

February 7, 2022

News and Views

Before looking at life during the Devonian Period, let's look at some news items that I thought were interesting:

Volcanoes, Earthquakes and Geohazards

- Philippines: [Taal Volcano records 152 volcanic quakes, 'short-lived' phreatomagmatic burst.](#)
- Oregon: [Geologists 'closely monitoring' rising magma under Three Sisters volcanic region.](#)
- United Kingdom: [How structural geologists help forecast volcanic eruptions.](#)
- [Latest volcano news.](#)
- [Latest earthquakes from the United States Geological Survey \(USGS\).](#)
- [Earthquakes Canada.](#)
- [Forecasting landslides from space.](#)

Mining and Energy

- [Colombia to open gold, coal assets up for bids;](#) seeking foreign investment
- From the [United States Energy Information Administration \(USEIA\): Utilities' carbon-reduction goals will have little impact on U.S. CO2 emissions.](#)
- From the USGS, recovering rare earth metals from mine tailings: [Using Remote Sensing to Turn Trash into Treasure.](#)
- From the Atlantic: [Is California on the Verge of a Second Gold Rush?](#); I talked about gold and silver [a year ago on this blog.](#)
- [North Sea Abigail oilfield plan approved despite climate goals;](#) people need oil.
- [Scientists identify geological 'Goldilocks zone' for the formation of metal ore deposits.](#)

Research

- From [Nature Geology: A Jurassic record encodes an analogous Dansgaard-Oeschger climate periodicity;](#) looking into past climate changes.
- From the Geological Society of America: [New Geology articles published online ahead of print in January.](#)
- From the USGS: [Characterization of Ambient Groundwater Quality Within a Statewide, Fixed-Station Monitoring Network in Pennsylvania, 2015–19;](#) there was a lot of complaints about well water quality in Pennsylvania when natural gas extraction wells were being drilled in the shale deposits.

- Ancient tsunamis: [New analysis of tsunami deposits paints a clearer picture of Sanriku's past](#); research paper [here](#).
 - Evolutionary history: [Supermountains controlled the evolution of life on Earth](#); research paper [here](#).
 - Glacial history: [Western US 'megafloods' during last ice age might not have been so mega](#); research paper [here](#); the Missoula Scablands are a favourite subject for [Randall Carlson](#).
 - [How fault lines in a kitchen sink are changing what we know about geology](#); research paper [here](#).
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Life in the Devonian Period, The Age of Fishes



Figure 1 - Diorama of a Devonian Seafloor

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

The Devonian Period has been called the *Age of Fishes* because it was during this time fishes proliferated through the Earth's oceans, seas, and waterways. However, it would be a mistake to think that they were the predominant large creatures. During the Devonian Period, fishes co-existed with a large variety of invertebrates including [ammonoids](#), [bivalves](#), [corals](#), [brachiopods](#), [trilobites](#), and other [arthropods](#). When looking at the fossil fishes from the Devonian, we should keep in mind that then, as now, invertebrates outnumbered vertebrate animals.

By the start of the Devonian, 419 million years ago, jawed fishes had divided into three distinct groups:

- [Chondrichthyes](#), cartilaginous fishes;
- [Placoderms](#), ancient armoured fishes; and
- [Osteichthyes](#) bony fishes.

Chondrichthyes - Cartilaginous Fish

Chondrichthyes are fishes that have skeletons primarily composed of cartilage such as sharks and rays. The first unequivocal members of the group appeared in the Silurian and during the Devonian they proliferated into many taxa such as [Cladoseleche](#), [Eugeneodontiformes](#), [Symmoriida](#), [Xenacanthiformes](#), [Ctenacanthiformes](#), [Hybodontiformes](#), [Galeomorphi](#), [Squaliformes](#) and [Batoidea](#).

Palaeospondylus gunni

Among the [earliest representatives](#) of Chondrichthyes are [Palaeospondylus gunni](#). First described from Achanarras slate quarry in Caithness, Scotland, *Palaeospondylus gunni* is a rare fossil and an unique example of the early fish on earth. Small in size, around six centimetres long, it had an eel like structure.



Figure 2 - Reconstruction of *Palaeospondylus gunni*

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

Cladoseleche



Figure 4 - *Cladoseleche fylleri*

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

The first abundant genus of shark, *Cladoseleche*, appeared in the oceans during the Upper Devonian Period. First discovered in the [Cleveland Shale](#) along the south shore of Lake Erie.

some of the fossils are so well preserved that they included traces of skin, muscle fibers, and internal organs. *Cladoselache* grew to around 2 m in length and had features similar to modern [mackerel sharks](#). The fossils suggest that it had five to seven gill slits, had no scales and a short rounded snout with its mouth at the front of the skull. It's overall form suggests that it moved with speed and agility, both capture prey and avoid other predators.

Armoured Fishes - Placoderms

The Placoderms, or armoured fishes are among the best known of the Devonian fishes and often figure prominently in discussions of the Age of Fishes. Placoderms first appeared during the Llandovery Epoch of the Silurian Period and were abundant throughout the Devonian Period. They became extinct at the end of the Devonian during the [Hangenberg event](#). Here are a couple of examples of Placoderms.

Dunkleosteus terelli



Figure 4 - *Dunkleosteus terelli* - Placoderm Fish Skull

Credit: Tim Evanson, [Creative Commons Attribution-Share Alike 2.0 Generic](#) license

Described as the "[biggest, meanest, scariest predator around](#)", *Dunkleosteus terelli* lived in the Upper Devonian and was the largest species of the *Dunkleosteus* genus that includes 8 related species.

An [arthrodire](#) placoderm, *D. terelli* had heavy bony plating around their head and body. It grew to about 15 metres in length and weighed about 1000 kilograms. [Studies estimate](#) the force of its bite was remarkably powerful 5,000 kg. there are suggestions that its prey included *Cladoselache*.

Fossil remains of *D. terelli* are found in Late Devonian formations in the United States including the Cleveland Shale in Ohio, the [Conneaut Group](#) in Pennsylvania, [Chattanooga Shale](#) in Tennessee, and the [Lost Burro Formation](#) in California.



Figure 5 - *Dunkleosteus terelli* Size Comparison

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

Coccosteus cuspidatus

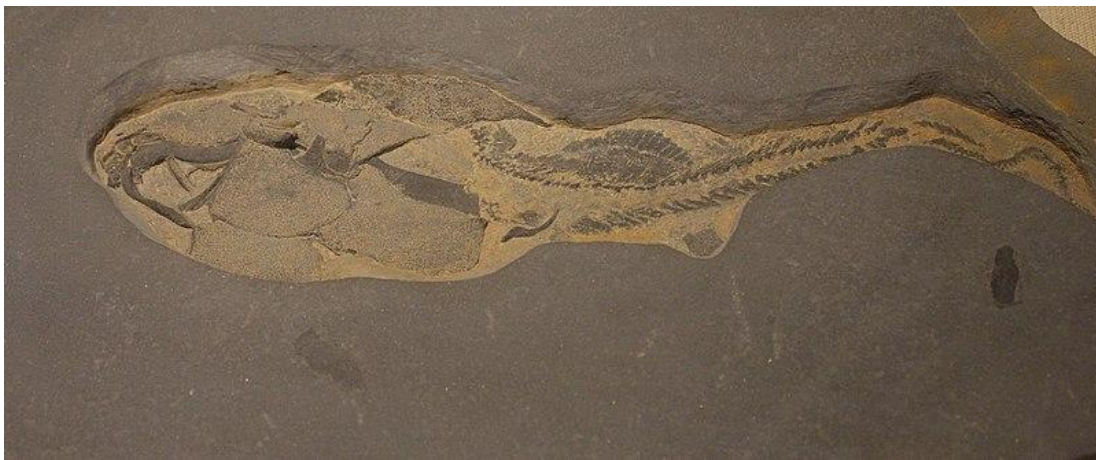


Figure 6 - Fossil of *Coccosteus cuspidatus*

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

Another arthrodire placoderm, [Coccosteus cuspidatus](#) lived during the Middle Devonian and is known from Devonian deposits in the Scottish [Orcaadian Basin](#). Full grown specimens ranged from 20 to 40 cm in length and are often found in freshwater sediments.



Figure 7 - Reconstruction of *Coccosteus cuspidatus*

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

Osteichthyes - Bony Fish

The modern bony fishes, Osteichthyes, first appeared in the late Silurian or early Devonian. By the Early Devonian, the Osteichthyes had divided into the two main classes that continue to this day: the [Actinopterygii](#), the ray finned fishes, and the [Sarcopterygii](#), the lobe finned fishes. Let's look at a couple of examples of these from the Devonian Period.

Cheirolepis



Figure 8 - *Cheirolepis canadensis*

Credit: [Placoderm2](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license

Fossils of [Cheirolepis](#), an extinct genera of ray finned fish, are found in Devonian formations in Europe and North America. There are six known species of *Cheirolepis*, the best known of which are:

- [C. trailli](#), the type species of the genera originally found in Middle Devonian formations in Scotland; and
- [C. canadensis](#), originally found in Upper Devonian rock in the [Miguasha National Park](#) in the Gaspé region of Quebec.

Cheirolepis appears to have been a predatory fish that lived in freshwater bodies and in estuaries. It had a streamlined body suggesting that it moved with speed and agility.

Lobe Finned Fishes and Tetrapods

The Sarcopterygii or lobe finned fishes are the second great group of bony fishes that first appeared in the Silurian and later diversified in the Devonian. The Sarcopterygii split into two lineages during the Lower Devonian: the [coelacanth](#)s and the [rhhipidistia](#)n.

The earliest fossil remains of coelacanth are from the [Early Devonian of Australia](#). Study of the

fossil remains of coelacanths indicate that they thrived in open water ([pelagic](#)) ocean habitats during the Devonian and later [Carboniferous](#). Although thought to have gone extinct at the end of the Cretaceous, two species of the genus [Latimeria](#) live today in the Indian Ocean, one species living off the east coast of Africa (*L. chalumnae*) and the other in the vicinity of Indonesia (*L. menadoensis*).



Figure 9 - Model of a Devonian Coelacanth, Houston Museum of Natural Science
Credit: [Daderot, Creative Commons CC0 1.0 Universal Public Domain Dedication](#)

The rhipidistians, which appeared to have lived in estuaries and freshwater habitats, later split into [lungfish](#) and the [tetrapodomorphs](#).



Figure 10 - Fossil Lungfish, Devonian Caithness Flagstone, Scotland
Credit: [marsupium photography, Creative Commons, Attribution-Share Alike 2.0 Generic license](#)

Lungfish are known from the Devonian to the present, with about six species remaining today in Africa, South America and Australia, suggesting a common ancestry in ancient [Gondwana](#)

The tetrapodomorphs are the ancestors of tetrapods and thus, in turn, are the ancestors of all the terrestrial vertebrates: amphibians, reptiles, dinosaurs (including birds), and mammals (including us).

Among the earliest tetrapodomorphs to be found in a terrestrial environment was [*Tiktaalik sp.*](#) Found on Ellesmere Island, Nunavut, *Tiktaalik* appears to have been a lobe-finned fish that was capable of living outside the water. The fossil bones of *Tiktaalik* have basic wrist bones and simple rays reminiscent of fingers.



Figure 11 - Fossil *Tiktaalik*, Field Museum, Chicago

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



Figure 12 - Reconstruction of *Tiktaalik*

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

Some Thoughts

We don't know for certain if *Tiktaalik* is the ancestor of the tetrapods or even if it is a close relative of whatever tetrapodomorph was. Such are the vagaries of fossil preservation, the best we can say, for now, is that *Tiktaalik* is pretty much what we would expect to find in a tetrapodomorph that had the potential to evolve in what became the rest of the vertebrates.

It gives pause to think, however. Among the lobe-finned fishes, coelacanths found a comfortable niche in the equatorial ocean, first the [Tethys](#) and recently the Indian Ocean. Lungfish ventured into various water bodies and had the ability to survive droughts, they found a comfortable niche in the mud. Tetrapodomorphs, seem to have had greater challenges and consequently were subject to more severe natural selection; they ended up taking over the world.

Here's a humorous suggestions as to why the tetrapodomorphs left the water.

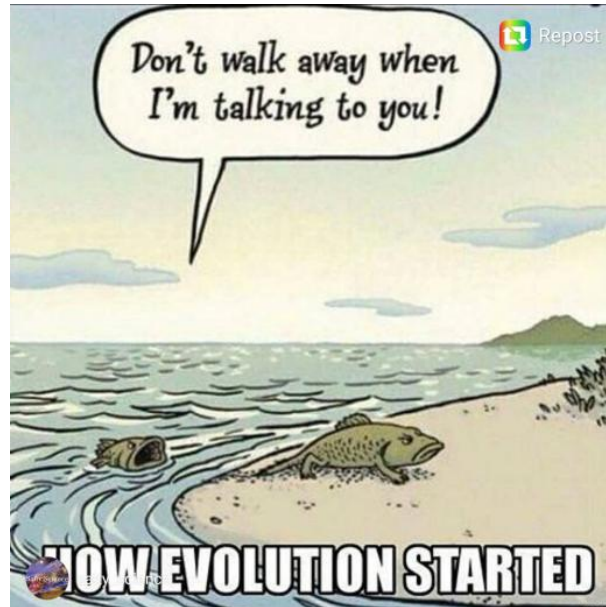


Figure 13 - Evolution meme

Credit: [Vulture Writer](#)

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.