The rise of fishes illuminated by discovery of fossil treasure hoard

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Five early Silurian fishes from China rewrite the evolutionary story of "from fish to human" Credit: IVPP

Scientists from the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) of the Chinese Academy of Sciences have recently discovered two fossil repositories in the early Silurian strata in southwestern Chongqing and Guizhou that are rewriting the evolutionary story of "from fish to human."

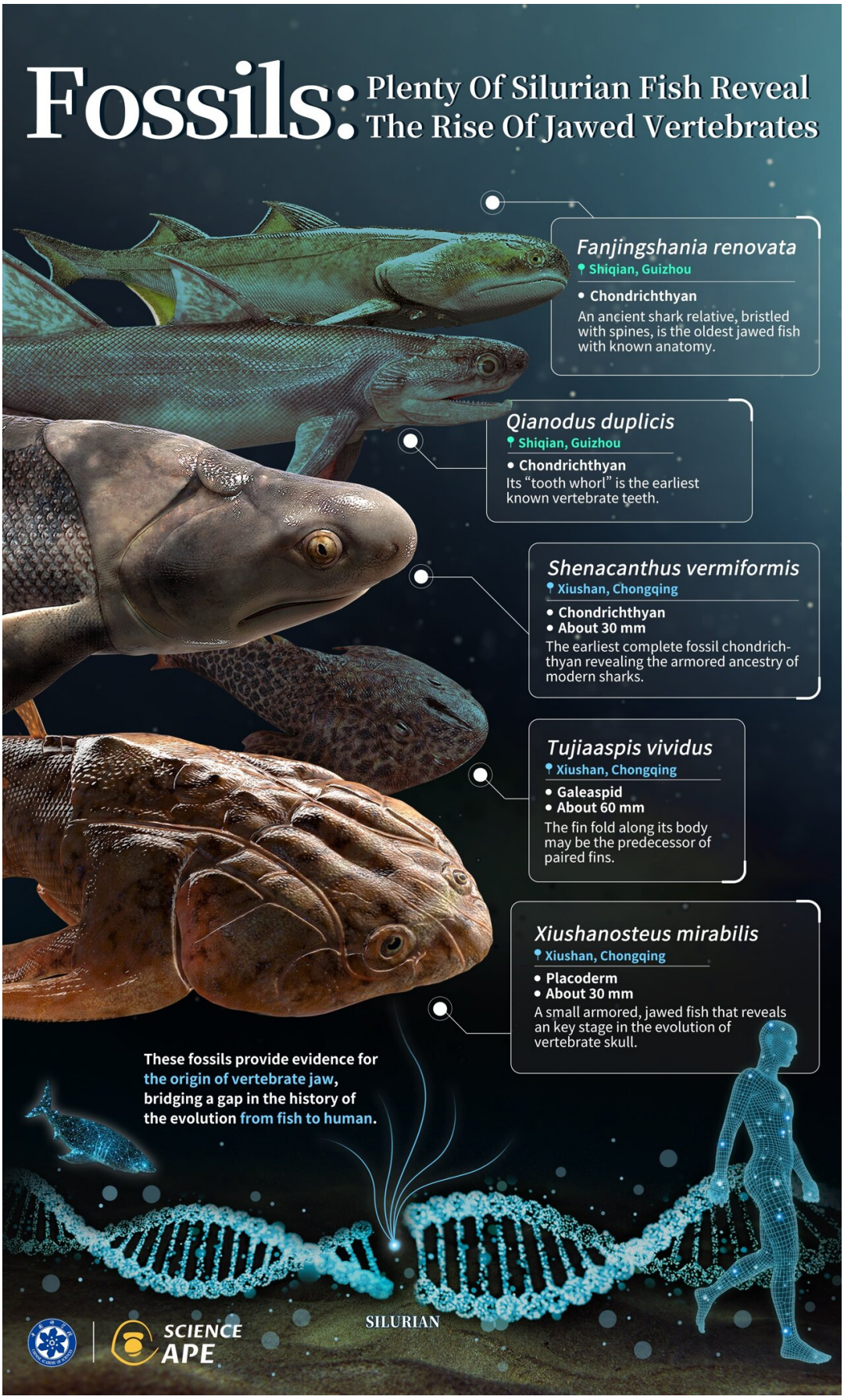
Their findings will be published on *Nature* on Sept. 28 in four articles in the same issue.

Among the extant vertebrates, 99.8% of species, including humans, are gnathostomes or jawed vertebrates. The basic body plan and several key organs of human can be traced back to the origin of gnathostomes. The rise of jaws is one of the biggest innovations in the history of vertebrates.

However, how this innovation happened remains murky, mainly because fossils of early jawed vertebrates were only found in large numbers until the beginning of the Devonian (419 million years ago), while molecular data prove that the origin of jawed vertebrates should be earlier than ~450 million years ago. Hence, there is a huge gap in the fossil record of the early jawed vertebrates, spanning at least 30 million years from Late Ordovician through most of the Silurian.

The latest findings of Zhu Min's team from IVPP are unearthed from two new fossil depositories, shedding light on the rise of jawed vertebrates: These jawed fishes were already thriving in the waters of the South China block, at least 440 million years ago, and by the late Silurian, more diverse and larger jawed fishes had evolved and began to spread around the world.

Discoveries of fish fossils from the two depositories help to trace many human body structures back to ancient fishes, some 440 million years ago, and fill some key gaps in the evolution of "from fish to human," and provide further evidence to the evolutionary path.


Fossils: Plenty Of Silurian Fish Reveal The Rise Of Jawed Vertebrates
Fanjingshania renovata
Shiqian, Guizhou
• Chondrichthyan
An ancient shark relative, bristled with spines, is the oldest jawed fish with known anatomy.
Qianodus duplicis
Shiqian, Guizhou
• Chondrichthyan
Its "tooth whorl" is the earliest known vertebrate teeth.
Shenacanthus vermiformis
Xiushan, Chongqing
• Chondrichthyan
• About 30 mm
The earliest complete fossil chondrichthyan revealing the armored ancestry of modern sharks.
Tujiaaspis vividus
Xiushan, Chongqing
• Galeaspid
• About 60 mm
The fin fold along its body may be the predecessor of paired fins.
Xiushanosteus mirabilis
Xiushan, Chongqing
• Placoderm
• About 30 mm
A small armored, jawed fish that reveals an key stage in the evolution of vertebrate skull.
These fossils provide evidence for the origin of vertebrate jaw, bridging a gap in the history of the evolution from fish to human.
SILURIAN
SCIENCE APE

Five early Silurian fishes from China rewrite the evolutionary story of "from fish to human". Credit: NICE Tech/ScienceApe

The Chongqing fish fossil depository in the Upper Red Beds of the Silurian system dates back to 436 million years ago. It is the world's only early Silurian Lagerstätte (fossil depository with exceptional preservation) that preserves complete, head-to-tail jawed fishes, providing a peerless chance to peek into the proliferating "dawn of fishes." This fossil "treasure hoard" stands among other great Chinese Lagerstätten, including Chengjiang Biota and the Jehol Biota, all providing key puzzle pieces previously missing in the tree of life.

More information: The oldest complete jawed vertebrates from the early Silurian of China, *Nature* (2022). DOI: 10.1038/s41586-022-05136-8. www.nature.com/articles/s41586-022-05136-8

Galeaspid anatomy and the origin of vertebrate paired appendages, *Nature* (2022). DOI: 10.1038/s41586-022-04897-6 , www.nature.com/articles/s41586-022-04897-6

The oldest gnathostome teeth, *Nature* (2022). DOI: 10.1038/s41586-022-05166-2 , www.nature.com/articles/s41586-022-05166-2

Spiny chondrichthyan from the lower Silurian of South China, *Nature* (2022). DOI: 10.1038/s41586-022-05233-8 , www.nature.com/articles/s41586-022-05233-8

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