Researchers use computed microtomography to identify well preserved fossil arthropod

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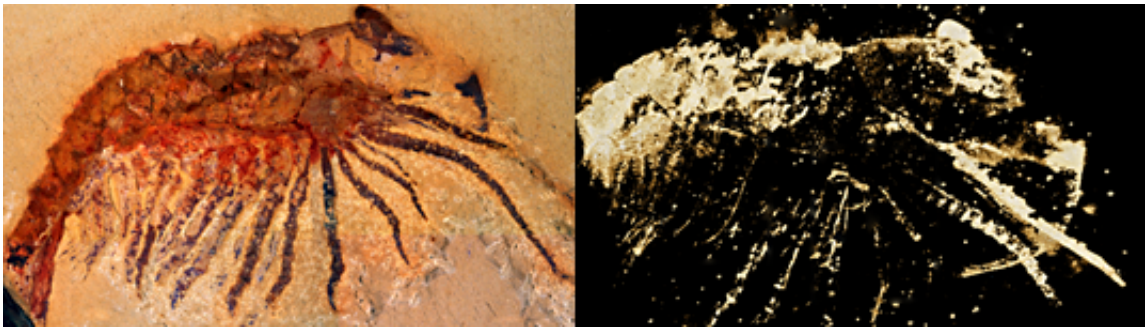

The figure on the right shows a light micrograph of the fossil, while the microtomographic image left reveals fine details of structures hitherto concealed within the slab.

Ludwig Maximilian University researchers have used computed microtomography (micro-CT) to identify to the species level an exceptionally wellpreserved fossil arthropod from the famous Chengjiang Lagerstätte in China.

Modern imaging methods make it possible to perform detailed, non-invasive studies on the internal structures of irreplaceable fossil specimens. Researchers led by Dr. Yu Liu of LMU's Department of Biology II now demonstrate the power of this approach by using computed microtomography (micro-CT) to investigate a specimen recovered from the famous fossil beds of Chengjiang in southwestern China. The results of the study, which appear in the online Open Access

journal *Scientific Reports*, demonstrate the ability of micro-CT to reveal anatomical details preserved inside fossil slabs.

The fossil Lagerstätte Chengjiang in China is a UNESCO World Heritage Site, which harbors a rich fossil assemblage dating from 520 million years ago. The rocks preserved here are among the oldest that document the so-called Cambrian explosion – the relatively abrupt appearance of a highly diverse, species-rich multicellular fauna in the fossil record. And many of the specimens discovered in these beds are extremely well preserved. In particular, their soft parts have left clear impressions in the sediments that accumulated here. Imprints of organisms with mineralized skeletons often extend for several millimeters below the surface of the slabs of sediment in which they are embedded. In order to study their structure, such specimens must first be removed from the surrounding rock matrix. "Because this inevitably involves the destruction of at least some of their fine structure, most of the published work on Chengjiang's fossils is based on careful examination of surface structures with the help of optical and fluorescence microscopy," as Yu Liu explains.

The LMU team now reports the first in-depth microtomographic study of a three-dimensionally preserved fossil from Chengjiang. The term micro-CT refers to a method in which multiple X-radiographs of a specimen are taken from different angles, and then assembled with the help of mathematical procedures to yield a three-dimensional model of the original. It is now a well-established analytical tool in palaeontology, but has not yet been widely applied to fossils from Chengjiang. Yu Liu's study uncovers internal structures in a specimen recovered from the site, which allow the fossil to be identified as Xandarella spectaculum, a rare species of arthropod that shows similarities to the iconic (but now extinct) trilobites, and is known only from Chengjiang. The three-dimensional reconstruction reveals informative details of the fossil's morphology, which had hitherto remained hidden in the rock matrix. On

the basis of the new results, Yu Liu confidently asserts that "microtomography is a powerful technique for the analysis of the three-dimensionally preserved specimens recovered at Chengjiang."

More information: "When a 520 million-year-old Chengjiang fossil meets a modern micro-CT – a case study." *Scientific Reports* 5, (2015) DOI: 10.1038/srep12802

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