The Hickey System

Taking the name of the leaf in vein, or Prehistoric plants made easy

by Janet H. Weinberg

If Leo Hickey sometimes has a far-away look, it's probably because he is thinking about 50-million-year-old fossils and about a time when palm trees grew on top of the Rocky Mountains. But unlike his specimens, Hickey is very much alive, and concerned about public understanding of paleontology, the study of living things from the fossil record.

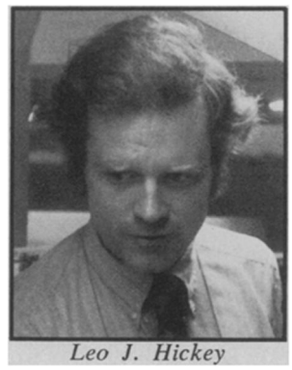
Hickey is a paleobotanist (studying the fossil history of plants) at the Smithsonian Natural History Museum in Washington, D.C. His studies seem disconnected on the outside—reconstructing the ancient climate of the Rocky Mountains, studying the fossilized remains of plants, and revitalizing the Natural History Museum itself—but they are all subtly interrelated.

"It's not unusual for a modern paleobotanist to study rocks," Hickey says. "Fossilized plants are often buried in rocks, so there is frequently as much information about the environment in the rocks as in the plant specimen. If you find fine-grained carbon, you know there were swampy conditions. From this, you can tell something about the plant's requirements—temperature, nutrients, moisture."

Hickey actually began his scientific career by studying rocks—he charted the various rock strata deposited in a thick formation in western North Dakota called the Golden Valley Formation. This work was aimed at reconstructing the climates in that region during the past few aeons.

Paleontologists have determined, he said, that "back 200 million years ago, the Rocky Mountains were mostly below sea level, low mountains appearing as islands off the coast of a continent to the east, with a seaway in between." Over about 100 million years, plate tectonics and volcanic activity gradually built the mountains up, and sediments collected and narrowed the gap between the mountains and the rest of the continent. Swamps formed and warm temperate forests grew over the Rockies. The Ice Age and changing rainfall patterns killed off the temperate and subtropical plants, but their fossil remains can still be found on dry plateaus in Utah, and 9,500 feet up in the Rockies.

"As I began to identify fossil leaves in the Golden Valley Formation," Hickey said, "I found that the methods generally used were totally wrong. There were no systematics, and people were practically guessing about the identities of the plants." So Hickey got sidetracked from rocks for a while, and spent four years developing a whole system of classification based solely on the leaf characteristics of plants.



Leo J. Hickey

"Most herbarium specimens are identified through their flowers, but most plants only flower during a brief season. If a plant has deciduous leaves, at least it can be identified for half of the year using my system, and a tropical plant can be identified all year." And, of course, fossil leaves can be more accurately identified.

Hickey found that the vein patterns in leaves can be used to judge primitiveness versus higher adaptation. He has theorized that regular venation patterns, instead of totally or partially random ones, might have evolved because of the special advantage they give in protecting the leaf from tearing. The random venation might also represent a lack of chemical sophistication in the developing leaves.

Leaves from the earliest known flowering plants (angiosperms), those from the Cretaceous Era (130 to 65 million years ago), appear to fit into Hickey's classification scheme. Because of this, he and his colleagues have been able to tackle one of the biggest problems in the field—where and how and when did seed plants evolve into angiosperms, with their successful flowering adaptation?

Modern-looking angiosperm leaves from the Cretaceous Era have been found around the Potomac, and "it seemed to some that the precursors

Photos: J. Weinberg

Mastodon-sized baggie is used during renovation of the Natural History Museum.

must therefore be much older, and evolved over a long period of time," Hickey says. "But my work with leaf venation shows that these Cretaceous specimens have random venation and are not modern, and that their development probably wasn't much earlier."

A long paper discussing this by Hickey and James A. Doyle, a botanist at the University of Michigan at Ann Arbor, is in press now.

Although some of them may seem a bit esoteric, Hickey's efforts are not all directed at other paleontologists. He is also the chairman of the exhibits committee for the Natural History Museum, which is currently redesigning the entire museum.

"We want to get away from the old idea of compartmentalization, which too frequently occurs in science, and which is expressed in our exhibits. In order to understand environments, we must learn ecology, and the exhibits don't show this.

"In natural history, the objects are our basic resource, and our biggest challenge is to reorganize them, while intruding as little as possible on their integrity, so that they make sense in the light of new developments and interconnections in natural science.

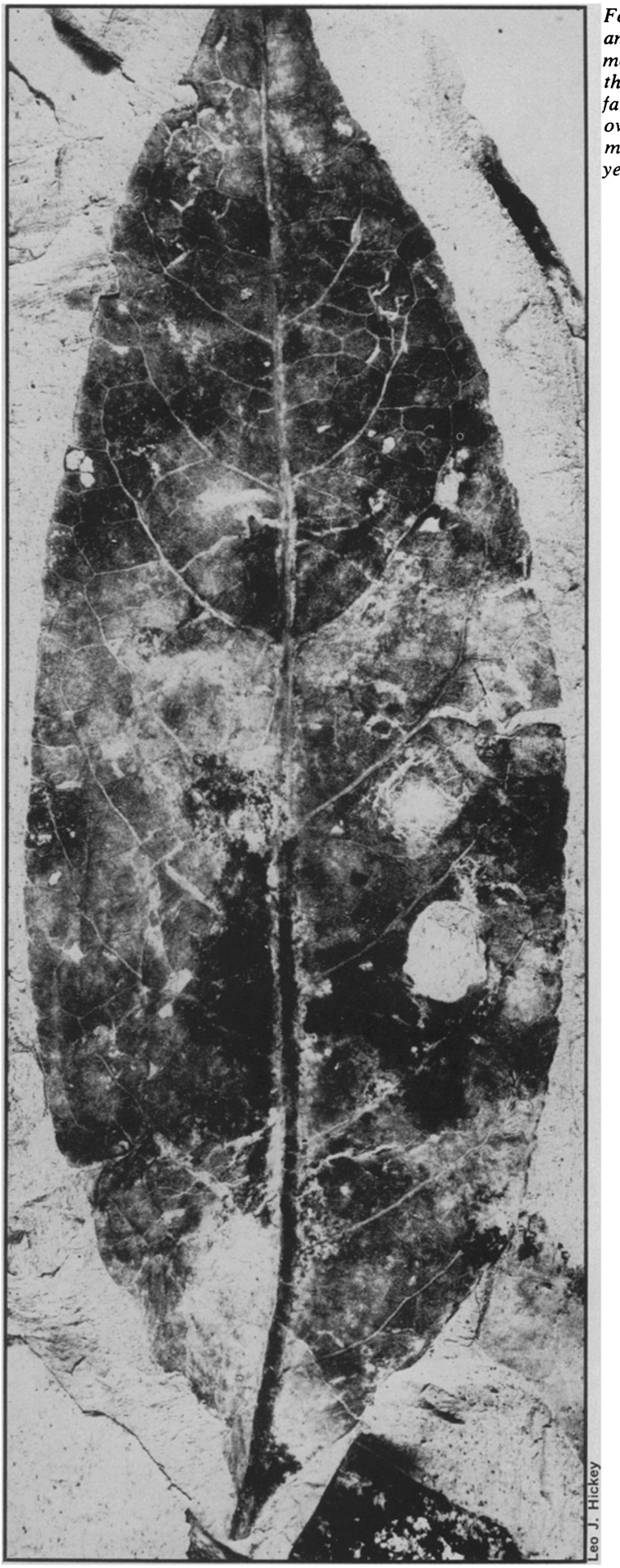
"Unlike art objects or aesthetically beautiful mineral specimens," Hickey said, "natural history objects must be organized, so we are attempting to position them in space so that certain relationships become clear. For example, we recently tore down the exhibit in the Hall of the Ice Age Mammals, with the huge mastodons, and skeletons. That particular display really gave no idea that during the existence of those animals, glaciation was taking place, major extinctions were occurring and man was coming on the scene.

"We thinned out the vertebrates, put in glacial rocks and maps, glacial men, and arranged some of the animals on platforms to make them look like part of fossil digs. So even if a person were to walk through and not read the labels and text, he could get an intrinsic understanding of how these animals fit into the overall environmental picture."

The Ice Age exhibit will reopen in mid-September, and the rest of the museum will be reorganized one hall per year.

Paleontological studies in general, and Hickey's work in particular, rather than just esoteric, specialized fact-finding, are efforts to establish interconnections between the distant past and living ecosystems, including man.

"I think the concept of geologic time should be part of our cultural heritage," Hickey said. "I think it is very important for us to understand the place of humans in the vast stretch of years that went before us." □



Fossil leaf, an extinct member of the tea family, is over 50 million years old.