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(G*) Probing for blood vessel preservation in Tyrannosaurus rex using synchrotron radiation

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The increasing availability of high-intensity radiation via synchrotron light source facilities has revolutionized paleontology research in the last couple decades. Synchrotron techniques are often non-destructive, allowing thorough imaging and chemical analysis of fossils without damaging precious specimens. Hard tissue skeletal remains such as bones and teeth have long been the only source of information about ancient creatures that lived over 66 million years ago. However, while much more rare, soft tissue structures and remains of original organic material can be preserved in deep time, and they can provide a more lifelike reconstruction of ancient ecosystems.

Here, using a suite of high-resolution imaging and chemical analysis techniques performed at the Canadian Light Source (CLS), a vast network of blood vessels has been characterized inside a rib bone from a specimen of *Tyrannosaurs rex*. The techniques used include micro–Computed Tomography (μ-CT), X-Ray Fluorescence (XRF), X-Ray Absorption Near Edge Structure (XANES), as well as Scanning Electron Microscopy (SEM). The vessels were found to be composed predominantly of goethite, an iron (III) molecule that has been associated with exceptional preservation in previous studies. This specimen, nicknamed Scotty, famous for being the largest *T. rex* ever uncovered, was found in a Late Cretaceous (67-66 Ma) deposit of southwestern Saskatchewan, Canada. Scotty is known to have sustained many injuries, including a fracture on the rib bone of interest. We suggest that healed injuries may provide a target for future studies of soft tissue preservation in dinosaurs. This research can also help us construct the pathway of physical, chemical, and biological processes that led to the exceptional preservation of Scotty.

Keyword-1

synchrotron radiation

Keyword-2

paleontology

Keyword-3

blood vessels

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