EDITION 2026

V20260528

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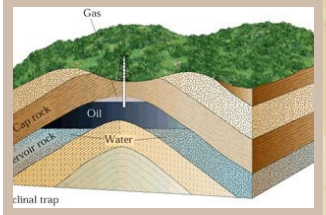

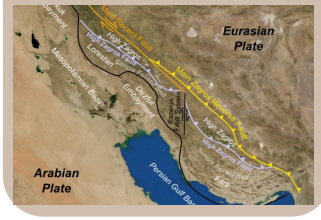

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Geo in the Iran-war

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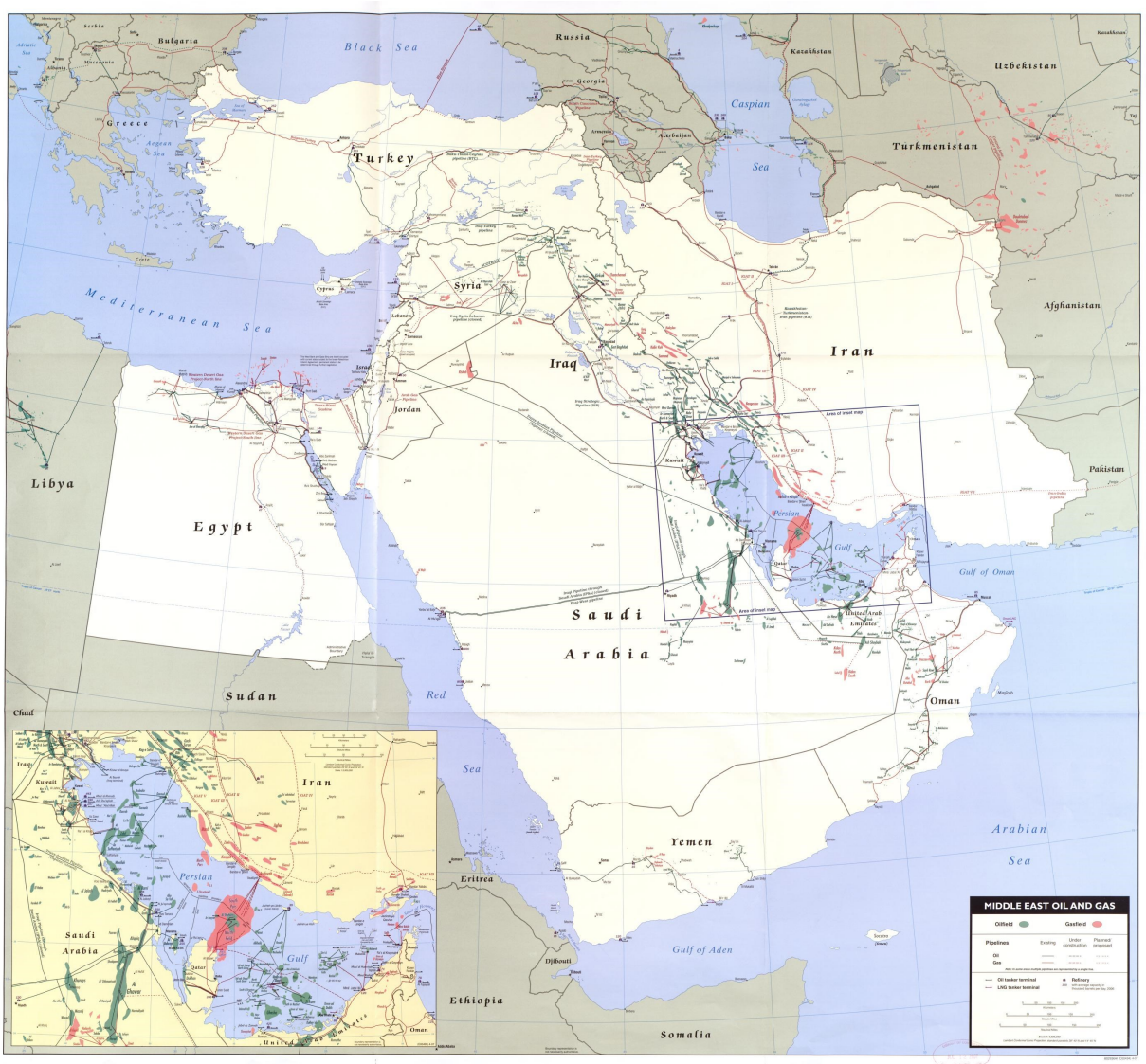
The disastrous, destructive and hostile developments in the Middle East that affect both humanity and the environment prompt us to take a closer look at the geopolitical concepts behind our daily news. Globalisation has made the world vulnerable. The development of global supply chains and the dispersal of production across continents mean that this US/Israel–Iran war poses a threat to the whole world. This war reveals the current geopolitical power balance and organised global economies like never before.

In this special edition of the GeoNewsletter, we will focus on the geological, geographical, and economic aspects of this war. We will also examine nuclear weapons, as this war has altered the geopolitical balance with regard to nuclear weaponry.

Satellite image of the Persian Gulf; the narrowest part is the Strait of Hormuz.

Middle-East, vulnerable infrastructure

Since the US/Israel-Iran war, the general public is very much aware of our total dependency on fossil fuels and the crucial role of global transport. This knowledge was once mostly restricted to geographers and economists.
Twenty per cent of the world's oil and gas originates from the Persian Gulf and passes through the Strait of Hormuz. This oil flow is of particular importance to countries in Asia. However, it also affects Europe, as oil prices are set globally.
Looking at the map of the Middle East (the countries in white) below, the concentration of oil and gas fields and the extensive network of pipelines used to transport fossil fuels is striking. Furthermore, the countries surrounding the Persian Gulf depend heavily on desalination facilities for drinking water, which makes the infrastructure extremely vulnerable to acts of war.



This map shows the oil and gas fields (in green and red, respectively), pipelines, tanker terminals and refineries in the Middle East (countries in white). Source: Library of Congress Geography and Map Division Washington. Permalink (to enlarge): https://www.loc.gov/resource/g7421h.ct002142/

Persian Gulf, hotspot for oil and gas

Why is the Persian Gulf region so rich in oil and gas? The region's geology provides an ideal environment for producing and naturally storing hydrocarbons, which form from chemical reactions involving fossilized organic matter, such as algae. These conditions have produced numerous vast oil and gas fields far more productive than those in the North Sea or Russia.

The image below illustrates the geological processes involved. The Persian Gulf—which has only been flooded since the end of the last Ice Age— is part of the Arabian Plate. This tectonic plate is moving northeast towards the Eurasian Plate at a speed of ~2 cm per year. The collision between these two plates created the Zagros Mountains in Iran, stretching almost 2,000 km from the Gulf of Oman to the Turkish border.

This mountain-building process did not occur in the southern part of the Persian Gulf, where tectonic forces instead created extensive folding and domes in ancient rock formations at great depths, with high temperatures and pressure. Hydrocarbons were 'trapped' at the crest of the fold (anticline) if impermeable rock layers, like salt, lie above them. This is why rich oil and gas fields are found here. Eighty per cent of the world's oil reserves are found in anticlines.

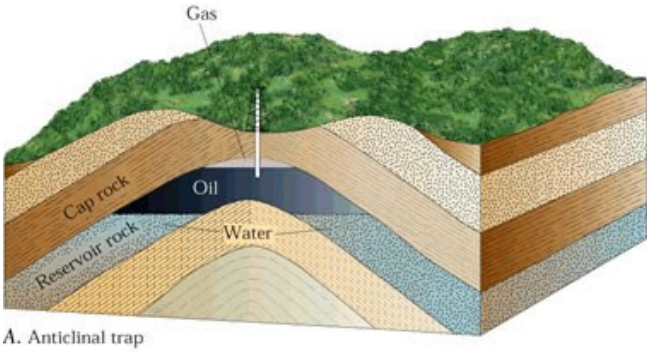


Image right: Schematic representation of an anticline, an upward fold in rock layers caused by lateral pressure. A syncline is a downward fold. Fabio Cramer via Wikimedia.

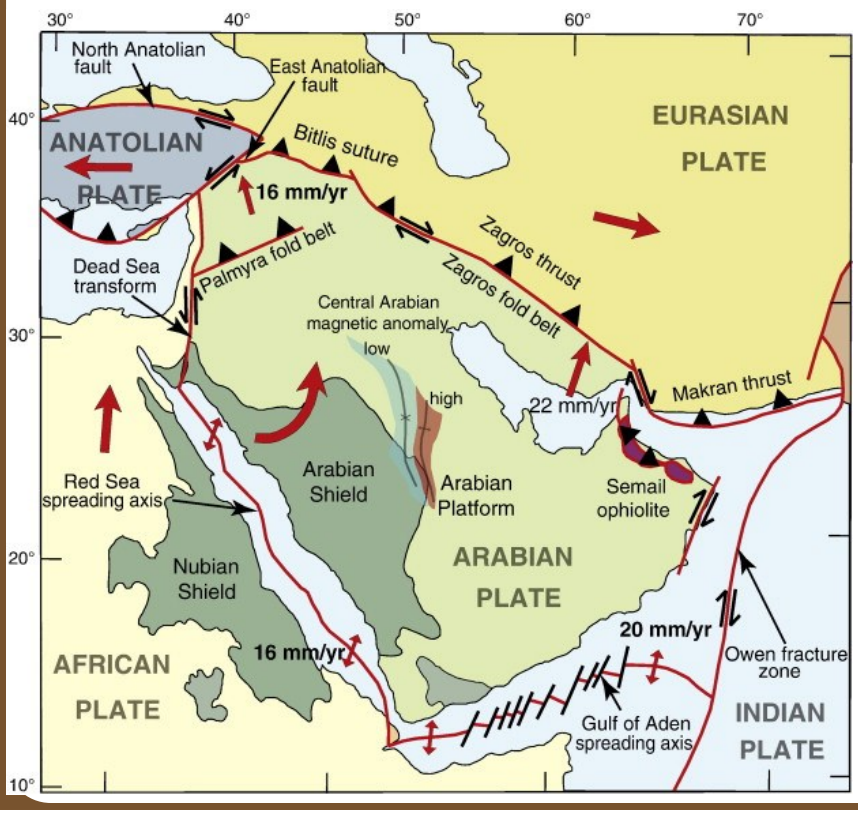


Image left below: Arabian plate boundaries. Adapted from Johnson and Stern, 2010.

Strait of Hormuz, a geopolitical bottleneck

Image top right: Hormuz Island (red arrow) is located at the southeastern end of the Zagros Fold and Thrust Belt, where the Arabian and Eurasian plates collide. Tectonic forces cause salt layers to migrate towards the Earth's surface, forming salt domes. Image via Wiki.

Insert: Arabian-Nubian Shield in supercontinent Pannotia. Link to source.

Image below right: Satellite image of the teardrop-shaped island of Hormuz (42 km²) in the Persian Gulf. NASA Earth Observatory image by Lauren Dauphin, using Landsat data from the U.S. Geological Survey.

The narrow Strait of Hormuz, which connects the Persian Gulf and the Gulf of Oman, is now widely recognised for its importance to global maritime trade. The strait is named after the small salt dome island of Hormuz. Its rock composition illustrates the Persian Gulf's geological evolution and the importance of salt deposition.
The rainbow colours of Hormuz are due to a variety of evaporites, primarily rock salt (halite/NaCl), gypsum, anhydrite and volcanic rocks reddened by iron minerals.
In tectonically active zones, such as active plate boundaries, layers of salt can deform and migrate towards the Earth's surface. This process can potentially result in the formation of salt domes, such as the Hormuz Dome.

Why are there such narrow straits and passages around the Arabian Peninsula, such as the Strait of Hormuz? This is due to active plate tectonics in the area. The Persian Gulf is all that remains of the ancient Tethys Ocean, which is being compressed.
The Strait of Bab el-Mandeb, between the Gulf of Aden and the Red Sea, is an important yet vulnerable shipping lane providing access to the Red Sea and the Suez Canal.

While the Persian Gulf is comparable to the Mediterranean Sea in that it is a remnant of an ancient ocean (doomed to close in millions of years) the Red Sea is a newly formed ocean, opening up by 16 mm every year along the north-south fracture (insert on page 3).

Bab el-Mandeb is another strait of strategic importance. Link to source.

Kharg Island, from pearls to oil

The northern part of Kharg Island was bombed on the night of 13–14 March 2026. Although an invasion by the US was reportedly imminent at the end of March, geopolitical and military experts now say this is less likely.
The coral island is located in the northern part of the Persian Gulf. Most of the ports are located on the east coast, and the southern part of the island is densely packed with storage tanks.
Known as the 'oil artery' of the Middle East, Kharg Island is where 90% of Iranian oil — nearly 5% of global oil production — is transshipped, at a rate of approximately 1 billion barrels per day. The great depth of the surrounding waters means that supertankers can be loaded here before sailing through the Strait of Hormuz towards Asia. China is the largest importer. The oil comes primarily from three offshore fields and is transported to Kharg via undersea pipelines.

The 22 km² island has a natural freshwater supply. Notable archaeological finds include ancient irrigation systems, Stone Age burial sites and the remains of Christian monasteries.
The island was formed by active plate tectonics, which caused ancient coral platforms to rise to the surface and create steep cliffs where the rocks fractured.

Satellite image of Kargh Island in 2002. Source: Earth Sciences and Image Analysis Laboratory, Johnson Space Center.

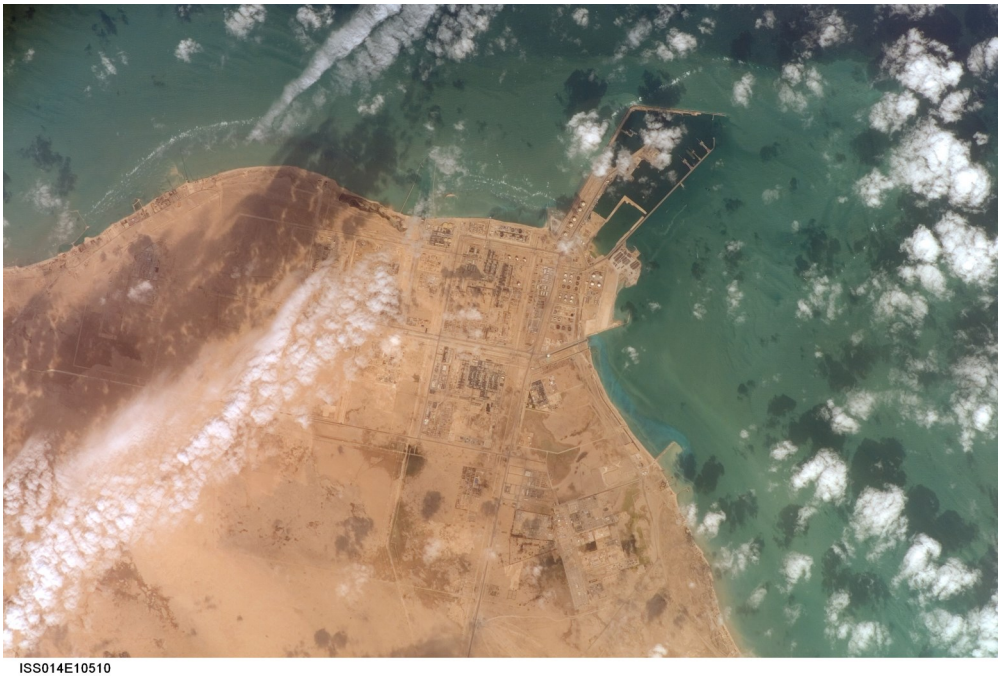
Before the economy became oil-based in the 1960s, the population relied on agriculture and pearl fishing for their livelihood. During the colonial era, the island was briefly under Portuguese control and a trading post was established there by the Dutch in 1752. The Dutch East India Company subsequently constructed Fort Mosselstein to safeguard their trading interests.

Kargh Island is regarded as the "oil artery"of the Middle East. Photo by Tasnim News Agency, via Wikimedia Commons CC BY 4.0,

Commodities on hold

In 2025, nearly a third of the world's crude oil trade passed through the Strait of Hormuz. Most of these exports were destined for Asia, with almost half going to China and India. Four per cent is routed to Europe, equalling 600,000 barrels a day. Many non-oil commodities are also transported through the Strait of Hormuz. Some examples are given below.

Nitrogenous **fertilisers**, for instance, are distributed worldwide. The African continent is particularly vulnerable. Ammonia is used to produce urea, a key ingredient in fertilisers. However, ammonia is toxic, which is why the Gulf state of Qatar has ceased production entirely.
Qatar's **helium** plants account for a third of the world's supply. Helium is essential for cooling MRI scanners used in healthcare, in particle acceleration and semiconductor fabrication.
Eight per cent of the world's **aluminium** is produced in the Gulf region. Most Middle Eastern smelters are located along the Strait of Hormuz. The war is therefore disrupting the supply of raw materials to the smelters, as well as the export of processed aluminium. The United Arab Emirates (UAE), Bahrain and Saudi Arabia are the top three aluminium-producing countries. More than 80% of processed aluminium is exported via the strait. Other key non-oil commodities affected by the closure of the Strait of Hormuz include methanol, sulphur, graphite, iron, and MEG, which is used in the manufacture of polyester fibres.



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Satellite image of Ras Laffan Industrial City, a harbour and industrial complex in NE Qatar. Image by NASA.

Encouraging a new nuclear power

In April 2026, Trump threatened to 'wipe out the entire Persian civilisation'. According to geopolitical analysts, this could encourage Iran to develop nuclear weapons. Professor Robert Pape, of the University of Chicago, estimates that Iran will possess multiple nuclear weapons in the near future. He believes that it will become less likely that Iran will allow inspectors from the UN 'watchdog', the International Atomic Energy Agency (IAEA), to monitor its activities. The IAEA monitors the use of uranium for purposes other than nuclear energy.

The world entered a new era when the New START Treaty, which limited the nuclear arsenals of Russia and the US, expired on 5 February 2026 and was not renewed. There are currently nine nuclear powers worldwide: The United States, Russia, the United Kingdom, France, North Korea, Pakistan, India and China. Israel is also believed to be among them, although this has never been officially confirmed. In addition to these nine states, there are also so-called nuclear threshold states that could produce a nuclear weapon within a short period of time, including Brazil, Canada, Germany, the Netherlands, South Africa, Sweden and possibly Australia and South Korea.

May 2016: the American secretary of State John Kerry and Iranian Foreign Minister Zarif meet in Vienna to discuss the implementation of the Joint Comprehensive Plan of Action (JCPOA).

The IAEA also monitors Iran's nuclear programme. Sanctions were imposed when it emerged that Iran was not complying with the Nuclear Non-Proliferation Treaty. Ten years ago, Iran and the five permanent members of the UN Security Council (China, France, Russia, the United Kingdom and the United States), as well as Germany and the EU, signed the Joint Comprehensive Plan of Action (JCPOA). The JCPOA contained restrictions on uranium enrichment and set out a fifteen-year plan to reduce the stockpile of low-enriched uranium. However, in October 2017, President Trump unilaterally withdrew from the JCPOA. In 2025, the IAEA reported the presence of large quantities of highly enriched uranium (60%) in Iran. This was followed by the '12 Day War' in June 2025, during which Israel and the US bombed Iran's key nuclear facilities. The recent attack by Israel and the US on 28 February 2026 may have had the same objective, although this is unclear.

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