

**June 2, 2025**

## **News and notes**

Before going on to discuss the geology and geopolitics of Korea, 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**

- [Ukraine launches major drone attack on Russian bombers, security official says.](#)
- [Japan proposes rare earth cooperation with US in trade talks.](#)
- [Beijing 'Imminent' Threat to Taiwan: U.S. Defense Secretary Issues Stark Warning.](#)
- [Infographic: Rare earth spheres of control.](#)
- Crime: [Libya Arrests Three for Storming NOC Amid Threats to Oil Supply.](#)
- The [Red Line Podcast: Who Controls Eastern Congo?](#)

## **Research and News**

- [Biological nitrogen cycling within terrestrial hot springs: A Mars analogue system.](#)
- [Geochemical study on nitrogen isotope composition, speciation distribution, and influencing factors of vitrinite-rich coal seams during the Late Carboniferous.](#)
- [Sediment Depositional History and Processes for the Eurasian Basin Since 54 Ma, Arctic Ocean.](#)
- Melting rock for fun and science: [Formation of the high pressure jeffbenite phase from glass at ambient pressure.](#)
- [Gastropod-rich lacustrine carbonate deposits in N Iberia: a depositional, climatic and ecological record of the Late Miocene.](#)
- [Combining end-member analysis of sediment grain-size and outcrop studies to interpret ancient aeolian sediments: Upper Cretaceous Tangbian Formation, Jitai Basin, China.](#)
- [Igneous rocks as a viable source of fixed nitrogen to the prebiotic world.](#)
- [Eruption, Emplacement and Internal Architecture of Massive and Super-Massive Inflated Submarine Basalt Lava Flows, Walvis Ridge Hotspot Track, IODP Expeditions 391/397T.](#)
- Video: [AI Is Flooding Science With Fake Research.](#)

- [Re-examination of coastal submergence events during the last 4000 years in the Ukishima-ga-hara lowland, central Japan: an aid for the long-term evaluation of the Fujikawa-kako fault zone.](#)
- [Stratigraphic correlation and paleogeography of the Upper Cretaceous Suquash Outcrop Area, Vancouver Island, Canada.](#)
- [Mafic-ultramafic intrusions of Matokulma, Palojärvi, and Hongonniittu within the Central Finland Granitoid Complex with special reference to their petrogenesis and ore potential.](#)
- [Development and factors controlling tropical carbonate barrier island systems—Bar Al Hikman; mid-late Holocene, Oman.](#)
- [Homrit Akarem Post-Collisional Intrusion, Southeastern Desert, Egypt: Petrogenesis of Greisen Formed in a Cupola Structure and Enrichment in Strategic Minerals.](#)
- [1865 Ma tholeiitic magmatism during an extensional episode of the Svecofennian orogeny: the Kaiplot gabbros in Nagu \(Nauvo\), southwestern Finland.](#)

## Zircons in Geology

Zircons are really neat [windows into geological processes](#).

- [Foundational uncertainties in terminal Ediacaran chronostratigraphy revealed by high-precision zircon U-Pb geochronology of the Nama Group, Namibia.](#)
- [From single batholith to global detrital zircon archive: Earth dynamics as seen from zircon Eu anomalies.](#)
- [How Cambrian sediments mantled the Laurentian craton in southeastern California: Biomats, detrital zircon provenance, and maximum depositional age of Sauk I onset.](#)

## Plate Tectonics

- [The dynamics and surface signal of slab break-off in continental settings: Insights from 3D numerical modelling.](#)
- [Basin response to slab detachment under the Eastern Betics.](#)
- [Constraining Solid Dynamics, Interface Rheology, and Slab Hydration in the Hikurangi Subduction Zone Using 3-Dimensional Fully Dynamic Models.](#)
- [Kinematics of the Cretaceous Rifting in the Chainons Béarnais and Bigorre Basin \(North Pyrenean Zone\): Insights From Magnetic Fabrics and Mineral Anisotropy.](#)
- [Heritage of Tethyan Oceanic Transform Faults Within Alpine Orogens: Paleomagnetic Evidence From the Shkoder-Peja Transverse Zone \(Northern Albania\).](#)
- [Kilometers-scale subsidence of the inner Puerto Rico Trench wall since the Pleistocene.](#)
- [The First-Order Crustal Structure and Basin Architecture of the Canadian Arctic Margin.](#)

- [Regional tectonics, crustal deformation and contrasting batholith orientations in southeastern Australia: why is Late Devonian central Victoria different?](#)

## Paleontology

- [Biogenic origin of secondary eggshell units in dinosaur eggshells elucidates lost biomineralization process in maniraptoran dinosaurs](#); Phys.org summary [here](#).
- [Taphonomic controls on a multi-element marine skeletal fossil record](#).
- [Exceptionally preserved ovaries in an ancient horseshoe crab](#).
- [Tail of defence: an almost complete tail skeleton of \*Plateosaurus\* \(Sauropodomorpha, Late Triassic\) reveals possible defence strategies](#).

## Ore and Petroleum Geology

- Petroleum reservoir geology: [Uncertainty evaluation and model optimization in multi-source reservoir modeling](#).
- Ore geology: [Constraints on ore vectoring from geochemical fingerprints of porphyry style pyrite](#).
- [Petrogenesis and geochronology of the granulite facies gneissic suite hosting the Katanning Gold Deposit, Yilgarn Craton, Southwest Western Australia](#).
- [3D seismic modeling of the Amal oil field to evaluate CO2 storage potential in depleted reservoirs, Southern Gulf of Suez](#).
- Ore geology: [Structural controls on lithium mineralization in shear-zone hosted granitic pegmatites of the Zulu pegmatite field, Zimbabwe – implications for exploration](#).

## Mining and Energy

- [MEG Energy Safely Evacuates Non-Essential Personnel from Christina Lake Regional Project Amid Wildfires](#).
- Related to today's posting: [Korea to evaluate proposed Ugandan nuclear power plant site](#).
- [EIA Paints Bearish Picture for Oil Market With Record Supply, Low Demand](#).
- [Sama targets polymetallic resource upgrade in Côte d'Ivoire](#).
- [New gold and silver mine officially opens in central B.C. as premier faces backlash for fast-track plans](#).
- [Darlington SMR contract awarded to Candu Energy](#).
- Geothermal development: [Quaise demos drill bit that will go deeper than humans have ever gone](#).
- [Diamond mining industry cracks under pressure](#).
- [Pivotal pipeline decision looms to determine fate of Canada's next big LNG terminal](#).

- [Supreme Court spurns Native American religious claim over copper mine on sacred land.](#)
- [Elon Musk Says Oil Is “Small-Time”.](#)

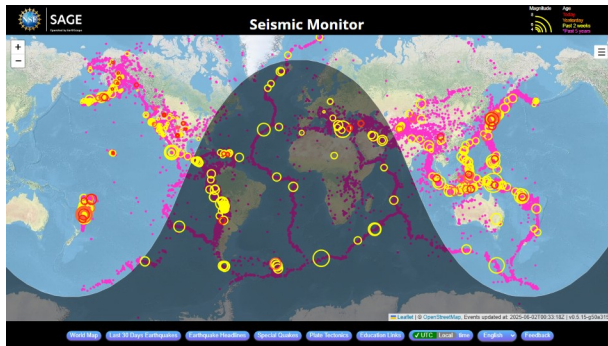
## Environmental Geology and Hydrogeology

- [Spatial Variability and Health Risk Assessment of Fluoride Contaminated Groundwater in Eastern India Using Machine Learning.](#)
- [Soil bulk density and porosity connecting macro- and micro-scales through geometry.](#)
- [Declining Freshwater Availability in the Colorado River Basin Threatens Sustainability of Its Critical Groundwater Supplies;](#) Phys.org summary [here](#).

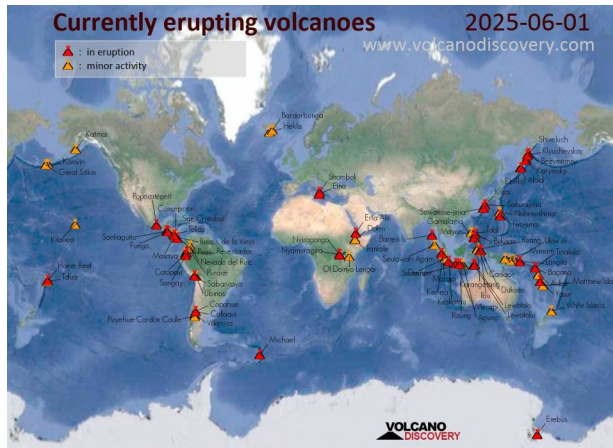
## Glaciers and Climate Change

- Watching snow melt: [Monitoring the Melting of Snow Stored in Snow Dumps \(Yuzhno-Sakhalinsk, Russia\).](#)
- Periglacial environment: [Trace elements in soils of the Antarctic ice-free areas: Insights on natural geochemical values, anthropogenic impact and possible remobilisation upon permafrost thaw.](#)
- [Proglacial lakes substantially modulate the surface mass balance of deglacial ice sheets.](#)
- [Glacier collapse swallows part of Swiss village.](#)

## 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.](#)

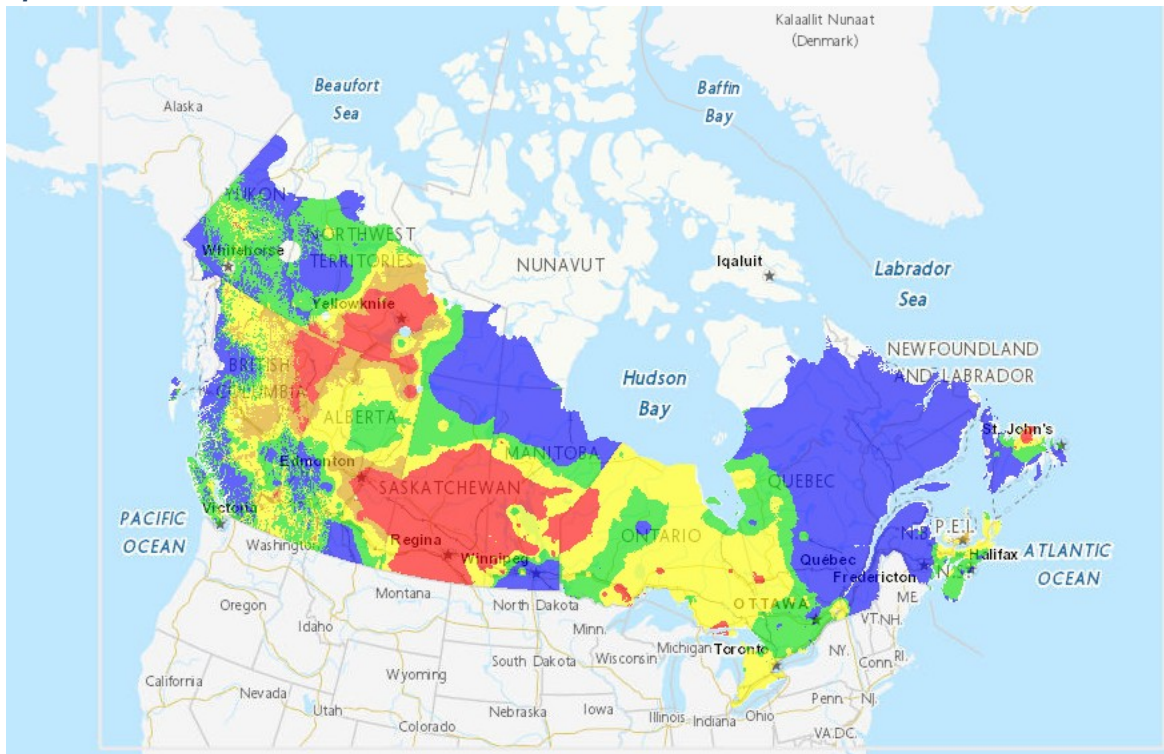
- Volcano Watch – [Halema‘uma‘u Eruption Reaches New Heights as HVO Updates Volcano Alert Notifications](#).
- Yellowstone Volcano Observatory: [A new view of Biscuit Basin \(literally!\)](#)
- Réunion Island: [Effusion Rate Trends at Piton de la Fournaise: A Review of 24 Years of Space-Based Thermal Observation](#).
- [Ionospheric disturbances associated with the eruption of Mt. Asama observed by TEC data and HF Doppler sounding](#).
- [Using dissolution surfaces in crystal clots to quantify pressure changes preceding the 2006 eruption of Augustine Volcano, Alaska](#).
- Campi Flegrei: [Scientists warn one of world's supervolcanoes is awakening: 'It will plunge the planet into chaos'](#).
- [Numerical Modeling Integrated With Field Observations and Analytical Data of the 2021 Cumbre Vieja Eruption Improves Understanding of Eruption Dynamics at Mafic Volcanoes](#).
- [Quadruple volcanoes on secret Soviet military base linked to climate-altering eruption 200 years ago – Earth from space](#).
- [May 25, 2025: Lava Fountaining Soars 1000ft into the Air at Kilauea Volcano, Hawaii \(CAM C\)](#).
- [NASA Satellite Images Could Provide Early Volcano Warnings](#); Live Science summary [here](#).

### **Earthquakes**

- [Euro-Mediterranean Seismological Centre \(EMSC\)](#).
- [Earthquakes Monitoring Live Worldwide](#).
- [Seismogenic Effects in Variation of the ULF/VLF Emission in a Complex Study of the Lithosphere–Ionosphere Coupling Before an M6.1 Earthquake in the Region of Northern Tien Shan](#).
- [Machine Learning-Based Detection and Localization of Tectonic Tremors in the Japan Trench](#).
- [Thermal Properties Influence Earthquake Slip on the Alpine Fault, New Zealand](#).
- Generating earthquakes in the lab for fun and science: [Under what circumstances is the final size of a laboratory earthquake predictable at the onset of the P-wave?](#)
- [The 2023 Mw 7.8 Kahramanmaraş earthquake rupture increases potential failure along the northern Dead Sea Fault](#).
- [Double threat of Cascadia earthquake and sea-level rise could change Pacific Northwest coast forever](#).

- [Unveiling the vertical ionospheric responses following the 2024 Noto Peninsula Earthquake with an ultra-dense GNSS network.](#)
- [Remarkable video captures fault slip in the Myanmar earthquake.](#)
- [Characteristics of Deep Long-Period Earthquakes at Alaska Volcanoes From 2005 to 2017.](#)
- [Influence of the 2011 Tohoku-oki earthquake on the strain-rate field around the Noto Peninsula.](#)

### **Wildfires and other Geohazards**



**Interactive Wildfire Map of Canada**  
**Credit: [Canadian Wildland Fire Information System](#)**

- 06/01 [Thousands evacuated in 3 provinces as Canadian wildfires threaten air quality in some U.S. states.](#)
- 05/31 [The 3D Dynamics of a Wildfire Plume Extending Across the Top of the Planetary Boundary Layer Using an Airborne Doppler Lidar.](#)
- 05/29 Avalanches: [Dynamic Process of Dry Snow Slab Avalanche Formation: Theory, Experiment and Numerical Simulation.](#)

### **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; the May 2025 newsletter from the Groundwater Project is [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](#).

## Upcoming Events

- [Sedimentary Geology and the Energy Transition Conference, June 2-5, 2025 – Salt Lake City, UT USA](#).
- Calgary, AB: [2025 Bootleggin' Breakfast – July 8<sup>th</sup> & 10<sup>th</sup>](#); during the Calgary Stampede.
- [June 10, Kentucky Geological Survey 64th Annual Seminar: Geology in the Modern World](#).
- [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 2, 2025

## Geology and the Fate of Societies – Korea

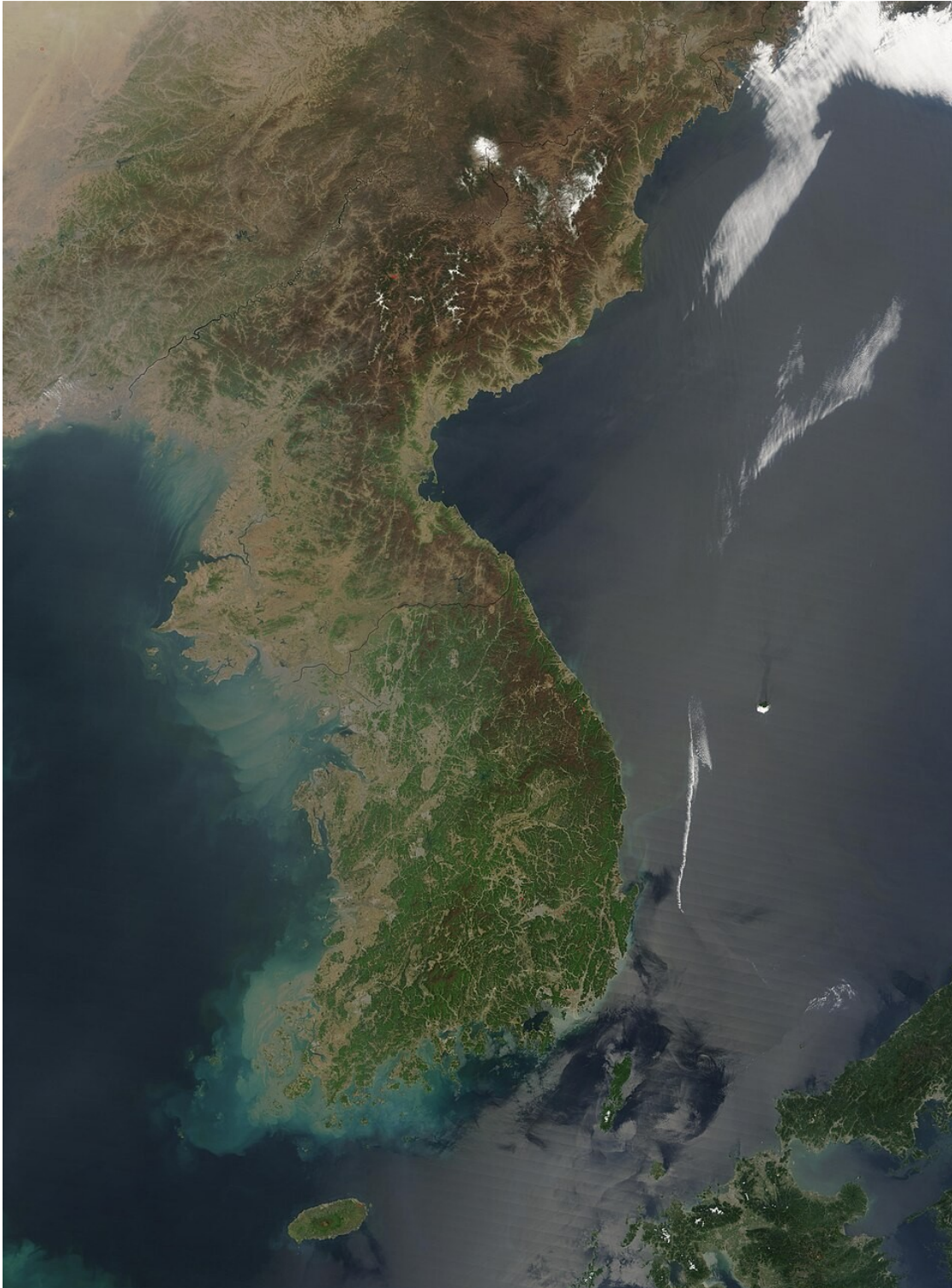


Figure 1 – Moderate Resolution Imaging Spectroradiometer (MODIS) Image of Korea  
Credit: Jeff Schmaltz, [NASA's Visible Earth](#), [public domain](#)

[Korea](#) is situated on a peninsula in [East Asia](#) and includes [Jeju Island](#) together with some smaller islands. The Korean Peninsula is divided between two states: [North Korea](#) (Democratic People's Republic of Korea, DPRK) and [South Korea](#) (Republic of Korea, ROK). Korea shares land borders with [China](#), to the northwest, and [Russia](#), to the northeast. To the southeast, across the [Korean Strait](#), is [Japan](#). The total area of Korea is 223,172 square kilometres (km<sup>2</sup>).

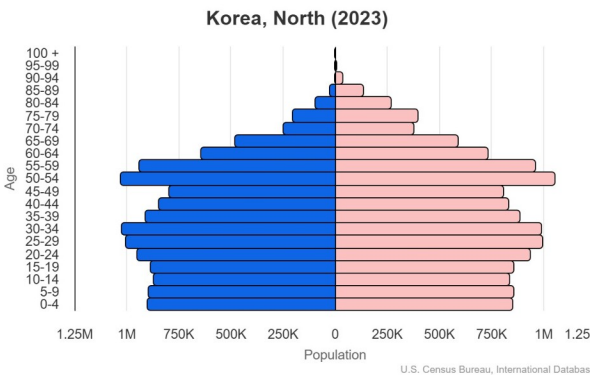
The DPRK is a unitary one-party [socialist republic](#) under a [totalitarian hereditary dictatorship](#). The current leader is [Kim Jong Un](#) (a.k.a. Dear Leader); the Premier is [Pak Thae-song](#); and the Vice President is [Choe Ryong-hae](#). The legislature is called the [Supreme People's Assembly](#) whose Chairman is [Pak In-chol](#). The Capital City and largest city in the DPRK is [Pyongyang](#) (pop. 3,157,538).

The ROK is a unitary [presidential republic](#). The current acting President and Prime Minister is [Lee Ju-ho](#). The legislature is called the [National Assembly](#), whose Speaker is [Woo Won-shik](#). The Capital and largest city in the ROK is [Seoul](#) (pop. 9,659,322 in the metropolitan area).

According to the [Central Intelligence Agency](#) (CIA) [World Factbook on the DPRK](#), the total area of the country is 120,538 km<sup>2</sup>, of which 120,408 km<sup>2</sup> is land and 130 km<sup>2</sup> is water. The population of the DPRK, according to the CIA, is 26,298,666, 63.2% of whom live in urban areas. Of the approximate 26.3 million people in the DPRK, almost all are ethnic [Korean](#) with a very small number of [Chinese](#) and [Japanese](#) (some Japanese are in Korea [unwillingly](#)). [Korean](#) is the official language. In terms of religion, the CIA states that “autonomous religious activities now almost nonexistent; government-sponsored religious groups exist to provide illusion of religious freedom”. Traditional religions in the DPRK are [Buddhism](#) and [Confucianism](#). There are also some [Christians](#) and followers of [Chondogyo](#) (Religion of the Heavenly Way). In terms of education, 100% of the total population aged 15 and over can read and write and people can expect to stay in school 11 years. Economically, the per capita [GDP \(PPP\)](#) is \$1,800; the [Gini](#) coefficient is 16.6, indicating low inequality (everyone is poor); and the [Human Development Index](#) is high at 0.766. In 2023, [the top exports of North Korea](#) were fake hair (\$167m), ferroalloys (\$33.3m), tungsten ore (\$25.9m), electricity (\$22.3m), and cars (\$17.8m). The top destinations were China (\$292M), Poland (\$10.3M), Senegal (\$10.3M), Angola (\$10.2M), and Austria (\$10.1M). Also in 2023, the top [imports of North Korea](#) were processed hair (\$160m), soybean oil (\$90m), mixed mineral or chemical fertilizers (\$80.7m), synthetic filament yarn woven fabric (\$80.5m), and rice (\$76.8m). The top origins were China (\$2B), Togo (\$24.7M), Peru (\$18.5M), Gabon (\$17.7M), and India (\$1.88M).

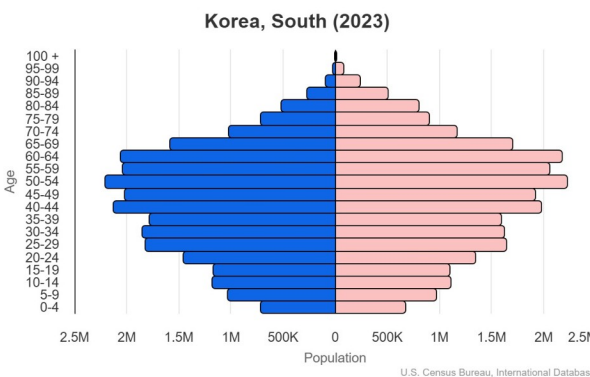
According to the CIA [World Factbook on the ROK](#), the total area of the country is 99,720 km<sup>2</sup>, of which 96,920 km<sup>2</sup> is land and 2,800 km<sup>2</sup> is water. Also according to the CIA, the population of the ROK is 52,081,799, 81.5% of whom live in urban areas. Of that approximately 52 million people, almost all are ethnic Koreans with some [Chinese](#) and a few other foreigners such as [English language teachers](#). Korean is the official language, and many [Koreans have learned English](#). In South Korea 60% say they have no religion; [Protestant Christians](#) are 17%; Buddhists are 16%; and [Catholic Christians](#) are 6%. Many people in the ROK also carry on at least some Confucian traditions and practices. In terms of education, 98.8% of the total population are literate and people can expect to stay in school for 17 years. Economically, the per capita [GDP \(PPP\)](#) is \$65,112; the [Gini](#) coefficient 33.36, is 16.6, indicating medium inequality; and the [Human Development Index](#) is very high at 0.937. The [top exports of South Korea](#) were integrated circuits (\$9.78b), cars (\$6.3b), refined petroleum (\$3.63b), motor vehicles; parts and accessories (8701 to 8705) (\$1.71b), and passenger and cargo ships (\$1.59b). The most common destination for the exports of

South Korea are China (\$162B), United States (\$118B), Hong Kong (\$28.8B), Japan (\$28.4B), and Chinese Taipei (\$28.2B). The top [imports of South Korea](#) were crude petroleum (\$6.3b), integrated circuits (\$4.74b), petroleum gas (\$2.75b), refined petroleum (\$1.89b), and machines and apparatus of a kind used solely or principally for the manufacture of semiconductor boules or wafers, semiconductor devices, electronic integrated circuits or flat panel displays (\$1.57b). [Over three-fifths](#) (63.1%) of South Korea’s total imports by value in 2024 was purchased from fellow Asian countries. Trade partners in North America supplied 13.7% of South Korean import purchases while another 13% worth originated from Europe. Smaller percentages came from providers in Oceania (5.2%) led by Australia and New Zealand, Latin America (3.1%) excluding Mexico but including the Caribbean, then Africa (1.8%).



**Figure 2a – Demographics of North Korea**  
[Credit: U.S. Census Bureau, International Database, public domain](#)

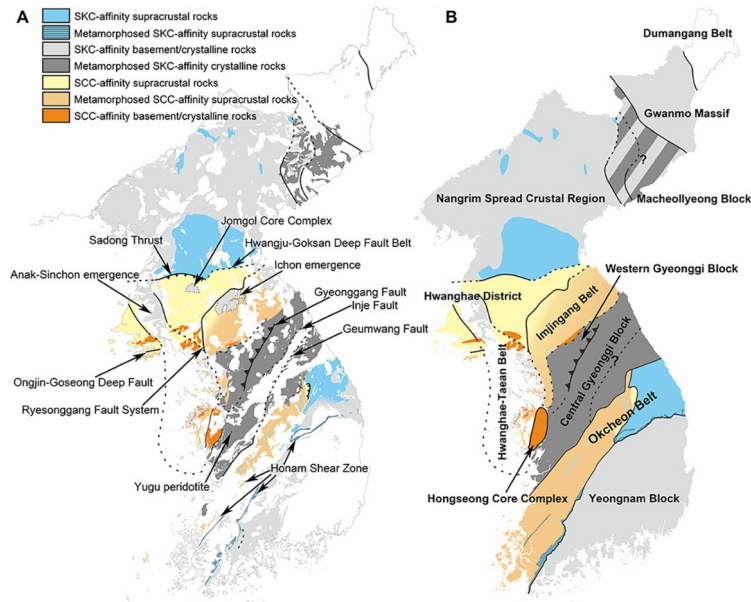
The demographic profile for North Korea shows a middle-aged country with a relatively stable population. The median age is 35.9 years; 19.9% of the population is under 15 years of age; and 68.9% are between 16 and 64. The total fertility rate is 1.82 births per woman (below the replacement rate of 2.1), the net migration rate is 0.0 migrant(s)/1,000 population (almost no one gets in or out), and the annual growth rate is 0.40%. The life expectancy for both sexes is 72.9 years (male: 70.2 years, female: 77 years).



**Figure 2b – Demographics of South Korea**  
[Credit: U.S. Census Bureau, International Database, public domain](#)

The demographic profile for South Korea shows an aging population that is shrinking and may, in fact, be in [demographic collapse](#). The median age is 45.5 years; 11.3% of the population are under 15 years of age; 69.4% are between 15 and 64 years of age; and 19.3% are over the age of 65. The total fertility rate is 0.72 births per woman (below the replacement rate of 2.1), the net migration rate is 2.6 migrant(s)/1,000 population, and the annual growth rate is -0.14%. The life expectancy for both sexes is 84.3 years (male: 80.3 years, female: 86.6 years).

## Geology



**Figure 3 – Tectonic Evolution of Korea**

**Credit:** Graphical Abstract of [Park et al, 2025](#)

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The geology of Korea is a reflection of its [evolution](#); the main components of Korea's geology are:

1. In the Northeast of Korea are the Macheollyeong Belt, the Gwanmo Massif, and the Dumangang Belt. The [Paleoproterozoic](#) aged Macheollyeong Belt consists of low-grade metasedimentary sequences of the [Macheollyeong Group](#). [Triassic](#) aged plutons intrude into the Macheollyeong Belt. The Gwanmo Massif includes [Late Archean](#) to Paleoproterozoic aged [amphibolites](#), [greenschists](#), [banded iron formations](#), [mica schists](#) and [gneisses](#). [Permian](#) aged [granitoids](#) and [Jurassic](#) aged [batholiths](#) intrude the [Gwanmo Massif](#). The Dumangang Belt consists of Archean aged [basement rock](#) overlain by [Carboniferous](#) to Permian aged sedimentary rocks. Also included in the Dumangang Belt are [Late Permian](#) aged [ophiolites](#) in the southwestern part of the Dumangang Belt.
2. Also in North Korea is the [Nangrim Massif](#). The basement rocks of the Nangrim Massif consist of the gneisses of the Archean aged Nangrim Group and the gneisses and schists of the Paleoproterozoic [Jeungsan Group](#). Overlying the basement rocks are metasedimentary sequences including the [Mesoproterozoic Hwanghae Group](#), the [Neoproterozoic Sangwon Supergroup](#), and the [Ediacaran Guhyeon Group](#). Neoproterozoic dyke sills and [Cambrian](#) to [Devonian](#) sequences are also distributed in the southern part of the massif. Also in the area of the Nangrim Massif is the [Paleozoic](#) aged [Pyeongnam Sedimentary Basin](#) as well as several small-scale [Late Jurassic](#) to [Early Cretaceous](#) aged sedimentary basins.
3. In the middle of the Korean Peninsula is the [Gyeonggi Massif](#). The crystalline basement of the massif consists of massif mainly of banded, [porphyroblastic](#) or [augen](#) gneisses together with minor amounts of [marble](#), amphibolite, and [quartzite](#). The massif has been intruded by widespread Jurassic granitoids. In the western part of the massif includes [Neoproterozoic](#) aged

[tonalitic migmatites](#), Neoproterozoic plutonic intrusions and meta-igneous rocks, the Paleozoic Wolhyeonri Complex, and Triassic aged non-marine sequences. In the central part of the Gyeonggi Massif are the Neoproterozoic [Gubongsan Group](#) and the [Gapyeong Formation](#). In the eastern part of the massif there are small patches of strongly metamorphosed Devonian sequences. The Gyeonggi Massif is intruded by several Triassic aged plutons, including some small-scale diorites and gabbros. Throughout the massif are several small-scale non-marine basins such as the [Yuljeon Basin](#) in the mid-eastern part of the massif. In the northwestern part of the massif is the Triassic to Jurassic aged sandstones of the [Gimpo Group](#). There are also two Early Cretaceous aged sedimentary basins the [Namyang and Tando](#) Basins in the midwestern part of the massif. In the southern part of the Gyeonggi Massif are the [Pungam](#), [Eumseong](#), [Gongju](#), and [Buyeo](#) sedimentary basins. All these small basins filled [grabens](#) formed by [extensional tectonic](#) actions.

4. The southernmost part of the basement of the Korean Peninsula is the [Yeongnam Massif](#) which includes the [Taebaeksan Basin](#). These basement rocks are various kinds of Paleoproterozoic gneiss and granite with Permian to Triassic aged plutonic intrusions. While much of the basin is the Cretaceous aged [Gyeongsang Basin](#), the northern part of the massif is overlain by the Paleozoic Taebaeksan Basin which consists of the Cambrian to [Ordovician](#) aged Joseon Supergroup and the unconformably overlying Carboniferous to Permian [Pyeongang Supergroup](#). There are also several Late Cretaceous basins, including the [Yeongdong](#), [Muju](#), [Jinan](#), [Neungju](#), [Hampyeong](#), and [Haenam](#) basins.
5. The [Imjingang Belt](#) is an E-W trending [fold and thrust belt](#), located at the northern margin of the Gyeonggi Massif and consists largely of Devonian to Carboniferous aged metasedimentary strata.
6. The [Okcheon Belt](#) is a NE-SW-trending fold and thrust belt located at the southeastern boundary of the Gyeonggi Massif, where it contacts the Yeongnam Massif. It consists largely of weakly metamorphosed Neoproterozoic–Paleozoic sequences.
7. The [Pyeongnam Basin](#) refers to the region in midwestern North Korea where the Cambrian to Ordovician aged [Joseon Supergroup](#) and the late Paleozoic [Pyeongang Supergroup](#) are found. The Joseon Supergroup is a shallow marine siliciclastic-carbonate succession. The Pyeongan Supergroup consists of siliciclastic deposits disconformably overlying the Joseon Supergroup
8. In the midwestern part of South Korea are three distinct lithotectonic units: the [Chungnam Basin](#), the [Wolhyeonri Complex](#), and the [Taeon Group](#). The Chungnam basin is a Late Triassic to Early Jurassic sedimentary basin. The Wolhyeonri Complex consists of Neoproterozoic igneous and sedimentary rocks that were metamorphosed by the middle Paleozoic thermal event. The Taeon Group is an Upper Paleozoic sedimentary sequence.

Figure 4 is a general geologic map of Korea.

Geologic Map of the Korean Peninsula

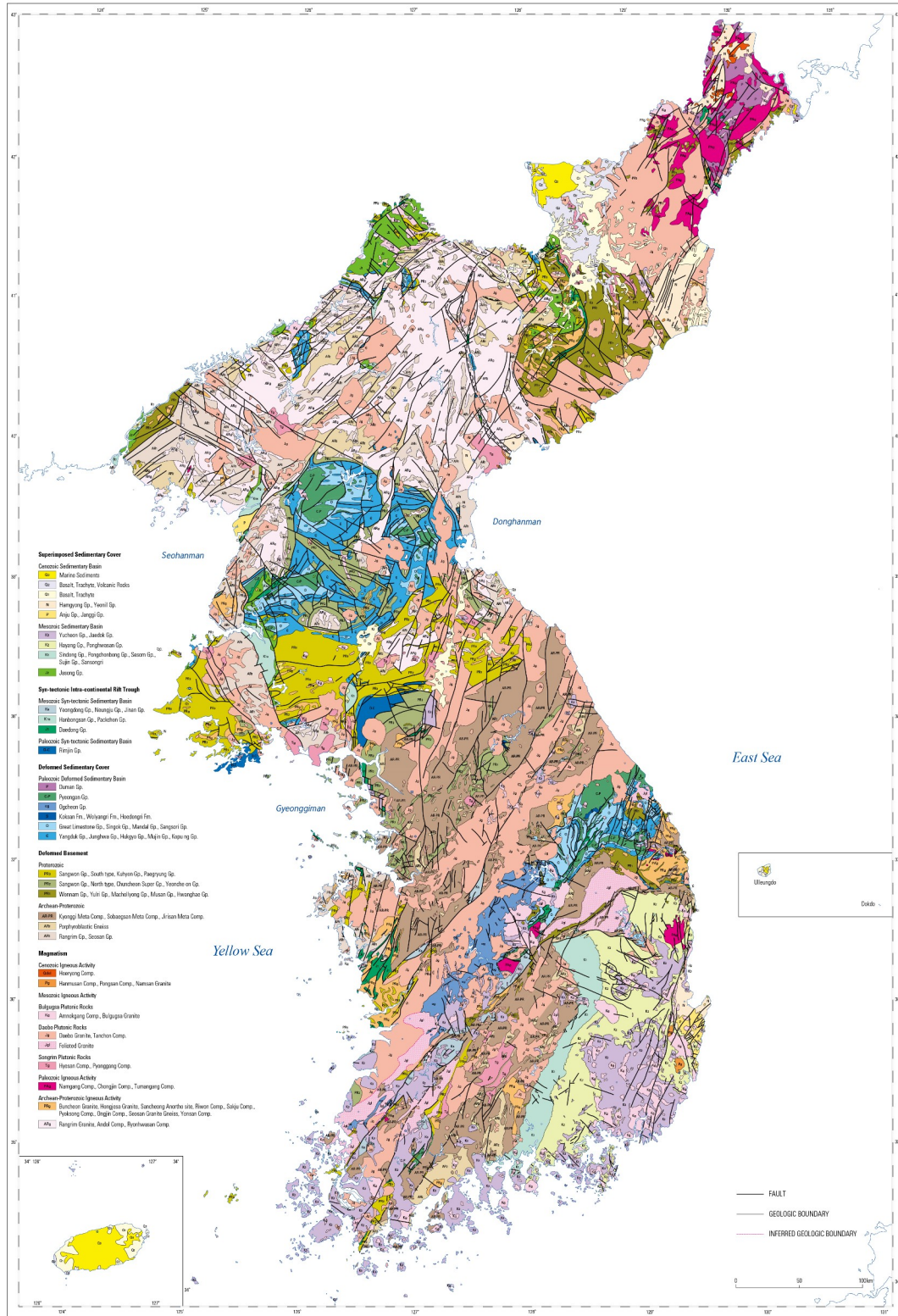


Figure 4 – General Geology Map of Korea

Credit: [The National Atlas of Korea, Vol II](#), ©Ministry of Land Infrastructure and Transport

For further reading on the Geology of Korea, there is a lot to read, follow up on the links above and check out these two publications:

- Sung Kwun Chough, 2013, *Geology and Sedimentology of the Korean Peninsula*, Elsevier, <https://doi.org/10.1016/C2012-0-02847-5>, another download site [here](#).
- Lee, Dai Sung, 1987, *Geology of Korea*, Geological Society of Korea, archived [here](#).

## Resources

### *Food Production*



**Figure 5 – Rice Paddy in Gyeongju, South Korea**

**Credit: riNux, [Creative Commons Attribution-Share Alike 2.0 Generic](#) license**

According to the CIA in North Korea 21.5% of the land is used for agriculture (arable land: 19.1%, permanent crops: 2.1%, permanent pasture: 0.4%) and in South Korea 16.2% of the land is used for agriculture (arable land: 13.5%, permanent crops: 2.1%, permanent pasture: 0.6%). Forest and other uses make up the rest of the land use. The top ten crops in North Korea, based on tonnage, are: maize, vegetables, rice, apples, cabbages, fruits, sweet potatoes, potatoes, beans, and soybeans. In South Korea, the top ten crops, based on tonnage, are: rice, vegetables, cabbages, milk, onions, pork, chicken, eggs, tangerines/mandarins, and potatoes. Agriculture makes up 22.5% of the GDP in North Korea and 1.6% of the GDP in South Korea. Statistics on agricultural production from the [United Nations Food and Agriculture Organization](#) (FAO) can be found [here](#).

A couple of interesting statistics. South Korea grows a wider variety of agricultural products than North Korea, with the data table for the ROK showing 93 crop or livestock entries and the table for the DPRK showing only 59. Also, according to the FAO, 45.3% of the population of the [DPRK](#) was malnourished in 2017-19 (the last date for available statistics) whereas 2.6% of the ROK was considered malnourished in 2002-04 (the last date they bothered collecting that statistic). The FAO [Global Information and Early Warning System](#) file on North Korea is [here](#), and the file on South Korea is [here](#).



**Figure 6 – A Fishing Boat at [Ganghwa Island](#)**  
**Credit: [Nt, Creative Commons CC0 1.0 Universal Public Domain Dedication](#)**

Koreans love [to eat fish](#) and the fishing industries in both the [DPRK](#) and the [ROK](#) are significant sources of food for both parts of the peninsula. The industry in the both the ROK and DPRK includes wild-caught fish, [aquaculture](#) and a [recreational fishery](#). A lot of the recreational fishery in the DPRK is actually people supplementing their diet.

Both the Koreas have issues with fisheries management and the DPRK has been accused of [pirate fishing operations](#). Also, both countries have had [issues with China](#) with regards to fisheries management. An interesting, though sad fact, is that North Korean fishermen frequently get lost at sea, with their [ghost ships](#) and dead crews washing up on shore.

Statistics on fishing from the FAO on the ROK catch can be found [here](#). In 2001 (the latest available information) the catch in the DPRK amounted to 200,000 tons and aquaculture produced 63,700 tons.

## Mineral Resources

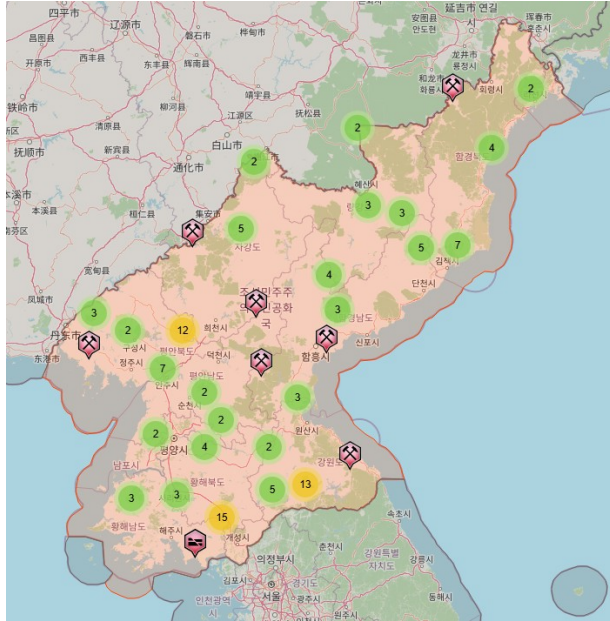


**Figure 7 – [Janggunitite](#) Sample from [Jaesan-myeon](#)  
Credit: [KIGAM](#), [Korea Open Government License Type I: Attribution](#)**

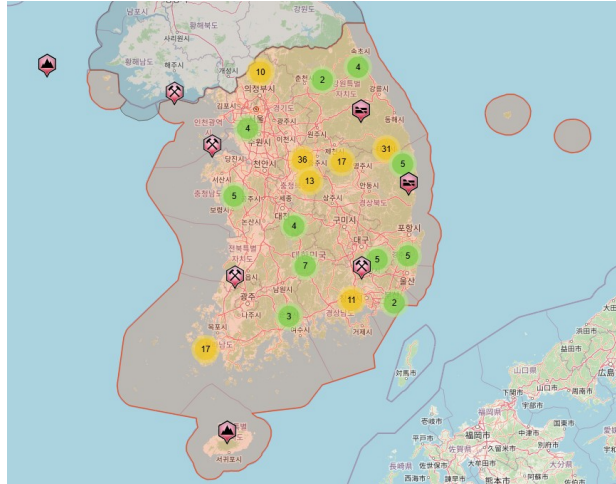
The complex geology of Korea has given the peninsula a wide variety of mineral resources. According to the [USGS Minerals Yearbook for North Korea](#), the DPRK produces metallic minerals, industrial minerals, and fuel/energy minerals. Metallic minerals include copper, gold, lead, iron ore, molybdenum, silver, tungsten, and zinc. Industrial minerals include cement, graphite, magnesite, phosphate rock, and sea salt. Fuel minerals include coal and uranium. Mine locations are shown on Table 2 of the yearbook.

According to the [USGS Minerals Yearbook for the Republic of Korea](#), the ROK also produces metallic minerals, industrial minerals, and fuel/energy minerals. Metallic minerals include antimony, cadmium, copper, gallium, gold, indium, iron, lead, lithium, molybdenum, nickel, palladium, platinum, rhenium, silver, and zinc. Industrial minerals included bismuth, clay, cement, diatomaceous earth, feldspar, graphite, limestone, marble, mica, nephrite jade, quartzite, pyrophyllite, sea salt, talc, titaniferous magnetite and titanium oxide, and zeolites. Fuel minerals include coal, natural gas, and petroleum. Mine locations are shown on Table 2 of the yearbook.

Figures 8a and 8b link to interactive mineral occurrence maps of the [DPRK](#) and the [ROK](#).



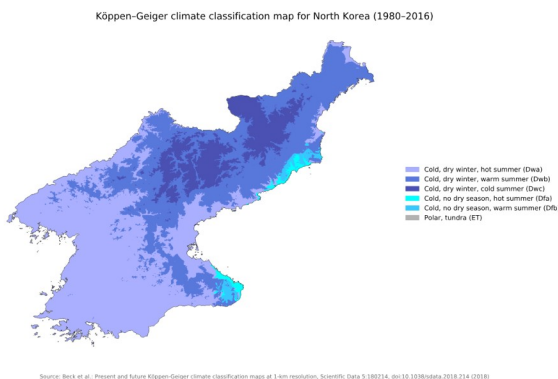
**Figure 8a – Interactive Mineral Occurrence Map of North Korea, Credit ©Mindat.org**



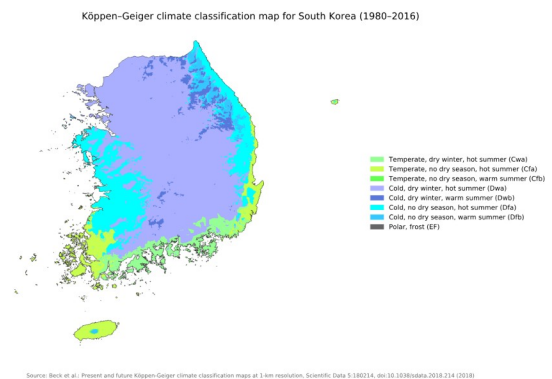
**Figure 8b – Interactive Mineral Occurrence Map of South Korea, Credit ©Mindat.org**

Not shown on the Mindat maps are the locations of the petroleum and natural gas deposits. Petroleum and natural gas are extracted from the [Donghae-1](#) field in the offshore [Ulleung Basin](#) (a.k.a. [Tsushima Basin](#)) in the [East Sea \(Sea of Japan\)](#). Recent report indicates that [Korea's Ulleung Basin may hold 5.1 billion barrels of oil reserves](#).

## Climate



**Figure 9a – Köppen Climate Map, DPRK**  
**Credit: Beck et al, 2018, Creative Commons Attribution-Share Alike 4.0 International license**



**Figure 9b – Köppen Climate Map, ROK**  
**Credit: Beck et al, 2018, Creative Commons Attribution-Share Alike 4.0 International license**

The climate of Korea is generally temperate, colder in the north and more temperate in the south, the climate zone are: Temperate, dry winter, hot summer ([Cwa](#)); Temperate, no dry season, hot summer ([Cfa](#)); Temperate, no dry season, warm summer ([Cfb](#)); Cold, dry winter, hot summer ([Dwa](#)); Cold, dry

winter, warm summer ([Dwb](#)); Cold, dry winter, cold summer ([Dwc](#)); Cold, no dry season, hot summer ([Dfa](#)); Cold, no dry season, warm summer ([Dfb](#)); and Polar, frost ([EF](#))

South Korea looks like a good place to visit. It is a modern industrial country with all the amenities that you would expect. The [South Korean official tourism site](#) has useful information. [Lonely Planet](#) and [Climates to Travel](#) also have useful information. Travel advisories, [here](#) and [here](#), suggest normal precautions. As usual, keep an eye on the news before you travel to the ROK.

As for North Korea, the best advice is just not to go. Travel advisories, [here](#) and [here](#), concur with that advice. The people that run the DPRK really don't want outsiders to see what they are up to.

## History and Geopolitics

### History

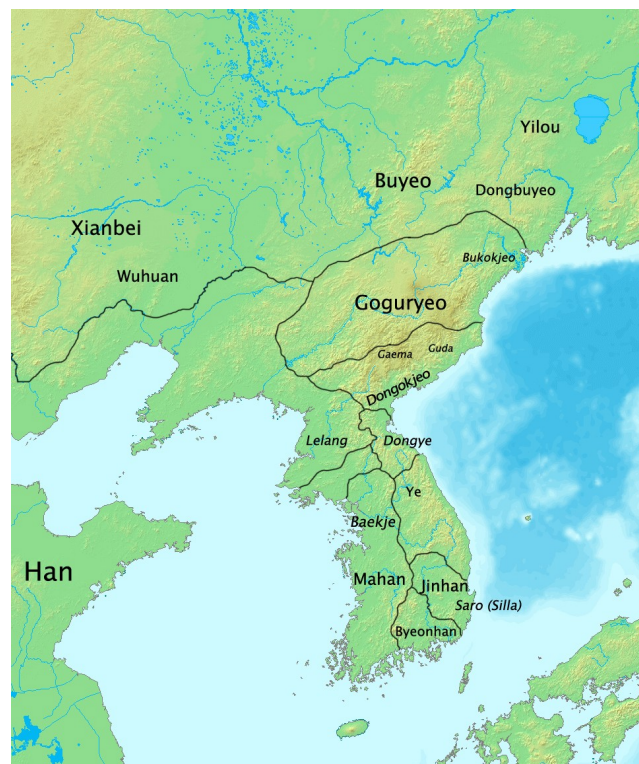


Figure 10 – Korea ca. 1 AD

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

The [history of Korea](#) has lots of interesting details, and if you want to look into them, check out these links [here](#) and [here](#) for a start. Before going into the more modern history of Korea, let look at three of the general trends that have shaped the country's culture and outlook.

1. **Unity and disunity.** For much of Korea's history there was no unified Korean state. In the years between 1 AD and 1000 AD, Korea was generally divided between at least [three states](#), sometimes more. Needless to say, these states engaged in [regular interstate warfare](#). Eventually, one state, [Goryeo](#), came to dominate the peninsula evolving into the [Joseon state](#) in 1392 and later a [Korean Empire](#) from 1897–1910.

2. **Foreign Occupation.** As if their internal disputes were not enough, Koreans have had to endure foreign invasions and occupation at various points in their history. Foreign invaders/occupiers include:
- China. One of the earliest state level societies in Korea, the [Gojoseon](#) Kingdom, became a vassal of the [Han dynasty](#) in the late 2<sup>nd</sup> Century BC;
  - The [Khitan](#)-led [Liao dynasty](#) of [Northeast China](#) and the [Mongolian Plateau](#) invaded and occupied the northern part of the Korean Peninsula around 1000 AD;
  - The [Mongols](#) invaded and conquered Korea, ruling the country as part of the Chinese Yuan Dynasty in the 13<sup>th</sup> and 14<sup>th</sup> Centuries AD;
  - The Japanese unsuccessfully invaded Korea in the [Imjin War](#), 1592 – 1598; the Chinese [Ming Dynasty](#) sent troops to help the Koreans eject the Japanese;
  - Again, the [Japanese, in 1910](#), this time the Japanese stayed until 1945;
  - The [Soviet Union](#) (in North Korea) and the [Americans](#) (in South Korea) in [1945](#).
3. **Foreign Influence.** One of the biggest cultural influences on Korea has been [from China](#). Starting in [ancient times](#), the Chinese have influenced agriculture, [religion](#), and government administration in Korea. In more recent times, Western religions and political ideologies, such as [Marxism](#) and [Capitalism](#), have taken hold in Korea. The DPRK, in particular have really taken to the [Stalinist interpretation of Marxism](#), with the predictable results such as the [mass incarceration of political dissidents](#) and other [human rights abuses](#). [Market capitalism](#) has taken hold of the ROK, with the consequence of creating a modern industrial state.



Figure 11 – Crew of an M24 Tank along the Naktong River Front, August 17, 1950  
[Credit: Sgt. Riley, U.S. Army, public domain](#)

The modern history of Korea begins with the [post-WW2 settlement of Korea](#) when the [Soviet Union's army in Manchuria](#) occupied the northern half of the Korean peninsula and [American troops](#) occupied the southern half. The Soviets installed a loyal Communist, [Kim Il Sung](#) (grandfather of the current Dear Leader) as President of the DPRK. The Americans installed [Syngman Rhee](#) as President of the ROK, he was also an [authoritarian](#). As the result of Kim's ambitions, DPRK troops invaded the ROK in 1950, sparking the [Korean War](#). The three years of the Korean War were a [bloody affair](#) and in the end, the border between the north and south changed only a little.

Following the Korean War, both north and south attempted to recover. In both countries, the recovery was slow and it can be argued that the DPRK never really got very far. It was a different story in the ROK, beginning in the 1980's the country went from [one of the poorest in the world to the modern industrial economy](#) that they are today.

### *Geopolitics – A Divided Nation*



**Figure 12 – The Bridge of No Return in [Panmunjeom](#) (border between the ROK and the DPRK)  
Credit: [User: Filzstift](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license**

The DPRK and ROK each have unique internal problems. For the DPRK, the leadership has the challenge of maintaining their iron grip on the country's politics. This requires constant vigilance, hence the walling off of the country from foreign, even Chinese Communist, influence. It is not easy, since the DPRK trades with China and Russia and has even [sent soldiers](#) to aid Russia in the Ukraine War. It will be interesting to see if Kim Jong Un can maintain his iron rule. Dear Leader is not stupid, and must understand that the most dangerous time for an authoritarian regime is when they attempt reforms and

loosen their grip on the country's politics. Don't expect any reforms soon. However, while strong, the DPRK authoritarian regime may be brittle. Kim has to worry about ambitious army officers overthrowing him. If and when it comes, regime change in the DPRK could be rapid, and bloody. I sure that there are some people on either side of the border who would like to see Kim swinging from a lamppost.

For the ROK, their problems are no less severe. Although they have a lively democracy – you got to admire people willing to get into [fist fights in their National Assembly](#) – and a powerful economy, the demographics of South Korea suggest that something has gone terribly wrong. You would expect a happy people to easily replace themselves. But this is not happening, in fact, the country appears to be on the verge of demographic collapse.

Having defeated many foreign foes, the Koreans may be laid low by the forces of [modernity](#). One [common feature of modern society](#) is the difficulty that many young people have in both family formation raising children. This, of course impacts on how the larger society maintains enough people to function. I think that examining [incentives](#) might be the key to solving this problem, although there may be a place for encouraging traditional family structures. While it is very profitable to put young women to work in factories, the long term result of this policy is to de-incentivize child rearing. For many women in the modern world, like Korea, there just isn't the time to both work and raise the kids. Destroying your future workforce and consumer base may not be so profitable after all.

Externally, both the DPRK and ROK have a common problem – each other. For their part, the DPRK keeps constant pressure on the ROK, as in this [story](#). The ROK fears a repeat of the 1950 invasion, they have built up very effective armed forces and are constantly vigilant. They also have the [American allies](#) to help.

For their part, the DPRK fear the influence of the ROK. The South has shown what hard working people – and most Koreans are hard working – can build given a little freedom. The fear of the ROK, and their American allies, probably lies behind the [DPRK acquisition of nuclear weapons](#) – the ultimate “don't mess with us” statement.

Besides the Americans, other countries have a stake in what happens in Korea. Russia is interested in trade and especially the ammunition ([152 mm howitzer shells](#)) that the DPRK are making for them. The North Korean soldiers helping out in the Ukraine War are also appreciated. While I doubt that Russia would want to take over the place, a hostile regime in Korea would be a threat to Russia's Far East outpost in Vladivostok.

China has a big stake in what happens in Korea. Their relationship with the DPRK resembles that hegemon/vassal relationship that occurred in ancient times where the Koreans were free to order their own affairs provided that they did not cause trouble for China. China also maintains a profitable commercial relationship with the ROK. For now, the situation suits China. However, a change in Korea, such as a re-unification under the auspices of the ROK, could be threatening to China and invite their intervention. Another cause for Chinese intervention in Korea is if the leadership of the DPRK becomes unstable, with an unknown status for who controls the nuclear weapons. Another related issue is: what would China do if the DPRK actually attacked someone with their nukes? The Chinese have little tolerance for disorder and would probably intervene to guard their own interests.

A final player in the power game in East Asia is Japan. With their huge economy, Japan has a large influence on their neighbours affairs. Unfortunately for Japan, there is little love lost between them and their Chinese or Korean neighbours – the memory of [Japanese behavior in WW2](#) is still on their minds even though the number of Japanese alive who actually participated in the horrors of the war is vanishingly small. No matter, past grievances are potent fuel for the national feelings of China and both Koreas. In fact one thing that both the ROK and the DPRK can agree on is their dislike of the Japanese. Still, Japan has a stake in what happens in the Korean Peninsula and can be expected to at least watch the situation closely if not actively assist their American allies.

That wraps up this short look at Korea. I am optimistic for the ROK, I think that they will not allow a demographic collapse. Expect some sort of movement, probably religious, that encourages family formation and child rearing. The South Koreans are already starting to [address the issue](#).

I am not so optimistic for the DPRK. As long as they are under the thumb of the Kim family, most North Koreans will endure miserable living conditions. Any change is likely to come from within the regime, for example by an ambitious army officer overthrowing Dear Leader and attempting to reform the country's civil and economic culture. It will not be easy, and could involve Chinese intervention to suppress disorder, and prevent the formation of a hostile regime.

Of course the elephant in the room is a possible outbreak of war between the North and South in Korea. There are many possible scenarios; here are a couple [here](#) and [here](#). If you have the curiosity, there are many more if you search for them. There is even a fantasy [YouTube channel](#) that presents battle simulations. If such a war breaks out, it is difficult to predict how it will end. It could take place as part of a larger Great Power conflict involving the USA, China, and Russia with some Japanese input.

It's worth keeping an eye on.

## **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.