

September 4, 2023

## News and notes

Before going on to discuss the geology and geopolitics of the [Benelux Countries](#) – [Belgium](#), [The Netherlands](#) and [Luxembourg](#) – here are some news items I thought were interesting.

## Research

- [MineralImage5k: A benchmark for zero-shot raw mineral visual recognition and description](#); Tech Xplore summary [here](#).
- [Simulated diagenesis of the iron-silica precipitates in banded iron formations](#).
- [Sahara space rock 4.5 billion years old upends assumptions about the early Solar System](#).
- Lecture by Nick Zentner: [How did the Rocky Mountains Form?](#)
- Oceanography: [Changes in Seasonality of Saltwater Inflows Caused Exceptional Warming Trends in the Western Baltic Sea](#); Phys.org summary [here](#).

## Paleontology

- Scientific American: [Paleontology Is Far More Than New Fossil Discoveries](#).
- [Fossil Friday: Seventy Years of Textbook Wisdom on Origin of Multicellular Life Turns Out to Be Wrong](#).
- I am adding this [paleontology blog](#) to my blog roll, here is an interesting entry: [Blade Runner: Helicoprion & The Strangest Jaws in the Fossil Record](#).
- [The early Cambrian \*Kylinxia zhangi\* and evolution of the arthropod head](#); behind a paywall, Phys.org summary [here](#).
- [Artist on walk finds 168 million year-old fossil on French beach](#).
- Hindustan times: [Geologist finds marine fossils at icy heights in Ladakh](#).
- [Partial skeleton from the Paleocene of New Zealand illuminates the early evolutionary history of the Phaethontiformes \(tropicbirds\)](#); Phys.org summary [here](#).
- [Possible fungus-eating cucujiformian beetle larvae with setiferous processes from Cretaceous and Miocene ambers](#).
- [The Rhabdodontidae \(Dinosauria, Ornithischia\), an enigmatic dinosaur group endemic to the Late Cretaceous European Archipelago](#).

## Glaciers and Climate Change

- Rethinking the Milankovitch cycles: [Late Pleistocene 100-kyr glacial cycles paced by precession forcing of summer insolation](#); Phys.org summary [here](#).

- [Greenland Was Much Greener 416,000 Years Ago.](#)
- [Clay formation prolonged global warming event 40 million years ago, according to new biogeochemical model](#); original research papers [here](#) and [here](#).

## Environmental Geology and Hydrogeology

- Aquifer mapping: [Fresh submarine groundwater discharge offshore Wellington \(New Zealand\): hydroacoustic characteristics and its influence on seafloor geomorphology](#); Phys.org summary [here](#).
- [Mapping potentially groundwater-dependent vegetation in the Mediterranean biome using global geodata targeting site conditions and vegetation characteristics](#); Phys.org summary [here](#).
- [Warming temperatures exacerbate groundwater depletion rates in India](#); Phys.org summary [here](#).

## Mining and Energy

- From the United States Geological Survey (USGS): [Australia, Canada and the US Unify Critical Minerals Data](#).
- Getting along with small scale operators: [Coexistence of artisanal gold mining with companies in Latin America](#).
- Not getting along with small scale operators: [First Nations want moratorium on placer mining](#).
- Really not getting along, from Nigeria: [Vacate site now, FG orders illegal miners](#).
- Popular Science: [What's the most sustainable way to mine the largest known lithium deposit in the world?](#)
- [Digital soil mapping of lithium in Australia](#); Phys.org summary [here](#).
- Mining problems: [Insight: Coal miners forced to save for a rainy day by insurance snub](#).
- Carbon sequestration problems: [A developer chose a rural carbon sequestration site to avoid controversy. It didn't go well](#).
- Consequences of green energy: [The calm before the storm? The making of a lithium frontier in transitioning Portugal](#).
- More green energy problems: [Wind Woes: Orsted's \\$2.3 Billion Charge Exposes US Offshore Wind Woes](#).
- [Oil Rises to Highest in Over Seven Months on Supply Worries](#).

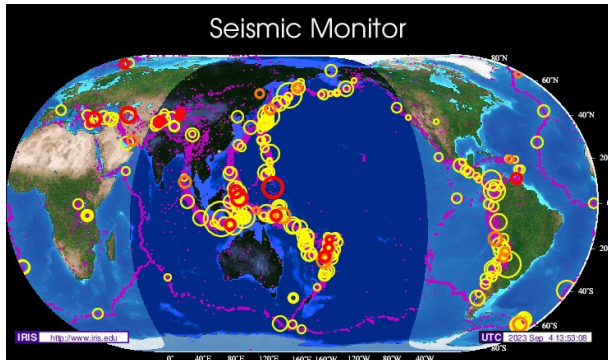
## Geologists

- Career opportunities: [Colorado School of Mines warns of 'grey tsunami' of mining industry retirements](#).
- [Ontario professor part of NASA's geology team for Artemis III moon mission](#).

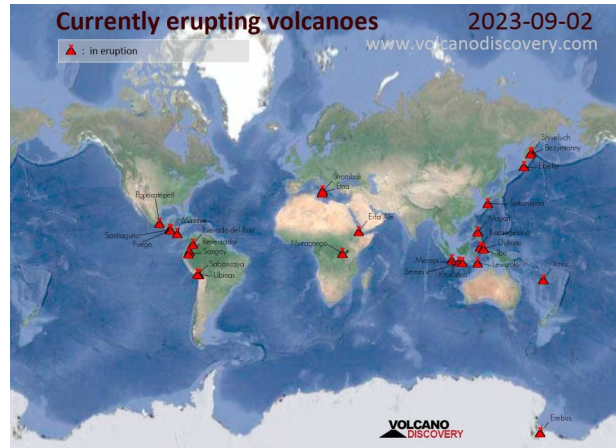
## Crooked Scientists

- [Former Alabama chemistry prof faked data in grant applications: Federal watchdog.](#)

## Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

- USGS Volcano watch: [Using remote acoustic monitoring to distinguish volcanic styles.](#)
- Also from the USGS: [KABOOM! Crater to Bay \(Yellowstone Volcano Update — September 2023\).](#)
- [Smithsonian / USGS Weekly Volcanic Activity Report.](#)
- Hunga Tonga-Hunga Ha'apai, the gift that keeps on giving: [Did the Tonga eruption cause this year's extreme heat?](#)
- More research from Hunga Tonga-Hunga Ha'apai: [Two-way coupled long-wave isentropic ocean-atmosphere dynamics](#); Phys.org summary [here](#).
- [Physical modeling of spikes during the volcanic tsunami generation](#); Phys.org summary [here](#).
- [Using Deep Learning for Flexible and Scalable Earthquake Forecasting](#); Phys.org summary [here](#).
- Earthquake research: [A Methodology to Combine Shaking and Ground Failure Models for Forecasting Seismic Damage to Buried Pipeline Networks](#); behind a paywall, Phys.org summary [here](#).
- More earthquake research: [Predicted results of weak and strong ground motions at the target site of the blind prediction exercise as steps-2 and -3, Report for the experiments for the 6th international symposium on effects of surface geology on seismic motion.](#)
- From Judith Hubbard: [M5.5 offshore of Panama](#); also [Ultra-deep M7.1 earthquake in Indonesia shakes Bali](#); and [Magnitude 3.6 earthquake strikes near Cleveland, Ohio](#).
- Fires: [North America's summer of wildfire smoke: 2023 was only the beginning.](#)

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## Geology and the Fate of Societies – Benelux States



Figure 1 – Belgium, The Netherlands and Luxembourg

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This week, we are going to look at the [Benelux Countries](#) – [Belgium](#), [The Netherlands](#) and [Luxembourg](#) – as a unit since they share a common history, geology and geopolitical characteristics. Currently, all three countries are part of the [European Union](#) (EU) and the [North Atlantic Treaty Organization](#) (NATO), both of which have their headquarters in [Brussels, Belgium](#). Another name for the Benelux is the [Low Countries](#).

Here are the basics about the three countries; according the [United States Central Intelligence Agency World Factbook](#).

## ***Belgium***

The [Kingdom of Belgium](#) has a total area of 30,528 square kilometres (km<sup>2</sup>), of which 30,278 km<sup>2</sup> is land and 250 km<sup>2</sup> is water. It borders on [Germany](#), to the east; Luxembourg, to the southeast; [France](#), to the southwest; the [English Channel](#) and the [North Sea](#), to the west; and The Netherlands, to the north. West of the English Channel, is, of course, England, part of the [United Kingdom](#).

The current population estimate (from the [CIA Factbook](#)) is 11,913,633. Belgians make up 75.2% of the population with Italians (4.1%), Moroccan (3.7%), French (2.4%), Turkish (2%), Dutch (2%) and others (10.6%). Belgians are [strongly divided](#) along linguistic/ethnic lines with about 60% speaking Dutch ([Flemish](#)) and 40% speaking French ([Walloons](#)). There is also a small [German-speaking community](#) in Belgium.

The capital city of Belgium is [Brussels](#). The Head of State is [King Philippe](#) and the current Prime Minister is [Alexander De Croo](#).

## ***Luxembourg***

The smallest of the three Benelux countries, the [Grand Duchy of Luxembourg](#) has a total land area of total: 2,586 km<sup>2</sup> with negligible water area. It is landlocked and is sandwiched between Belgium to the northwest, France to the southwest and Germany to the east.

The current estimate ([from the CIA Factbook](#)) for the population of Luxembourg is 660,924. The ethnic breakdown of the population is Luxembourger (52.9%), Portuguese (14.5%), French (7.6%), Italian (3.7%), Belgian (3%), German (2%), Spanish (1.3%), Romanian (1%), and other (14%). The official language of Luxembourg is [Luxembourgish](#), a [West Central German](#) language related to standard [German](#). Both German and French are used as [administrative languages](#) in Luxembourg.

The capital is [Luxembourg City](#). The Head of State is [Grand Duke Henri](#) and the current Prime Minister is [Xavier Bettel](#).

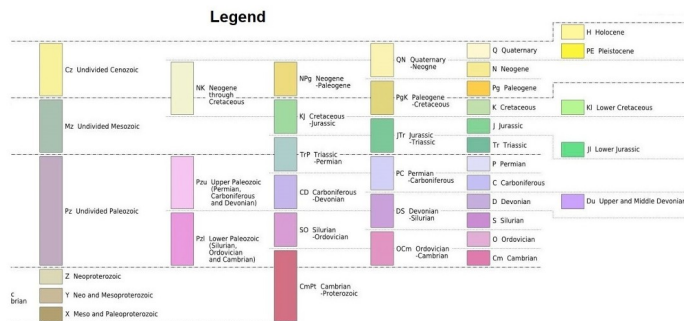
## ***The Netherlands***

[The Kingdom of the Netherlands](#) is the largest of the Benelux countries with a total area of 41,543 km<sup>2</sup> of which 33,893 km<sup>2</sup> is land and 7,650 km<sup>2</sup> is water. The Netherlands also includes the [overseas possessions](#) of [Aruba](#), [Bonaire](#), [Curaçao](#), [Saba](#), [Sint Eustatius](#) and, part of [Sint Maarten](#). (I discussed the geology and geopolitics of these islands as part of the [May 15<sup>th</sup> posting on the Lesser Antilles](#)). The Netherlands proper is bordered by the North Sea and the United Kingdom to the west, Germany to the east and Belgium to the south.

The current estimate (from the [CIA Factbook](#)) for the population of The Netherlands is 17,463,930. The ethnic breakdown of the country is Dutch (75.4%), others from the EU (6.4%), Turkish (2.4%), Moroccan (2.4%), Surinamese (2.1%), Indonesian (2%), and unspecified other (9.3%). The official language of The Netherlands is Dutch, although [Frisian](#) is used in the [Province of Friesland](#).

The capital of the Netherlands is [Amsterdam](#), although the seat of government is in [The Hague](#). The Head of State is [King Willem-Alexander](#) and the current Prime Minister is [Mark Rutte](#).

# Geology



**Figure 2 – Surficial Geology of the Benelux Countries**  
 Extracted from [Europe geological map](#) by Eric Gaba – [Wikimedia Commons user: Sting](#)  
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The Benelux Countries lie on the western part of the [Eurasian Plate](#). Past orogenies that have shaped the basement rocks include the [Hercynian Orogeny](#) and the [Caledonian Orogeny](#), both of which occurred during the [Paleozoic Era](#). In general, the oldest rocks, Paleozoic and [Mesozoic](#), are towards the south and the younger [Cenozoic](#) deposits are to the north. The geology of the three countries is fairly complex. So rather than go through it all, here are links to find summaries of the [geology of The Netherlands](#), the [geology of Belgium](#), and the [geology of Luxembourg](#).

## Resources

### *Agricultural Resources*

All three of the Benelux Countries have substantial agricultural production. As part of the EU, they benefit from and contribute to the Common Agricultural Policy.

**Belgium:** Agriculture in Belgium is divided between crop production and raising livestock. Livestock production accounts for 65 percent of the nation's farms, mostly cattle, pigs and poultry. Dairy production is also important and the country is self-sufficient in these products. Belgium's main crops include barley, corn, potatoes, sugar beets, wheat, and assorted fruits and vegetables. Statistics on Belgian agriculture are available [here](#) and [here](#).

**Luxembourg:** The main agricultural areas in Luxembourg are around the Moselle River. Livestock production is the largest sector, about 80% by monetary value. Crops include wine grapes, barley, oats, potatoes, wheat, and fruits. Statistics on agriculture in Luxembourg are available [here](#) and [here](#).

**The Netherlands** is the powerhouse here, and is the [second largest exporter of food in the world](#). Fertile land combined with among the most advanced techniques produce an abundance of dairy products, beef and veal, chicken, duck, lamb, pork, and turkey. Eggs and beef are the main livestock exports. Crop production includes barley, corn, potatoes, sugar beets, and wheat. Extensive statistics are available [here](#) and [here](#).

One interesting feature of agriculture in the past few years has been the attempt to reduce agricultural production in order to [reduce greenhouse gas emissions](#). This has resulted in [furious protests by Dutch farmers](#). As usual, the people trying to change the rules are unlikely to feel the effects of those changes. Reduced food production eventually means that someone will have to go without.

### *Mineral Resources*

**Belgium and Luxembourg:** Mineral production in Belgium can be broken down by geographic regions. The Flanders region, which constitutes the northern half of Belgium, produced principally industrial minerals, such as clay, loam, and sand and gravel by open pit mining. The Wallonia region produced primarily metals and metallic products. USGS statistics on the mineral industry of Belgium and Luxembourg are [here](#).

**The Netherlands:** The mineral industry of the Netherlands comprised primarily processing of metals, extraction of natural gas and petroleum, processing of nitrogen for fertilizer, and the mining of industrial minerals, such as salt. USGS statistics on the mineral industry of The Netherlands are [here](#).

Natural gas production in the Netherlands, from the [Groningen gas field](#) has been significant. The field is the largest natural gas field in Europe and one of the largest in the world. With the closure of the

[Nordstream gas pipeline from Russia](#) you would think that there would be great demand for gas produced in Western Europe. But no, [Netherlands plans to end Groningen gas production by Oct 1, 2023](#).

## Climate

The climate of [Belgium](#), [The Netherlands](#) and [Luxembourg](#) can best be described as cool and wet, with Luxembourg tending to a more [continental climate](#) while Belgium and The Netherlands have a more [maritime climate](#).

## History and Geopolitics

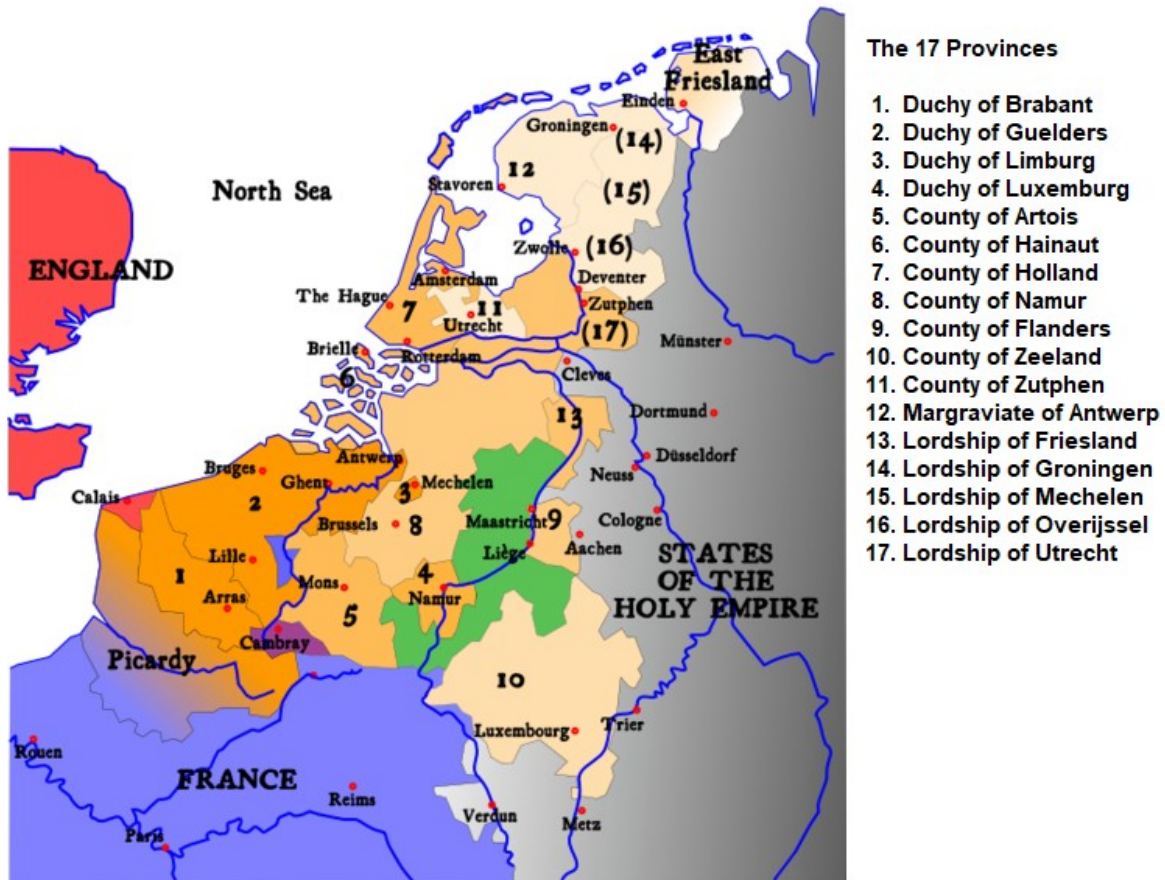


Figure 3 – Burgundian Netherlands 1477

Credit: Denis Jacquerye, [Creative Commons Attribution-Share Alike 1.0 Generic](#) license

This history of the Low Countries is a summary. These links lead to detailed histories of [Belgium](#), [The Netherlands](#) and [Luxembourg](#).

In antiquity, the earliest recorded inhabitants of the Benelux Countries were the [Belgae](#), as recorded by [Gaius Julius Caesar](#) in his history/self-serving propaganda [The Gallic Wars](#). After [Caesar's Legions](#) were finished [subjugating](#) the Belgae, and the other inhabitants of Gaul, the territory became a relatively peaceful part of the [Roman Empire](#).

When the [Western Roman Empire](#) began to fall apart, various barbarian [war bands invaded](#), wrecking the place. One of these war bands, the [Franks](#), took up residence in the Low Countries. Under [Charlemagne](#) (I talked about him in my [post on Austria](#)), the Low Countries were incorporated into the first iteration of the [Holy Roman Empire](#). After Charlemagne died, his polity came to be divided into three main states, [West Francia](#), the future France, [East Francia](#), the future Germany and Austria, and a [Middle Francia](#) that stretched from [Italy](#) to the Low Countries. Eventually, the Low Countries came under the rule of the [Dukes of Burgundy](#). Burgundian rule lasted until 1477, when [Mary the Rich](#), last Duchess of Burgundy, married [Maximilian, Archduke of Austria](#), putting the Low Countries under the rule of the [Hapsburgs](#). Under [Charles V](#), the Hapsburg realm reached its greatest extent and included not only Austria and the Low Countries but also Spain and its overseas territories.

While the aristocrats were playing their games of war and acquiring titles to various lands, the people of the Low Countries were generally left to their own devices, provided they paid their taxes. The cities of the Low Countries such as [Amsterdam](#), [Antwerp](#), [Bruges](#), [Ghent](#), [Utrecht](#), and [Ypres](#) took up commerce with a vengeance, becoming the centres of the [cloth trade](#). Later, they expanded into all manner of trade with the [Dutch reaching out and conquering modern Indonesia](#) during the [Age of Exploration](#) and becoming wealthy on the spice trade.

Troubles came in the 16<sup>th</sup> and 17<sup>th</sup> centuries with the [Protestant Reformation](#) and the Dutch revolt against their Hapsburg rulers, also called the [Eighty Years War](#). By the end of the conflict, in 1648, the territories that make up the modern Netherlands secured their independence while the rest of the Low Countries remained part of the Hapsburg domains, first as the [Spanish Netherlands](#) and later as the [Austrian Netherlands](#). The dividing line was effectively those lands that could be rendered impassible by flooding, such as the provinces of the modern Netherlands, and those which could not, such as the rest of the Low Countries. The Dutch territory became predominately Protestant while the Hapsburg domains remained Roman Catholic.

There were many local wars and the Low Countries continued to conduct commerce. In the process, the Netherlands especially became wealthy and [invented most of the features of modern capitalism](#).

The English, especially, intervened in the wars of the Low Countries since they feared that any country that dominated the Channel Coast on the European continent would use it as a staging ground to invade England. This was the case with the [English defeat of the Spanish Armada](#), where the Spanish were attempting to transport their army in the Spanish Netherlands (modern Belgium) to England.

The English had a complicated relationship with The Netherlands. The two countries fought over various issues in the [Anglo-Dutch Wars](#). Later, the British Parliament invited [William of Orange](#), and his English princess wife [Mary](#), to be joint monarchs of the United Kingdom.

The next big break in the history of the Low Countries was its conquest by France and its leader [Napoleon Bonaparte](#) during the [Napoleonic Wars](#). Following the end of the Napoleonic Wars with the defeat of Napoleon's forces near the [Belgian town of Waterloo](#), The Low Countries were combined into a single state, the [United Kingdom of the Netherlands](#), which broke up into the Netherlands, Belgium and Luxembourg in 1830 following [a revolt by the Belgians](#).

During the remainder of the 19<sup>th</sup> Century the three states of the Low Countries lived fairly peacefully, with Belgium picking up a colonial empire in the [African Congo](#) and The Netherlands growing rich off of international trade, especially [in the Dutch East Indies](#). This all came to a crashing end in 1914 when [Germany invaded Belgium and Luxembourg](#) as part of their dispute with France. [Belgium](#) and [Luxembourg](#) both suffered horribly during [World War One](#) (WW1). The Netherlands was [neutral during WW1](#).

The end of the WW1 in 1918 led to another, even more terrible war in 1939 when all three countries were conquered by [Nazi Germany](#). [Belgium](#), [Luxembourg](#) and the [Netherlands](#) all suffered greatly during [World War Two](#) (WW2). Liberation by the Western Allies couldn't come soon enough.

Following WW2, the Low Countries re-built their shattered countries and joined together for mutual cooperation, first in the [Benelux agreements of 1958](#) and later in the European Union. The modern Benelux Countries are peaceful, prosperous states. In the process, Belgium and the Netherlands gave up their overseas possessions in the [Belgian Congo](#) and the [Dutch East Indies](#) as unprofitable.



**Figure 4 – Ships at the Port of Antwerp, Belgium**

**Credit:** Alf van Beem, [Creative Commons CC0 1.0 Universal Public Domain Dedication](#)

Geopolitically, the Low Countries show through their history the perils and benefits of their location. The Netherlands and Belgium, especially, have prospered mightily by their location on the North Sea and at the mouths of the [Rhine](#) and [Meuse](#) rivers. This made the Low Countries ideal locations for [water-borne trade](#). Also, as pointed out above, the main division between Belgium and The Netherlands is a geopolitical/geographic one, i.e. one based upon the ability to make an effective defence from invasion in the 16<sup>th</sup> and 17<sup>th</sup> centuries by flooding the land.

The great wealth acquired through trade has made the Low Countries a target, especially for ambitious powers such as Austria, Spain, Germany, and France. As noted above, the British have a strong self interest in maintaining the independence of Belgium and The Netherlands, to stave off a possible invasion of England by those ambitious powers using the Low Countries as a staging ground.

Although all the countries that have invaded the Low Countries in the past are, together with the Benelux Countries, part of the European Union, [that union is a fragile thing](#). If European relations become violent, as has been the [normal case in European history](#), the Low Countries may yet again become the [Cockpit of Europe](#). Also, the past sins of [Dutch](#) and [Belgian colonialism](#) are coming back to them in the form of [migration to the Low Countries](#), in many cases from their former colonies.

So, the geopolitical future for the Low Countries, and the rest of us, remains uncertain – as always.

### **Standard Caveat**

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.