



# An Enigmatic Tumor-like Structure in a Dinosaur Bone

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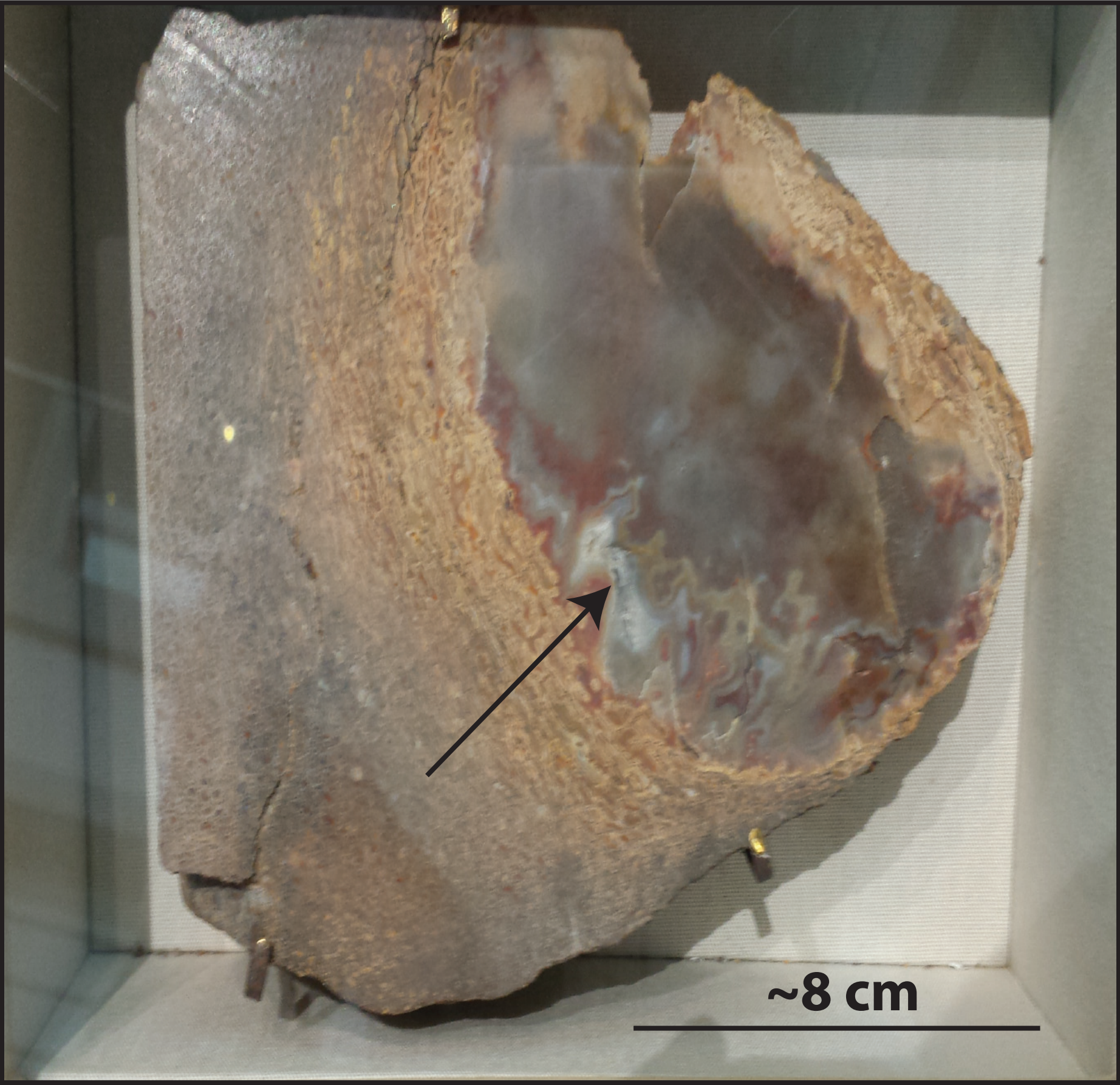


## Introduction

For a long time, cancer was assumed to be a disease that had come into existence relatively recently. However, evidence suggests that it dates back to at least the Devonian period, with a fossil of the armor-plated fish *Dunkleosteus*. This poster will examine new possible evidence that indicates cancer was even more widespread than previously thought, particularly in the bones of dinosaurs. Is cancer something that all dinosaurs could develop? Does the way it affects birds reflect how it affected dinosaurs? Is this fossil a genuine instance of Mesozoic cancer? To answer these questions, scientific data about cancer in dinosaurs and living animals must be examined, the ways in which the disease impacted the animals must be investigated, and the possible changes of cancer through time must be considered.

## Methods

The following research methods were employed 1) literature searches, 2) thought experiments, and 3) examination of fossil bone from the late Michael Sincak's private collection currently located in the McKenzie Study Collection. The fossil was compared with tumors from living animals in an attempt to diagnose the structure through microscopic examination. In addition, we've consulted pathologist Dr. Lisa Stevens D.O. and Dr. Randy Kulesza Jr., Ph.D. to examine the fossil and offer a professional opinion.



Example of a sauropod bone with a cancerous growth housed in the Carnegie Museum.

## Data

The fossil from the Sincak collection is the partial section of a vertebra from a sauropod dinosaur, however, the specific type is uncertain. The bone's size, structure, and the fact that it comes from the Morrison Formation in Colorado suggest *Camarasaurus* as a possible candidate. The bone includes a white and cream-colored mass of abnormal structure about 3cm across and 2cm deep. The bone is cut, with a cross-sectional view of the structure clearly visible on the cut surface and a small portion visible on the other side. The doctors at LECOM provided the following report on the fossil evidence: "The specimen was examined under a dissecting microscope in order to better inspect the suspected lesional area. Cellular and nuclear details are not able to be visualized as the cells/fossilized cells do not appear to be enlarged. As such, this might cast some doubt on our final interpretation. Within the specimen, a small, well-circumscribed area of anastomosing irregular bony trabeculae is identified and is surrounded by what appears to be thick, sclerotic bone. This haphazard arrangement of the bony trabeculae is consistent with an osteoid osteoma and osteoblastoma. Further differentiation between these lesions would require histological examination of the specimen" (Stevens and Kulesza). These types of tumors are found in humans, although they are usually restricted to younger individuals. They cause acute locational pain and can weaken the bone, which can lead to breakage. In rare cases, they can lead to aggressive and malignant forms with similar characteristics to osteosarcoma.



Sauropod vertebra section with tumor on loan from McKenzie study collection.



*Camarasaurus* as envisioned by Jacob Stokes



Opposite view showing the back of the tumor.

## Discussion & Conclusions

According to a study conducted by Bruce Rothschild that included thousands of museum specimens, cancer and similar afflictions were found to be oddly exclusive to the hadrosaurs. However, the variety of specimens that have been found since indicate that this is not the case, as many fossils from different types of dinosaurs have been found with tumor-like growths. For example, a *Gorgosaurus* was found in 2003 by Cliff and Sandy Linster with what appeared to be a tumor encroaching upon the cerebellum and brainstem. In addition, x-rays have shown tumor-like growths in other specimens, including hemangiomas, desmoplastic fibromas, and osteoblastomas. The presence of these structures and others indicate that localized and metastatic cancer occurred in dinosaurs as well as modern organisms. Given that dinosaurs have been found to be endothermic, this would have increased their vulnerability to carcinogens due to their warm-blooded physiologies. Therefore, the epidemiology of dinosaurs suggests that the wide range of cancerous illnesses they suffered from was due to their genetic propensity, mutagens in the environment, or possibly a combination of both. This particular fossil is just one piece of evidence in the growing collection that continues to paint a picture of dinosaurs as real animals that faced problems that still affect the world today.

## References

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