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WALKING IN A FOSSILIZED RAINFOREST

When the Appalachian Mountains—the Himalayas of their day—were nearing completion roughly 300 million years ago, what is now North America was located near the equator. A shallow sea covered several US states-to-be, including the southern parts of Illinois and Indiana. On land, tall forests of lycopsids, prominent members of the division comprising the first vascular plants, towered 30 to 50 meters high—the living carbon of the Carboniferous Period.

A large earthquake shook this early tropical paradise, causing the subsidence of a huge swath of forest near a tidal estuary. The forest was covered with water and buried in mud, conditions that were ideal for preservation of whatever the forest comprised.

In a coal mine in eastern Illinois, 100 meters below ground, a seam of coal formed from the floor of this Pennsylvanian mire forest has been removed. The mine's ceilings are densely covered in fossils, and more than 1000 hectares of underground passages reveal the forest's composition.

Two paleobiologists, the Smithsonian's William DiMichele and University of Bristol's Howard Falcon-Lang, collaborated with Illinois State Geological Survey scientists John Nelson and Scott Elrick and Peabody Coal Company's Philip Ames to map the spatial structure of the assemblage. Their study is published in the May issue of *Geology.*

Two locations, one on the landward side of the forest and the other on the seaward side, were sampled and compared. Both sites displayed a layered structure; the landward, less-submerged section of the forest showed greater diversity. Of the 50 distinct forms (morphotaxa) of plants found, the most abundant were those towering arborescent lycopsids and tree ferns of subcanopy size. Mixed into the understory were patchy, less-abundant groups, among them seed ferns (pteridosperms), mangrove-like cordaitaleans, and tree-sized horsetails (sphenopsids).

CONNECTING A FOSSIL TREE'S STUMPS AND CROWNS

A fortuitous find in upstate New York has resolved another mystery about Earth's earliest forests. A quarry near Gilboa, New York, has exposed sandstone casts of large stumps dating from the Middle Devonian (385 million years ago). Their lack of crowns has made it difficult to ascertain what type of plants they were. Since first discovered in 1870, they have been variously interpreted as progymnosperms (early nonseed plants), pteridosperms (early seed plants), lycopsids, and cladoxylopsids (other nonseed groups).

Scientists from Binghamton University, New York State Museum, and Cardiff University have examined two recently exposed specimens of large trees that had fallen sideways, with the aerial portions preserved as well as the trunk and base. The lower portion is identical to the stumps formerly known as *Eospermatopteris,* and the crown has been identified as the fernlike tree *Wattieza,* placing the whole plant in the cladoxylopsid group of early nonseed plants. Their report appears in the 19 April issue of *Nature.*

As reconstructed from both specimens, the plant, which looks superficially like a palm, is estimated to have been at least eight meters tall. Comparisons with stumps of other Gilboa specimens indicate that this plant was not as large as *Wattieza* could grow—diameters of the other stumps are as much as twice the size of the newly found one. The branches clustered at the crown bear both sterile and fertile appendages, the latter having recurved tips bearing sporangia. The trunks show longitudinal rows of attachment scars that become less distinct toward the base, suggesting that branches were shed like fronds, generating an abundance of litter that may well have supported early arthropods.

"Cladoxylopsids were an important group of large (now we know just how large!) plants," lead author William Stein says, "that clearly were the dominant elements of terrestrial ecosystems before the origin of seed plants. No one knows for sure if they left living descendants.... They were magnificent in their own completely unique way."

MIGHTY *PROTOTAXITES*

Fossils of a large plantlike organism made of interwoven tubes, called *Prototaxites,* have also been difficult to classify until now. Dating to the Lower Devonian (over 400 million years ago), the fossils of eight-meter-long, unbranched trunks lacking any telltale structures, such as leaves, roots, or reproductive parts, indicate *Prototaxites* was anatomically distinct from vascular plants. When discovered in 1859, *Prototaxites* was thought to be a primitive conifer; a recent chemical analysis has determined it to be a giant fungus.

Scientists led by C. Kevin Boyce, from the University of Chicago, have analyzed the carbon isotope composition of *Prototaxites* and other plant specimens from five Upper and Lower Devonian sites (see the May issue of *Geology*). The isotopic composition of *Prototaxites* specimens ranged widely, distinguishing them from photosynthesizers with more uniform carbon profiles. The wide isotopic range of *Prototaxites* within the same assemblage suggests that it was a heterotroph that lived off a variety of substrates.

This finding confirms the idea, originally proposed in 1919 and revived in 2001 by the Smithsonian's Francis Hueber, a coauthor of the study, that the strange organism is a fungus. When it first appeared on land, *Prototaxites* would have dwarfed the vascular plants of its day, but it went extinct 350 million years ago, by which time terrestrial plants had diversified and gained significantly in stature.

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