

June 23, 2025



**Peonies in My Garden, June 18<sup>th</sup>, 2025**

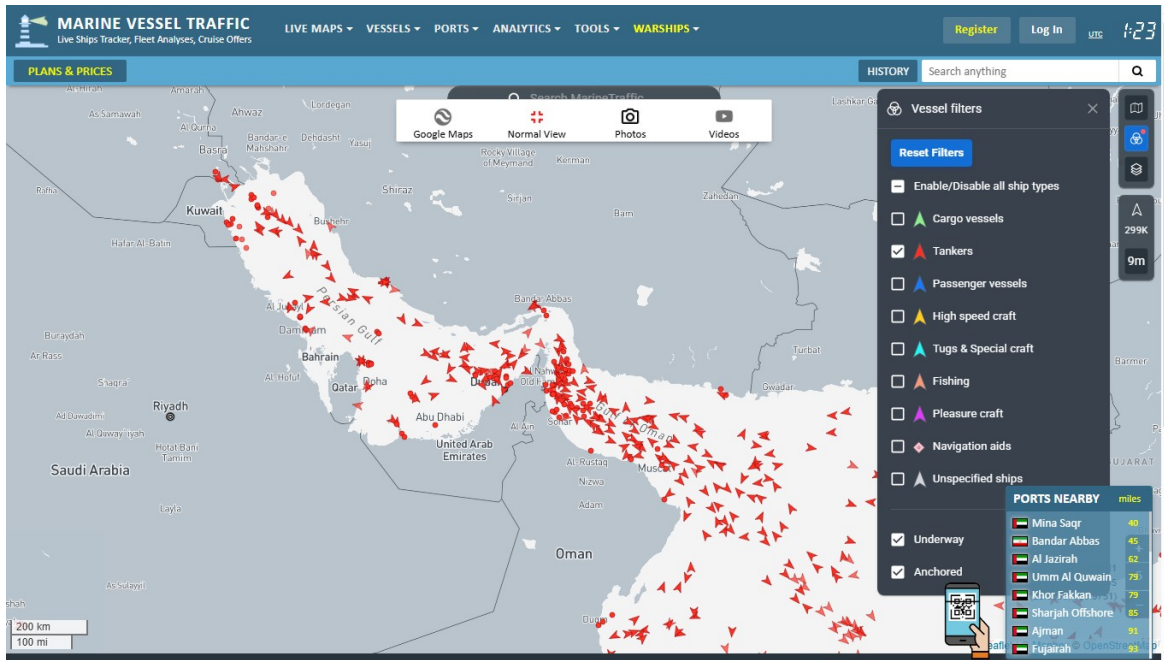
### **News and notes**

Before going on to discuss the geology and geopolitics of [Laos](#), here are some news items 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](mailto:raymondreichelt@gmail.com).

## Geopolitics



**Tanker Traffic in the Strait of Hormuz, June 22, 2025**

**Credit:** ©Marine Vessel Traffic, Live Ships Tracker, Fleet Analyses, Cruise Offers

- Iran/Israel
  - [Strikes on Iranian nuclear sites thrust US into escalating Middle East conflict.](#)
  - [Shell CEO: Contingency Plans Ready If Strait Of Hormuz Closure Triggers Energy Shock.](#)
  - [Iran Launches 2,000 km-Range Sejil Missiles at Israel for the First Time in History.](#)
  - [Haifa oil refinery's facilities shut down following Iranian missile strike.](#)
  - [An overview of Iran's main gas field and oil infrastructure.](#)
- America's [Summer of Love](#):
  - [EXCLUSIVE: Portland IED bomber suspect revealed to be far-left 'No Kings Day' recruiter.](#)
  - [Hegseth deploys additional 2,000 National Guard troops to Los Angeles.](#)
  - [Minnesota senator, wife recovering after horrific shooting: 'Incredibly lucky to be alive'.](#)
  - From Alexander Dugin: [The Coming New American Civil War.](#)

## Research and News

- [Source-to-Sink Signal Propagation in a Small, Coupled Catchment-Deep-Sea Fan System: The Sithas Example From the Corinth Rift \(Pleistocene, Greece\).](#)

- Great Oxygenation Event: [Enhanced phosphorus regeneration linked to Ediacaran ocean oxygenation](#).
- [Microfacies analysis and diagenetic history of Lower to Middle Eocene carbonates at Umm Russies area in the northeastern desert of Egypt](#).
- [Petrochronology of Alkaline Intrusive Magmatism in the Central High-Atlas \(Morocco\) and Relationships With Jurassic Salt Diapirism](#).
- [Blue Light Fluorescence in Marine Sediments](#).
- Coral reef development: [Rivers Influence Reef Pass Formation in the Society Islands](#); Phys.org summary [here](#).

### From Out of this World

- [Halogen abundance evidence for the formation and metasomatism of the primary lunar crust](#).
- [The Moon is Covered in Tiny Orange Glass Beads. Now We Know Why](#).

### Plate Tectonics

- [Inferring Tectonic Plate Rotations From InSAR Time Series](#).
- [Latest Cretaceous to Cenozoic Exhumation Patterns in the Northern Andes From the Sedimentary Provenance Record on the Broken Retro-Foreland Putumayo Basin](#).
- [The Uplift of Armorica and the Bretonian Movements of the Variscan Orogeny-New Insights From Detrital Zircons in the Early Carboniferous Terrigenous Rocks of the Laval Basin \(Armorican Massif, France\)](#).
- [Tracking the Caribbean Magmatic Evolution: The British Virgin Islands as a Transition Between the Greater and Lesser Antilles Arcs](#).
- [Sedimentary stratigraphy and structure of the eastern Central Valley, California, USA: Implications for Cenozoic tectonics of the Sierra Nevada](#).

### Evolution

- [Identification of key steps in the evolution of anaerobic methanotrophy in \*Candidatus Methanovorans\* \(ANME-3\) archaea](#).
- Florida: [Scientists issue stark warning after harmful creatures breed to form hybrid species: 'We have confirmed the presence of hybrid swarms'](#).
- [An unknown bacteria on Earth has developed in the Chinese space station: astronauts are faced with a situation straight out of a science fiction movie](#);
- Related satire: [Kansas Outlaws Practice Of Evolution](#).

## Paleontology

- [Global cooling drove diversification and warming caused extinction among Carboniferous-Permian fusuline foraminifera](#); Phys.org summary [here](#).
- [An indentation in a 33,000-year-old right calcaneus of the ground sloth \*Lestodon\* \(\*Xenarthra\*, \*Folivora\*\) from Uruguay and its possible human agency](#).
- Forgotten in a museum drawer: [Rediscovered lost holotypes of two Paleogene mammals, a Neogene bird, and other published specimens from an orphaned collection](#).
- Also forgotten: [A Jar of Fossil Bones Long Stored at a Museum Led Scientists to Discover a Goblin-Like Lizard From 76 Million Years Ago](#).
- [Articulated specimens provide new insights into the iconic Mesozoic shark genus \*Sphenodus\*](#).
- [Revision of Middle Cambrian trilobites and agnostids from Cape Breton Island, Nova Scotia, reveals a Guzhangian faunal interval in the Avalonian cover sequence](#).
- [Microbial mound origin for enigmatic, sea-floor, circular structures? Purbeck Limestone Group, offshore Dorset, U.K.](#)
- [A ctenochasmatid pterosaur from the Portland Limestone Formation \(Late Jurassic, Tithonian\) of southern England](#).
- [Cryogenian life analogue: Biosignatures of diverse eukaryotic life from a Snowball Earth analogue environment in Antarctica](#); SciNews summary [here](#).
- [Trionychian turtles from the Early Miocene \(Burdigalian\) Moghra Formation, Egypt, including a new species of \*Carettochelyidae\*](#).
- [New ichthyofaunal microfossils from the Late Permian at Chaotian, Sichuan, Southwest China](#).
- [Skeletal ossification of Middle Triassic pachypleurosauro \*Keichousaurus hui\* \(Reptilia: Sauropterygia\) revealed by zinc distribution](#).
- Bonebed: [Stratigraphic Position and Age of the Upper Triassic Placerias Quarry, East-Central Arizona, USA](#).
- [The most complete Early Jurassic ichthyosaur from North America](#); SciNews summary [here](#).
- [Osteology and histology of a \*Plateosaurus trossingensis\* \(Dinosauria: Sauropodomorpha\) from the Upper Triassic of Switzerland with an advanced chronic pathology](#); SciNews summary [here](#).

## Mining and Energy

- Regulation reform, Australia: [Queensland Government puts RSHQ under microscope](#).
- [BofA sees \\$4,000 gold price on US debt concerns, not war](#).
- [Congo extends cobalt export ban by three months](#); related: [Congo's cobalt conundrum](#).

- [Marathon assessing damage at Texas City refinery, sources say](#); cleanup from fire on [June 14<sup>th</sup>](#).
- [U.S. primary energy production, consumption, and exports increased in 2024](#).
- Petroleum reservoir geology: [AVO reflectivity and pre-stack seismic impedance inversion for gas sand channel detection at South Abu El Naga Field, Onshore Nile Delta, Egypt](#).
- [Niger junta seizes French nuclear giant Orano's uranium mine](#).
- [Ontario Doubles Down on Nuclear Power](#).
- Newfoundland: [Preparing the Baie Verte Peninsula for an Expected Mining Boom](#).
- Canadian based [Greenland Resources awarded 30-year molybdenum exploitation licence](#).
- [“Meta Goes Underground”: Tech Giant Joins U.S. Startup to Build 150-Megawatt Geothermal Powerhouse Deep Below Earth](#).
- [Xi's giant iron ore trader is shaking up a \\$130 billion market](#); related: [Iron Ore Prices Tumble To 9-Month Low, Citi & Goldman Ratchet Down Price Target](#).
- [Petroleum Systems of the Shu-Sarysu Basin, Kazakhstan: A Review of Devonian–Permian Gas Potential](#).
- [Saskatchewan to rebuild its coal fleet, despite federal regulations calling for its demise](#).
- [Ukraine cedes the exploitation of its gold, kaolin, and graphite deposits to a single country](#).
- [U.S. Battery Makers Declare National Emergency After China's Antimony Ban](#).
- [Geothermal energy company drills 15,765 feet into the earth, breaking many records in the process](#); = 4,805 metres.
- [Canadian mining company stripped of gold mine operation for six months by Mali court](#).
- [Goodbye to energy dependence – Alaska discovers more than 1,100 TWh hidden under the ice, and the find could change the world](#).
- Ocean bed mining: [Europe unveils the largest treasure ever found beneath the ocean with nearly 45,000 tons extracted annually](#).

## Environmental Geology and Hydrogeology

- Arsenic in well water: [Map Shows States Where Drinking Water Contamination is Highest](#).
- [Trump admin eyes Mojave Desert groundwater as potential source for arid Arizona](#).
- Nova Scotia: [Work to clean up contaminated former gold mine site to begin this year](#).
- Biosolids: [Homeowners Worried About Chemicals Being Spread In Sewage Fertilizer](#).

- Really bad science: [Trump Closes Notorious EPA Lab that Conducted Illegal Human Experiments.](#)
- [PFAS-eating bacteria discovered in Veneto soil.](#)
- [Cambodia moves to groundwater regulation amid rising water security concerns.](#)

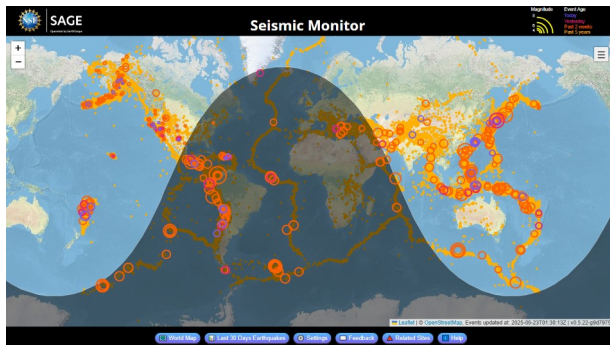
## Glaciers and Climate Change

- [Fundamentally unchanged northwestern African rainfall regimes across the Plio-Pleistocene transition](#); Phys.org summary [here](#).
- Climate change, the Anthropocene and methane: [Tree methane exchange in a changing world](#); Phys.org summary [here](#).
- [Relationships between African landforms, regolith materials, and Cenozoic climate change: Implications for sedimentary source-to-sink systems.](#)
- [Human influence on climate detectable in the late 19th century.](#)

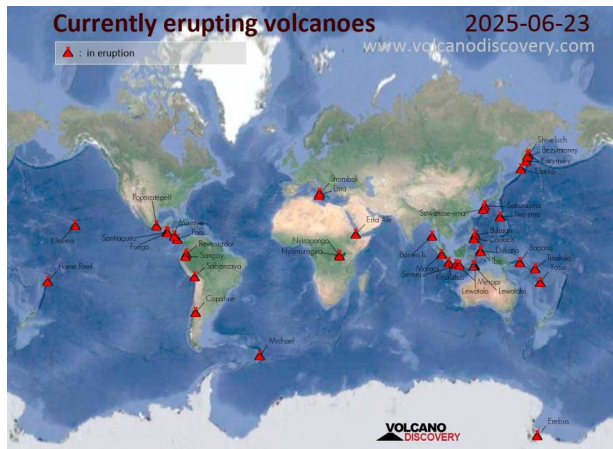
## Geologists in the News

- [Ontario Geoscientist, Andrea Waldie, P.Geo., FGC, honoured with 2025 Canadian Professional Geoscientist Award.](#)

## 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.](#)
  - Volcano Watch – [School's out for Summer: Introducing New Interns at HVO!](#)

- [Is it safe to drink the water in Yellowstone's backcountry?](#)
- Video: [Live Now: 24/7 Fuego Volcano Eruption in 4K Ultra HD \(Guatemala\)](#).
- Video: [Lava Fountains Likely Set New Record For Kilauea Eruption \(June 20, 2025\)](#).
- [A Narrow Magma Conduit of the Changbaishan Volcano Revealed by High-Resolution Receiver Function Imaging](#).
- [Interconnectivity of Magmatic and Hydrothermal Systems of Aluto Volcano in the Main Ethiopian Rift Inferred From Seismicity](#).

### **Earthquakes**

- [Euro-Mediterranean Seismological Centre \(EMSC\)](#).
- [Earthquakes Monitoring Live Worldwide](#).
- [A Northeast-Dipping Zone of Low-Frequency Earthquakes at the Southern Edge of Cascadia Subduction](#).
- Research: [Slip Modes Along a Structurally-Driven Earthquake Barrier in Chile](#).
- [Unusually powerful M5.1 Earthquake hit near Semnan in Iran on Friday Evening](#); Euro-Mediterranean Seismological Centre summary [here](#).
- Iceland, video: [Uncertainty is Growing During Widespread Tension and Seismic Activity](#).
- Santorini, video: [Tensions in the Subsurface – MULTIPLE QUAKES! Is this the Start of another Earthquake Swarm?](#)
- [Shallow Fault Zone Structure Affects Rupture Dynamics and Ground Motions of the 2019 Ridgecrest Sequence to Regional Distances](#).
- [Toward Earthquake Early Warning in Nevada: Seismic Network Configuration and Warning Time Analysis](#).
- Iceland: [One of the strongest quakes since seismic activity began](#).
- [Sudbury-area seismic activity shakes some parts of the community](#); Earthquakes Canada details [here](#) and [here](#).
- [Building Damage Assessment of the March 2025 Myanmar Earthquake](#); Phys.org summary [here](#).

### **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](#).

## Upcoming Events

- Calgary, AB: [2025 Bootleggin' Breakfast – July 8<sup>th</sup> & 10<sup>th</sup>](#); during the Calgary Stampede.
- [August 3 – 7, Golden, Colorado, 18th Biennial meeting of the Society of Geology Applied to Mineral Deposits](#).
- [Society for Sedimentary Geology conference, Mountjoy IV – August 10-13, 2025, in Montreal, Canada](#).
- [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](#).
- [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](#).
- 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.

June 23, 2025

## Geology and the Fate of Societies – Laos



**Figure 1a – Laos**

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



**Figure 1b – Location of Laos**

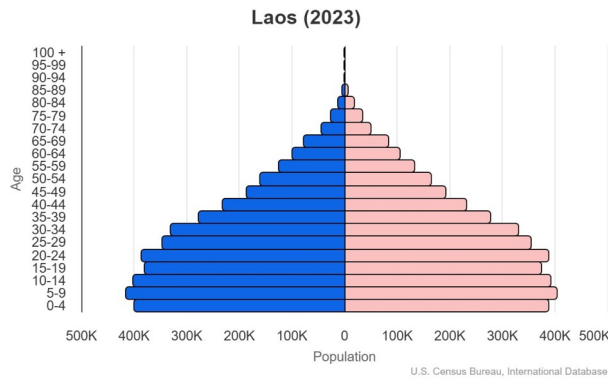
**Credit:** [CIA World Factbook, public domain](#)

[Laos](#), officially the [Lao People's Democratic Republic](#) (LPDR), is a landlocked country in Southeast Asia. Laos shares borders with: [Burma \(Myanmar\)](#) to the northwest; [China](#), to the north; [Vietnam](#), to the east; [Cambodia](#), to the south; and [Thailand](#) to the west. Laos is a [communist state](#) under the rule of the [Lao People's Revolutionary Party](#) (LPRP). The General Secretary of the LPRP, and the country's President, is [Thongloun Sisoulith](#); the Prime Minister is [Sonexay Siphandone](#); and the Vice Presidents are [Bounthong Chitmany](#) and [Pany Yathotou](#). The legislature is called the [National Assembly](#), the President of which is [Saysomphone Phommvihane](#). The Capital and largest city is [Vientiane](#) (pop. 840,940).

According to the [Central Intelligence Agency](#) (CIA) [World Factbook on Laos](#), the country has a total area of 236,800 square kilometres (km<sup>2</sup>), of which 230,800 km<sup>2</sup> is land and 6,000 km<sup>2</sup> is water. Also according to the CIA, 7,953,556 people live in Laos, 38.2% of whom live in urban areas. Ethnically, the country has an ethnically mixed population made up of 53.2% [Lao](#) people, 11% [Khmu](#), 9.2% [Hmong](#), 3.4% [Phouthay](#), 3.1% [Tai](#), 2.5% [Makong](#), 2.2% [Katong](#), 2% [Lue](#), 1.8% [Akha](#), and 11.6% other. The official language of Laos is [Laotian](#). English and French are widely spoken and the separate ethnic groups speak their own indigenous languages. In terms of religion, 64.7% are [Buddhist](#), 31.4% say they have no religion (good [Communist atheists](#)), 1.7% are [Christian](#); and 2.1% are either something other or do not declare their religious affiliation. [Animism](#) and other [traditional faiths](#) are often practised concurrent with Buddhism, atheism, and other faiths. 85% Laotians over the age of 15 can read and write; people can expect to spend 10 years in school.

Economically, the per capita [GDP \(PPP\)](#) is \$9,727; the [Gini coefficient](#) is 36.4, indicating medium inequality; and the [Human Development Index](#) is medium at 0.617. In 2023, the [top exports of Laos](#) were electricity (\$2.15b), potassic fertilizers (\$840m), gold (\$653m), uncoated paper (\$453m), and copper ore

(\$428m). The top destinations were China (\$3.41B), Thailand (\$2.99B), Australia (\$367M), United States (\$306M), and Cambodia (\$190M). In 2023, the [top imports of Laos](#) were refined petroleum (\$1.24b), cars (\$247m), raw sugar (\$244m), delivery trucks (\$186m), and machinery (\$160m). The top origins were Thailand (\$4.64B), China (\$2.9B), Japan (\$100M), Singapore (\$66.2M), and Germany (\$44.2M).

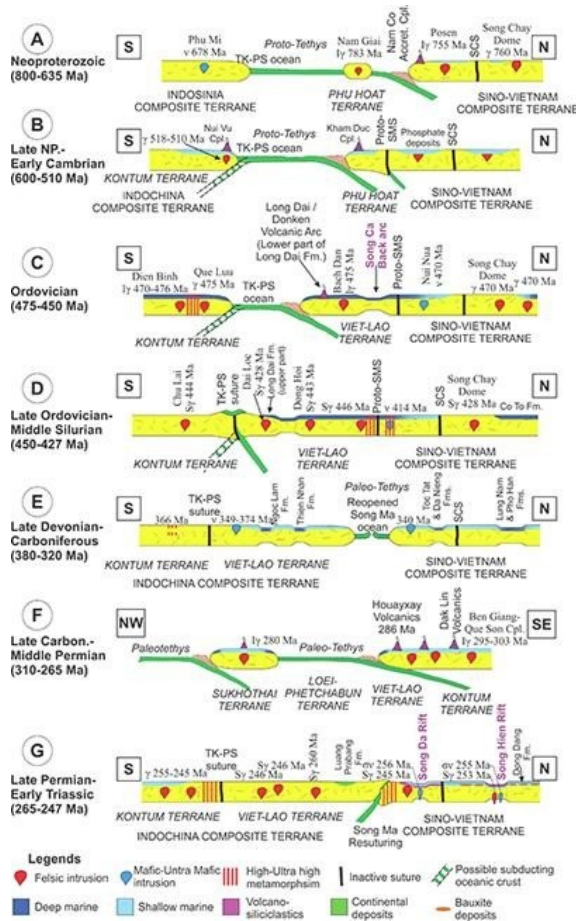


The demographics of Laos shows a fairly young country. The median age is 25.4 years; 30.1% of the population is under 15 years; 65% are between 15 and 64 years; and only 4.8% are 65 years and over. The total fertility rate is 2.30 births per woman (above the replacement rate of 2.1), the net migration rate is -1 migrant(s)/1,000 population, and the resultant annual growth rate is 1.30%. Life expectancy for both sexes is 68.6 (male: 67.4 years, female: 70.7 years).

**Figure 2 – Demographics of Laos**

[Credit: U.S. Census Bureau, International Database, public domain](#)

## Geology

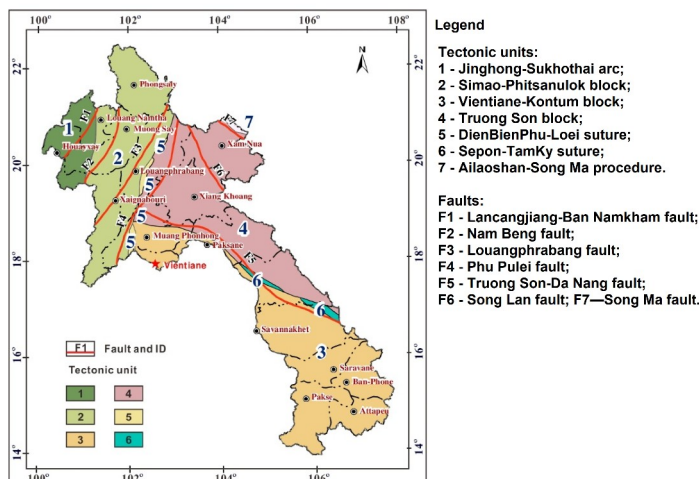


**Figure 3 – Tectonic History of Indochina**

[Credit: Graphical Abstract of Tran et al, 2020](#)

The geology of Laos is a function of its tectonic history as part of Indochina. There were six major episodes in the [tectonic history of Indochina](#):

1. Beginning in the [Neoproterozoic Era](#) and continuing into the [Cambrian Period](#), modern day Indochina was a [geological terrane](#) made up of a [shallow marine depositional environment](#). As well, other terranes that would later become part of Indochina were separated by the [Proto-Tethys Ocean](#). Tectonic movements brought these separate terranes together at the [Proto-Song Ma suture](#) by the end of the [Lower Cambrian](#).
2. From the [Middle Cambrian](#) to the [Lower Ordovician](#), a shallow shelf [carbonate deposit](#) developed north of the Proto-Song Ma suture. Meanwhile, south of the Proto-Song Ma suture, were the [deep marine](#) and [volcanic arc](#) deposits.
3. Between the [Middle Ordovician](#) and the [Silurian Period](#) there was an episode of active tectonic processes. The [Tam Ky-Phuoc Son Ocean](#) subducted beneath the [Viet-Lao terrane](#) in the north and the [Kon Tum terrane](#) in the south. This subduction process continued into a collisional orogeny that sutured the Kon Tum terrane with the Viet-Lao and [Viet-Cambodia](#) terranes along the [Tam Ky-Phuoc Son suture](#). This orogeny brought together much of Indochina into a unified super terrane.
4. The episode that occurred between the [Devonian](#) and [Lower Mississippian](#) of the [Carboniferous Period](#) began with a rise in sea level ([marine transgression](#)) during the [Middle Devonian](#) followed by a drop in sea levels ([marine regression](#)) that lasted from the [Upper Devonian](#) to the Lower Mississippian.
5. The [Song-Ma Ocean re-opened](#) in the north part of Indochina between the [Middle Mississippian](#) of the Carboniferous and [Middle Permian](#), splitting the Indochina and Sino-Vietnam terranes. In the west, a [volcanic / plutonic belt](#) formed with the eastern subduction of the [Paleo-Tethys](#) under the Indochina super terrane.
6. A [mantle plume](#), called the [Emeishan](#), together with [continental rifting](#) occurred between the [Upper Permian](#) and [Lower Triassic](#). This orogeny, called the [Indosinian Orogeny](#), brought together the [Indochina and Sino-Vietnam terranes](#) along the [Song Ma suture](#).



**Figure 4 – Tectonic Sketch of Laos**  
 Credit: Figure 1 in Wang *et al*, 2022,  
[Creative Commons Attribution-Share Alike 4.0 International license](#)

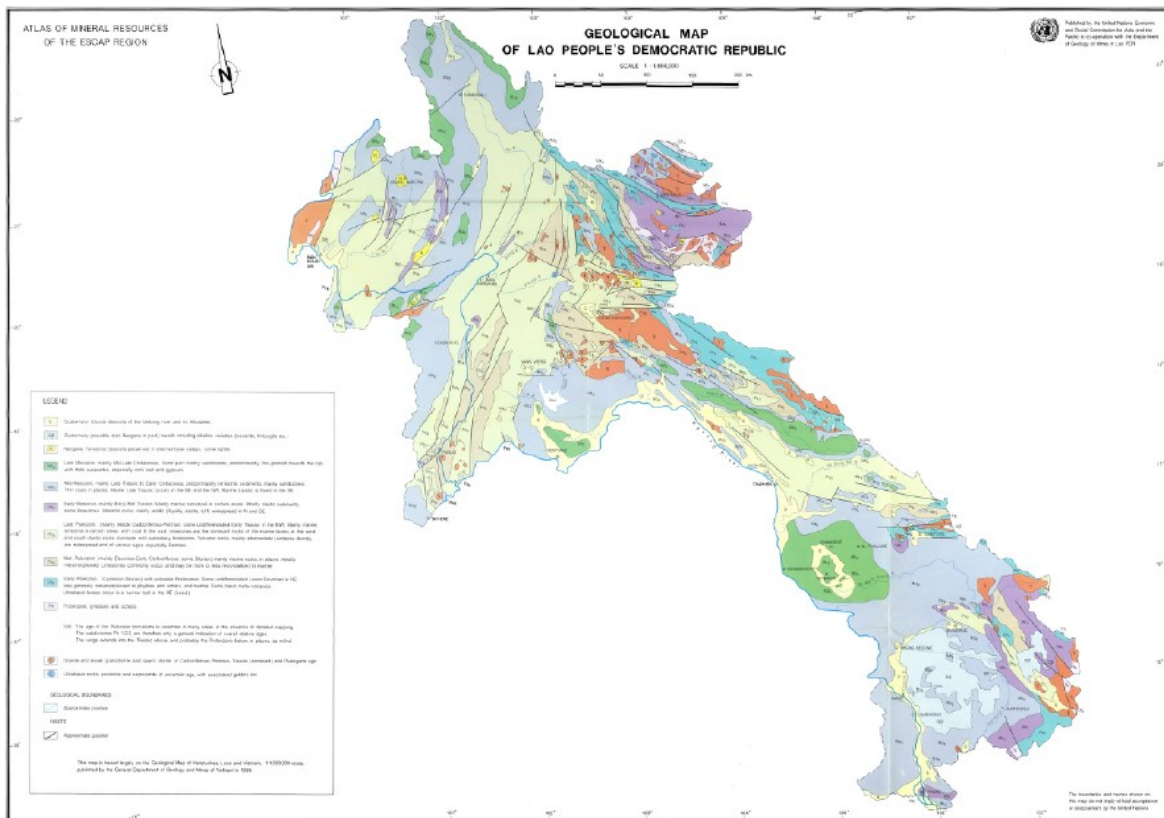
The main [tectonic units of Laos](#), as shown in Figure 4, include: the [Jinghong-Sukhothai arc](#); the [Simao-Phitsanulok block](#); the [Vientiane-Kontum block](#); the [Truong Son block](#); the [DienBienPhu-Loei suture](#); the [Sepon-TamKy suture](#); and the [Ailaoshan-Song Ma orogenic belt](#). Within these blocks, the major fault zones include: the [Lancangjiang-Ban Namkham fault](#); the Nam Beng fault; the [Louangphrabang fault](#); the [Phu Pulei fault](#); the [Truong Son-Da Nang fault](#); the Song Lan fault; and the [Song Ma fault](#).

Following the main assemblage of the Indochina block, there was a period of [tectonic uplift](#) during the [Triassic](#). This uplift, and subsequent erosion placed sedimentary deposits into [marine basins](#). Volcanism during the Triassic uplift created [volcanic deposits](#) of [dacite](#), [rhyolite](#) and [tuff](#).

Most rocks in Laos dating from the [Jurassic](#) and [Cretaceous](#) are [sedimentary terrestrial deposits](#) except for the [Lower Jurassic](#) aged marine deposits of the [Sekong Valley](#).

[Paleogene](#) deposits are generally absent in Laos. Freshwater sediments, shale, sandstone, marl, and lignite, from the [Neogene](#) are found in the small valleys between mountain ranges. [Uplift](#) and volcanism occurred during the [Pliocene](#) and [Pleistocene](#), causing [intense erosion](#). This erosion, included the development of [karst topography](#) in the [Phou Hin Poun region](#) and the [Vang Vieng Karst Mountains](#). The valley of the [Mekong River](#) contains predominantly [Holocene](#) aged sediments.

Figure 5 links to a detailed map of [the geology of Laos](#).



**Figure 5 – Geological Map of Laos**

**Credit: [United Nations Atlas of Mineral Resources of the ESCAP Region](#), public domain**

For further information on the geology of Laos, follow up on the links as well these summaries [here](#) and [here](#).

## Resources

### *Agriculture*



**Figure 6 – Green Paddy Fields and Karst Mountains at Sunset with Clouds in Vang Vieng, Laos**  
**Credit: [Basile Morin](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license**

According to the CIA, agriculture uses 9.8% of the land in Laos (5.3% arable land, 1.5% permanent crops, 2.9% permanent pasture, 4,410 km<sup>2</sup> irrigated land) and accounts for 16.1% of the country's GDP. In 2023 the top ten agricultural products based on tonnage are cassava, root vegetables, rice, sugarcane, vegetables, bananas, maize, rubber, coffee, and watermelons. Production statistics from the [United Nations Food and Agriculture Organization](#) (FAO) can be found [here](#). Also according to the FAO, [36.3% of the population](#) suffered from moderate to severe food insecurity 2021-2023. The FAO Country Brief on Laos can be found [here](#), giving current conditions.

Although rice ranks only in third place in terms of tonnage produced, it is the most important crop, accounting for 60% of the cultivated (arable) land. Rice, especially [sticky rice](#), is an important part of [Laotian culture and cuisine](#). Rice is grown in both paddies, wet-farming, and as upland rice using [slash and burn methods](#). Rice paddies are often also [used as fish farms](#) when the fields are flooded. Much of the agriculture in Laos is [subsistence agriculture](#), although the sale of farm products is a common practice so the line between commercial and subsistence farming is fairly flexible.

Significant cash crops include the legal crops of coffee and tea as well as the [illegal cultivation of opium](#). The FAO indicates that 177,662 tones of coffee and 16,399 tonnes of tea were harvested in 2023. The [United Nations Office on Drugs and Crime](#) estimated that, [in 2023](#), opium poppy cultivation was on approximately 5,000 hectares of land producing about 63 tonnes that year. Bizarrely enough, some [adventurous spirits travel to Laos](#) to try out the local opium, as well as other drugs, sometimes with [tragic results](#).



**Figure 7 – Opium Poppy**

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

### *Hydroelectric Power*



**Figure 8 – [Theun Hinboun Dam](#), Central Southern Laos**

**Credit:** [Jirrupin](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

Hydroelectric power, for both domestic consumption and export, is considered a major resource with the Lao government aspiring to be the “[Battery of Southeast Asia](#)”. As of 2024, there are [56 hydroelectric dams in Laos](#) with a total generation capacity of 43,841 Gigawatts. An additional 16 hydroelectric dams are planned. The development of hydroelectric power in Laos has not been without [controversy](#), and there was a significant [dam failure in 2018](#) that killed at least 40 people.

## Mineral Resources



Figure 9 – Native Copper from the [Sepon Mine](#)

Credit: [Mx. Granger](#), [Creative Commons CC0 1.0 Universal Public Domain Dedication](#)

According to the [USGS 2020–2021 Minerals Yearbook](#), the mineral industry in Laos include the [production](#) of metallic minerals, industrial minerals, and fuel minerals.

Metallic minerals production includes:

- Antimony, produced at a [scheelite](#) deposit in [Luang Namtha Province](#);
- Bismuth and tellurium, produced by [5N Plus Lao Industrial Resources Co. Ltd](#);
- Copper and gold, mined at the [Phu Kham Mine](#) and the [Sepon Mine](#), lead is also produced as a byproduct of copper and gold production;
- Gold, also mined at the [Ban Houayxai gold-silver mine](#), the [Phapon Mine](#), and the [Vangtat Mine](#);
- Iron ore, mined at an iron mine in [Boualapha, Khammouane Province](#), and the [Houaphanh iron ore mine](#);
- Silicon metal is produced by the [Lao Silicon Co, Ltd](#);
- Silver is produced at the Ban Houayxai gold-silver mine and the Phu Kham Mine;
- Tin, mined at the [Phon Tiou Mine, Hineboune District, Khammouane Province](#).

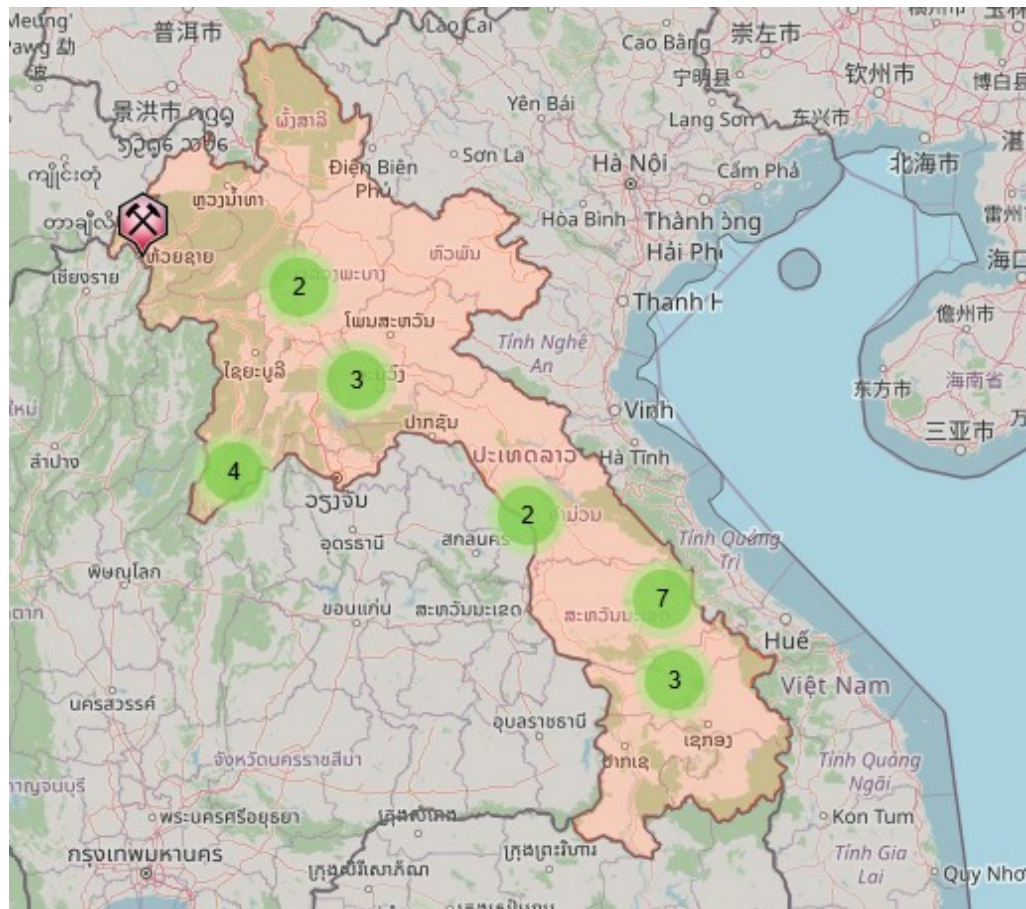
Industrial minerals include:

- Barite, from a [mine in Boualapha, Khammouane Province](#);
- [Cement](#) from around 14 production facilities;

- Common and high silica clay;
- Gemstones, sapphires from the [Ban Huay Xai sapphire mines](#);
- Gypsum, mined at five locations;
- Potash, mined at the [Dong Tai potash deposit in Khammouane Province](#); and the Guangcai Mine in [Savannakhet Province](#);
- Salt is produced at around 10 main artisanal salt works;
- Crushed limestone and sandstone at around five quarries.

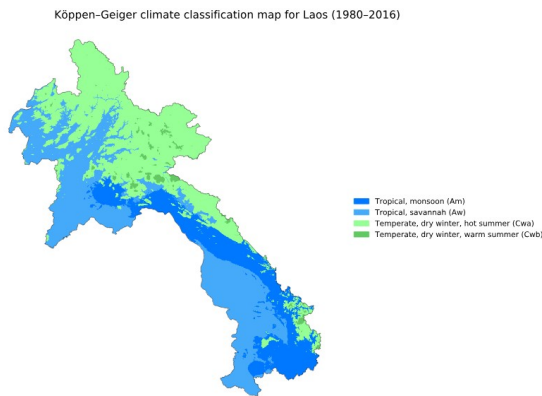
The mineral fuels produced in Laos are anthracite coal and lignite (brown coal). Anthracite and lignite are mined at a coalfield in [Vieng Phoukha, Luang Namtha Province](#). Lignite is also mined at coalfields in [Hongsa](#) and [Ngeune](#) in [Sainyabuli Province](#).

Figure 10, below, links to an interactive mineral occurrence map of Laos.



**Figure 10 – Interactive Mineral Occurrence Map of Laos**  
 Credit: ©Mindat.com

## Climate



**Figure 11 – Köppen-Geiger Climate Map of Laos**  
**Credit: [Beck et al, 2018](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license**

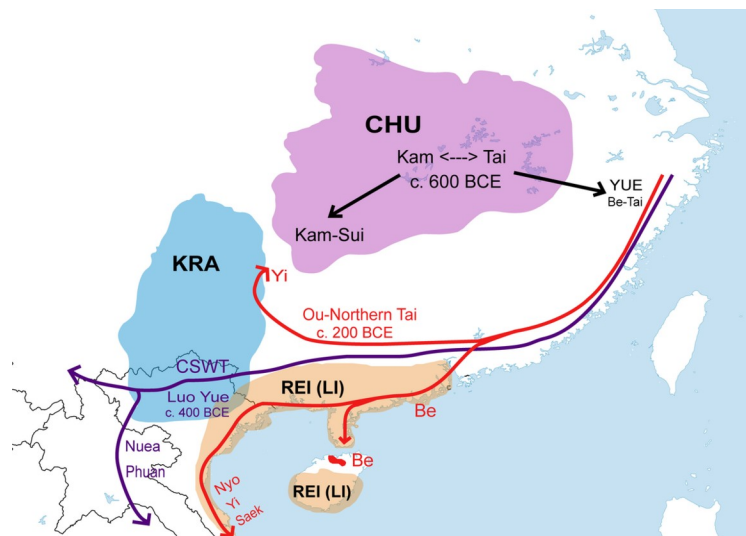
Source: Beck et al., Present and future Köppen-Geiger climate classification maps at 1 km resolution, Scientific Data 5:180214, doi:10.1038/sdata.2018.214 (2018)

The climate of Laos is generally tropical, varying from tropical monsoon ([Am](#)) and tropical savannah ([Aw](#)) in the lowlands to more moderate temperate ([Cwa](#) and [Cwb](#)) climates in the highlands.

Laos looks like an interesting place and the Laotians immigrants that I have met here in Canada are pleasant people, so Laos looks like an interesting place to visit. Travel advisories, [here](#) and [here](#), recommend caution due to crime, ranging from petty crime to organized banditry, and a tense security situation. Also, you might want to be careful with the landmines and [unexploded ordnance](#) in the [Plain of Jars](#), in [Xiengkhouang Province](#), as well as in the Laotian-Vietnamese border areas, including those traversing the former [Ho Chi Minh Trail](#). However, if you still want to go, check out the [official government tourism site](#), [Climates to Travel](#), and [Lonely Planet](#). I will leave it up to you, dear reader, if you want to follow up on [Trip Advisor's suggestions for viewing the Ho Chi Minh Trail](#). Just stay away from the [local hooch](#).

## History and Geopolitics

### History



**Figure 12 – Migrations of the Kra-Tai Peoples**  
**Credit: [Bookworm8899](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license**

The [history of Laos](#) is interesting and, if you want to go into details, check out these sites [here](#) and [here](#). Before going into the more recent history, let's look at a few general periods from their history.



The Laotian people are descended from [Kra-Tai](#) people that migrated into Indochina from modern day China early in the [Common Era](#). Other ethnic groups involved in this ancient *völkerwanderung* are the ancestors of the neighbouring [Dai](#), [Thai](#), [Isan](#), [Tai Yai \(Shan\)](#), [Tai Ahom](#), and [Tai Kassay](#) peoples. One of the first state level polities led by Laotian kings was the [Lan Xang State](#) that lasted from 1353 to 1707 AD.

Following the demise of the Lan Xang State, other polities such as the [Kingdom of Luang Prabang](#), [Kingdom of Vientiane](#), and [Kingdom of Champasak](#) ruled in the region of modern Laos. Also, from the 1779 to 1893, following the [Thai-Laotian War](#), modern Laos was under the rule of neighbouring Thai [Thonburi](#) and [Rattanakosin](#) kingdoms. The Laotians were never happy with their Siamese rulers and a [revolt broke out 1826 -1828](#).

**Figure 13 – Indochina ca. 1540**

**Credit: Nicolas Eynaud, Creative Commons Attribution-Share Alike 4.0 International license**

As if their troubles with their neighbours in Indochina were not enough, in 1898, the [French](#) showed up and conquered modern Vietnam, Laos and Cambodia; ruling them as [French Indochina](#). The French lost their hold on Laos during the [Second World War](#) when the [Japanese occupied Indochina](#), although the Japanese did not arrive in Laos until 1945. In October 1945, with the imminent defeat of Japan in the Second World War, [King Sisavang Vong](#) (Sisavangvong) declared independence in April 1945. Sisavangvong's close relationship with the Japanese was unacceptable to many of his countrymen and in October 1945, Prince [Phetsarath Ratanavongsa](#) overthrew King Sisavangvong and [declared Laotian Independence](#) with Prince Ratanavongsa as Head of State.

Prince Ratanavongsa's tenure as head of State did not last long, as the French returned in April 1946 and re-installed Sisavangvong as King. Meanwhile the French were dealing, unsuccessfully as it turned out, with an insurgency by the [Viet Minh](#) and the [Pathet Lao](#). The defeat of the French Army at [Dien Bien Phu](#) brought an end to of the [First Indochinese War](#). With the [settlement of the First Indochinese War in 1954](#), the French vacated their former Indochinese colony.

At a subsequent [Geneva Peace Conference](#) held from 1961 to 1962, the official neutrality of Laos was recognized, a neutrality that was universally disregarded. Neutrality did not prevent the [North Vietnamese](#) from using Laos for transporting war supplies to their insurgent allies in South Vietnam along the [Ho Chi Minh Trail](#) during the [Second Indochina War](#). Nor did this official neutrality prevent the Americans [bombing the Ho Chi Minh Trail](#), or anywhere else they wanted to bomb, in support of their [South Vietnamese](#) allies in the war. Laos became the [most bombed place on earth](#), losing one-tenth of the

population of Laos, or 200,000 civilians and members of the military, as a result of being caught up in the Vietnam War.

Following the exit of the French, Laos fell into a [civil war](#) between Royalist factions supporting King Sisavangvong, and the communist the Pathet Lao. The Pathet Lao won and communists [rule Laos to this day](#). As for their neighbours, the North defeated the South in the Vietnam War.

From the history of Laos we can see three main big influences on their culture:

1. From their ancient homeland in China, the Laotians brought the culture that revolves around rice cultivation. This includes not only the yearly rhythms of field preparation, sowing, and reaping but also a whole panoply of nature gods and spirits that must be attended to. Also, from China, came elements of higher culture and ideas for state organization.
2. Probably during their folk wanderings, and almost certainly when they settled in Indochina, the Laotian peoples came into contact with, and adopted, the teachings of [the Buddha](#). One of the genius of Buddhism is its ability to integrate pre-existing folk religions, essentially sitting on top of them. This suited the people of Laos perfectly with their pre-existing rice growing culture and its pantheon of nature gods. Buddhism also brought Laos, and the rest of Indochina, into the orbit of [Greater India](#), bringing in the alphabet used for the [Laotian language](#), ideas for social organization at the state level, along with the religious teachings.
3. The final main influence has been from [Western Civilization](#), via the French. The French brought in modern ideas of [civil law](#) and state organization. Also with [modernity](#), the French introduced the [administrative class](#) that they trained in their colony to [Socialism](#). Now the observation that all models are wrong, but some are useful, applies to Socialism, especially in its [Marxist-Leninist](#) form. As an ideology for anti-colonialism, Socialism opposes the capitalist exploitation endured by the Laotians under the French Empire. In its [Stalinist](#) mode, Socialism also provides justification for harsh authoritarian rule. The Communist Pathet Lao learned their lessons well, incorporating the modern ideas of Socialism, Marxist-Leninism, and [ethnic nationalism](#) into their model for governance.

### *Geopolitics*



**Figure 15 – Pha That Luang, Vientiane**

**Credit: [Benh LIEU SONG](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license**

Internally, the rulers of Laos have the challenges lifting their people out of poverty while maintaining their grip on power. Until 1987, maintaining the paramount authority of the Communist Party was the top priority of the ruling clique, often causing anyone who opposed their rule [to flee the country](#). However,

[since 1987](#), perhaps inspired by changes in [China](#) and [Vietnam](#), the Laos government has attempted to loosen up their grip on the economy, with [some good results](#). Recently, a [long term plan](#) was announced to further economic growth.

Another challenge for the rulers of Laos is the multi-ethnic nature of the country, where ethnic Lao only form 53.2% of the population. In this, the [authoritarian tendencies](#) of the Marxist Pathet Lao has been useful. Perhaps too useful, since they have been accused, with some evidence, of [egregious human rights violations](#) against all Laotians, including ethnic minorities [such as the Hmong](#). Modernity, as practised through modern education systems also has a tendency to assimilate and/or [exclude ethnic minorities](#), especially in urban areas. This might seem a desirable thing until you consider the [inevitable backlash](#) against policies of ethnic assimilation. This could be a future problem as economic growth and urbanization continue.

In terms of their neighbours, Laos has had a history of violence with them and there continue to be differences. However, there is also a great deal of peaceful economic cooperation between Laos and their neighbours.

With regards to China, the two countries have a [close commercial relationship](#). China's [ambitions to be the regional hegemon](#) may not be comfortable for Laos, especially as it affects the [critical water resources of the Mekong River](#). Laos shares this concern about the Mekong with their [Thai, Vietnamese and Cambodian neighbours](#).

Laos and Vietnam shared common enemies during the Vietnam War, and the [relationship remains close](#). This [relationship](#) includes robust trade and [common concerns](#) with their Chinese neighbour.

[Cambodia and Laos](#) have a complicated relationship, despite their common Marxist ideologies. The two countries only recently (2019) agreed upon a [demarcation of their common border](#). The issues are [complex](#) but boil down to the problems of establishing national borders following the breakup of colonial empires, like [French Indochina](#). Cambodia [also has a current dispute with Thailand](#), again over an indistinct border.

Finally, there is [Thailand](#). Thailand was an American ally during the Indochina wars and [remains one today](#). Relations between Thailand and Laos were tense until around 1988, when the Thai government opened up the border to trade. Among the problems that Thailand has with Laos is the presence of [Lao and Hmong refugees in Thailand](#), people that fled troubles in Laos and whom the Thais would like to return home. In 2008, Thailand [forcibly expelled](#) ~5,000 Hmong and another 4000 in 2009. Complicating things further, Thailand also hosts some over [80,000 refugees from Myanmar](#). The situation appears to be unresolved. On the positive side, Thailand and Laos have agreed to [strengthen their peaceful relations](#).

That is it for this quick look at Laos. I am optimistic for the people of Laos, I think that they are likely to improve their lives through their own efforts. The challenge for the rulers, if they want to remain in power, is to do everything possible to aid Laotians in their quest for a better life. If not, the Laotians will just have to replace their elite. They are tired of being poor.

In the next few weeks, we will be on vacation, starting June 29<sup>th</sup>. I will blog news and views with some photos of the trip as well as observations on the geology encountered along the way. The geopolitical postings will resume July 21.

## **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.