A walk along the lakeshore, dinosaur-style

Quarry workers have uncovered what may be the most extensive group of dinosaur tracks known in eastern North America. Paleontologists say this set of more than 1,000 fossilized footprints, found in Culpeper, Va., offers new insight into the behavior of some of the first dinosaurs.

"I'm overwhelmed by the magnitude of the information that's available on the floor of this one quarry," says Robert E. Weems of the U.S. Geological Survey in Reston, Va. "This is the earliest extensive look at dinosaur behavior that we've got."

In a 6-acre space at the bottom of the quarry, Weems and others have identified tracks from two types of carnivorous dinosaurs and a puzzling third animal, which may have looked like a large horned crocodile. The roving reptiles left their marks in muddy ground near a lakeshore during the later stage of the Triassic period, some 210 million years ago, Weems said last week at a press conference announcing the finds. This geologic time sits at the very beginning of the dinosaurs' long and successful history on Earth.

Fourteen years earlier in the same quarry, workers with the Culpeper Stone Co. unearthed tracks at a level about 150 feet higher and 300,000 years later than the rock at the current quarry bottom. Weems, who also studied this earlier find, says those tracks recorded a wider variety of animals but showed less detail and were not as well preserved as the newly discovered imprints.

In recent years, the study of preserved footprints has undergone a renaissance among paleontologists. A long, continuous set of prints can reveal more information than bones can about how extinct animals moved. "It doesn't tell you where the animal died or was buried; it tells you where the animal was actually living and walking around. That's a very important aspect and one that tends to get neglected," says Nicholas Hotton, a vertebrate paleontologist with the Smithsonian Institution in Washington, D.C., who recently examined the quarry prints.

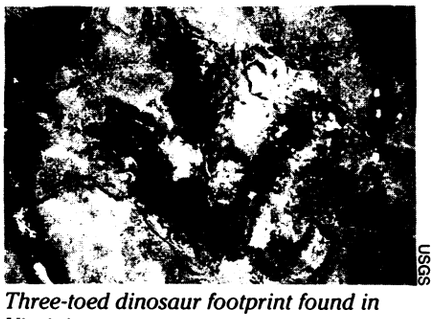
Two-thirds of the quarry tracks were made by a three-toed dinosaur that walked on two feet and stood about 11 feet tall. From the shape and size of the print, Weems has identified this beast as a member of the carnosaur group, which included distant relatives of *Tyrannosaurus rex*.

Weems says the tracks indicate this animal may have hunted with considerable stealth. One set of prints shows how the creature stopped abruptly and stood still without shuffling its feet, then restarted by rocking back on one heel, creating a double heelprint.

A smaller, three-toed dinosaur made about 10 percent of the tracks in the quarry. This was most likely a coelurosaur, a bird-like biped that reached about 8 feet in length, Weems says.

The third animal remains a mystery for now. With right and left legs spread about 4 feet apart in an extremely wide stance, this lumbering quadruped left hoof-shaped prints in the mud. At first, Weems thought a large sauropod dinosaur might have created this path, but the strides are too short. He now believes the tracks reflect a reptile that looked like a flattened crocodile with horns.

The trackways on the quarry floor represent a "true slice in time," he says. Geologists often use this phrase to mean a few hundred or even hundred thousand years. But Weems says all the tracks were made within a week.



USGS

Three-toed dinosaur footprint found in Virginia quarry.

The quarry company has redirected its work elsewhere and is aiding Weems as he measures and photographs the tracks and makes plaster and latex molds. But Weems says the tracks will soon disappear as explosives blast deeper, perhaps uncovering another layer of buried reptile prints. — *R. Monastersky*

MS gene discovery: A piece of the puzzle

A specific gene can heighten a person's risk of multiple sclerosis (MS), say scientists who have identified the gene and confirmed its link to the disease. Because the gene plays an important role in the function of certain immune cells, called T-cells, its discovery supports the hypothesis that a malfunctioning immune system causes the disease. If researchers can determine which part of the gene is linked to MS susceptibility, "the specific destruction of the T-cells which use that piece may be possible," says study coauthor Stephen L. Hauser of Massachusetts General Hospital in Boston. Such therapy has already succeeded in MS-afflicted mice, suggesting it's a realistic possibility in humans, he says.

Researchers have long suspected a genetic component in multiple sclerosis. Studies have demonstrated, for instance, that a person whose identical twin suffers from multiple sclerosis is at much higher risk for the disease than is another sibling. More recently, researchers have associated certain forms of the T-cell gene with multiple sclerosis in individual patients. Until now, however, no one had viewed the gene in its entirety or demonstrated its link to multiple sclerosis by showing its inheritance pattern in families, Hauser says.

Although the finding advances the study of multiple sclerosis, there are "probably 50 pieces in the MS puzzle," says Howard L. Weiner, head of MS research at Brigham and Women's Hospital in Boston. "This is one of the pieces . . . but it isn't the answer."

Hauser's work, described in the June 30 CELL, shows that people who carry specific forms of the identified gene run 3.3 times the MS risk of the general population. However, previous studies indicate that the risk faced by siblings of MS patients is fully 20 times that of the general population. For this reason, Hauser's team says that several genes, and perhaps one or more environmental factors, appear likely to be involved.

Multiple sclerosis destroys the fatty sheath of myelin surrounding nerve-cell axons, disrupting nerve transmission and producing varied and changing symptoms including weakness, tremors and impaired vision (SN: 10/10/87, p.234). Although the cause of the myelin destruction remains unknown, scientists suspect that multiple sclerosis reflects an immune system gone haywire, with misguided T-cells attacking the body's own tissues.

The T-cell hypothesis led Hauser and his team to look for an abnormality in a gene coding for a protein receptor that enables a T-cell to recognize its target. They used a refined form of a technique called pulse-field gel electrophoresis — which allowed them to view the whole gene unbroken — to "unequivocally identify the unique nature" of the two T-cell gene copies in 40 sibling pairs in which both siblings had multiple sclerosis, Hauser says.

They found that 15 of the sibling pairs had inherited the same two forms of the T-cell receptor gene from their parents and that only three pairs shared neither gene copy. This distribution differs significantly from what scientists would expect from a random sample of individuals. If the genes were not linked to the disease, Hauser explains, 10 of the 40 sibling pairs should carry the same two gene copies from their parents, 20 should have in common one of these copies, and 10 should have neither copy in common. Indeed, the researchers say they found exactly this ratio in their eight control families and in a comparison of MS patients with unaffected siblings.

— *I. Wickelgren*