

The Earliest History of Life: Solution to Darwin's Dilemma

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In 1859, Darwin stated the problem:

"If the theory [of evolution] be true, it is indisputable that before the lowest Cambrian stratum was deposited, long periods elapsed ... and the world swarmed with living creatures. [However] to the question why we do not find rich fossiliferous deposits belonging to these earliest periods ... I can give no satisfactory answer. The case at present must remain inexplicable; and may be truly urged as a valid argument against the views here entertained."

For the following 100 years, the missing fossil record of Precambrian life stood out as one of the greatest unsolved problems in natural science. In Darwin's day, the oldest known fossils were Cambrian trilobites, lobster-like animals entombed in Cambrian-age rocks laid down about 550 million years ago. But in the mid-1960s, understanding of the early history of life began to change as new finds -- not of animals, but of tiny microscopic microbes -- extended the fossil record into the remote reaches of geological time. Today, life is known to have emerged on Earth at least 3,500 million years ago and may have been present even 300 million years earlier, a documented history more than seven times longer than was known to science only a few decades ago and an antiquity of life's existence that no one had dared imagine. Indeed, we now know that Earth's early biota was dominated by microbial "pond scum," with new technology now providing means to image such ancient fossils in cell-by-cell detail -- fully, in three dimensions, even though they are completely embedded inside rocks -- and to analyze both their cellular form and their coaly, organic chemical composition.

Darwin was right: the Precambrian world did, in fact, "swarm with living creatures." The dilemma posed by the missing early record of life has been resolved -- the once unknown, and thought unknowable, has been discovered.

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