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Can the Best Fossils Ever Found Answer the Biggest Dinosaur Question?

Two creatures unearthed in 2006, and finally on display in North Carolina, might hold the key to a major debate over a certain animal's identity.

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This article is part of our Museums special section about how institutions are striving to offer their visitors more to see, do and feel.

If you've ever wanted to see, touch or even smell what life was like when the dinosaurs walked the earth, this is the place.

This month, the North Carolina Museum of Natural Sciences is opening an exhibit that will use scents and sounds mimicking an ancient forest to recreate a primeval paradise. The museum in downtown Raleigh will also display prehistoric murals and a trove of fossils meant to transport visitors "back to the Cretaceous," as Javan Sutton put it.

"We really want to take you there," said Sutton, the museum's director of exhibits and digital media.

This sensual feast is intended to captivate young audiences and inspire them to fall in love with science. At the same time, the paleontologists are hoping to commit science in public, allowing visitors into a process that has been constricted by private ownership of many significant fossil findings yet is still the best avenue for answering existential questions about the planet.

Some of the fossils from the dueling dinosaurs exhibition at the North Carolina museum. Cornell Watson for The New York Times

But the real showstopper is a whole other animal — maybe literally. That's because the exhibit is also debuting what many paleontologists consider the best fossils ever — ones they have spent years arguing about.

When these incredibly intact fossils were discovered in 2006, the bone hunter who found them in the Montana sandstone named them "the dueling dinosaurs," because they featured what appeared to be a Triceratops and a Tyrannosaurus locked in a death match. But was it really a T-Rex?

One creature was obviously a Triceratops, as it had the thick skull and rhino-like horn of the leaf eater depicted in the original "Jurassic Park." (Remember the sick dinosaur that foreshadows the film's chaos, the one with the huge dung pile the Laura Dern character sticks her hand in?).

But the odd little predator frozen in time beside it — wrapped around the Triceratops in a death grip — had the hallmarks of a T. Rex in every way except size.

Was it a Tyrannosaur? Maybe. But with its small body and tiny skull, it looked too small to be any old Rex.

Its age was also a mystery. Perhaps, paleontologists have argued, it was just a juvenile T. Rex, not yet fully grown.

Or was it not a Rex at all?

“Our hope is to settle the debate,” said Lindsay Zanno, the North Carolina museum’s head of paleontology.

During the exhibition, she said, the scientists on staff will put the fossils through a battery of tests, studying the duelists in a lab right in front of the public. They will be comparing the fossils with known Tyrannosaurus bones while also measuring growth patterns and other anomalies.

The dueling dinosaurs exhibition is meant to be visitor-friendly, so it includes an interactive screen and opportunities to stand close and watch researchers as they study the fossils. Cornell Watson for The New York Times

This isn't the first tiny Rex ever discovered, but it's by far the most complete.

The controversy over the identity of this mystery dinosaur started in 1942, when another strange 22-inch skull was found in Montana. Ever since, paleontologists have wondered whether similar Lilliputian finds were juvenile tyrannosaurs or a new species, which has been named Nanotyrannus.

The debate has been raging among dinosaur experts ever since, both online and IRL.

Answers have come slowly, said Thomas Carr, a Carthage College associate professor of biology, because most major finds "are unearthed by professional fossil hunters, not scientists." These people, he added, are more interested in earning T. Rex-sized paydays than in "answering scientific questions."

The challenge speaks to a little-known, ethically opaque corner of science: When the best specimens are in private hands, researchers are stuck with bone fragments and pieces.

Fossils are increasingly a luxury item, Carr said, objets d'art that more often belong to the ultra rich, "meaning they're not on display in public museums." (He added that it's perfectly legal to own dinosaur bones, if they were not dug up on public land.)

In 2020, a tyrannosaurus named Stan sold for a record $31.8 million to an unknown buyer. In this environment, many scientists worry that private fossil sales will deprive them of key data to answer pressing questions about prehistoric life.

"By one recent estimate, there are over 100 specimens of T. Rex," said Zanno. "Nearly half are held in private collections and therefore inaccessible to science."

She and other researchers hope that finding out more information about this mystery species could shed light on the rise and fall of all dinosaurs, by explaining how they evolved and how that evolution might have contributed to their extinction.

That's why the Dueling Dinosaurs find is so special. Here is a seemingly perfect, full skeleton. But what to make of its differences, like its slender snout and knifelike teeth?

"The thing is, we don't know because the duelers have never been studied," said Carr, who suggests Nanotyrannus are simply young T. Rexes, not a new, distinct species.

Legal battles had kept the duelers stuck in sediment. Until now.

Lindsay Zanno, the North Carolina museum's head of paleontology, said she hoped the scientific team could get closer to solving the mystery of an undersized dinosaur that might be a T. Rex — or an entirely different species. Cornell Watson for The New York Times

In 2020, after years of litigation, the Ninth Circuit Court of Appeals ruled that the duelists belonged to the family who owned the ranch where they were found.

Soon after, a deal was struck for the fossils to head to the North Carolina museum after its nonprofit arm raised around $14 million to purchase them and construct the exhibit, according to Zanno.

But even she cautions that it will still take years to find answers.“It's not as simple as 'is it a T. Rex or not,'” she said.

“We have to figure out what are all these individual tyrannosaurs and how many species we may have,” she added, referring to all of the other small T. Rex samples.

Zanno said her team has already “scanned data from 92 individual tyrannosaurus specimens from museums all over the world.”

The team, she said, will use those scans to help determine whether the bones of the dueling dinosaur are from “just a slightly different looking individual or a much smaller, older individual.”

One hypothesis is that “there are multiple tyrannosaur species,” she said. “We have to test all of these ideas.”

First the 67 million year-old bones must be painstakingly extracted from massive sediment boxes and thoroughly cleaned. Then the bones will be scanned via CT scan and 3-D scanner, so that the paleontologists can compare the results.

Subtle differences in bones are normal for all species, said Carr, the Carthage College professor. He cautioned that differences the museum found through these scans might be misleading, too, because “there are so few specimens to compare to.”

For these reasons, Zanno said, the exhibit, which took four years to plan and build, won’t have answers right away. But as the paleontologists go about their work, the public will be allowed to see the fossils being studied in real time in a glass-walled paleontology lab and another glass half-wall where visitors can ask questions of a staff paleontologist. If there’s a eureka moment, visitors will be there to witness it.

Dedicated fossils will also be on display for visitors to see up close and even touch.

One question that the team is looking to explore — as are other paleontologists — is how catastrophic was the mass extinction that killed off dinosaurs like T. Rex.

“If you think about the climate change leading to accelerated extinction events, T. Rex was incredibly specialized,” said Holly Woodward, a professor of anatomy and paleontology at Oklahoma State University. “If you take one of those links in the chain out, just one specialized herbivore it relied on, T. Rex goes extinct. That happened then and the same sort of thing can happen today to any type of carnivore. Just think what comes next.”

That's why it's so vital to fill in these gaps, said Zanno. And why these fossils are so vital.

"Fossils are not art objects," Zanno said. "Fossils are data about ourselves, our planet, our story. And we need to protect that for future generations. Every time we lose a tyrannosaur on the open market, we lose the opportunity to answer this question and so many others. It's all of our history."

A correction was made on April 30, 2024*: An earlier version of this article referred incompletely to the items that were funded by the $14 million raised by the nonprofit arm of the North Carolina Museum of Natural Sciences. The money was spent on construction to house the exhibit as well as the fossils, not only for the fossils.*

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