

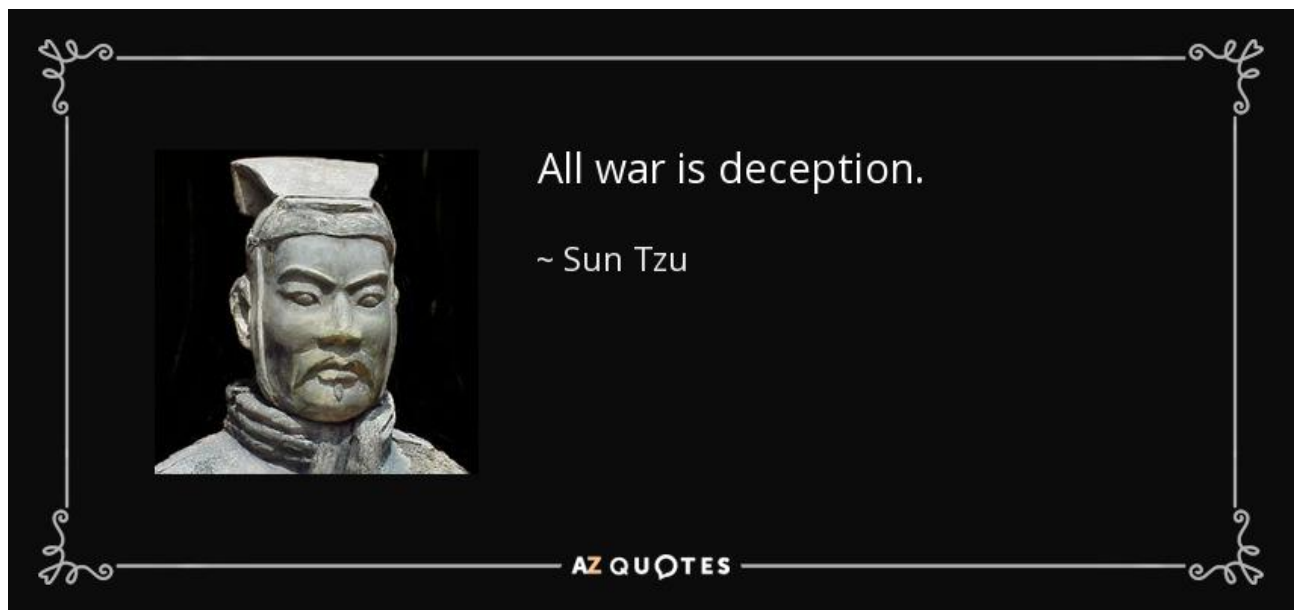
April 4, 2022

First, apologies for the glitches in last week's entry, I didn't notice and correct them till later in the week. I'll leave the March 28th posting on the blog site for an extra week.

News and notes

Before going on with a discussion on aquatic life during the Permian Period, let's take a look at the world of geopolitics followed by some news items that I thought were interesting.

Geopolitics - Ukraine



[Credit: A-Z Quotes](#)

The war in Ukraine continues. I wouldn't want to be one of Vladimir Putin's advisors who suggested that the "special military operation" in Ukraine would be over in a week or so. Keeping in mind Sun Tzu's observation, here are a couple of useful sites on the conflict:

- Daily updates at the [Institute for the Study of War](#), they are a bunch of [neo-conservative](#) consultants ([beltway bandits](#)), but their views can be useful.
- [Updates from the French Ministère des Armées](#), in French, but some browsers have a translation option.
- [Shirvan Neftchi of Caspian Report](#) has a good description of the tactics used in the conflict.
- [Moon of Alabama](#): daily commentary
- [Geopolitics and Empire](#) podcast - lots of commentary on the Ukraine war and other geopolitical issues.

Geopolitics - In General

If you wonder where the idea of "[geopolitics](#)" came from, it is one of those ideas that arose during the late 19th and early 20th centuries among academics. The topic continues to fascinate grand thinkers or people style themselves as such.

In the English speaking worlds, the basic ideas of geopolitics were first outlined by [Alfred Thayer Mahan](#) in his 1890 book [The Influence of Sea Power Upon History, 1660–1783](#). [Emil Reich](#) coined the word "geopolitics" in his 1904 book [Foundations of Modern Europe](#). [Halford J. Mackinder](#) further expanded on the topic in three publications: [The Geographical Pivot of History](#) (1904), [Democratic Ideals and Reality](#) (1919) and [The Round World and the Winning of the Peace](#) (1943). In the latter part of the 20th century [Henry Kissinger](#) and [Zbigniew Brzezinski](#) put forth their views on geopolitics in their books [Diplomacy](#) (Kissinger, 1994) and [The Grand Chessboard: American Primacy and Its Geostrategic Imperatives](#) (Brzezinski, 1997).

Geopolitical ideas have also been put forward in German, French and Russian publications. For example, the Russian thinker [Alexandr Dugin](#) has published extensively on the geopolitics, notably in his 2015 book [Last War of the World-Island: The Geopolitics of Contemporary Russia](#). ([Excellent review here.](#))

The basic idea of geopolitics is that the geographic location of a nation, or a group of closely aligned states, determines the possibilities and even fate of those [polities](#). For example, Dugin describes Russia as the main land power of Eurasia (the World Island) and, as a consequence, Russia is forever going to be in conflict with the outer reaches of the world, especially Anglo-American sea power of the United States its allies.

Geopolitics is an interesting concept, especially to those who look to grand historical narratives to explain the world. However, like any other grand theory, you need to evaluate it by the evidence.

Research

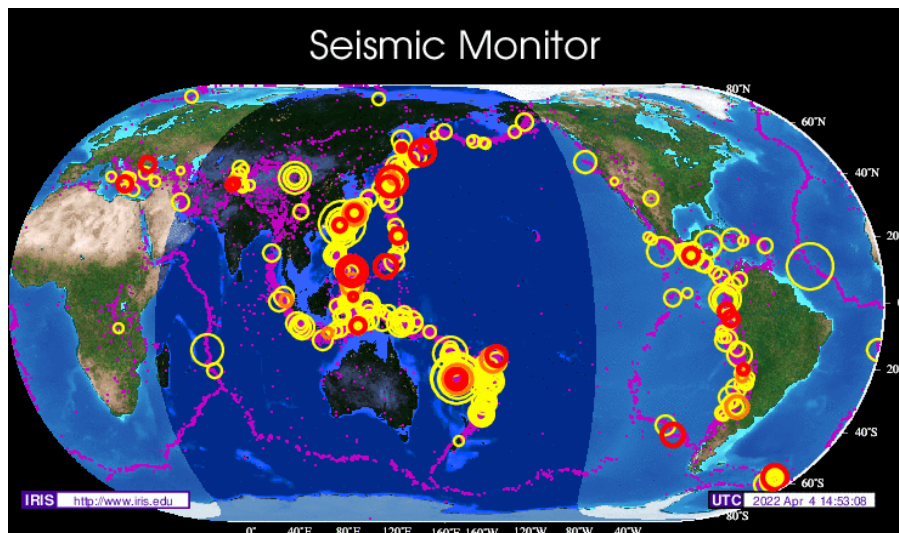
- Periodic mass extinction in the Jurassic: [Periodicity of Karoo rift zone magmatism](#).
- Improvements in geophysics: [Geophysical Inversion Using a Variational Autoencoder](#); includes a plain language summary.
- Ocean currents and climate: [Deep-sea hiatuses track the vigor of Cenozoic ocean bottom currents](#).
- Helium and the history of the Earth: [Primordial Helium-3 Exchange Between Earth's Core and Mantle](#), includes a plain language summary.
- [Planet-scale MRI: High resolution illumination of Earth's interior down to the planet's core](#).

- Permafrost: [New high-resolution estimates of the permafrost thermal state and hydrothermal conditions over the Northern Hemisphere](#); the Chinese have been taking an increasing interest in Arctic affairs.
- Pleistocene climate research: [Biomarker Proxy Records of Arctic Climate Change During the MidPleistocene Transition from Lake El'gygytgyn \(Far East Russia\)](#); summary article [here](#).
- Erosion: [New study solves mystery of how soft liquid droplets erode hard surfaces](#).
- Rock solid? [Nonlinear statistical damage constitutive model of granite based on the energy dissipation ratio](#); breaking rocks for fun.
- [A proposed new mineralogical classification system for granitic pegmatites](#); lots of rare metals in pegmatites.

Paleontology

- Evolutionary history: [Paleozoic origins of cheilostome bryozoans and their parental care inferred by a new genome-skimmed phylogeny](#). Related: [Bryozoan revelations](#); bryozoans as a model for understanding evolution.
- Asking the important questions: [How did cockroaches survive the asteroid that led to the extinction of dinosaurs?](#)

Volcanoes, Earthquakes and Geohazards



[Credit: Seismic Monitor, April 4, 2022](#)


- [Worldwide Volcano News and Updates](#).
- [Updates on the Taal Volcano, Philippines](#); on going eruption.

- Tonga Volcano: [2022 Tonga Volcanic Eruption Induced Global Propagation of Ionospheric Disturbances via Lamb Waves](#); related [study of the Hunga Tonga-Hunga Ha’apai eruption](#).
- [Volcanoes, diamonds, and blobs: A billion-year history of Earth’s interior shows it's more mobile than we thought](#).
- [Volcano monitoring at Mount Etna using fibre optic cables](#).

Energy and Mining

- From the United States Energy Information Administration (USEIA): [EIA explores effects of not building future interstate natural gas pipelines](#).
- Also from the USEIA: [Annual Energy Outlook 2022](#); includes an outlook for energy markets through 2050.
- [Biden’s Latest Plan To Curb Soaring Gasoline Prices Angers Drillers](#); you can't just "turn on the tap"; related: [release of oil from the Strategic Petroleum Reserve](#).
- More instability: [Gulf Oil Producers Seek U.S. Military Support Against Yemen Attacks](#).
- [New tech makes eco-mining a reality for Rare Earths](#).
- [Social acceptance of geothermal energy: Visualizing consensus building using models](#).
- Gold deposits in the North American [Great Basin: Nanoscale isotopic evidence resolves origins of giant Carlin-type ore deposits](#).
- Not a secret anymore: [Tesla inks secret multi-year nickel supply deal with Vale](#).
- Manipulating markets: [From VW to JPMorgan, the unlikely cast behind nickel’s big squeeze](#). Related: [Nickel price climbs in thin trading as investors weigh supply risks](#).

Upcoming - GAC-MAC Halifax 2022

GAC- MAC- IAH-CNC- CSPG May 15-18	AGC- AMC- AIH-SNC- SCGP 15-18 mai	<i>Riding the waves of change Surfer sur la vague du changement</i>  HALIFAX 2022
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Mark your calendars! Join us in Halifax from May 15-18, 2022 for the Annual Meeting of the Geological Association of Canada (GAC), Mineralogical Association of Canada (MAC), Canadian Society of Petroleum Geologists (CSPG) and International Association of Hydrogeologists Canadian National Committee (IAH-CNC). This meeting coincides with the 50th anniversary of the Atlantic Geoscience Society, the conference host organization. The conference promises a diverse program including special sessions, field trips, and short courses related to a wide variety of geoscience disciplines.

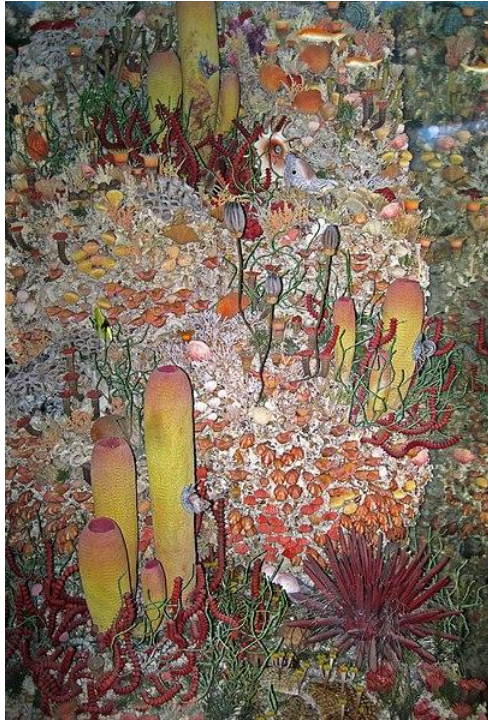
Please visit our website: <http://ags.earthsciences.dal.ca/Halifax2022/> and follow the conference social media accounts on Facebook (Halifax Geoscience), Twitter (HalifaxGeo2022) and Instagram (halifaxgeo2022) for more information.

See you in Halifax!

[Link](#)

April 4, 2022

Aquatic Life in the Permian Period



Aquatic vertebrate life during the [Permian Period](#) included: [ray finned fishes](#), primarily of the subgroup [Palaeopterygii](#) that includes modern [sturgeon](#) and [paddlefishes](#); [coelacanths](#), [lungfish](#), and cartilaginous fish such as [Xenacanthiformes](#), [Holocephali](#), and [Hybodonts](#).

Invertebrate life during the period is attested by abundant fossils of fossil [mollusks](#), [echinoderms](#), and [brachiopods](#). Permian mollusks included [ammonoids](#), [gastropods](#) and [pelecypods](#) (bivalves). Echinoderm fossils from the Permian include [bryozoans](#) and [crinoids](#). Other invertebrate fossils from the Permian include [corals](#), [sponges](#) and [foraminifera](#).

Let's take a look at some examples of these long gone creatures.

Figure 1 - Diorama of a Permian Seafloor

Credit: [James St. John](#), [Creative Commons Attribution 2.0 Generic](#) license

Invertebrates

Foraminifera

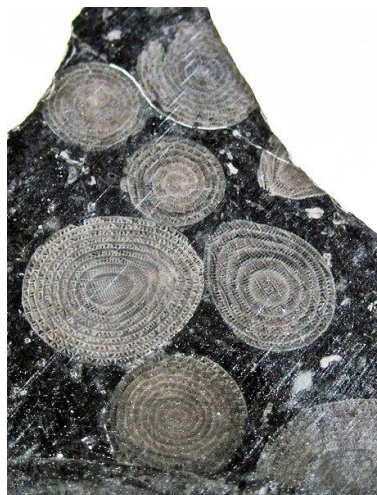


Figure 2 - *Yabeina globosa*, a Permian fusulinid foraminifera

Credit: [James St. John](#), [Creative Commons Attribution 2.0 Generic](#) license

Foraminifera are single celled [amoeba](#) like creatures that secrete a hard shell or "test", usually made out of [calcium carbonate](#) or [chitin](#). Calcium carbonate foraminiferan tests are often found in limestone deposits. [Fusulinid](#) foraminifera such as [Yabeina globosa](#), Figure 2, were common during the Permian.

Sponges



Figure 3 - Permian Sponge Fossil

Credit: [Field Museum](#)

The reef deposits of the [Permian Basin](#) in Texas are largely made up of the remains of [calcareous sponges](#). The largest of these sponge reefs were deposited during the [Guadalupian Epoch](#). [El Capitan](#) mountain in the [Guadalupe Mountains National Park, Texas](#) is an exposed portion of the 350-mile long Capitan Reef made up of lime mud, calcareous sponges and [stromatolites](#). The [Capitan Reef is an important aquifer](#) in Texas.

Molluscs - Pelecypods (Bivalves)

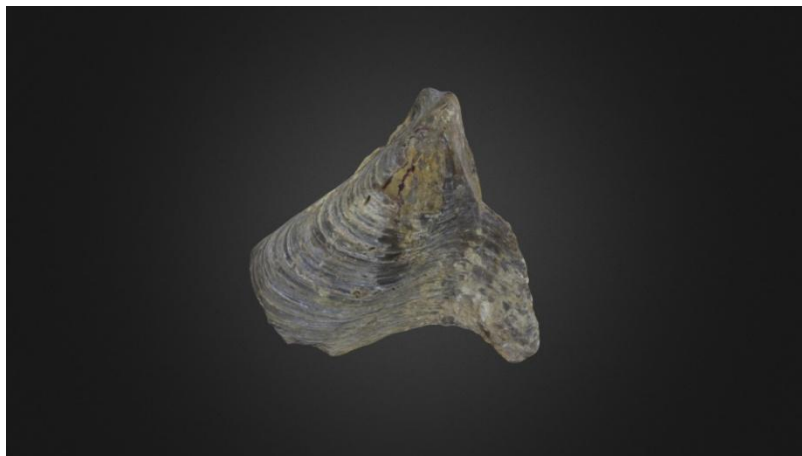


Figure 4 - Bivalve: *Myalina copei* (PRI 50306)

Credit: [Digital Atlas of Ancient Life](#), [CC BY-SA 4.0](#) license

Bivalve molluscs included many of the near shore and reef creatures that we see in modern times. [Myalina copei](#), an oyster, was an important component of the Permian Reefs of West Texas. Another example of Permian bivalves were [Alatoconchids](#), giant sized clams.

Molluscs - Gastropods



Figure 5 - Permian Snail Fossil

Credit: [c.j.b.](#), [CC BY 2.0](#) license

Another set of fossil invertebrates from the Permian are gastropods. While not the most common fossils, they show up in Permian limestone and shales and are often associated with brachiopods and corals in reef deposits.

Molluscs - Ammonoids

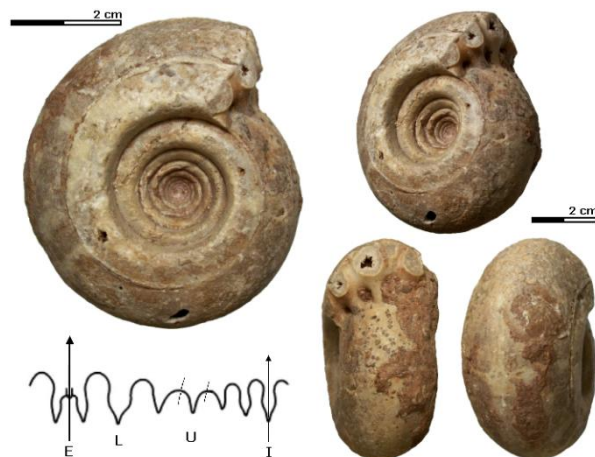


Figure 6 - *Metalegoceras*, a Permian Goniatite

Credit: [Antonov](#), [public domain](#)

Ammonoids first appeared in the [Devonian](#) Period and persisted until the just after [the end of the Cretaceous Period](#) in the earliest, [Danian Stage](#), of the [Paleocene Epoch](#). During the Permian Period, the most common ammonoid fossils are from [Goniatite](#) and [Ceratitida](#).

Goniatites fossils are found from the Devonian to [Triassic Period](#) rocks. Ceratitida ammonites arose during the late Permian and persisted until the Triassic.

Rugose and Tabulate Corals



Figure 7 - Close-up of Coral Heads Surrounded by Carbonate Grainstone
[Credit: Bruce Cornet, Ph.D., El Paso Community College](#)

Both [tabulate](#) and [rugose](#) corals were common reef building organisms during the Permian Period. Rugose corals were often solitary, like modern [sea anemones](#) whereas tabulate corals were all colonial. Both types of coral went extinct during the [End Permian Mass Extinction](#).

Brachiopods

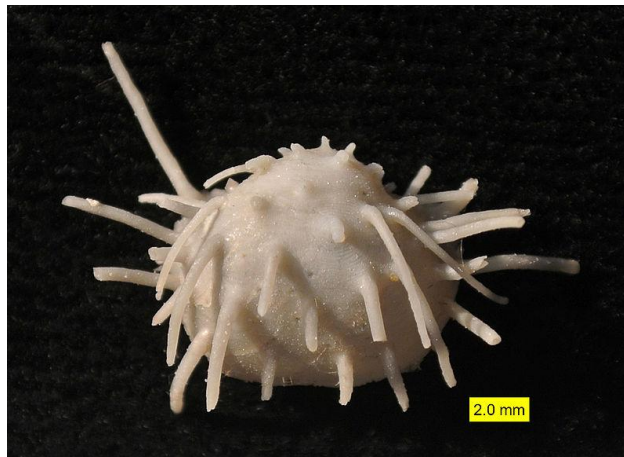


Figure 8 - A Permian Productid Brachiopod from Texas
[Credit: Wilson44691, Creative Commons CC0 1.0 Universal Public Domain Dedication](#)

Brachiopods were another common organism on Permian reefs, of which the [Productids](#) were among the most common. Characterized by weird spines on the shell, Productids arose during the Lower Devonian and persisted until the Upper Permian, possibly surviving into the Lower

Triassic. During their time, the Productids were an extremely successful and diverse group of brachiopods, often dominating late Paleozoic marine ecosystems.

Echinoderms - Bryozoans and Crinoids



Figure 9 - Permian Bryozoan *Ramipora hochstetteri* from Bjørnøya
Credit: [Natural History Museum](#), Oslo, Norway

Bryozoans are colonial echinoderms that first appeared in the Early [Ordovician](#) and continue to live today. During the Permian Period, they were widely distributed [usually found on shelf and open shelf environments](#).



Figure 10 - Permian Crinoid from Miyagi-prefecture, Japan
Credit: Junpei Satoh, [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

Crinoids or sea lilies are another echinoderm that first appears in the fossil record in the Ordovician and continues to live in modern times. During the Permian, crinoids were not as common as they previously had been but they are found in the fossil record from that time.

Vertebrates

Bony Fish - *Rhabdolepis*



Figure 11 - *Rhabdolepis macropterus*

Credit: [James St. John](#), [Creative Commons Attribution 2.0 Generic](#) license

Rhabdolepis was a genus of bony fish that lived during the Early Permian first described by [Louis Agassiz](#) in 1835 in the paper: *Contenant l'Histoire de l'Ordre des Ganoides*. In *Recherches sur les poissons fossils*, vol. 2, ed. L. Agassiz, 1–336. Neuchâtel: Petitpièrre.

Bony Fish - *Ebenaqua ritchei*



Figure 12 - Restoration of the Late Permian *Ebenaqua ritchei*

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

Another bony fish from the Permian was [Ebonaqua ritchei](#). Classified as a [bobasatraniiform](#) fish, fossils of *E. ritchei* were found near [Blackwater](#), Queensland, Australia in Late Permian deposits of the [Rangal Coal Measures](#).

Sharks - *Lebachacanthus senckenbergianus*



Figure 13 - *Lebachacanthus senckenbergianus*, a Permian Shark

[Credit: Yohanes Wahyu Nurcahyo, Creative Commons Attribution-Share Alike 4.0 International license](#)

A Xenacanthiform shark, [Lebachacanthus](#) is known from Early Permian deposits of both marine and freshwater origin. Fossils of [Lebachacanthus senckenbergianus](#) were first described by Anton Frisch (or [Antonín Frič](#)) in the 1889 paper *Fauna der Gaskohle und der Kalksteine der Permformation Böhmens*, Band 2 (4) 114 pp.(Rivnác), Prague.

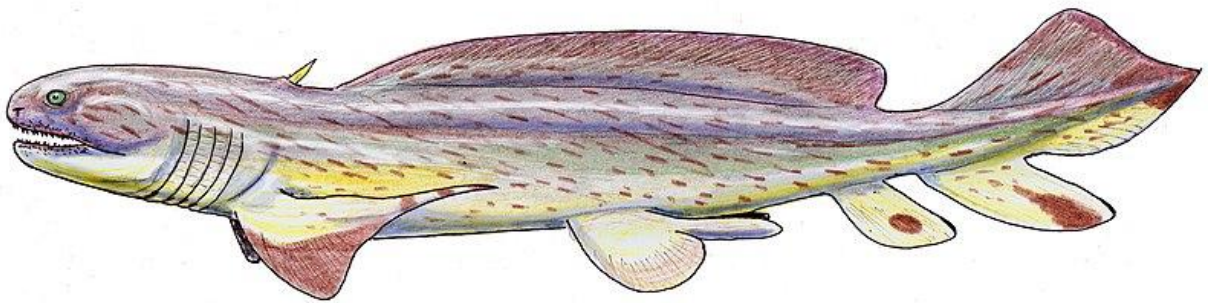


Figure 14 - Reconstruction of *Lebachacanthus*

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

Other Cartilaginous Fish: *Janassa bituminosa* and *Menaspis armatus*

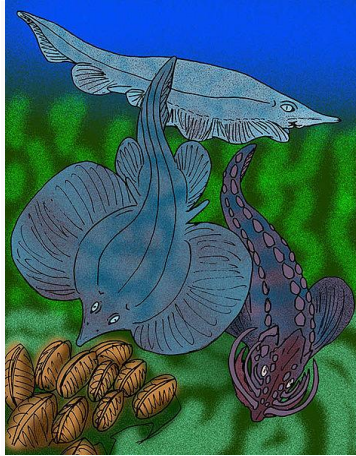


Figure 15 - Reconstructions of *Janassa bituminosa* and *Menaspis armatus*
Credit: [Apokrytaros](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

First described in 1984 in the paper H. W. Holzapfel and E. Malzahn. 1984. *Die Fischreste der küstennahen Sedimente des unteren Zechstein 1 Westdeutschlands*. *Geologica et Palaeontologica* 18:81-99, *Janassa bituminosa*, was a skate-like [petalodont](#) cartilaginous fish that lived from the [Carboniferous](#) to the upper Permian. Fossils of *J. bituminosa* have been found in Germany, fossils of the genus *Janassa* have been found in the United States.

Menaspis armatus is an extinct [holocephalian](#) cartilaginous fish that lived during the Permian. It was first described by J. Ewald in 1848 in the paper *Über Menaspis, eine neue fossile Fischgattung*, *Berichte Über die zur Bekanntmachung Geeigneten Verhandlungen der Königlich-Preussischen Akademie der Wissenschaften zur Berlin* 1848:33-35. It is thought to be closely related to the [Deltoptychius](#).

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.