

Jun-Yuan Chen

The Cambrian Evolutionary Explosion: Novel Evidence from Fossils Studied by X-ray Tomography

The Cambrian explosion (from 542 million years to 488 million years ago) is one of the great mysteries in evolutionary biology. It wasn't until this period that complex organisms became common and diverse. The magnitude of the event can be understood based on the contrast between the biota and the degree of diversity of the fossils from both sides. Great advances have been made in Cambrian palaeontology over the past century, especially the discovery of the well-preserved soft-bodied fauna from the Middle Cambrian Burgess Shale and the Lower Cambrian Maotianshan Shale deposits. The Cambrian side of the "Cambrian explosion" is richly illustrated and contrasts greatly with the Precambrian side. Compared with the Cambrian, our knowledge of Precambrian fossils is very limited. The discovery of the macroscopic Ediacaran biota in Australia in 1946 provided the first evidence of multicellular life before the Cambrian. Despite Ediacaran biota now being found worldwide, most of them are morphologically distinct from modern and even Cambrian life forms so that it is difficult to picture animal evolution across Precambrian and Cambrian. The great advances in Precambrian palaeontology, especially the intensive study of the Weng'an biota during the past 10 years, have significantly changed our view of the Cambrian explosion. The study of these extraordinarily preserved fossils biota is extremely difficult. A major challenge is 3-D reconstruction and determining the pattern of the cell organization in Weng'an embryos and their buried structures in Maotianshan Shale fossils. This talk will show that two recent technological approaches, propagation phase contrast synchrotron x-ray microtomography and microtomography, provide unique analytical tools that permit the non-destructive computational examination and visualization of the internal and buried characters in virtual sections in any plane, and virtual 3-D depictions of internal structures.



Jun-Yuan Chen is one of the leading paleontologists in the world. He is currently a senior scientist in Nanjing Institute of Geology & Paleontology and a Professor in Nanjing University, China. He has been the lead author of numerous *Science* and *Nature* articles and several textbooks, and coauthored more than 100 research papers, which revolutionarily changed the common view about the Cambrian explosion. His current work on Early Cambrian Maotianshan Shale biota and Precambrian Weng'an biota has contributed to the new understanding of the evolutionary origins of animals, especially vertebrates and arthropods.

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