348 and a medium Human Development Index of 0.622. Agriculture is the most common economic activity in Nepal and remittances from Nepalese working outside the country account for about a quarter of national income. Also important are foreign aid and tourism. One famous group of Nepalese people working outside the country are those in the the Brigade of Gurkhas of the British Army.

In 2024, the top exports of Nepal were soybean oil, knotted carpets, non-retail synthetic staple fibers yarn, coated flat-rolled iron, and spices (nutmeg, mace and cardamons). The top export destinations were India, United States, Germany, China, and France. In 2024, the top imports of Nepal were refined petroleum, petroleum gas, iron reductions, telephones, and cars. The top origins for imports were India, China, Singapore, Australia, and the United States.

For more details on the country, check out the Wikipedia and Grokipedia articles.

Geology

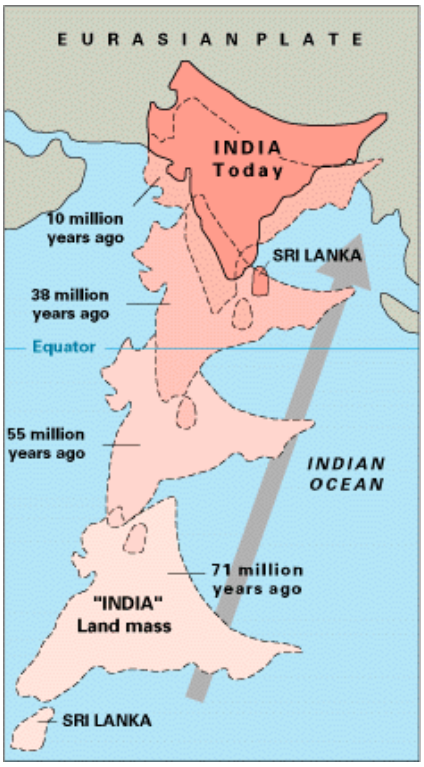
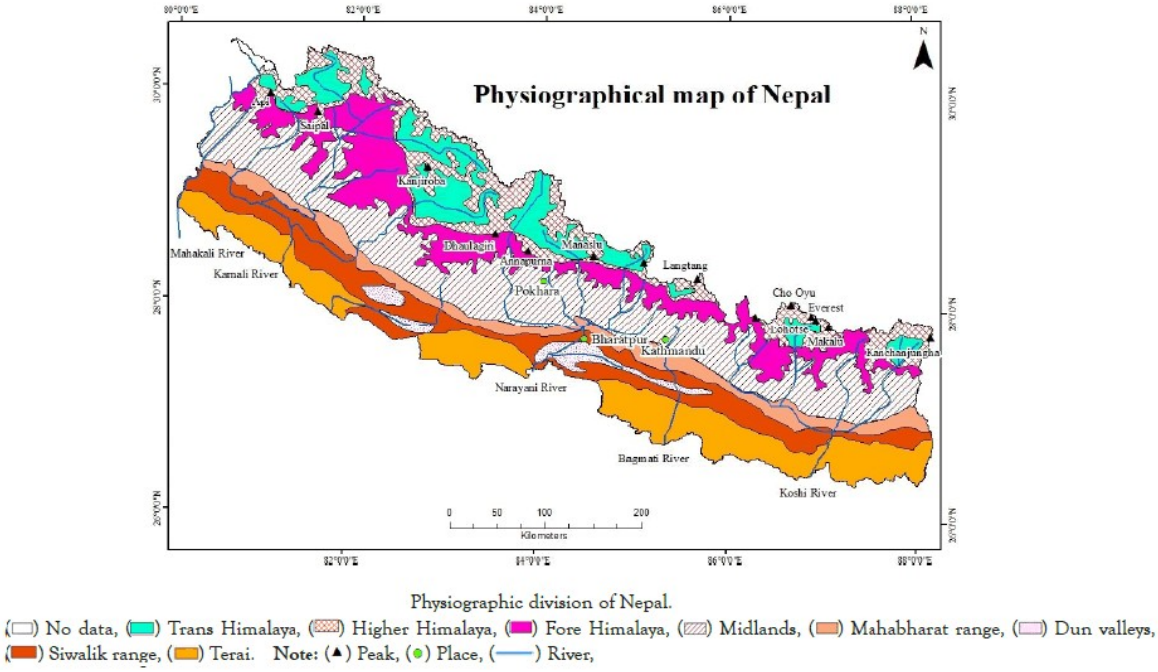


Figure 2 – Migration of the Indian Plate during the Cenozoic
Credit: USGS, public domain

The tectonic geology of Nepal is a result of the formation of the Himalayas during the Cenozoic. The tectonic movement of the Indian Plate that formed the Himalayas continues to today.



Physiographic division of Nepal.
(□) No data, (■) Trans Himalaya, (▨) Higher Himalaya, (■) Fore Himalaya, (▨) Midlands, (■) Mahabharat range, (□) Dun valleys, (■) Siwalik range, (■) Terai. Note: (▲) Peak, (●) Place, (—) River,

Figure 3 – Physiographic Division of Nepal
Credit: Figure 1 in Kshetri R (2023), Creative Commons Attribution License

Nepal can be divided into eight physiographic divisions:

1. The youngest is the Terai terrane, which is the northern edge of Indo-Gangetic Plain. Quaternary in age, the Terai consists mostly of alluvial deposits ranging from gravels close to the hills and finer grained material further south.

2. Also Quaternary in age are the deposits of the Dun (Chitwan) valleys. The Dun valleys are within the Siwalik /Churia Hills and are filled up by coarse to fine alluvial sediments.

3. Next oldest are the Siwalik / Churia Hills, Miocene to Pleistocene in age. The Siwalik Hills are made up of sandstone, siltstones, mudstone, shale, and conglomerate. These deposits were formed in the ancient Tethys Ocean.

4. Going further up slope towards the Himalaya Mountains, we have the more ancient deposits of the Mahabharat Range. Ranging in age from Precambrian to Paleozoic, the Mahabharat Range is made up of schist, phyllite, gneiss, quartzite, granite, and limestone.

5. Next we have the Midlands terrane, ranging in age from Precambrian to Mesozoic. The Midlands zone is also made up of schist, phyllite, gneiss, quartzite, granite, and limestone.

6. Further up slope, we have the Precambrian aged rocks of Fore or Sub Himalaya zone. The rocks of this zone are gneisses, schists, phyllites and marbles.

7. The highest parts of the Himalayas are the Higher Himalaya zone, also Precambrian in age. The rocks of the Higher Himalayas are gneisses, schists, migmatites, and marbles.

8. Beyond the Higher Himalayas are the deposits of the Tethys or Trans Himalaya zone. The rocks in this zone include the Precambrian gneisses, schists, and marbles of the higher Himalaya zone and the Cambrian to Cretaceous aged Tethys sediments such as limestones, shale, and sandstone.

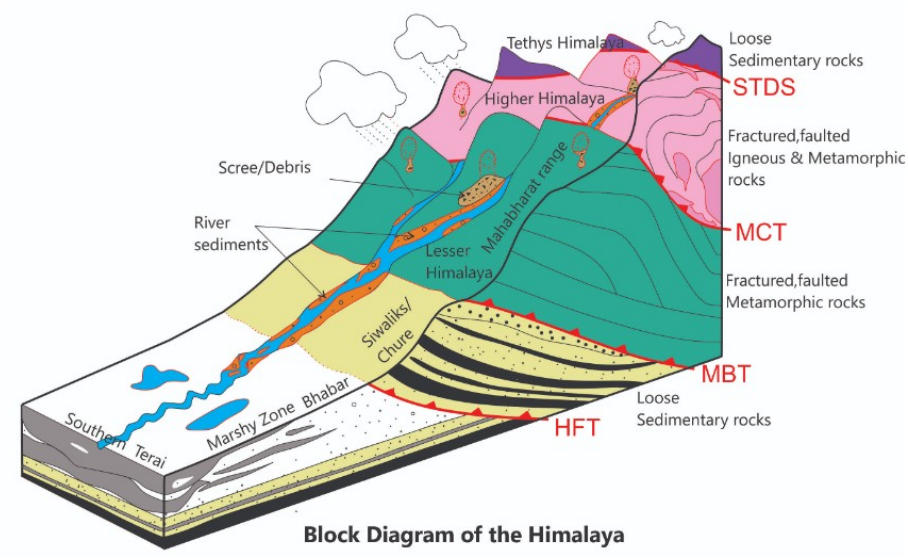


Figure 4 – Block Diagram of the Himalayas in Nepal
Credit: Nepal Department of Mines and Geology

Figure 4, above, illustrates the main physiographic divisions of Nepal as well as the major faults that divide them, these are:

- STDS, the South Tibetan Detachment System;
- MCT, the Main Central Thrust fault;
- MBT, the Main Boundary Thrust; and
- HFT, the Himalayan Frontal Thrust.

Figure 5, below, links to a more detailed geological map of Nepal.

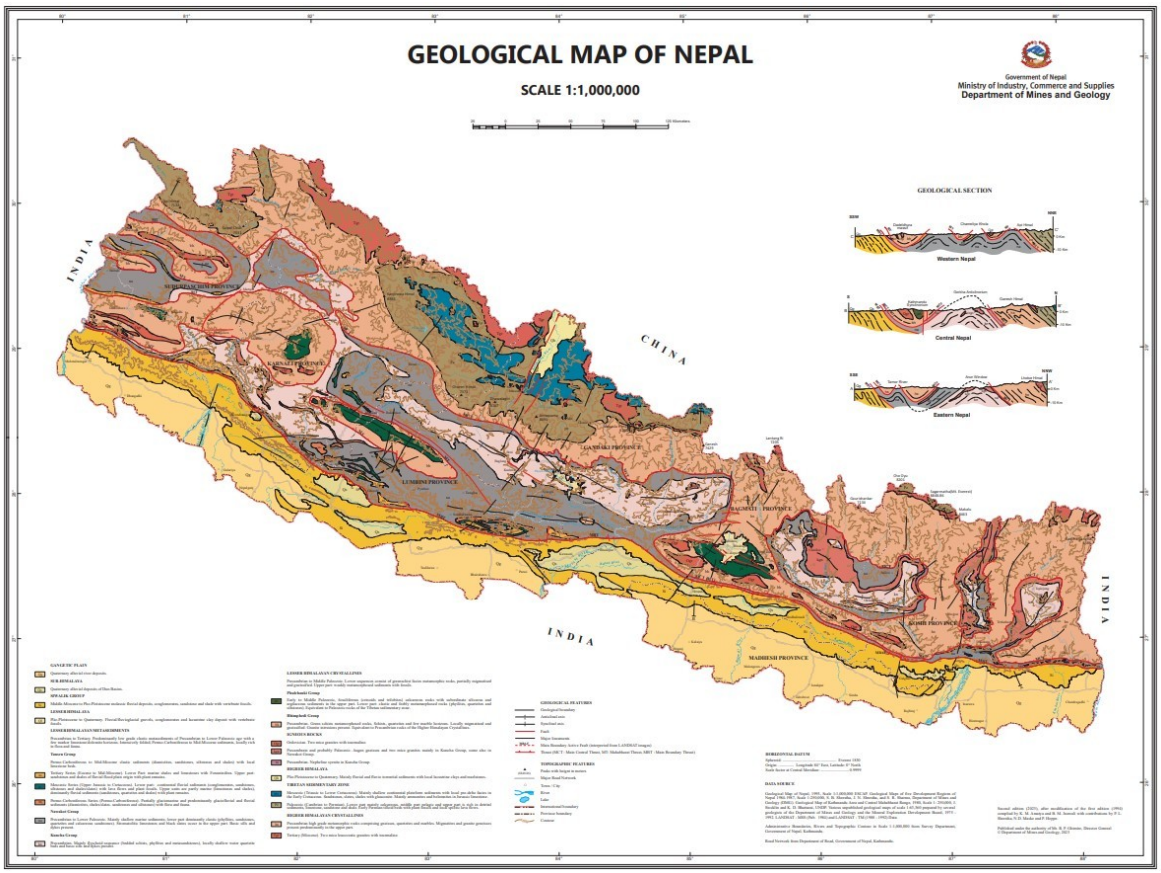


Figure 5 – Geological Map of Nepal
Credit: Nepal Department of Mines and Geology

Paleontology

Fossils from Nepal range in age from the ancient Mesoproterozoic Era to the current Cenozoic Era. Let's look at a few of these.

Mesoproterozoic - Dhading Dolomite Formation

Dating from the Calymmian Period of the Mesoproterozoic, the Dhading Dolomite Formation contains stromatolites, features constructed by cyanobacteria and other microorganisms.

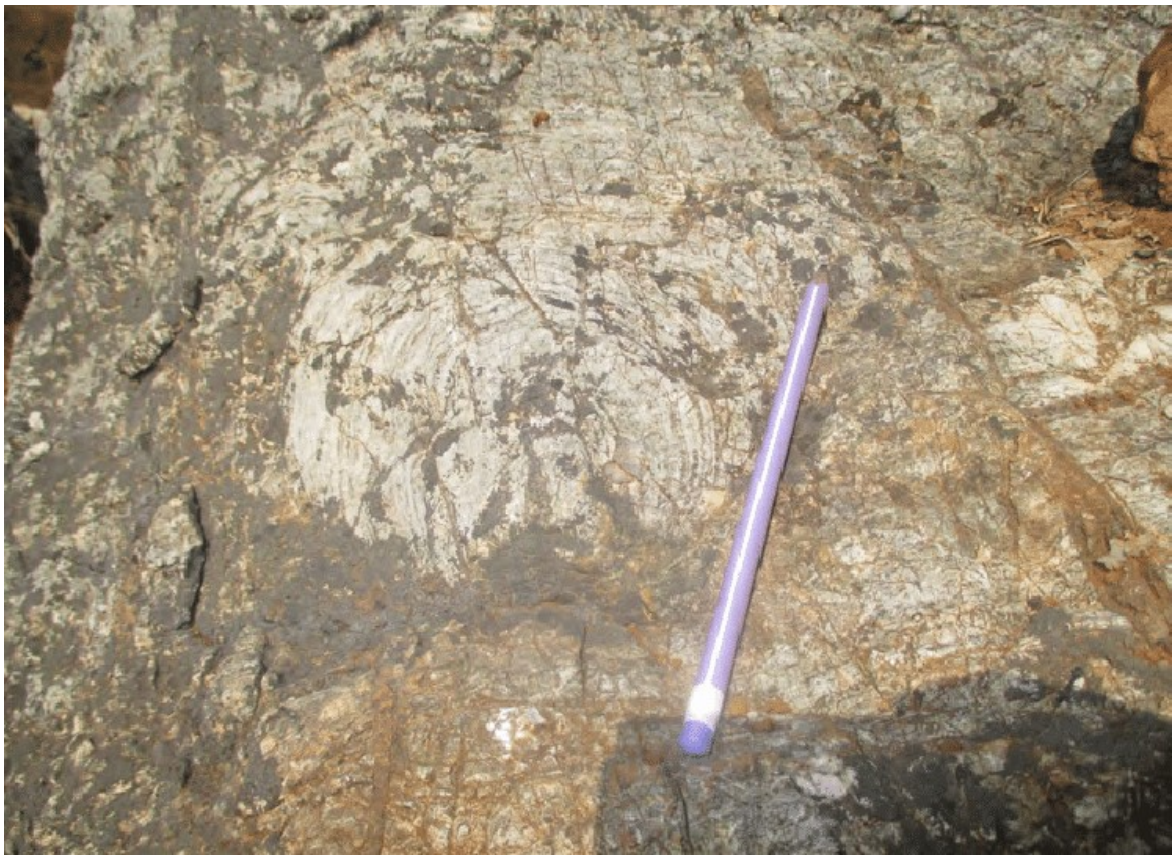


Figure 6 - Columnar Stromatolite in the Dhading Dolomite
Credit: Figure 6 in Bhattarai & Paudyal, 2018

Jurassic Ammonites

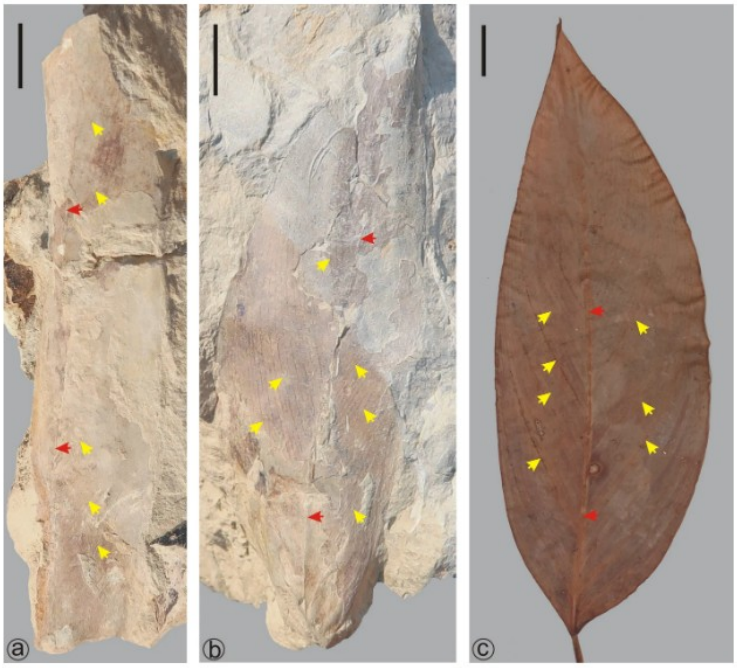
Figure 7 – Reconstruction of *Dactylioceras*
Credit: Nobu Tamura, Creative Commons Attribution-Share Alike 3.0 Unported license

Considered sacred in Nepal, ammonite fossils are found in Jurassic aged sediments of the Tethys Himalaya zone. Among the many ammonites are *Dactylioceras*, depicted above.

Cenozoic Fossils

Figure 8 – *Amphicyon* Fossil
Credit: Ghedoghedo, Creative Commons Attribution-Share Alike 3.0 Unported license

A wide variety of vertebrate fossils are found in the Cenozoic aged formations of Nepal, including *Amphicyon*, in Figure 8, above.



Fossil leaf of *Clinogyne ovatus* and modern leaf of *Marantochloa grandis* (syn. *Clinogyne grandis*). **a**, **b** Fossil leaf of *C. ovatus* Awasthi and Prasad showing shape, size, and venation pattern such as primary vein (red arrows), and secondary veins (yellow arrows). **c** Modern leaf of *Marantochloa grandis* (Benth.) Milne-Redh. (syn. *Clinogyne grandis* (Miq.) Benth. & Hook. f.) (GBIF Herbarium sheet no. 02245193) showing shape, size, and venation pattern such as primary vein (red arrows), and secondary vein (yellow arrows) (scale bar = 1 cm)

Figure 9 – Fossil Plants from the Siwalik Hills
Credit: Figure 4 in Paudel *et al*, 2025

The sediments of the Siwalik Hills also contain many plant fossils, as detailed in a recent paper from 2025.

Mineral Resources

Figure 10 – Elbaite, a variety of Tourmaline, from Nepal
Credit: Robert M. Lavinsky, Creative Commons Attribution-Share Alike 3.0 Unported license

According to the USGS Minerals Yearbook on Bhutan and Nepal, the mineral industry in Nepal is limited to production of industrial minerals, gemstones such as elbaite tourmaline, coal, and some metallic minerals. The most recent production statistics on mineral production in Nepal from the USGS can be found here.

Metallic Minerals

Metallic mineral production in Nepal is limited to three lead/zinc mines operated by Torex Mines Nepal Pvt Ltd., Black Head Mines Nepal Pvt Ltd., and the Nepal Metal Co. Ltd. There has also been small scale mining of iron ore, copper, cobalt, nickel and gold in the past.

Industrial Minerals

Industrial minerals produced include:

- Cement, produced at about 20 locations in Nepal.
- Dimension stone and crushed stone, produced at numerous quarries.
- Talc, mined at the Kharidhunga Mine.

Gemstones

Gemstones produced in Nepal includes precious stones such as emerald, rubies, sapphire, as well as semi-precious stones such as amethyst, aquamarine, beryl, garnet, kyanite, lapis lazuli, quartz, topaz, and tourmaline. Gemstone mining in Nepal appears to be done by artisianal miners and all the finishing of the jewels is, by law, done in Nepal.

Coal and Fuel Minerals

There are 11 small scale coal mines that are in operation scattered throughout Nepal. Coal production includes lignite from the Kathmandu Valley, together with coal from the Siwalik Hills and the Lesser Himalayas Range.

While there is no current petroleum production in Nepal, there are plans for oil exploration and some promising results (here, here and here). Some people have expressed concerns for the geopolitical implications of Nepalese oil development.

Figure 11 links to an interactive map of mineral occurrences in Nepal from Mindat.

Figure 11 – Interactive Mineral Occurrence Map of Nepal
Credit: Mindat.org

Summary

Figure 12 - Mount Cholatse and the Cho La Valley, Nepal
Credit: Vyacheslav Argenberg, Creative Commons Attribution 4.0 International license

Nepal looks like a promising place for further mineral exploration and development although there are inconsistencies in government regulation. In addition to the currently developed resources in precious and semi-precious stones, petroleum development is promising. A lot will depend on the attitude of the government to mineral development. People interested in paleontological research might also find Nepal a promising place.

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.