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Behind a Shopping Center in New Jersey, Signs of a Mass Extinction

By Kenneth Chang

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MANTUA TOWNSHIP, N.J. — Behind a Lowe's home improvement store here, scientists are methodically scraping and sifting through a quarry pit that may contain unique insights to the mass extinction that eliminated the dinosaurs.

Back then, about 66 million years ago, the oceans were higher, and this part of southern New Jersey was a shallow sea, 10 to 15 miles offshore from an ancient mountain range that rose from the water. Today's quarry pit was once the sea bottom, and one particular layer about 40 feet beneath the surface contains a bounty of fossils.

Kenneth J. Lacovara, a professor of paleontology and geology at nearby Rowan University, calls the layer a "mass death assemblage." He believes it may be the only known collection of animal remains that dates from the mass extinction itself.

It's just a hypothesis at the moment, and a tough one to prove. Dr. Lacovara and the university, which is to complete its purchase of the quarry this month, have deployed graduate students to meticulously catalog the fossils near in time to the mass extinction.

But they are not the only fossil hunters here.

Once a year for the past four years, the quarry has been opened to the public, and citizen paleontologists have come in droves — about 1,500 for the most recent community event last fall.

"I found a pile of rocks," said Alexandra Hopper of Mantua, one of the participants. "When we rinse them off, we're hoping some of them are fossils." The diggers kept the fossils they found, and there are plenty to go around. The doomed creatures in the pit were mostly clams and oysters. But the fossils of animals like crocodiles and sea turtles are here, too, as well as the occasional mosasaur, a ferocious aquatic lizard with two long teeth at the back of its throat that pointed toward its gullet, ensuring that any prey it swallowed would never struggle out.

Fossils are being found throughout the sediment that fills the pit, but the assemblage occupies a single concentrated layer. Bones and shells sometimes pile up when currents sweep dead sea creatures toward a particular eddy, where they accumulate over years or centuries.

But here the skeletons of the larger creatures remain largely intact. That suggests they all died at the same time and then settled gently on the sea bottom.

The dating of the fossil layer puts their deaths tantalizingly close in time to the impact of a meteor off what is now the Yucatán Peninsula in Mexico. Most paleontologists think that the climatic cataclysm that followed killed three-quarters of the species living on Earth — and all of the dinosaurs except those that evolved into birds.

In a cordoned-off area, graduate students scraped through a layer of 66-million-year-old sediments, carefully cataloging the remains of a "mass death assemblage." Christian

Hansen for The New York Times

A seeming paradox of mass extinctions is that scientists rarely find the remains of any of the billions of animals that died. All over the world, the bones of the last dinosaurs are almost always found well below the extinction layer, which is marked by iridium, an element concentrated in asteroids and comets.

For paleontologists, that is not a surprise, given the rare conditions needed to preserve fossils and the fact that world is not crammed with animals.

“Kill every deer in New Jersey and then try to find a dead deer, and you’re not going to find one,” said Kirk Johnson, the director of the Smithsonian National Museum of Natural History.

A future paleontologist would struggle to find a bone bed or other signs of an instant die-off, “because the square footage of animals isn’t very big compared to the square footage of the world,” Dr. Johnson said.

And yet here in Mantua, there is a mass death assemblage close to 66 million years old. “It sounds silly, but is it the case that this pit in South Jersey, behind Lowe’s, has the one window into this pivotal moment in time?” Dr. Lacovara said.

Finds and ‘Bone Wars’

A century and a half ago, southern New Jersey was a hotbed of dinosaur discoveries. While scattered bones had been found in Europe, the first nearly complete dinosaur skeleton — that of an 8-foot-tall, 14-foot-long duck-billed hadrosaurus — was dug up in a quarry in Haddonfield in 1858.

New Jersey became an early battlefield in the “bone wars,” the ferocious competition between two pre-eminent American paleontologists of the 19th century, Edward Drinker Cope of the Academy of Natural Sciences in Philadelphia and Othniel C. Marsh of Yale University.

Cope lived in Haddonfield and collected fossils in the area. After inviting Marsh for a visit, Cope claimed that his guest paid the Haddonfield quarry owners to send fossils to Yale, not to the academy.

In 1866, Cope described the bones of a meat-eating dinosaur, a relative of Tyrannosaurus rex, found in another Mantua quarry. But he and Marsh shifted their attention to grander fossil sites in the West, and New Jersey’s paleontological history faded.

In recent years, the most stunning dinosaur fossils have come from places as far away as Argentina, Mongolia and the Sahara. In 2014, Dr. Lacovara, then at Drexel University in Philadelphia, unveiled Dreadnoughtus, a behemoth unearthed in the Patagonia region of Argentina.

One of the amateur paleontologists shows a fossil of a Cucullaea clam that she found. Christian Hansen for The New York Times

If not for the recession in 2007, the fossils in Mantua might be buried and out of reach.

For the better part of a century, the Inversand Company scooped a dark greenish sand called marl from the quarry for use in water treatment plants. But tightened environmental regulations turned that business into a money loser, and Inversand started looking to close the site.

A Mantua redevelopment plan called for filling the hole and building apartments and a shopping center on top. Almost six years ago, Dr. Lacovara proposed something different. He wanted to preserve the quarry, both as a dig site for paleontologists and as a museum for inspiring the younger generation.

Paleontologists had long known about the fossils in the quarry and in other marl pits in the region.

Inversand enthusiastically supported the idea. Bulldozers cleared out a section of the pit so that Dr. Lacovara and his students could meticulously excavate fossils, and there they uncovered the mass death assemblage.

Township officials wanted to buy the quarry, but did not have the $2 million that the 65-acre site would cost.

Inversand was spending several hundred thousand dollars a year keeping the pumps running to divert water that would otherwise flow in. An application for a state grant remained in limbo. And so last summer company officials told Dr. Lacovara that the pumps would be turned off at the end of the year.

“That was going to be it, and the quarry was going to be a lake by mid-January,” he said.

Rowan turned out to be the savior.

After shipping the Dreadnoughtus skeleton back to Argentina at the end of 2014, Dr. Lacovara met with the university’s president, Ali A. Houshmand. Dr. Houshmand lured Dr. Lacovara, who was a student there when it was Glassboro State College, with a promise to create a school of the earth and environment, of which Dr. Lacovara would be the founding dean.

For Dr. Lacovara, an essential part of the deal was for Rowan to buy the Inversand quarry. Dr. Houshmand agreed.

Sandbox for All Ages

In September, crowds filled the quarry for the fourth annual community fossil dig. They arrived in four waves, at appointed times, and Dr. Lacovara greeted each group.

This summer, the Inversand Company, which owned the quarry, decided it could no longer afford to maintain the site. Rowan University agreed to buy it. Christian Hansen for The New York Times

“Who wants to find some fossils?” he exhorted. “Go have some fun.” For this day, the quarry was a scientific sandbox for people big and small.

In a cordoned-off area, some of Dr. Lacovara’s graduate students continued their work on the precious layer, explaining their finds to onlookers.

Elsewhere visitors scooped through the soil, presenting their finds to the experts, mostly the grad students, as if in a fossil version of “Antiques Roadshow” — except these heirlooms were millions of years old.

Some were just rocks, others hardened lumps of sand that came apart when squeezed. But there were thrilling exceptions.

“This is a brachiopod,” one expert told Michael Lloyd, 8, of Mantua, describing a clamlike creature.

“Daddy, I found a brachiopod!” the discoverer shouted.

With the future of the quarry now safe, Dr. Lacovara envisions more fossil days and school trips and a visitors center overlooking the pit. “We really want to integrate this in the community,” he said. “It’s a living, changing place.”

The hope is not necessarily to produce paleontologists, but to teach young people how to decipher the mysteries of the world.

“Kids start to think of science as a process,” Dr. Lacovara said. “It’s a way of asking questions about your world.”

As for the possibility that he has found a dinosaur-era graveyard dating to the mass extinction, Dr. Lacovara is careful to say that he does not have convincing evidence yet.

“We are in the trying-to-poke-holes-in-it phase,” he said. “There’s going to be so many arrows aimed at that.”

But it is a hypothesis worth pursuing.

“Certainly we have rocks that are near that time,” he said. “I know we’re damned close.”