Trilobites

edited by

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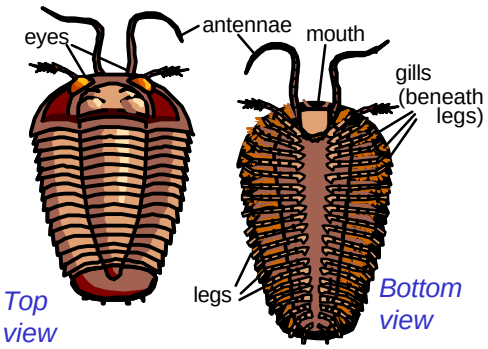
Note: In PDF format most of the images in this web paper can be enlarged for greater detail.

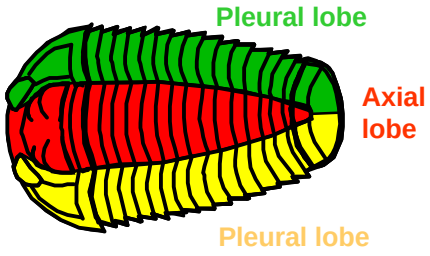
Introduction

Trilobites are hard-shelled, segmented arthropods that existed over 300 million years ago in the Earth's ancient seas. They were extinct before the dinosaurs existed, and are one of the key signature creatures of the Paleozoic Era, the first era to exhibit a proliferation of the complex life-forms that established the foundation of life as it is today. Although dinosaurs are the most well-known fossil life forms, trilobites are a favorite among those familiar with paleontology. What follows is a small selection of the world's known trilobites. The species have been chosen for their wonderful photographs available on the web, and for no other reason. Hopefully they give a feeling for the diversity and fascination for which these creatures are rightly known.

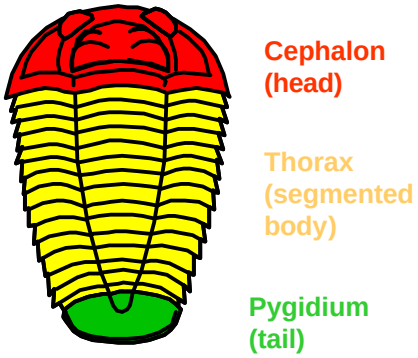
Trilobite Facts



- Trilobites are a type of extinct arthropod.
- Tri-lob-ite means three-part-body in Latin.
- Trilobite bodies can be divided into three axial (long direction) lobes
- Trilobites can also be divided into three longitudinal parts (short direction); a head called the cephalon, an abdominal region called the thorax, and a tail region called the pygidium.



- Trilobites were covered with an exoskeleton.
- Trilobite's exoskeletons were segmented, and they could roll into balls for protection.
- Some trilobite exoskeletons were covered with spines and bumps for added protection.
- Like many modern arthropods, trilobites shed their exoskeleton and developed a new one as they grew. This process is called molting. Most fossil trilobites are actually fossil trilobite molts. This is why fragmentary fossils are so common.



- Trilobites were the first group of animals in the animal kingdom to develop complex eyes.
- Trilobites were also one of the first organisms to develop multiple appendages for moving around.
- The oldest trilobite fossils are from the early Cambrian Period (about 550 million years ago). The youngest are from the Permian Period (about 250 million years ago).
- Trilobites were most numerous and abundant at the end of the Cambrian Period (about 500 million years ago).
- Trilobites lived in marine waters.
- Some trilobites could swim, others burrowed or crawled around on muddy sea floors.

- The smallest trilobite fossils are a centimeter or less in size.
- The largest trilobites were more than 70 cm long.

This fact sheet was compiled by geologists of the Kentucky Geological Survey, University of Kentucky, Lexington, Ky. For references and more information, go to the trilobite section of the KGS Web site at www.uky.edu/KGS/coal/webfossl/pages/arthros.htm#trilobita

Name: *Olenellus fowleri*—one of the oldest trilobite species known

Locality: Pioche Shale, Nevada, USA
Age: Lower Cambrian 540 million years old
Dimensions: 4.76 cm long x 2.5 cm wide

Some 540 million years ago life in the seas suddenly sprang forth in all of its complex glory. At the very root of this explosion is this rare *Olenellus fowleri* from the Pioche Shale of Nevada, perhaps the oldest known trilobite in the world, dating back to the lowest of Cambrian levels. With its worm-like epistothorax still evident *Olenellus fowleri* indicates its even more primitive Precambrian origins.

(Photograph courtesy of Bonhams & Butterfields Auctioneers)

Name: ***Modocia typicalis***

Locality: Millard Co., Utah
Age: Middle Cambrian 513-501 million years old
Dimensions: 4.0 cm long and 2.8 cm wide at the tips of the genal spines

Name: ***Elrathia kingi***

Locality: Millard County, Utah
Age: Middle Cambrian 513-501 million years old
Dimensions: 3.8 cm long

(scale bar is in centimeters)

Name: *Isotelus* sp.

Locality: Hudson Bay, Canada
Age: Upper Ordovician 445 million years ago
Dimensions: ~ 70 cm long—the world's largest trilobite

In 1998, a team of Canadian paleontologists working along Hudson Bay in northern Manitoba discovered the world's largest complete fossil of a trilobite.

(Photograph courtesy of The Manitoba Museum of Man and Nature)

Web Reference
http://www.umanitoba.ca/faculties/science/geological_sciences/stuff/geoaware/suletosi/

Largest Trilobites?

(Shown is a partially enrolled specimen 32 cm wide.)

Fossils of some of the largest trilobites ever found have been located in Portugal, and bear witness to a very active social life in these extinct marine arthropods. Artur Sá at the University of Trás-os-Montes and Alto Douro in Vila Real and his colleagues found fossils reflecting mass-mating, molting and furtive maneuvers among trilobites that lived during the **Middle Ordovician period, 470 million–460 million y. a**. The arthropod assemblage, from a roof-slate quarry in

the Arouca Geopark, captures five contemporary families of three trilobite orders in a single formation for the first time.

Sá's team notes gigantism among six of these species, with one specimen reaching **70 centimeters long**, and estimates for incomplete remains suggesting a possible 90 centimeters in another. The researchers suggest that their large size might be an adaptation to cold water.

Reference: Research Highlights—Geology: Middle Ordovician orgy. *Nature* 459, 302 (21 May 2009).

Web reference for the original article: *Geology* **37**, 443–446 (2009). See abstract of the paper below.

Giant trilobites and trilobite clusters from the Ordovician of Portugal

Juan C. Gutiérrez-Marco, Artur A. Sá, Diego C. García-Bellido, Isabel Rábano and Manuel Valério

Large quarrying surfaces of roofing slate in the Arouca Geopark (northern Portugal), formed under oxygen-depleted conditions, have yielded a unique Ordovician fossil lagerstätte that reveals new information on the social behavior of trilobites. It provides several of the world's largest trilobite specimens (**some reaching 70 cm**), showing evidence of possible polar gigantism in six different species, as well as numerous examples of monotaxic and polytaxic size-segregated autochthonous trilobite clusters, some of which contain as many as 1000 specimens. These reveal a very diverse social behavior, which includes temporary refuge from predation and synchronous molting and reproduction, demonstrated for the first time in five contemporary families of three different trilobite orders from a single formation.

Reference: *Geology*, May 2009, v. 37, no. 5, p. 443-446, doi:10.1130/G25513A.1

Name: *Cornuproetus* sp.

Locality: south of Foum Zguid, southern Morocco
Age: Lower Devonian ~ 397 million years old
Dimensions: 3.8 cm long from the anterior border of the head to the tip of the pygidium; 3.2 cm from anterior border of the head to tips of genal spines

(Prepared and photographed courtesy Kevin D. Brett)

***Cornuproetus* sp. front view**

(Prepared and photographed courtesy Kevin D. Brett)

Name: ***Paralejurus dormitzeri***

Locality: Ma'der Region, Morocco
Age: Middle Devonian 397-385 million years old
Dimensions: 3.4 cm long.

(Prepared and photographed courtesy Kevin D. Brett)

***Paralejurus dormitzeri* top view**

(Prepared and photographed courtesy Kevin D. Brett)

Name: *Leonaspis* sp.

Locality: Ma'der Region, Morocco
Age: Middle Devonian 397-385 million years old
Dimensions: 4 cm long and 4 cm wide at the genal spines.

***Leonaspis* sp. top view**

Name: *Ceratarges* sp.

Locality: Ma'der Region, Morocco
Age: Middle Devonian 397-385 million years old
Dimensions: 5.4 cm long and 3.8 cm wide at the tips of the genal spines

***Ceratarges* sp. rear view**

Name: ***Phacops rana rana***

Locality: Eighteen Mile Creek, Erie Co., New York, USA
Age: Late Devonian ~ 360 million years old
Dimensions: 3.0 cm long

(Prepared and photographed courtesy Kevin D. Brett)

***Phacops rana rana* top view**

(Prepared and photographed courtesy Kevin D. Brett)

Name: ***Kolihapeltis rabetensis***

Locality: Ma'der Region, Morocco
Age: Late Devonian ~ 360 million years old
Dimensions: 4.5 cm long and 4 cm wide at the genal spines

***Kolihapeltis rabetensi* top view**

Name: ***Koneprussia brutoni***

Locality: Ma'der Region , Morocco
Age: Late Devonian ~ 360 million years old.
Dimensions: 4.5 cm long

***Koneprussia brutoni* top view**

This specimen of *Kainops raymondi*, from the Haragan Formation, Early Devonian, Coal County, Oklahoma, can be used to demonstrate several aspects of trilobite morphology and fossil preparation.

(Prepared and photographed courtesy Kevin D. Brett)

This is the same specimen before preparation to remove the surrounding matrix of stone. Such work is time consuming and delicate work.

(Prepared and photographed courtesy Kevin D. Brett)

This is the same specimen again after preparation.

(Prepared and photographed courtesy Kevin D. Brett)

One of the most extraordinary features of trilobites is the structure of their eyes.

(Prepared and photographed courtesy Kevin D. Brett)

The trilobite eye is composed of solid calcite crystals pack together. *Kainops raymondi* has over a hundred of these crystals in each eye. What we see above are the individual round light gathering crystals. In other words, trilobite eyes do not decompose and are preserved as fossils because they were solid crystals to begin with.

(Prepared and photographed courtesy Kevin D. Brett)

Web Reference
http://www.trilobites.info/eyes.htm

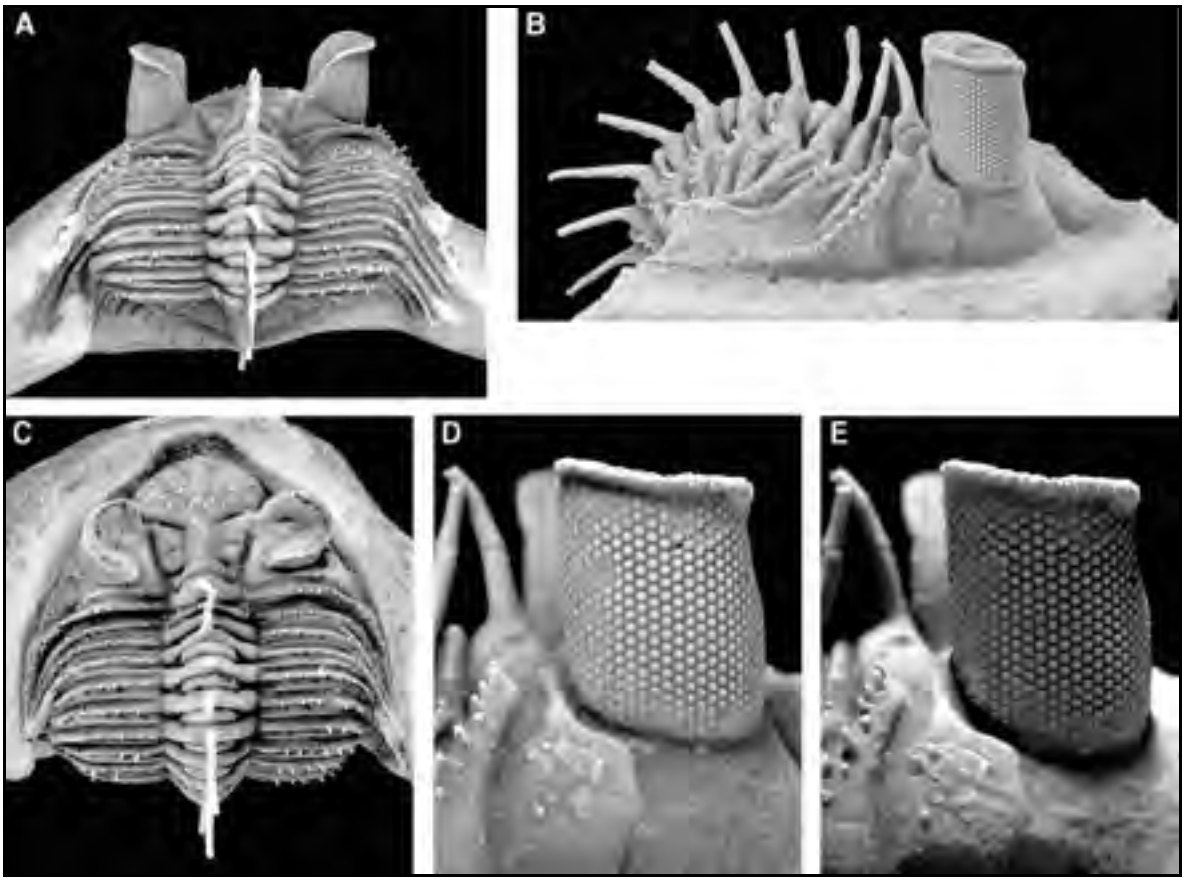


Figure 1. *Erbenochile erbeni* (Alberti). Devonian (Emsian) Timrahrhart Formation (Jebel Gara el Zguilma, near Foum Zquid), southern Morocco. (**A**) Posterior view showing overhanging eyeshades. (**B**) Lateral view. (**C**) Dorsal view. The headshield is 32 mm across. (**D**) Side view detail of right eye showing lenses under optimum illumination, and (**E**) how the eyeshade cuts out light from above, when directed as a parallel beam above the palpebral lobe.

"This eye is different from that of other trilobites in that the palpebral lobe above it extends outward over the whole of the visual surface as an eyeshade, or visor. Because the corneal surfaces are spherical, they are vulnerable to picking up stray light from directions other than the favored one normal to the surface of the eye. But the eye is so straight-sided that this hood effectively protects the visual surface from glare derived from surface light. We were able to demonstrate this by shining a parallel beam down from above the eye (Fig.1E); the eyeshade efficiently cuts out incident light from this direction."

Figure and excerpt from: Fortey, R. and Chatterton, B. (2003). A Devonian Trilobite with an Eyeshade. *Science*, 301(Sept. 19), 1689.

For more information on trilobites and their life history, I recommend Richard Fortey's book, *Trilobite: Eyewitness to Evolution*, Vintage Books (2000).

The photographs on these pages, except where noted, are courtesy of Hanman's Fossils and Minerals.

Other Trilobite Links

Dr. Sam Gon's *A Guide to the Orders of Trilobites*
http://www.trilobites.info/

Chris Clowes's Trilobite Page
http://www.peripatus.gen.nz/Taxa/Arthropoda/Trilobita/Trilobite.html

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For further information on related topics go to:

Alles Introductory Biology Lecture: *The Paleozoic Era*
http://fire.biol.wwu.edu/trent/alles/101Lectures_Index.html

Alles Biology Home Page
http://fire.biol.wwu.edu/trent/alles/index.html