

January 24, 2022

News and Views

Before going on to looking into life during the Silurian Period, let's look at some news items:

Hunga Tonga-Hunga Ha'apai Volcano

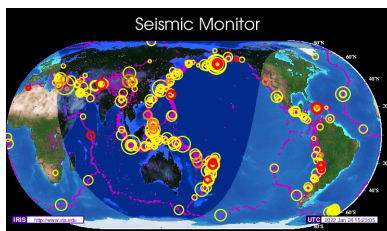
With an estimated explosive force equivalent to **10 megatons TNT**, Hunga Tonga-Hunga Ha'apai Volcano in the [Kingdom of Tonga](#) was truly an earth-shattering kaboom, here are some stories:

- Latest reports on the volcano at the [Hunga Tonga-Hunga Ha'apai website](#) set up by the Smithsonian Institution.
- [New Volcanic Island Unveils Explosive Past.](#)
- [Hunga Tonga-Hunga Ha'apai volcano \(Tonga\) activity update: spectacular video of passing shockwaves from Gemini North Observatory.](#)
- From the Echo newspaper, Mullumbimby NSW, Australia: [The Hunga Tonga-Hunga Ha'apai eruption: what comes next?](#)
- From Weather Nation: [Hunga Tonga-Hunga Ha'apai Volcanic Eruption.](#)
- From the Volcano Café (Because Volcanoes are Awesome): [The Hunga Tonga explosion.](#)
- [Tonga eruption: Shocking images show Hunga Tonga-Hunga Ha'apai almost completely wiped out.](#)
- [The most explosive eruption in 30 years, Hunga Tonga-Hunga Ha'apai rewrites tsunami rules.](#)
- The [Geology Hub](#) YouTube channel has some really neat reports on the Hunga Tonga-Hunga Ha'apai volcano.

Other Volcanoes

- [Eruption dynamics leading to a volcanic thunderstorm—The January 2020 eruption of Taal volcano, Philippines.](#)
- [Mount Etna's exceptional carbon dioxide emissions are triggered by deep reservoirs of the gas.](#)
- [Worldwide Volcano News and Updates.](#)
- [Volcano Videos.](#)

Earthquakes



- Magnitude 5.6: [Twin earthquakes in Afghanistan kill 26.](#)
- [Most recent earthquakes worldwide.](#)

Research

- [Linking Geology and Microbiology: Inactive Pockmarks Affect Sediment Microbial Community Structure.](#)
- Plate tectonics: [Tug of sun, moon could be driving plate motions on 'imbalanced' Earth.](#)
- From the Geological Society of America: [Rapid retreat of the southwestern Laurentide Ice Sheet during the Bølling-Allerød interval.](#)
- From Phys.org: [Weathering rocks hold clues to Earth's Great Oxidation Event](#); research paper [here](#).
- Also from Phys.org: [Radiometric dating sheds light on tectonic debate](#); research paper [here](#).
- From the United States Geological Survey (USGS): [Factors affecting groundwater quality used for domestic supply in Marcellus Shale region of North-Central and North-East Pennsylvania, USA](#); more accessible summary [here](#).
- [Muscular Study Reveals How Giant 50-Ton Sauropod Dinosaurs Moved and Evolved](#); research paper [here](#).
- [Impact of paleoclimate on present and future evolution of the Greenland Ice Sheet.](#)

Energy and Mining

- [Lithium price hits 'ludicrous mode' as battery metal extends 400% gain.](#)
- From the U.S. Energy Information Administration (USEIA): [EIA expects U.S. fossil fuel production to reach new highs in 2023.](#)

Shiny, Pretty Rocks

- [Sotheby's unveils 555.55-carat black diamond thought to come from outer space.](#)
- [Searching for the ultimate black opal](#); a 60 year search.
- [Museum set to shine in downtown Tucson during the Gem, Mineral & Fossil Showcase.](#)

Energy and Mining

- [Lithium price hits 'ludicrous mode' as battery metal extends 400% gain.](#)
- From the U.S. Energy Information Administration (USEIA): [EIA expects U.S. fossil fuel production to reach new highs in 2023.](#)
- [PDAC 2022 Convention moved to June.](#)

Falsehoods in Science

- [Attenborough fibbed about hundreds of dead walrus because he wanted what the WEF wants.](#); by [Dr. Susan Crockford](#).

January 24, 2022

Life in the Silurian Period

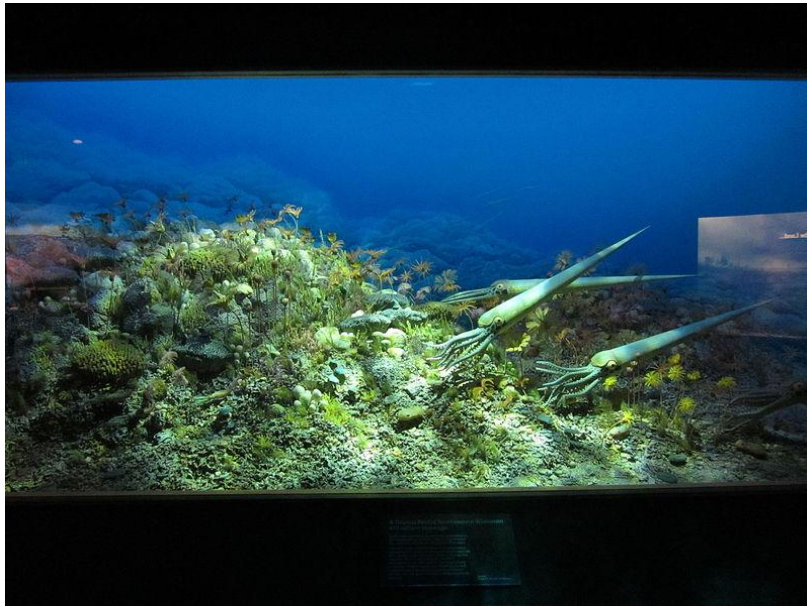


Figure 1 - Diorama of the Silurian Sea, [Milwaukee Public Museum](#)

Credit: [Evan Howard](#), [Creative Commons](#), [Attribution-Share Alike 2.0 Generic](#) license.

The Silurian period followed a major global extinction on earth, the [Ordovician/Silurian mass extinction](#). Made up of a series of catastrophes, the Ordovician/Silurian mass extinction resulted in the extinction of approximately 75 percent of marine genera.

The Silurian Period witnessed the evolution of at least three major forms of life:

- The appearance of the first land plants,
- The colonization of dry land by terrestrial invertebrates, and
- The evolution of jawed fish.

Marine Life During the Silurian Period

Marine life during the Silurian Period included invertebrates, such as cephalopods, graptolites, arthropods such as trilobites and the giant sea scorpion [Eurypterus](#), as well as vertebrates such as the jawed fish [Birkenia](#), [Andreolepis](#) and [Psarolepis](#).

Another feature of the Silurian was reef ecosystems. These thrived on the epicontinental seas bordering the terrestrial continents and consisted of a wide variety of corals, crinoids, and other animals.

Let's look at some examples.

Arthropods - Trilobites



Figure 2 - Trilobite *Calymene celebra*

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

Trilobites did fairly well in the Ordovician-Silurian mass extinction with approximately 74% of the genera surviving. Consequently, assemblages of early Silurian trilobite resembled those of the preceding Ordovician Period. Typical trilobite families of the Silurian included [Lichida](#) and [Phacopida](#). The Phacopida family including [Calymenina](#), of which *Calymene celebra* ([the Wisconsin State Fossil](#)) was a member.

Arthropods - Eurypterus



Figure 3 - *Eurypterus remipes*

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

Eurypterus is an extinct genus of [eurypterids](#) also called "sea scorpions", that lived during the Silurian Period. There are approximately 15 known species of *Eurypterus*, including *Eurypterus remipes* shown in Figure 3. In general, they were generalist species, equally likely to engage in predation or scavenging. They hunted small soft-bodied invertebrates like worms.

Cephalopods



Figure 4 - *Cyrtoceras* sp.

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

Typical cephalopods of the Silurian include [Michelinoceras](#), [Octamerella](#), [Gomphoceras](#), [Spyroceratidae](#), [Cyrtoceras](#) (Figure 4), and [Galtoceras](#). Like all [cephalopods](#), including modern versions, [Silurian cephalopods](#) were predators.

Vertebrates - Early Jawed Fish

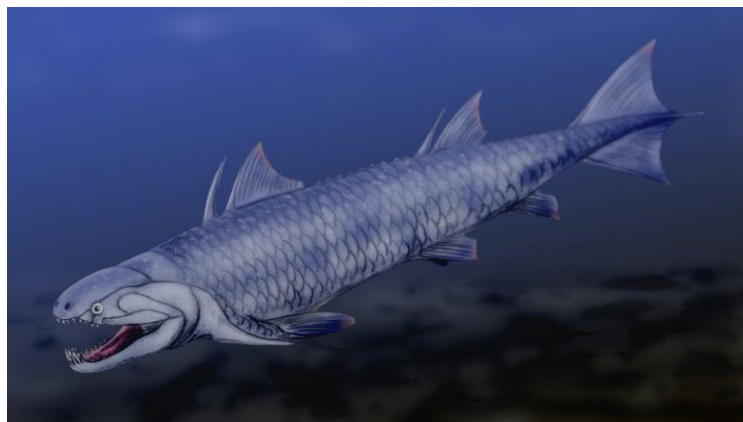


Figure 5 - *Psarolepis* sp.

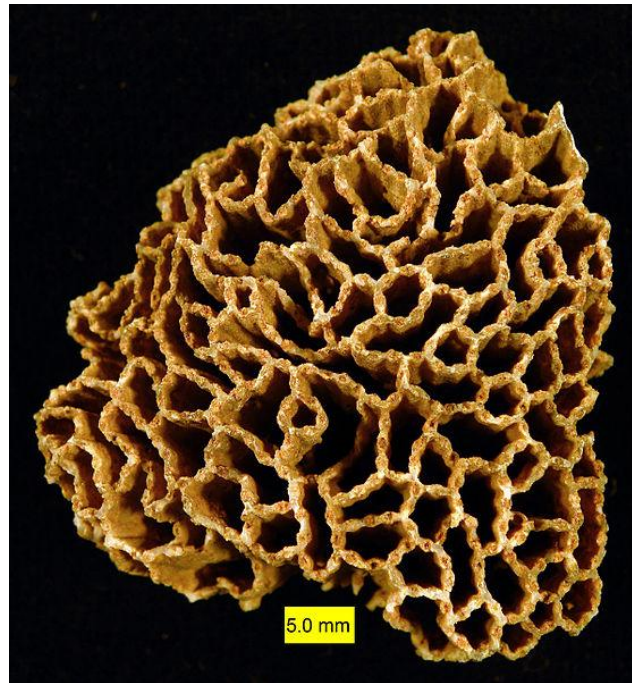
Credit: [Nobu Tamura](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license.

As we noted above, the Silurian Period saw the evolution of jawed fish like [Birkenia](#), [Andreolepis](#) and [Psarolepis](#) (Figure 5).

Fossils of *Psarolepis* have been found mainly in South China and were first described by paleontologist Xiaobo Yu in 1998. *Psarolepis* seems to be representative of the common ancestor of lobe-finned and ray-finned fish, and thus ancestral to [tetrapods](#), such as us.

We should be careful when identifying a fossils as the definitive ancestor to later creatures. This is because of the vagaries of fossil preservation. The actual species that was ancestral to tetrapods (like us) may never have been preserved and all we have is a close relative that resembles it.

Reef Building Organisms



**Figure 6 - [Halysites sp.](#) a Silurian Tabulate Coral
Credit: [Wilson44691](#), public domain**

Reef communities ecosystems are characterized by complex interactions among many types of organisms. In the Silurian period, reefs were made up of corals, such as the tabulate coral [Halysites](#) in Figure 6, [sponges](#) and bivalves such as [brachiopods](#). [Stromatoporoids](#), an extinct type of sponge, were also important constructors in Silurian reefs but do not exist today.

Terrestrial Life

The Silurian is the first Period for which we have conclusive evidence of terrestrial plants. These fossils included species such as [Baragwanathia](#), [Cooksonia](#) and [Psilophyton](#).

The earliest *Cooksonia* date from the middle of the Silurian and its fossils are distributed around the world. Most type specimens come from Britain, where they were first discovered in 1937. *Cooksonia* are the oldest known plant to have a stem with vascular tissue.

Psilophyton is another genus of fossil plants; currently there are eight species in this genus. The fossils are known from compression, impression, and permineralized anatomy. Fossil specimens come from northern Maine, Gaspé Bay of Quebec, New Brunswick, and the Czech Republic. The average specimen was around 60 cm tall.



Figure 7 - *Baragwanathia* sp.
Credit: [Canley](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

Baragwanathia is a genus of extinct [lycopsid](#) plants of Late Silurian to Early Devonian age (427 to 393 million years ago). Fossils of *Baragwanathia* have been found in Australia, Canada, China and the Czech Republic.

Also, as a general rule, if you find terrestrial plants you will also find animals that eat the plants. Fossil evidence of terrestrial animals has been found in from [Early Silurian rocks from the Central Appalachians](#), in the [Upper Silurian rocks in Shropshire, England](#) and in [coprolites](#) from [the Upper Silurian rocks of Gotland, Sweden](#).

Figure 8 shows the fossils of terrestrial animals from the Silurian of Shropshire, England.

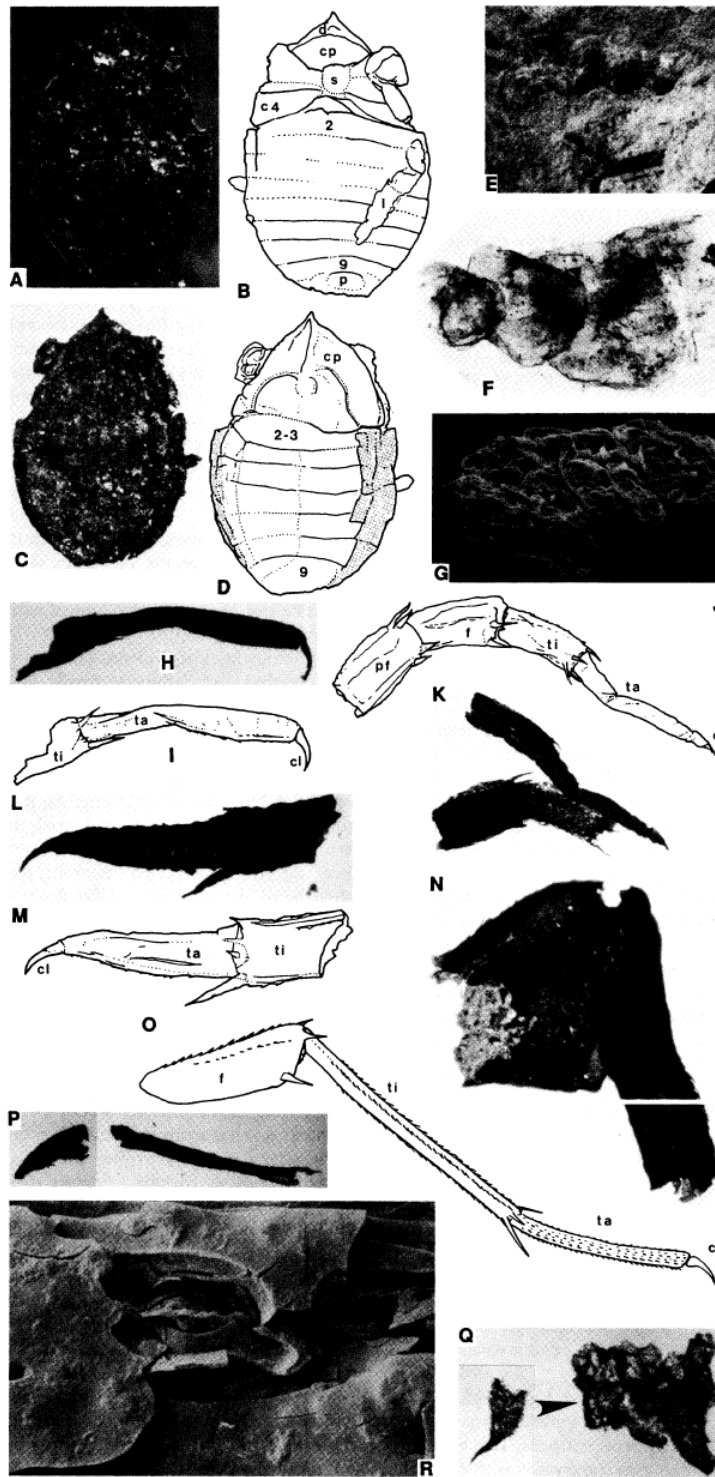


Fig. 1. Terrestrial biota from the Ludlow Bone Bed Member of Silurian (Pridoli) age, Ludford Lane, Ludlow, England. All photographs taken in incident light unless stated otherwise. (A–D) Trigonotarbid arachnid, (A) ventral view ($\times 31$), (B) drawing of (A), (C) dorsal view ($\times 31$), (D) drawing of (C); (E and F) kampecarid myriapod, (E) in rock, with bifurcating sterile axis of rhyniophytoid *Hostinella* below ($\times 4.4$), (F) anterior (?4) attached somites, isolated from the rock, anterior to left, transmitted light ($\times 27$); (G) SEM photograph of distal five segments of ?antennal appendage (possibly centipede) from series of 15 segments, note rows of setae at distal borders of segments ($\times 170$); (H, I, and L to P) ?scutigero-morph centipede type 1 (sawblade), (H) posterior leg, end of tibia, tarsus, and claw ($\times 30$), (I) drawing of (H), (L) anterior leg, end of tibia, tarsus, and claw ($\times 37$), (M) drawing of (L), (N) end of femur and basal part of tibia ($\times 60$), (O) reconstruction of femur to tarsus of a typical leg, (P) end of femur and nearly complete tibia ($\times 21$); (J to K) ?scutigero-morph centipede type 2 (hairy), (J) drawing of (K), (K) pre-femur, femur, tibia, tarsus, and claw, transmitted light ($\times 33$); (Q) posterior end of unknown arthropod, with pair of cerci and ornament of minute spinules, transmitted light ($\times 44$); (R) SEM photograph of stoma on sterile axis ($\times 750$). In (K), (P), and (Q), the two parts of the fragile specimens were previously joined but were disturbed during mounting. Abbreviations: cl, claw; cp, carapace; d, doublure; c4, coxa of fourth leg; f, femur; s, sternum; l, leg (poorly preserved); p, pygidium; pf, pre-femur; ta, tarsus; ti, tibia; numerals on (B) and (D) refer to opisthosomal sternites (B) and tergites (D).

Figure 8 - Fossils of Terrestrial Animals

From: Jeram, A., P. Seldon and D. Edwards, December, 1990, *Land Animals in the Silurian: Arachnids and Myriapores from Shropshire England*, Science (New York, N.Y.)

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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.