

The Causes of the Cambrian Explosion

The earth is four-and-a-half billion years old. But, it wasn't until 500 million years ago that animals evolved. And their evolution came quickly. All the basic body plans of most of the animals that ever lived appeared within twenty million years.

The very first animals had evolved before the Cambrian. The "Explosion" during the Cambrian was really an explosion of the bilateral body plan. This means the two sides of the animal match. Life's key designs happened in what seems like a single evolutionary leap. Every new shape of life that followed has been a variation on those body plans. And, perhaps more remarkably, no new body plans have evolved since.

What caused this major event in the history of life on earth? In 2016, all of the causes are still unknown. Scientists do agree that most likely there were both biological and physical causes interacting.

One explanation is that the genetic code became more complex. The genetic code controlled simple animals, like sponges and jellies, for a long time. In the Cambrian it evolved to control more complex, bilateral animals. This led to a rapid evolution of many new body plans in a short period of time.

A second explanation for the Explosion is that there was a major shift in the nature of the planet. The changes were most likely in the oceans, home to all living things at the time. The most obvious possibility was a rise in oxygen levels. That would allow more complex, active animals that require more oxygen for an active life style. In 2016, scientists are studying whether there was a change in oxygen levels at the start of the Cambrian.

A third explanation is that an evolutionary arms race began. Some animals had evolved movement and the power to hunt. Then prey animals evolved new ways to defend themselves. Size is a great benefit for a predator. Once a big, fast-swimming, predator evolved there was new potential for attack. Prey then evolved to be larger, with protective spines. Or they evolved to be faster and able to escape.

With more predators and prey, the food web became complex enough to provide many things to eat. And so an arms race for control of that food developed. As more and more animals evolved, that arms race increased the battles of the hunter and the hunted. And the explosion of life was the response.

A fourth explanation is that a rapid rise in sea level flooded the land. The flooding caused erosion that washed minerals into the sea. This increase in minerals in the sea, like calcium and phosphorus, meant more was available to animals to use. Almost every animal group with hard body parts first appeared in the Cambrian.

A final explanation is that in the early Cambrian animals began to tunnel down into the sea floor. Before, animals had grazed only on the surface. These burrowing animals opened new habitats and then animals evolved to use the new habitats. Burrowing beneath the sea floor also made new nutrients available. And it provided new hiding places. The rise of these new animals permanently changed the nature of the sea floor.