

## CAMBRIAN EXPLOSION

A remarkable event in Earth's history is recorded in the fossil record at the beginning of the Cambrian time period, about 540 million years ago. Within 10 million years (a very *short* time geologically-speaking), there suddenly appeared a whole range of complex animals, preserved within the rock layers. Many of them are the earliest known representatives of modern animals. In addition to the sudden increase in numbers of different animals, many seemed to have acquired hard skeletal parts also, for the first time in Earth's history. The Burgess Shale fauna lived a short time after this **Cambrian Explosion** of life, and because they are so well preserved, these fossils provide the best window into this time of great evolutionary innovation.

During most of Earth's 4.5 billion-year history, the life that existed on Earth was simple in form. Only in the last 12% of Earth's long history has life blossomed into the enormous number of different species alive today. The oldest fossils on Earth are 3.5 billion years old, and were found in Australia. They represent simple bacteria and cyanobacteria, single-celled prokaryotic organisms with their genetic material floating freely within the cell. By 2 billion years ago, eukaryotic organisms (with a "true" nucleus containing the DNA) in the form of algal plankton had evolved.

The first fossil evidence indicating that *multicellular* animals had appeared on Earth are *trace fossils*, or the tracks and burrows that these animals might have left in the soft sediment in which they crawled. Biological evidence (from analysis of the rate of gene sequence divergence) gives the origin of animals groups on Earth to be between 700 and 1200 Million years ago. However, the first fossils of animals themselves date back to 680 million years ago. These are the Ediacaran fossils, named after the Ediacaran Hills in southern Australia.

They are impressions left in sandstone of soft-bodied marine animals resembling sea pens, jellyfish, and marine worms. Similar fossils from the same time period have been found elsewhere in the world, however scientists are uncertain whether or not they are related to modern animals. After nearly 4 billion years of slow progress, is the sudden appearance of abundant fossils at the beginning of the Cambrian, representing a wide spectrum of complex, specialised animals.



Illustration of Selkirkia Marine Worm by Larry Isham  
Courtesy of the Smithsonian Institute (BS-SB 23)

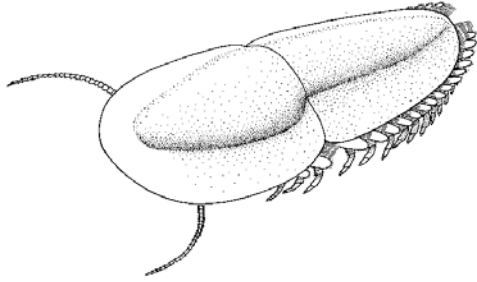


Illustration of Naraoia trilobite by Larry Isham *Courtesy of the Smithsonian Institute* (BS-SB 24)

Much scientific debate continues today about what might have been the cause for this great increase of life at the beginning of Cambrian time. Some scientists believe that the chemical composition of the atmosphere finally resulted in enough oxygen in the oceans to be able to support more complex metabolisms. Others claim that some genetic threshold had been reached, allowing for a large “tool kit” of genes in which evolution could work with. Trilobites, abundant in the Cambrian, were the first creatures to acquire eyes.

Perhaps it was the development of the ability to see and the introduction of light into the creatures’ dark world that fuelled an “arm’s race”, as creatures struggled to adapt to new predatory and prey relationships when they saw each other for the first time. Another hypothesis is that conditions were ripe at the start of the Cambrian, as the Earth recovered from a global Ice Age and conditions became favourable to life again.

**The Burgess Shale fossils of Walcott’s quarry, as well as other Burgess Shale deposits elsewhere in the world play a key role in understanding the evolutionary processes associated with this “explosion” of life at the beginning of the Cambrian.**

References:

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Illustration of diraphoria an articulate brachiopod by Larry Isham, Permission of the Smithsonian Institute (BS-SB 25)

