

May 5, 2025

## News and notes

Before going on to discuss the geology and geopolitics of [Jordan](#), 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

- Politics of climate research: [Earth science societies take on US climate report after Trump administration dismisses researchers](#).
- Australian election: [Trump style governance? Australia's richest says yes, voters seem to disagree](#).
- [Trump announces secondary sanctions on any country that purchases oil or petrochemicals from Iran](#).
- [Venezuela Desperate For China To Buy More Oil](#).
- Civil disorder: [China Erupts: Furious Workers Riot As Factories Collapse Under Trump's Tariffs](#).
- [U.S., Ukraine Sign Minerals Deal in Major Breakthrough for Peace Talks](#).
- [Canada election tells a tale of 2 demographics split on top issues](#).
- [New front in US-China rivalry opens, this time in Congo's copper and cobalt mining heartland](#).

## Research and News

- [Hikers find gold cache worth up to \\$680,000 in Czech mountains](#).
- Bad science: [Weekend reads: Journal halts submissions, citing NIH cuts; rejected paper published by 'mistake'; feds cancel grant amid misconduct allegations](#).
- Writing geological reports: [Joint extraction method for entity relations from mineral resources reports integrating dependency parsing and improved graph convolutional networks](#).
- Geochronology: [Cretaceous and Cenozoic calcareous nannofossil biostratigraphy of the NW inland basins of Colombia](#).
- [Rift-Related Low-Pressure–High-Temperature Granulite Facies Metamorphism Generates Widespread Peraluminous Crustal Melts: Evidence From the Early Jurassic Mexican Crust](#).
- [Classification of compaction degree in shallowly buried extremely thick gravel layers and analysis of geological influencing factors](#).

- Deltas: [The Topset-Foreset Rollover Does Not Coincide With Real Shoreline Positions in Clinoforms Over Substrate Deformation.](#)
- AI and geology: [GeoMinLM: A Large Language Model in Geology and Mineral Survey in Yunnan Province.](#)
- [Stratigraphic structure and fault interpretation of the foreland basin system in the middle Taiwan Strait.](#)
- [Formation of Mg-silicates in the microbial sediments of a saline, mildly alkaline coastal lake \(Lake Clifton, Australia\): Environmental versus microbiological drivers.](#)
- [Mt Stuart, Washington State: Beware Occam's Razor.](#)
- [From concave-up to concave-down: river profile transitions driven by lowland avulsions in the Río Colorado terminus system, Bolivia.](#)
- Lithologic diversity: [Large melt diversity at a mid-ocean ridge thermal low.](#)
- [Seismic Geomorphology of an Early Eocene Canyon-Channel-Lobe System North of Shetlands.](#)
- Fluvial geology: [Hybrid approaches enhance hydrological model usability for local streamflow prediction.](#)
- [GRILSS: opening the gateway to global reservoir sedimentation data curation.](#)
- [Oligocene–Miocene development and evolution of the south Dome Rock Mountains basin, lower Colorado River corridor, Arizona, USA.](#)
- Radiometric dating: [Timing of Dike and Sill Emplacement in the Inner Aureole of the Alta Stock, Utah Determined by Zircon and Monazite Petrochronology.](#)
- [Legacy Seismic and Gravity Data in the Vicinity of Great Meteor Seamount and Its Tectonic Implications.](#)
- [Micro-Scale Characterization of Marine Sediment Structures: The Potential and Challenges of X-Ray  \$\mu\$ CT Imaging.](#)
- Geochronology: [Anchoring the Swedish Time Scale to the radiocarbon time scale – An absolute age for De Geer's zero varve.](#)
- [Cenozoic Structurally Controlled Hydrothermal Activity Revealed by Apatite Thermochronology in the Convoy Range \(Southern Victoria Land, Antarctica\).](#)
- It's aliens, aliens I tell you: [Enigmatic Deep-Water Seafloor Depressions East of Tortue Island, Northern Haiti Margin.](#)
- [A one-billion-year-old Scottish meteorite impact](#); Yahoo summary [here](#).

- [Detrital zircon geochronology and sedimentary provenance of the fossiliferous Ediacara Member, South Australia.](#)
- [Sedimentary response to glacial-interglacial cycles in an alluvial fan at the marginal East Asian monsoon zone, northern China.](#)
- [The Hidden Internal Flow Dynamics of Shear-Thinning Magma in Dikes](#); Phys.org summary [here](#).

## Plate Tectonics

- [Lower crustal foundering drove the uplift of southern Tibet during the Paleocene.](#)
- [Gondwanan continental collision drives gravitational spreading and collapse of the ancestral East Antarctic mountains.](#)
- [New Kinematic Model of the Early Opening of the Equatorial Atlantic Realm.](#)
- [Pure dip-slip along the Tuz Gölü Fault Zone accommodates east-west extension of Central Anatolia](#); Phys.org summary [here](#).
- [Heterogeneous Mantle Metasomatism Controlled by Continental Subduction: Evidence From Post-Collisional Mafic Rocks in the North Qaidam Orogen.](#)
- [Pacific hotspots reveal a Louisville–Ontong Java Nui tectonic link](#); Phys.org summary [here](#).
- [Hydration weakening and destruction of the North China Craton.](#)
- Japan's convergent plate boundary: [Unraveling Processes and Rheology of the Tohoku Earthquake Cycle Using Bayesian Inference.](#)

## Mineralogy

- Rare Earth Element mineralogy: [Allanite-\(Sm\),  \$\text{CaSm}\(\text{Al}\_2\text{Fe}\_2^+\)\(\text{Si}\_2\text{O}\_7\)\(\text{SiO}\_4\)\text{O}\(\text{OH}\)\$ , the third samarium mineral from Jordanów Śląski, Lower Silesia, Poland.](#)
- [Estimating the iron oxidation state of serpentinite using X-ray absorption fine structure spectroscopy.](#)
- [New Mineral Names!!!](#)
- [Nanoscale mineralogical evidence confirms Cu transport as chloride complexes in brines in the Central European Kupferschiefer district.](#)

## Paleontology

- [A Digital Analysis of the ‘Phoenix Trackway’ at the Hanxi Cretaceous Dinosaur Tracksite, China.](#)
- [Episodic body size variations of early Paleozoic trilobites associated with marine redox changes.](#)

- [New Late Cretaceous zhelestid mammal from the Bayanshiree Formation, Mongolia](#); Phys.org summary [here](#).
- [Early Devonian non-trilobite arthropods from the Iberian Chains \(North East, Spain\)](#).
- [A new pedunculate cirripede \(barnacle\) from the Early Cretaceous of Central Queensland, Australia](#).
- [For a while, crocodile: crocodylomorph resilience to mass extinctions](#); SciTechDaily summary [here](#).
- [Record of Foraminifera test composition throughout the Phanerozoic](#); Phys.org summary [here](#).

## Mining and Energy

- [OPEC+ Stuns Market With Larger Than Expected Output Hike](#).
- [US adds 10 more mining projects to fast-track permitting list](#).
- [Copper price rises as China considers trade talks with US](#).
- [Trump names NorthMet copper-nickel mine in Minnesota a federal priority](#).
- [Alberta oil sands projects poised to grow on lower costs, strong reserves](#).
- [US greenlights rare earth mine next to Mountain Pass in California](#).

## Ore and Petroleum Geology

- [Copper and gold metallogeny in West China: An overview](#).
- [Ambient noise tomography reveals deep ore-forming structures of shear zone-type gold deposits at Dongchuan, Kunming Province, China](#).
- [Superdeep Diamond Genesis Through Fe-Mediated Carbonate Reduction](#).
- [Alteration zonation and mineralogy of the Dibaonamugang Lithocap: Implications for mineral exploration in the Duolong Ore District, NW Xizang \(Tibet\), China](#).
- [Uranium and U-bearing minerals in the Husab uranium deposit in Namibia: Occurrence, composition, age, and implications for uranium mineralization process](#).
- Petroleum geology: [Formation permeability estimation using mud loss data by deep learning](#).
- [Geology, Geochemistry, and Potential Origins of the Basin Volcano-Sedimentary Lithium Deposit, Kaiser Spring Volcanic Field, Northwestern Arizona, U.S.A.](#)

## Environmental Geology and Hydrogeology

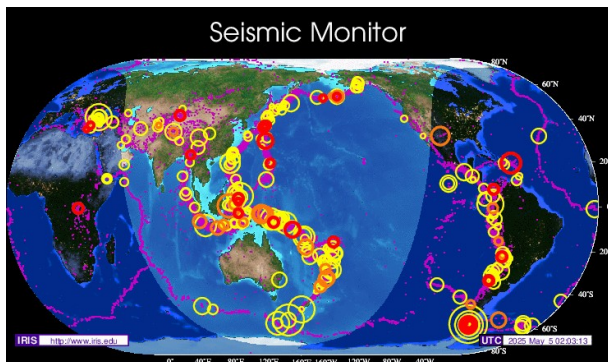
- [Study of well data reveals fluid pressure distribution and origin in the upper crust of the Irpinia region \(Southern Apennines, Italy\)](#).
- [Trump Administration Challenges State Climate Laws in Court](#).

- Carbon capture: [Revisiting the Stratigraphy and Structure of the Faroe Islands Flood Basalts for Large-Scale CO<sub>2</sub> Storage in Basalt Reservoirs.](#)
- [The role of a salt pillow in deep saline aquifer integrity and shallow groundwater resources.](#)

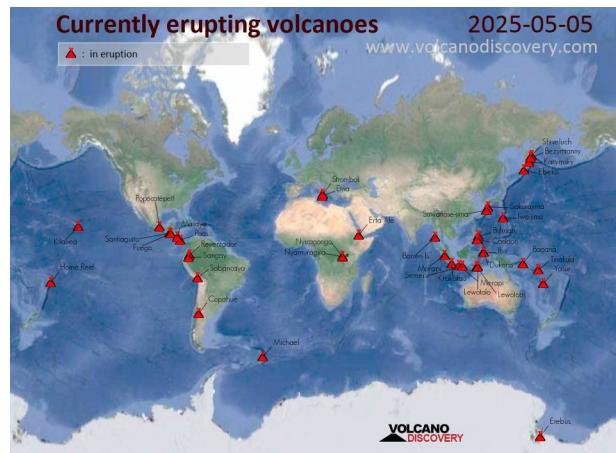
## Glaciers and Climate Change

- [Vegetation feedbacks accelerated the late Miocene climate transition](#); Phys.org summary [here](#).
- [Back to an ice-free future: Early Cretaceous seasonal cycles of sea surface temperature and glacier ice.](#)

## 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.](#)
  - [Ho‘omākaukau means preparedness.](#)
  - [Using custom earthquakes to define the top of Yellowstone’s magma reservoir.](#)
- [The recurrence of geophysical manifestations at the Campi Flegrei caldera](#); Phys.org summary [here](#).
- [Constraining the timing and climate forcing of the Long Island \(Papua New Guinea\) and Tarumae \(Japan\) eruptions and other 17th century volcanic eruptions.](#)
- [Low sulfur emissions from 2022 Hunga eruption due to seawater–magma interactions](#); Phys.org summary [here](#).

## **Earthquakes**

- [Euro-Mediterranean Seismological Centre \(EMSC\)](#).
- [Earthquakes Monitoring Live Worldwide](#).
- Research: [Estimating Focal Mechanism of Small Earthquakes Using S/P Amplitude Ratios of Distributed Acoustic Sensing Records](#).
- [Energy budget analysis of fault motion in a granular rock box simulation](#).
- [Upper Mantle Earthquakes Along the Edge of the Wyoming Craton](#).
- Drake Passage: [Unusual M7.4 earthquake strikes south of South America](#); USGS summary [here](#).
- [The Wasatch Fault: Geoheritage that Informs Society About Seismic Risk](#).
- Breaking rocks for fun and research: [Premonitory Slip, Rupture Propagation, and Frictional Sliding on Laboratory Faults in Porous Sandstone: Effects of Loading Rate and Confining Pressure](#).
- [Magnitude 4.1 earthquake shakes Salt Lake City](#); USGS summary [here](#).
- [Seismic Event Identification: Context to Confidence](#).
- [M6.2 and 6.8 earthquakes southwest of New Zealand](#); USGS summary [here](#).
- [Changes in seismic anisotropy at Ontake volcano: a tale of two eruptions](#); Phys.org summary [here](#).
- [Nonplanar 3D fault geometry controls the spatiotemporal distributions of slip and uplift: evidence from the Mw 7.5 2024 Noto Peninsula, Japan, Earthquake](#).
- [Earthquake activity in the Torishima Rift and Sofu Seamount, and its relationship to the October 2023 tsunamis in Japan](#).

## **Geohazards**

- Landslides: [Monitoring debris flow dynamics: insights from 4D-LiDAR observations in Ohya landslide, Central Japan](#).
- [Increased flood exposure in the Pacific Northwest following earthquake-driven subsidence and sea-level rise](#).

## **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

- [The USGS David A. Johnston Cascades Volcano Observatory will be hosting an Open House for the public on May 10, 2025!](#)
- [Geoscience Beyond Borders, GAC-MAC-IAH-CNC 2025 Ottawa, Ontario, May 11-14, 2025.](#)
- [GeoConvention 2025, Calgary Telus Convention Center May 12 – 14, 2025.](#)
- [May 15, 2025: NGWA’s Problematic Contaminant Webinar Series: Limiting Metals Mobilization During Managed Aquifer Recharge.](#)
- [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.
- [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](#).
- [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](#).

May 5, 2025

## Geology and the Fate of Societies – Jordan



Figure 1a – Jordan

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



Figure 1b – Location of Jordan

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

The [Hashemite Kingdom of Jordan](#) is found in the [Southern Levant](#) region of [West Asia](#). Jordan borders on [Syria](#) to the north; to the east is [Iraq](#); to the south is [Saudi Arabia](#); to the west are [Israel](#) and [Palestine](#). Also on the western border is the [Jordan River](#) and the [Dead Sea](#). Jordan also has a small coastline along the [Gulf of Aqaba](#), part of the [Red Sea](#) in its southwest. Across the Gulf of Aqaba is [Egypt](#).

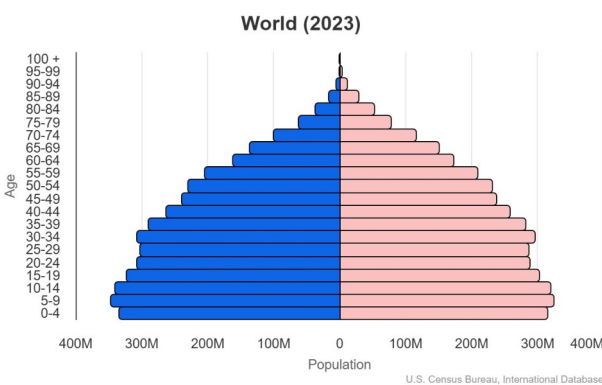
The government of Jordan is a unitary parliamentary [constitutional monarchy](#). The King is [Abdullah II](#), and his Prime Minister is [Jafar Hassan](#). The Jordanian legislature is called [Parliament](#) (مجلس الأمة, Majlis Al-Umma) which is divided into an upper house, [the Senate](#) (مجلس الأعيان, Majlis Al-Aayan) and a lower house, the [House of Representatives](#) (مجلس النواب, Majlis Al-Nuwaab). The Capital and largest city in Jordan is [Amman](#) (pop. 4,061,150).

According to the [Central Intelligence Agency](#) (CIA) [World Factbook](#), Jordan has a total area of 89,342 square kilometres (km<sup>2</sup>), of which 88,802 km<sup>2</sup> is land and 540 km<sup>2</sup> is water. Also according to the CIA, 11,174,024 people live in Jordan, 92% live in urban areas. The [Wikipedia site on Jordan](#) indicates that of the ~11.2 million people in Jordan, 95% are ethnic [Arabs](#), 3% are [Circassian](#) and [Chechen](#), 2% are [Armenians](#) and others. [Arabic](#) is the main language, [English](#) is a common second language.

Wikipedia indicates that almost all, 95%, of Jordanians are [Sunni Moslem](#). Of the remainder, 3% are various forms of [Christians](#), 1% are [Druze](#) and [Bahá'í](#), and the remaining 1% are something other. The

CIA indicates that 98.4% of the total population age 15 and older can read and write. People can expect to be in school for 10 – 11 years.

Economically, the per capita [GDP \(PPP\)](#) of Jordan is \$12,809; the [Gini Coefficient](#) is 35.4, indicating medium inequality; and the [Human Development Index](#) is high at 0.736. In 2023, the [top exports of Jordan](#) were potassic fertilizers (\$1.91b), calcium phosphates (\$1.05b), jewellery (\$824m), phosphoric acid (\$706m), and packaged medications (\$606m). The top destinations for their exports in 2023 were United States (\$3.14B), India (\$1.92B), Saudi Arabia (\$1.67B), China (\$1B), and Iraq (\$946M). In 2024, Jordan was the world's largest exporter of calcium phosphates (\$1.05b), and phenol derivatives (\$237M). In 2023, the top [imports of Jordan](#) were cars (\$2.31b), refined petroleum (\$1.8b), gold (\$1.35b), crude petroleum (\$1.04b), and jewellery (\$869m). The top origins for their imports were China (\$4.87B), Saudi Arabia (\$3.88B), United Arab Emirates (\$2.27B), India (\$1.58B), and United States (\$1.48B).

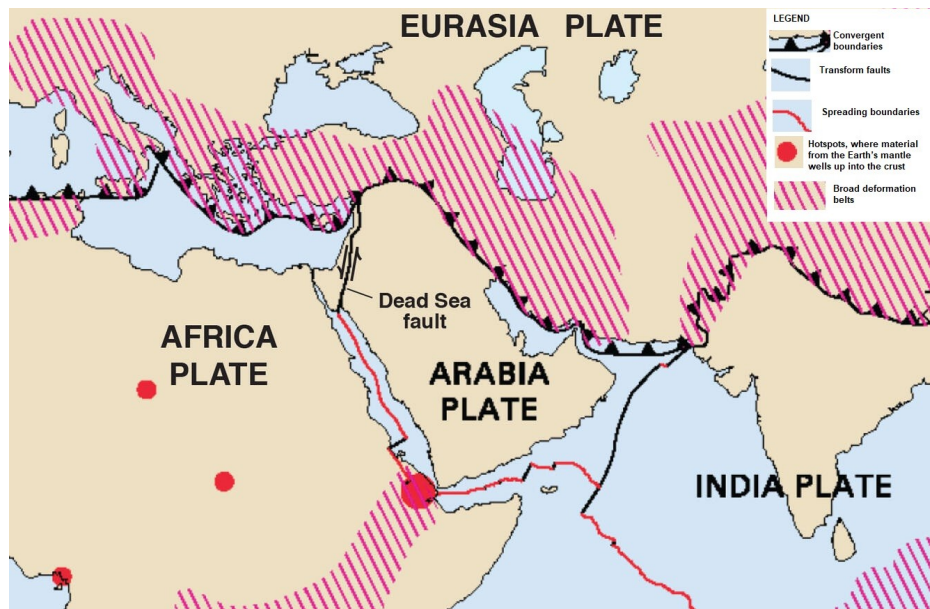


The [demographics of Jordan](#) show a fairly young population that is stabilizing. The median age is 25 years old; 30.9% of the population is less than 15 years old; and 64.9% is between 15 and 64 years old. The total fertility rate is 2.91 births per woman, above the replacement rate of 2.1. The net migration rate is -10.9 migrant(s)/1,000 population and the annual growth rate for the population is 0.79%. Jordanians can expect to live 76.3 years.

**Figure 2 – Demographics of Jordan**

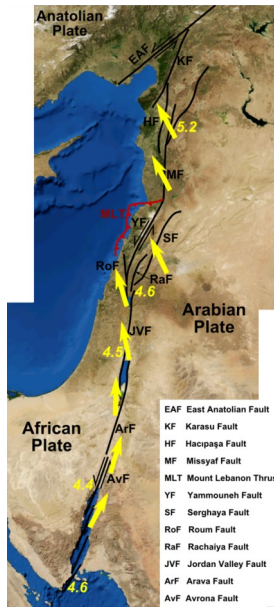
[Credit: U.S. Census Bureau, International Database, public domain](#)

## Geology



**Figure 3 – Plate Boundaries of the Middle East**

[Credit: USGS, public domain](#)



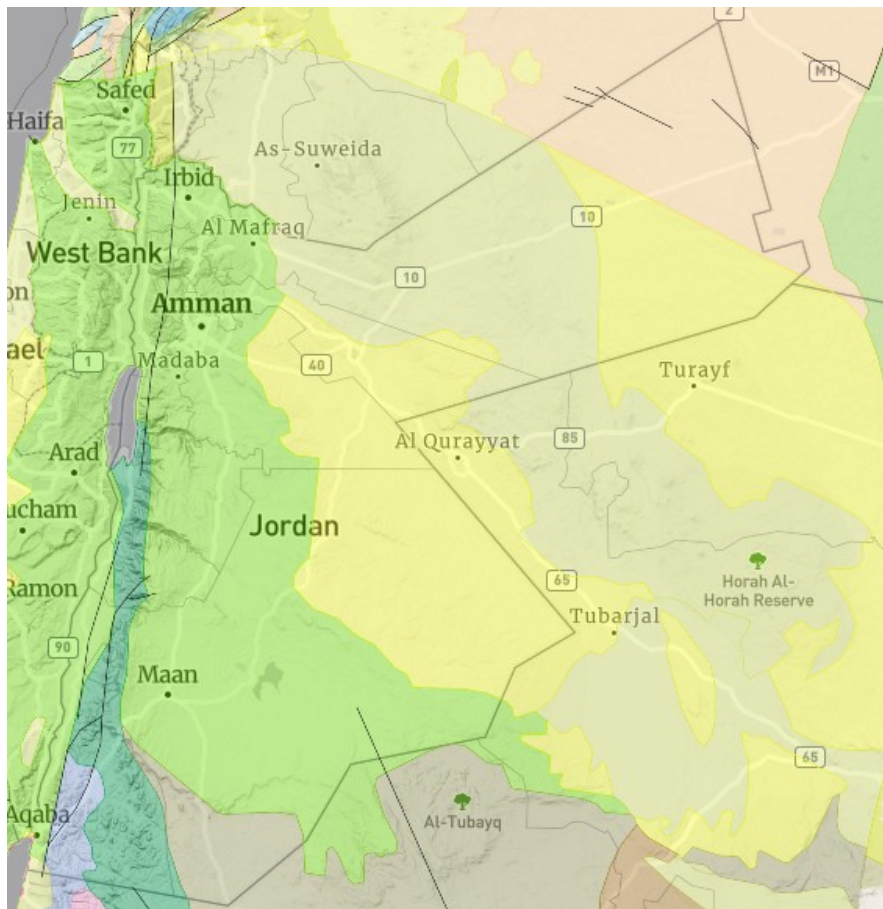
Jordan sits on the [Arabian Tectonic Plate](#). To the west is the [Dead Sea Fault](#), a [transform fault](#) in the [Jordan Rift Valley](#). Across the Jordan valley is the [African Plate](#).

Constituent faults in the Dead Sea Fault west of Jordan include:

- The [Avrona Fault](#);
- The [Arava Fault](#);
- The [Jordan Valley Fault](#); and
- The [Rachaiya Fault](#).

**Figure 4 – Dead Sea Transform Fault**  
**Credit: [Mikenorton, Creative Commons Attribution-Share Alike 3.0 Unported license](#)**

Figure 5, below, shows the basic bedrock geology of Jordan from [Macrostrat](#). To query the lithology, click open the figure, and click onto the lithology of interest.



**Figure 5 – Interactive Geology Map of Jordan (click on the map to go to interactive function)**  
**Credit: [Macrostrat, Creative Commons Attribution-Share Alike 4.0 International license](#)**

The Geology of Jordan ranges in age from [Precambrian](#) to [Holocene](#). The oldest rocks in Jordan are found in the Wadi al 'Arabah of south Jordan. These rocks are [Neoproterozoic](#) to [Cambrian](#) aged [basement rocks](#), mostly [plutonic intrusions](#) of [aplite](#), [diorite](#), [gabbro](#) and [granodiorite](#).

The next oldest deposits are Cambrian to [Ordovician](#) aged sedimentary rocks, mostly [sandstones](#), that outcrop along the eastern side of the Jordan Valley. Going further east, are [Late Cretaceous](#) sedimentary rocks, including [marls](#), [cherty limestone](#) and [phosphorite](#), originally deposited in the [Neo-Tethys Ocean](#).

Further east still are [Paleogene](#) to [Pleistocene](#) aged sedimentary rocks, mostly limestone, marl and [evaporites](#). Also, in the northeast corner of Jordan are [Eocene](#) aged limestones. Finally, there is a large area of [Quaternary](#) aged volcanic rocks, predominately [basalt](#).

For more information on the Geology of Jordan, check out the [Geology of Jordan – Field Guidebook](#).

## Resources

### *Agriculture*



**Figure 6 – Farmland in Jordan**

**Credit: [Dale Gillard](#), [Creative Commons Attribution 2.0 Generic](#) license**

According to the CIA World Factbook, 11.6% of the land in Jordan is agricultural land (2.3% arable land, 0.9% permanent crops, 8.4% permanent pasture). There are 875 km<sup>2</sup> of irrigated land in Jordan. Most agricultural land in Jordan is in the Jordan Valley. Of the remaining land, 1.1% is forest and 87.3% is something other, mostly desert. Agriculture accounts for 4.8% of the country's GDP. According to a [2021 report](#), agricultural production in Jordan supplies only 19% of Jordan's food requirements, employs 1.8% of country's workforce, uses 65% of Jordan's freshwater resources.

The top ten agricultural products in 2023, based on tonnage are tomatoes, milk, chicken, potatoes, olives, cucumbers/gherkins, onions, chillies/peppers, peaches/nectarines, and sheep milk. Production statistics

from the [United Nations Food and Agriculture Organization](#) (FAO) can be found [here](#). More information from the FAO on Jordan can be found [here](#) and [here](#). There are no statistics on food insecurity in Jordan.

### **Water Resources**



**Figure 7 – The River Jordan**

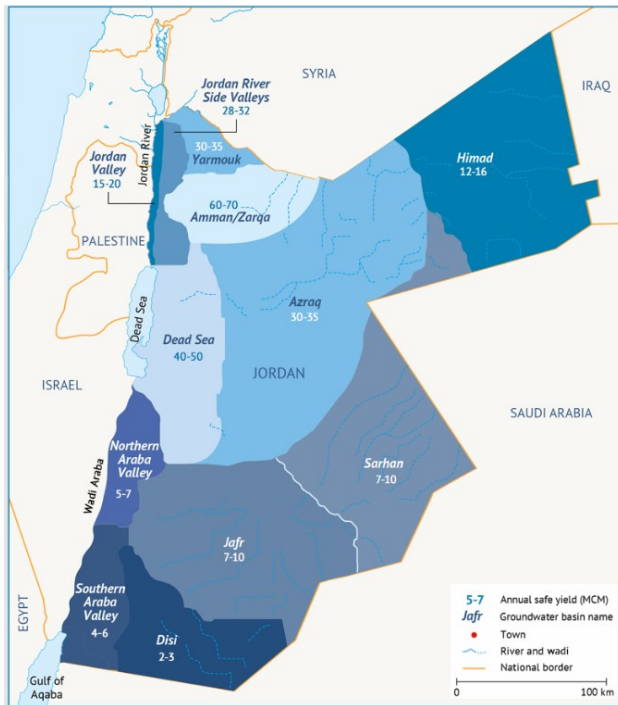
**Credit:** [Bill Rice](#), [Creative Commons Attribution 2.0 Generic](#) license

In a desert country like Jordan, water resources are a matter of life and death – that’s why Mark Twain is alleged to have said that “[whiskey’s for drinking and water is for fighting](#)”. As [Moslems](#), few Jordanians would be interested in the whiskey, but they would agree with the sentiment about water. The [water resources in Jordan](#) can be divided into surface water and groundwater.

Surface water resources in Jordan are from three rivers: the [Jordan](#), the [Yarmouk](#) and the [Zarqa](#). Surface water in Jordan contributes about 28% of the total water supply and provided 288 million cubic metres (MCC) of water in [2017](#). There are [conflicts over water use](#) in the region, such as between [Jordan and Syria](#) over the Yarmouk River, and especially between [Jordan and Israel](#) over the River Jordan. Control over [water resources was one of the causes of the 1967 Six Day War](#).

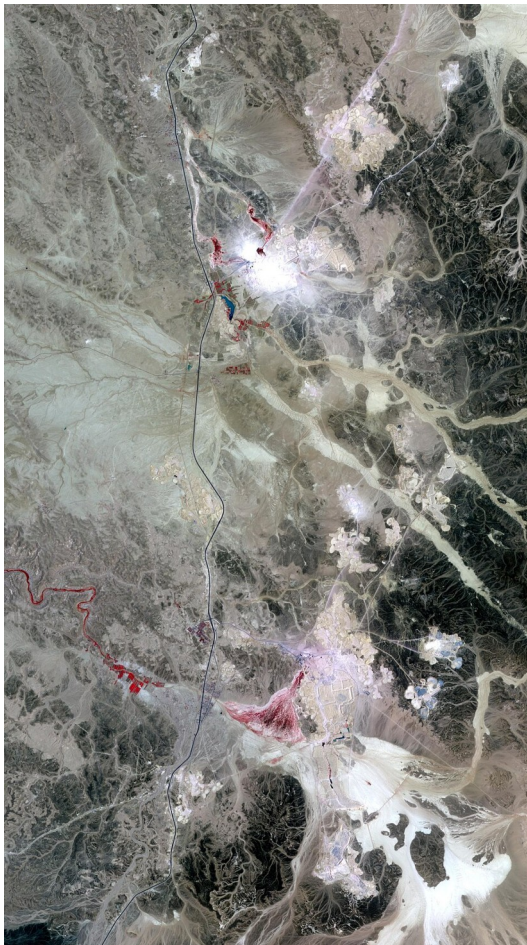
Approximately [618 MCM/year](#) of groundwater is abstracted every year. [One report](#) estimates that the sustainable yield from the aquifers is 275 MCM / year. [In 2017](#), the agricultural sector consumed about 45% of the country’s groundwater resources.

Figure 8, below, shows the major aquifers and the estimated sustainable yield from them. Jordan shares use of two of the aquifers with other countries: the Yarmouk with Syria and the Dis with Saudi Arabia.



**Figure 8 – Annual safe yield of groundwater basins in Jordan in MCM**  
**Credit: Fanack after Altz-Stamm, 2012**

## Mineral Resources

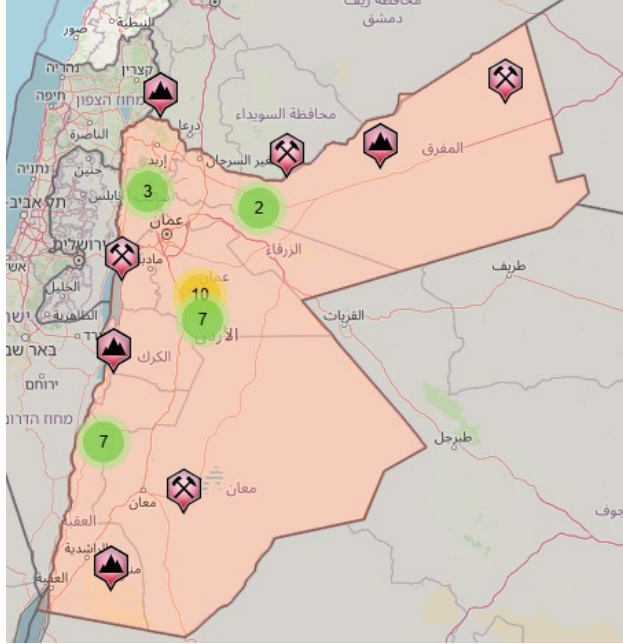


According to the [USGS report](#) on the Mineral Industry of Jordan, the main minerals commodities mined in Jordan include bromine, phosphate rock, and potash. Mineral fuel production includes conventional petroleum and natural gas together with petroleum product from oil shales.

Bromine is produced by the [Jordan Bromine Co. Ltd.](#) at their [facility](#) at [Ghor Al Safi](#) on the Dead Sea. [Jordan Phosphate Mines Co.](#) produces phosphate rock from mines at [Al Hassa](#), [Al-Shidya](#), [Eshidiya](#), and [Wadi Al Abiad](#). [Arab Potash Co.](#) produces potash from their facility at Ghor Al Safi on the Dead Sea.

Natural gas is produced in the [Risha gas field](#) undergoing [further development](#) this year. Conventional petroleum is produced in the [Hamza oilfield](#). Petroleum from oil shales is produced at [mine and plant](#) at [Attarat um Ghudran](#), [Al Qatranah](#).

**Figure 9 – Phosphate Mines, Jordan,**  
**Credit: (ASTER) team, NASA/METI/AIST/Japan Space Systems, public domain**



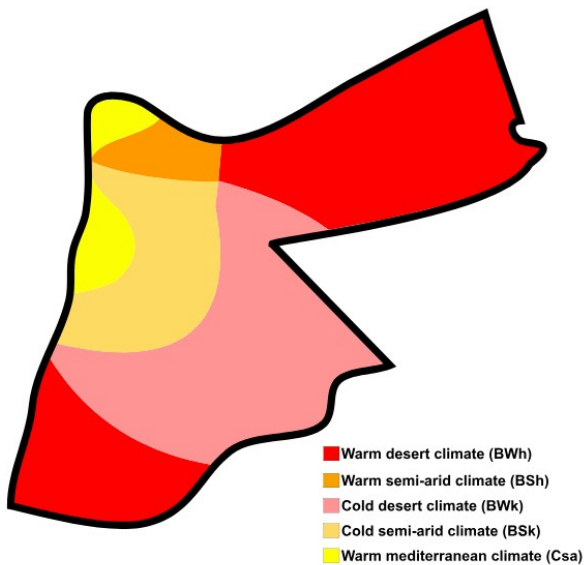
**Figure 10 – Interactive Mineral Occurrence Map of Jordan**  
 Credit: ©Mindat.org

In addition to the major mines and facilities listed above, the [USGS report](#) notes that Jordan mines or quarries: feldspar, gypsum, kaolin, limestone, pumice, sand, dimension stone (basalt, calcium carbonate, granite, marble and travertine), and zeolites.

Figure 10 links to an interactive map mineral occurrences in Jordan.

## Climate

Jordan map of Köppen climate classification



**Figure 11 – Köppen Climate Classification, Jordan**  
 Credit: [Ali Zifan, Creative Commons Attribution-Share Alike 4.0 International license](#)

The CIA World Factbook describes the Jordanian climate as mostly arid desert with a rainy season in the west part of the country (November to April). There are five Köppen climate zones in Jordan: warm desert climate ([BWh](#)), warm semi-arid climate ([BSH](#)), cold desert climate ([BWk](#)), cold semi-arid climate ([BSk](#)), and warm mediterranean climate ([Csa](#)).

There is [research](#) to suggest that the climate of Jordan, and the whole Levant, has changed over the past 20,000 years with dramatic variability in precipitation over the years.



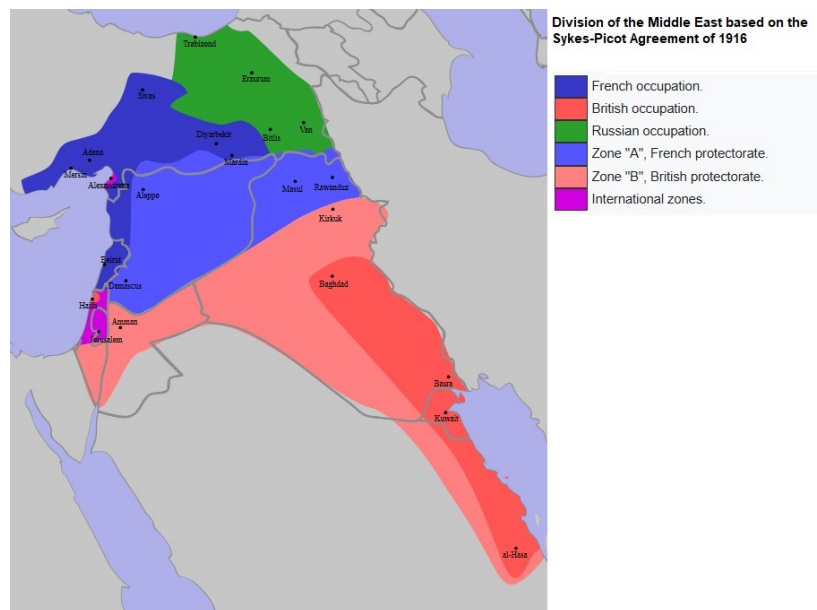
**Figure 12 – Wadi Rum Rock Formation**

**Credit:** [Pieter van Eekeren](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license

If you like desert landscapes, and the bare rock exposures, Jordan looks like an interesting place to visit. Travel advisories ([here](#) and [here](#)) warn of danger due to terrorism, civil disorder, and warfare in neighbouring states. [This site](#) does a good job of putting the risks into context, but its job is to encourage tourism. As usual, if you want to go to Jordan, check out the current situation and make your choice; you can also check out [Climates to Travel](#) and [Lonely Planet](#).

## History and Geopolitics

### History



**Figure 13 – Division of the Middle East Based Upon the [Sykes-Picot Agreement](#) of 1916**  
**Credit:** [Rafy](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

The Hashemite Kingdom of Jordan is a successor state to the [Ottoman Empire](#), formed after the end of [World War I](#). If you want to dig into the history of Jordan prior to WWI, you can start by checking out these sites [here](#) and [here](#). We'll summarize the modern history of Jordan since that is the one that most significantly affects the geopolitics of the country.

The Kingdom of Jordan as its roots in the [Arab Revolt](#) fomented by the [British](#) against their Ottoman opponents during WWI. The main [Arab army](#) in the Revolt was the led by [Sharif Hussein](#) of the [Hashemite](#) tribe. During the conflict, the British, [French](#) and [Russians](#) agreed on how they wanted to divide up the Ottoman Empire after the war in the secret [Sykes-Picot Agreement](#) of 1916. After the end of WWI, the agreement kicked in and the land we now call Jordan, Israel and Palestine came within the rule of the British. One of the British agents stirring up the Revolt was an archaeologist, [T. E. Lawrence](#) a.k.a. Lawrence of Arabia.

One of the things that the British did after the war was to establish a local government called the [Emirate of Transjordan](#). The British had promised the Arabs self-government in order to get their support, a promise the T. E. Lawrence is said to have personally made on his honour as a British officer. The result was self government for the Arabs in was then called [Transjordan](#) under the rule of [Abdullah I](#), a son of [Sharif Hussein](#). The British essentially left the Arabs to rule themselves under Abdullah, maintaining a [Royal Air Force](#) base in the country to help suppress raids by [Wahhabi brigands](#) and providing guidance to the Jordanian government. Also, although Abdullah was technically an absolute monarch, the British induced him to hold [elections](#) for a legislative council in 1929, the first ever held in the country.

After [World War II](#), the British announced that they would get out of the business of trying to rule in Palestine and Jordan. Under a [United Nations plan](#), Palestine was to be divided between the Jews and Arabs, and Transjordan was to become a Kingdom. King Abdullah went about preparing for the British exit by building an army. A talented British general, [John Glubb](#), a.k.a. Glubb Pasha, trained Abdullah's army, the [Arab Legion](#) as it was called, to a very high standard. (Glubb is also the author of a work called the [Fate of Empires](#), well worth reading.)

In 1948 the British left and the trouble began.

Jordan, Egypt and Syria [all attacked the Jewish population in Palestine](#) in an attempt to prevent the establishment of a Jewish state. It didn't work out well for the [Palestinian Arabs](#), many of of whom were driven out of the new State of Israel and into refugee camps. King Abdullah's forces captured the [West Bank](#) and held it until the [1967 War with Israel](#). Also, King Abdullah was proclaimed King of Palestine by the [Jericho Conference](#). The Jericho conference also led to the formal annexation of the West bank into the Kingdom of Jordan. Not everyone was happy with the annexation of the West Bank and the proclamation of Abdullah as King of Palestine; in 1951, a Palestinian seeking an independent Palestinian state [assassinated Abdullah in Jerusalem](#).

Abdullah was succeeded first by his son [Talal of Jordan](#) who proved to be less than able. In 1952, his son [Hussein bin Talal](#) overthrew his father and ruled as King until his death in 1999.

King Hussein's reign included many troubles, but he proved to be an able leader for his country. In 1967, Jordan, Egypt and Syria joined forces for a [war against Israel](#). The Israelis struck first and Jordan ended up losing control over the West Bank. In the following years, Jordan's problems included restive

Palestinians, some of whom, the [Black September Movement](#), attempted to overthrow King Hussein in 1970. Black September [had the support of Syria](#), who sent [part of their army](#) into Jordan. The King's forces defeated Black September and their Syrian allies, expelling them from the country. The remnants of Black September went on to Lebanon to cause [more trouble](#).

The Black September crisis proved to be a watershed for Jordan. King Hussein essentially gave up on ever ruling the West bank again, recognizing the [Palestine Liberation Organization](#) (PLO) as the sole legitimate representative of the Palestinian people, going so far as to proclaim his support for the Palestinians in the [First Intifada](#). Later, when it transpired that the PLO was working to overthrow Hussein, he broke relations with them in 1988. In 1989 Jordan also had problems with [food-price riots](#). Despite these troubles, Hussein kept his throne.

In 1990-91, Hussein publicly supported [Saddam Hussein](#) in the [First Gulf War](#) but did not actually participate. Later, in 1994, Hussein signed a [peace deal with Israel](#), a deal that has been honoured in the past 31 years.

King Hussein died of cancer in February 1999 and was succeeded by his son, the current King Abdullah II. His reign has been marked by attempts at economic and political reforms. The most serious threat to his regime were the so-called [Arab Spring protest of 2011-12](#). Abdullah II remains King of Jordan, the Jordanian branch of the Hashemite family seems to have the gift of good luck in maintaining themselves in power.

### *Geopolitics – A Dangerous Corner of the World*



**Figure 14 – View of Amman, Jordan towards the Flagpole at the Royal Palace**  
**Credit: [Daniel Case](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license**

The Kingdom of Jordan has many challenges, both internally and externally. [Internally](#), as you might guess from the history of the country, the politics of Jordan are a rough game. On top of the practical economic problems, such as Jordan's need to import food, there are the ambitions of Jordanians who think that they can do a better job of running the country than the King. It doesn't help that the country is divided between the [Bedouin tribes and the Palestinians](#). Many Palestinians favour the [Muslim Brotherhood](#), an organization opposed to the monarchy and that was officially [banned in Jordan](#). Also, as in many other countries, [corruption](#) is a drag on economic development in [Jordan](#), generally misallocating capital away from its most productive use. There is no way of easily seeing where things will go in Jordanian politics, other than to keep a close eye on the news.

Externally, Jordan is in a dangerous part of the world. Their best external relations appear to be with [Saudi Arabia](#). Last fall, [the Kings of Jordan and Saudi Arabia met](#) and appear to have good relations. Gone are the days that Wahhabi bandits ride out of the desert to raid settlements in Jordan.

Jordan's relationship with Israel is complicated. Officially at [peace with each other](#), it is an uneasy peace with many in Jordan [none-too-pleased](#) with Israel's treatment of Palestinians. I doubt that Jordan and Israel will come to blows, but things could change if the King is ever deposed.

The most challenging external relation for Jordan are the continuing troubles in Syria and Iraq. The [civil war in Syria](#) threatens to spill over into Jordan, an unpleasant possibility. While not currently in a civil war, the [instability in Iraq](#) presents another challenge to the peace of Jordan. It wasn't that long ago that [militants from Isis](#) were attempting to set up a new [Caliphate](#) in the territory they conquered in Iraq and Syria. The Jordanians have to keep close watch on developments in both those countries.

Further afield, other parties interested in Jordan include the United States, Russia, China and the European Union (EU). [Jordan has been an American ally](#) for decades, and both sides have an interest in having a good relationship. One of the things preventing trouble between Jordan and Israel, for instance, are the close relations both have with the USA. It will be interesting to see how the American interests in the Levant change with the administration of President Trump.

Jordan's [relationship with Russia](#) is more complicated. Russia, and the former Soviet Union, have been strong supporters of Syria, including when Syria invaded Jordan in support of Black September. Currently, Jordan is attempting to maintain [good relations with Russia](#), and also advocating for a [negotiated end to the Ukrainian War](#). One outcome of the Ukrainian War has been the suggestion by King Abdullah that there is a [need for a strong military alliance](#) among the nations of the Middle East.

Jordan's relations with China is mostly economic. Jordan is [deeply indebted to China](#), to the tune of billions of dollars. For example, China financed the building of the [Attarat power plant](#) that uses oil shale mined at Attarat um Ghudran. Jordan is committed to paying China approximately \$8.4 billion over 30 years for that investment. Paying off that debt could be a heavy burden, failing to pay it might invite Chinese "management" of Jordanian affairs; as is the pattern in other Chinese "investments", such as [those in Africa](#).

Finally, there is [Jordan's relationship with the EU](#). It is one that mostly focuses on economic issues, with the EU being Jordan's largest trading partner. Maintaining that [good relationship](#) should be in both party's interests.

I am guardedly optimistic for Jordan. I have a sentimental attachment to monarchy as an institution and I think that Jordan shows the utility of having a monarch to maintain stability. Certainly the monarchs of Jordan have shown astute leadership meeting their many challenges over the years. One of those ongoing challenges lies in encouraging those seeking to build and opposing those seeking chaos. The King of Jordan and his country have quite a challenge ahead of them.

## **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.