

February 28, 2022

News and Views

Before going on to the world of the Pennsylvanian Period, let's look at some news items that I thought were interesting.

Geopolitics



Tectonic Geology of the Ukraine

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

There are lots of issues behind the current war in the Ukraine, one thing to keep in mind is the Donbas region and its mineral resources, this is the part of the Ukrainian Republic that the Russians will probably keep. Here are some useful postings from the web on the Donbas:

- [Ukraine Conflict Update](https://www.understandingwar.org/); check <https://www.understandingwar.org/> for daily updates.
- Summaries of Ukrainian natural resources: [Ukraine: Mining, Minerals and Fuel Resources](#), [Natural Resources of Ukraine](#) and [Mineral Resources of Ukraine](#).
- Ecological costs of development: [Donbas: the New Exclusion Zone](#).
- [Maps of the Ukraine](#).
- [Ukraine crisis will disrupt crude, coal and LNG flows even without sanctions](#).

Paleontology Research

- An earth shattering Spring: [The Reign of the Dinosaurs Ended in Spring: Revelations From Bones of Fish That Died When the Asteroid Hit](#).
- [Student finds fossil of 170-million-year-old winged reptile on Scottish island - BBC News](#).
- [Long-necked dinosaurs probably had even longer necks than we thought](#).

- Oldest known Ediacaran fossils from China: [Implications for Ediacaran biological evolution from the ca. 602 Ma Lantian biota in China.](#)
- Nightmare creature: [Predatory Cockroach From Dinosaur Era Found Trapped in Amber.](#)
- [Largest human family tree ever created retraces the history of our species.](#)

Other Research

- Mechanics of glacial rebound: [Seismic study reveals key reason why Patagonia is rising as glaciers melt.](#)
- Geology of rare earth elements(REE): [Partitioning of REE between calcite and carbonatitic melt containing P, S, Si at 650–900 °C and 100 MPa.](#)
- Real courage: [NASA Aircraft Fly Into Snowstorms To Study Snowfall.](#)
- From the Hadean: [Earth's Water Came from Enstatite Chondrite-Like Asteroids.](#)
- Plate tectonics and cratonic accretion: [A Forgotten Continent From 40 Million Years Ago May Have Just Been Rediscovered.](#)

Volcanoes, Earthquakes, Landslides and Geohazards

- [Hidden weaknesses within volcanoes may cause their collapse.](#)
- [Discovery of ancient underwater landslide could help Middle Eastern nations realize tsunami hazards.](#)
- [Ridgecrest shows how earthquakes damage Earth's crust.](#)
- From Geology Hub: [This Week in Volcanoes.](#)

Mining and Energy

- February 22: [Gold Price Tops US\\$1,900 As World Tensions Grow](#); here is the [February 28 price](#): US\$2,430.38 / Troy Ounce.
- [Current oil prices.](#)
- Risk premium: [Tanker Rates On Russian Crude Routes Triple.](#)
- [Biden set to tout US progress on critical minerals production.](#)
- From the United States Energy Information Administration (USEIA): [Monthly Energy Review.](#)
- [Big Oil Isn't Losing Any Sleep Over The EV Revolution.](#)
- [How Australia's geology gave us an abundance of coal – and a wealth of greentech minerals to switch to.](#)

Images from Space

- [Ice Age Canadian Lakes](#); I live 28 km south of Lake Manitoba.

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The World of the Pennsylvanian Period

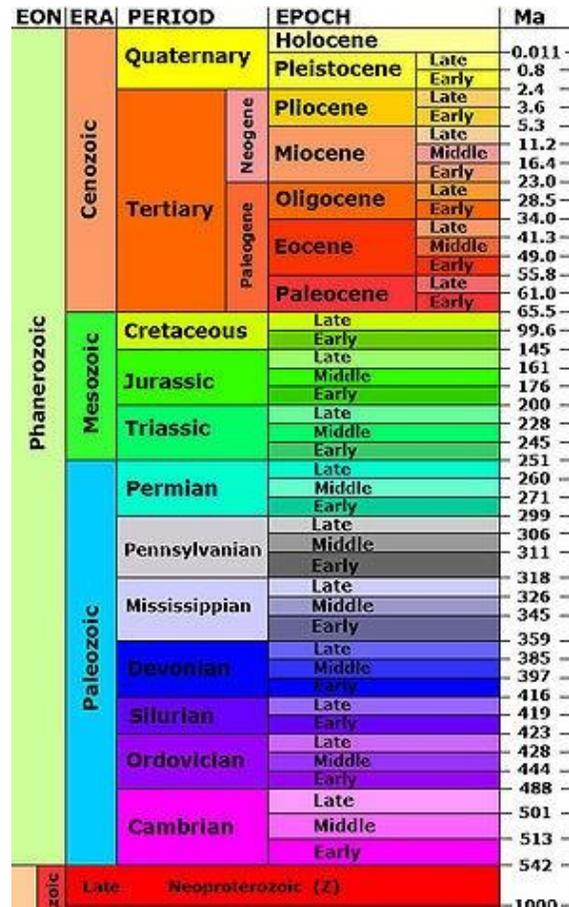


Figure 1 - Phanerozoic Time Scale

Credit: Modified from File: [Geologic time scale.jpg](#),
 United States Geological Survey, public domain

The second part of the [Carboniferous Period](#), called the [Pennsylvanian Period](#) in the conventions of North American geology, lasted from 323.2 million years ago (Mya) to 298.9 Mya. In this posting we will look at the paleogeography and the subdivisions of the Pennsylvanian. Next week we'll look at the life of the Pennsylvanian.

Pennsylvanian Paleogeography

During the Pennsylvanian [Pangaea](#) continued to come together through the collision of [Laurasia](#) and [Gondwana](#). The mountain building episodes ([orogenies](#)) that contributed to this cratonic accretion included:

- In what is now Russia and Asia, the [Uralian orogeny](#) began in the Pennsylvanian Period and continued into the [Jurassic Period](#).

- In what is now North America and Western Europe, the [Alleghanian and Caledonian orogeny](#) began during the Late [Mississippian](#) and continued into the [Permian](#).
- In what is now Chile, South America, the [Toco orogeny](#) occurred during the Pennsylvanian and Permian.

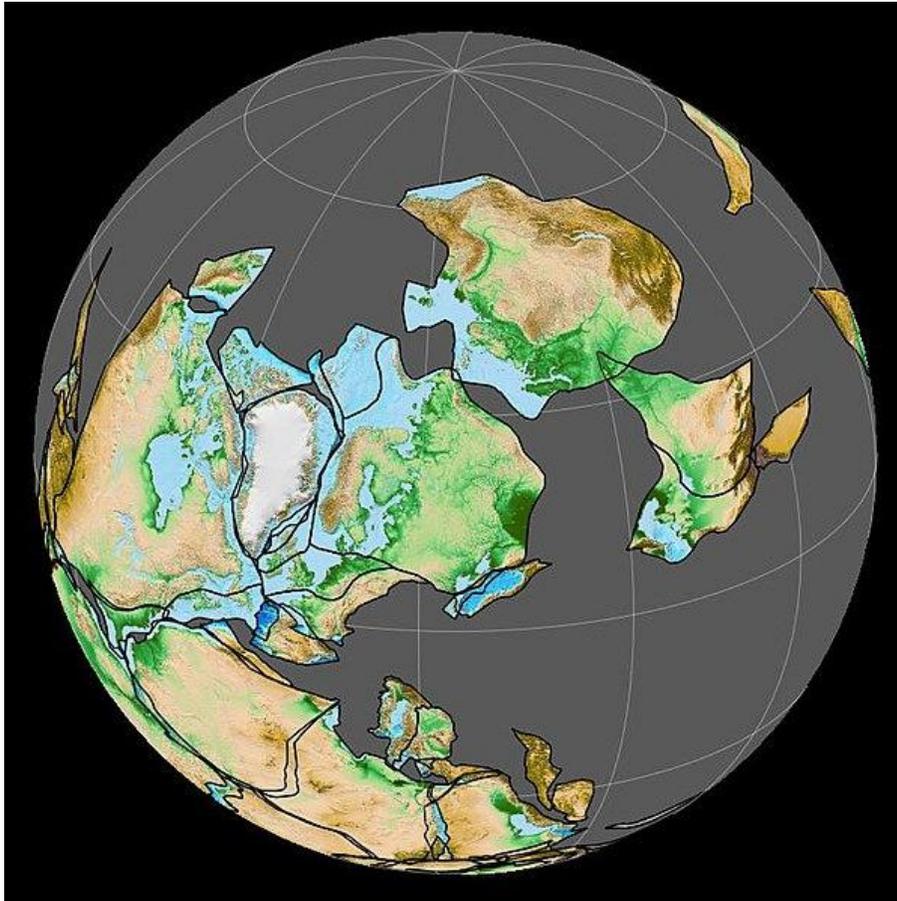


Figure 2 - Late Pennsylvanian, 300 Mya

Credit: [Fama Clamosa](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license.

Another important tectonic feature of the Pennsylvanian was a time of major volcanism that occurred 296-310 Mya during the end stages of the Pennsylvanian; this volcanic event deposited the [Skagerrak-Centered Large Igneous Province](#) (SCLIP). The SCLIP consists of approximately 228,000 km² of currently exposed volcanic material found in the [Skagerrak](#), the [Oslo Fjord](#), the central North Sea and Northeast Germany. As well, there are 14,000 km² of volcanic [sills](#) in Scotland, England, Germany, the Netherlands, and Sweden; and 3,353 km total length of volcanic [dykes](#) in Scotland, Norway, and Sweden.

The equator ran from present day San Francisco to Nova Scotia and into Britain and France during the Pennsylvanian. The consequence of this was that those regions enjoyed a tropical climate; a climate that contributed to the growth of forests and the deposition of coal in those

tropical forests. Outside of the tropical areas, glaciers grew in Gondwana, which during the Pennsylvanian stretched into south polar regions.

One of the consequences of the deposition of coal was the removal of atmospheric carbon; the concentration of carbon dioxide in the atmosphere decreased to one of its all time global lows in the Pennsylvanian and early Permian. This led not only to the growth of glaciers in Gondwana, but also to a general cooler and drier of the climate throughout the Earth. This climate was unfavourable to rainforests and the creatures that lived in them and led to an event known as the [Carboniferous Rainforest Collapse](#). In this event, forests shrank into isolated patches and were mostly confined to wet valleys further. Only a little of the original forest plants and animals survived this climate crisis.

Subdivisions of the Pennsylvanian

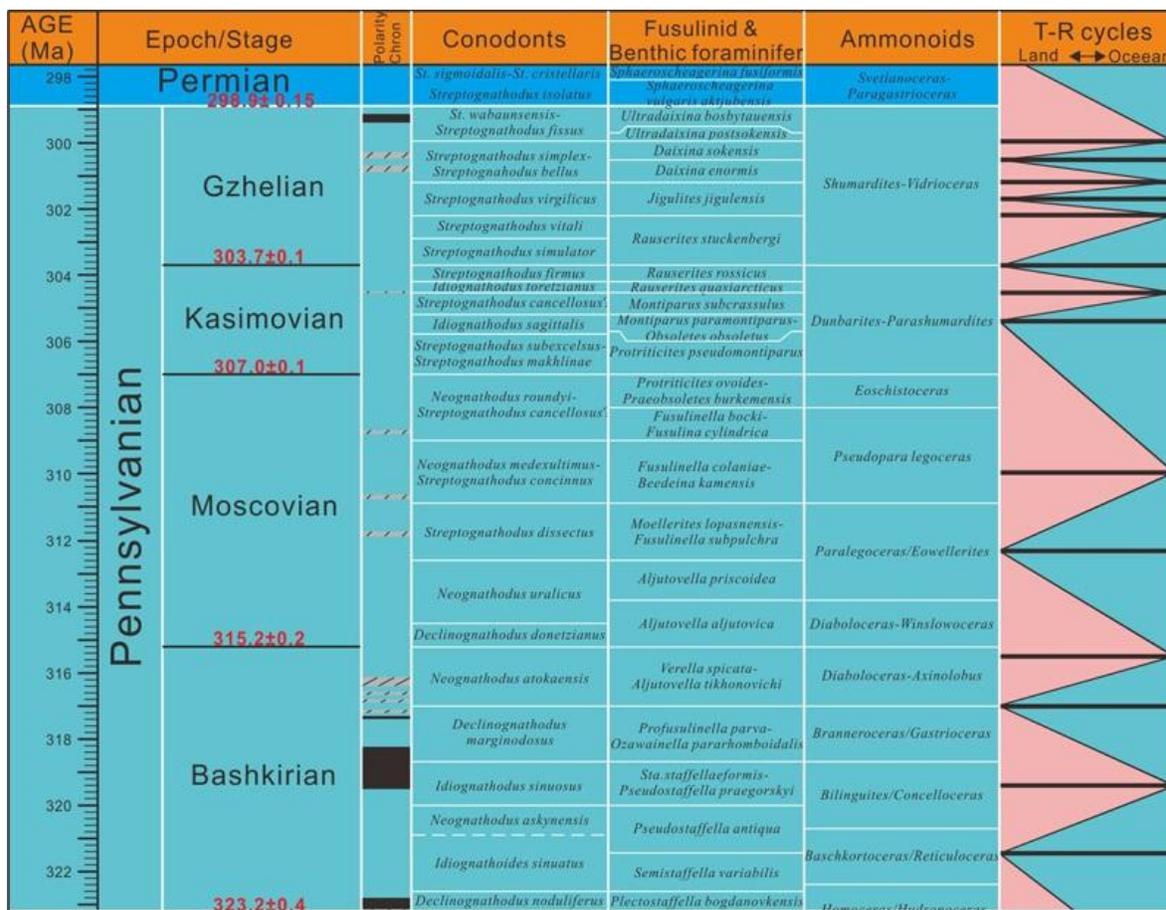


Figure 3 - Subdivisions of the Pennsylvanian Period

Credit: International Subcommittee on Carboniferous Stratigraphy

The Pennsylvanian is divided into four subdivisions: the [Bashkirian](#) (the oldest), the [Moscovian](#), the [Kasimovian](#) and the [Gzhelian](#) (the youngest). All these subdivisions are named after places in Russia.

The Bashkirian subdivision covers the time from 323.2 to 315.2 Mya. The base of the Bashkirian is marked by the first appearance of [conodont](#) species [Declinognathodus noduliferus](#). The top of the subdivision (the base of the Moscovian) is marked by the first appearance of conodonts [Declinognathodus donetzianus](#) or [Idiognathoides postsulcatus](#), or at the first appearance of [fusulinid](#) [Aljutovella aljutovica](#). The Bashkirian was named after [Bashkortostan](#) in the southern [Ural Mountains](#) of [Russia](#), home of the [Bashkir people](#). The [Global Boundary Stratotype Section and Point](#) (GSSP) type location for the base of the subdivision is in the [Battleship Wash Formation](#) at [Arrow Canyon, Nevada](#).

The Moscovian subdivision covers the time from 315.2 to 307 Mya. The base of the fusulinid [biozone](#) of [Obsoletes obsoletes](#) and [Protriticites pseudomontiparus](#) mark the top of the Moscovian (base of the Kasimovian) is or with the first appearance of the [ammonite](#) genus [Parashumardites](#). The subdivision is named after the city of Moscow, Russia. No GSSP type location for the Moscovian Stage has been defined.

The Kasimovian subdivision covers the time from 307 to 303.7 Mya. It corresponds to a subdivision in use in the United States called the Missourian. The Kasimovian saw the Carboniferous Rainforest Collapse, at 305 Mya, noted above. The top of the Kasimovian is close to the first appearances of the fusulinid genera [Daixina](#), [Jigulites](#) and [Rugosofusulina](#) or the first appearance of the conodont [Streptognathodus zethus](#). The Kasimovian is named after the Russian city of [Kasimov](#).

The Gzhelian subdivision covers the time from 303.7 to 298.9 Mya. The top of the Gzhelian, and the base of the Permian Period, is at the first appearance of the conodont [Streptognathodus isolatus](#). The upper boundary GSSP is at [Aidaralash](#), in the Ural Mountains of Kazakhstan. The Gzhelian is named after the Russian village of [Gzhel](#) in the Ramensky District of the [Moscow Oblast](#), Russia.

The Formation of Coal



Figure 4 - Bituminous Coal
Credit: [Chris 7](#), [USGS](#), public domain

The Carboniferous Period, of which the Pennsylvanian Period is considered a sub-period by the [International Subcommission on Carboniferous Stratigraphy](#), is named after the huge deposits of coal that are found in the rocks of the Carboniferous. Coal geology and mining is a huge subject, one that I hope to return to in the future, but we'll take a quick look at it here since it is so important in understanding the Carboniferous and Pennsylvanian.

When dead vegetation accumulates faster than it can decay and be recycled, the immediate result is the accumulation of [peat](#). During modern, i.e. [Holocene](#), times, this mostly happens in cold climate regions such as Ireland, the [taiga](#) regions of Siberia and in the forests of northern Canada. During the Carboniferous (in Europe) and the Pennsylvanian (in North America), this accumulation of plant material happened in tropical forests. When sea levels rose, the peat beds became buried under [clastic sediments](#) and were compressed by the weight of the overlying material. Over time the peat became compressed into first [lignite, or brown coal](#), and with deeper burial the lignite became [sub-bituminous](#) and then [bituminous coal](#). If the rocks are subjected to [metamorphism](#), for example through orogeny, the bituminous coal can be further compressed into [anthracite coal](#) and eventually into [graphite](#).

<p>Plant material --> Peat --> Lignite --> Sub-bituminous --> Bituminous --> Anthracite --> Graphite --> Increasing Heat and Pressure --></p>

Figure 5 - The Progression of Coal Formation

That's the brief summary of coal formation, we will look deeper into the subject in a future posting.

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.