

Yolks of Yore: Oldest Animals Found

Chinese and U.S. researchers have discovered the oldest known animal fossils—a set of exquisitely preserved embryos and other remains of complex creatures that populated the oceans 570 million years ago.

"This really is an unusually clear window on an important period of evolution," says one of the discoverers, Andrew H. Knoll of Harvard University.

The fossils from South China buoyed paleontologists, who have found themselves forced to the sidelines in recent years as molecular biologists used genetic tools to probe the origin of animals. Paleontologists feared that fossil evidence from the dawn of animal life lay beyond their grasp, but the new finds may spur efforts to search even older rocks for microscopic embryos, which until recently have been overlooked.

"They are magnificently preserved. It is a whole new way of looking at what was going on at that time," comments

Douglas H. Erwin, a paleontologist at the National Museum of Natural History in Washington, D.C.

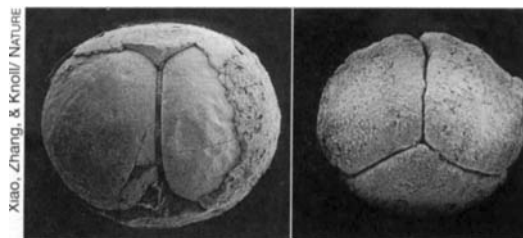
Two independent groups of researchers found the microscopic remains in phosphate mines near the town of Weng'an in Guizhou Province. One group discovered juvenile sponges and unidentified animal embryos, all less than a millimeter across. Chia-Wei Li of National Tsing Hua University in Taiwan and his colleagues describe their work in the Feb. 6 *SCIENCE*.

Knoll's team, which reports its findings in the Feb. 5 *NATURE*, found a diverse array of embryos caught in the earliest stages of development, as the eggs began dividing into multiple cells. Many of the embryos cannot be classified, but some display a distinctive pattern of division at the four-cell stage, according to Knoll, Shuhai Xiao of Harvard, and Yun Zhang of Beijing University. They tentatively identify these specimens as bilaterian animals—creatures more complex than sponges or jellyfish.

At the start of development, most animal embryos split lengthwise into two equal hemispherical cells. In the second step, these cells divide vertically again to produce quarter spheres similar to an apple cut into four wedges. Some of the Chinese embryos show a different pattern. In the second division, one hemisphere divided vertically while the other split horizontally.

Among living animals, only crustaceans develop in this fashion, says R. Andrew Cameron, a developmental biologist at the California Institute of Technology in Pasadena. The distinctive Chinese embryos belonged either to early relatives of crustaceans or to some unknown, extinct lineage, he says.

The one-half-millimeter specimens



Fossil embryos from China preserved at the two-cell (left) and four-cell stages.

are relatively large and presumably contained an abundant supply of yolk to nourish the dividing cells. This finding indicates that the animals skipped the simple larval stage of most modern marine invertebrates, says Cameron. Instead, the embryos apparently developed into more complex subadult stages, as some modern arthropods and vertebrates do.

The Chinese fossils—estimated to be between 590 and 550 million years old—push back the record of animal life by only a few million years. Large, so-called Ediacaran fossils first appeared in 565-million-year-old rocks (SN: 11/22/97, p. 326) and were followed soon thereafter by tracks attributed to wormlike creatures. The tracks and Ediacaran fossils have proved difficult to interpret, whereas the new embryos offer clearer proof that animals existed at this time, say researchers.

Until last year, most paleontologists had not even considered looking for early embryos. The race started after researchers uncovered jellyfish embryos in 540-million-year-old rocks from the early Cambrian period, a time of explosive animal evolution (SN: 11/15/97, p. 319). This find prompted a reexamination of fossils found near Weng'an that had previously been identified as colonial green algae.

The embryos fuel debate about how and when animals first arose. In a 1996 study of genetic mutations among modern species, biologists calculated that the major animal lineages separated 1.0 to 1.2 billion years ago. Many paleontologists balked at the finding because it implied that half of animal history was missing from the fossil record. A new gene study, published in the Jan. 20 *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES*, concludes that animal lineages diverged only 670 million years ago.

Stefan Bengtson of the Swedish Museum of Natural History in Stockholm says that paleontologists may be able to help resolve the issue. "If we start systematically looking for things that may be embryos, we are very likely to find even more of them." —R. Monastersky

Did water carve canyon on Mars?



This view of the Nanedi Vallis canyon on Mars offers what may be the best evidence yet that water once flowed on the Red Planet. Taken Jan. 8 by the Mars Global Surveyor spacecraft, the image is the first to show a channel (arrow) at the bottom of the canyon.

The dried-up, 200-meter-wide channel suggests that a continual flow of water helped carve Nanedi Vallis, says Michael C. Malin of the Surveyor camera team and Malin Space Science Systems in San Diego. In contrast to the rounded boulders near the Mars Pathfinder landing site, which suggest that a catastrophic flood coursed through that area, the channel points to a steady stream of water that may have lasted millions of years.

"A lot of people have been talking about water on Mars, but this is getting down to the next level of detail," says Malin. Both water and volcanic activity may be responsible for sculpting the canyon, he adds. Vice President Al Gore unveiled the image Feb. 2 at a federal budget briefing.

—R. Cowen