

A Forest Grows in Antarctica

Antarctica, for the most part, is a lifeless continent of rock and ice. Over the last 15 years, scientists have come to believe that the stark and frigid landscape we see today has existed for a very long time; the climatic message embedded in sea sediments is that once an ice sheet enveloped East Antarctica 15 million years ago, it never let go.

Now, however, scientists working on the continent itself have uncovered the wooden remains of what they believe was an extensive forest that flourished only 400 miles from the South Pole about 3 million years ago.

"This is sure evidence that the ice sheet went through a very major period of waning about that time," says Peter Webb, who discovered the wood with a team of researchers last November and December. "Antarctica workers have got to start to think in terms of more dramatic changes of the glacial record."

The idea of a permanently ice-clad Antarctica first began to melt a few years ago when Webb, a paleontologist at Ohio State University in Columbus, and his co-workers discovered marine microfossils in the Transantarctic Mountains (SN: 7/2/83, p. 6). Webb concluded that 4 million years ago, as well as at earlier times, the ice sheet had retreated and seaways stretched across East Antarctica. Then, when the sheet advanced, it carried the fossils from the ocean basin to the mountains.

The new find of roots and stems of wooden plants and of pollen in an area stretching about 1,300 kilometers along the Transantarctic Mountains means not only that the ice retreated but also that the climate was warm enough to support a shrublike beach forest. "The presence of the wood means that there was deglaciation on a major scale, with conditions radically different than they are today," says David Elliot, chief scientist of the recent National Science Foundation polar expedition, of which Webb's group was part. "This is a very significant find." Webb thinks the forest region a few million years ago must have resembled the present-day fjords of Chile and Norway.

According to Webb, before the forest developed, the region was covered by a considerable amount of ice. So an important question is where the forest and pollen came from. "Had the forest been living there all the time, and are we overestimating the severity of the earlier glacial record?" he wonders. Had life developed on its own in Antarctica? Or had the plants and pollen been carried to Antarctica from other continents?

Webb notes that 40 million years ago,



Wooden traces of Antarctic forest.

Antarctica was the middle link in a migration path for marsupials and other life traveling from South America to Australia, when both continents were much closer to Antarctica. By a few million years ago, Australia had moved very far away from Antarctica, so that "any migrations that took place along the same route would have come to a rather disastrous end," he says. "However, in my wilder moments I think that Antarctica may have received these migrations from lower latitudes." Just in case, Webb's group is on the lookout for remains of insects and other creatures that might have lived in the Antarctic forest.

Because the different scientific teams have only recently returned from the expedition, they have not had time to extensively compare their finds. One possible area of contention with the work of Webb's group is the dating of the wood, which so far has been estimated with the ages of microfossils found in the sediment with the wood. If the wood was much older than a few million years, its significance would lessen, since it would have little bearing on the more recent glacial history of Antarctica. Moreover, traces of life have been discovered in Antarctica dating back 200 million years or older. But Webb and Elliot say they are relatively certain that the wood is fairly young because it is not very fossilized: It still floats and can be burned.

In addition to finding evidence that the recent glacial history of Antarctica is more dynamic than was previously thought, Webb's group concluded that the continent may have been more tectonically active as well. The researchers discovered that the deposits containing the wood fossils are sliced by faults, which displaced sediment layers by as much as 1,000 meters. This indicates that the Transantarctic Mountains have risen very rapidly in the last few million years. Previously scientists had assumed that they had risen slowly, over a 40-million-year period.

"It seems that Antarctica is not the one or two plates that people have been thinking about," says Webb. "The big plates ... appear to be broken up in

smaller plates that are interacting against each other," resulting in rapid growth of the mountains.

This fast growth also makes it easier to accept the idea of retreating ice sheets. The faults show that a few million years ago, the mountains were lower than had been assumed. And the lower the mountains at that time, the less ice would be required to cover them and hence the less ice would have to be melted when the sheets retreated.

Scientists are interested in documenting the past growth and destruction of the world's ice sheets because, according to one line of thinking, these changes are key to the shifting sea levels during the earth's history: Sea level rises when the ice sheets melt and falls when they grow. The recent discoveries in Antarctica, says Webb, are some of the first real steps toward correlating ice sheet growth with sea level fluctuations. — S. Weisburd

Government probes gene-splice test

"Greenhouse" experiments on genetically engineered bacteria injected into fruit and nut trees were among the tests reviewed by the Environmental Protection Agency (EPA) in making its decision last year to issue a permit to scientists at Advanced Genetic Sciences, Inc. (AGS) of Oakland, Calif., for the first field test of a genetically engineered organism (SN: 11/23/85, p. 324). But EPA did not know that these prior experiments on about 50 trees were not performed in a greenhouse, as the company had implied, but in the open air on the roof of the AGS building.

The company admits to the outdoor tests, which were disclosed last week in the Washington Post, but says its scientists acted in "good faith" because they did not consider the experiment to be an "environmental release" subject to EPA approval. EPA says the tests violated the federal requirement that the agency be notified before any field tests of genetically altered microbial pesticides. The U.S. House of Representatives' Committee on Science and Technology held a hearing March 4 to find out "how these events could have occurred."

"It's a scandal," says Jeremy Rifkin of the Washington, D.C.-based Foundation on Economic Trends. "It is a black day for the [biotechnology] industry."

Rifkin expects a court decision this week on his challenge to the AGS field-test permit. Meanwhile, the field tests — which were planned for early this spring

— have been delayed by officials of Monterey County, where the proposed test plot is located (SN: 1/25/86, p. 56). In the field test, a plot of strawberry plants is to be sprayed with bacteria, which AGS calls Frostban, from which scientists have removed the gene responsible for triggering ice formation during light frosts.

The company showed “a real lack of wisdom” in not seeking EPA approval of the rooftop tests, John Bedbrook of AGS told the House committee. “With hindsight,” the company now can see the EPA position, he says, and will “conduct our future work accordingly.” But Bedbrook argues that the rooftop tests were as safe as those performed in a greenhouse, since the microbes were first contained within a syringe and then injected into the trees themselves. However, no provisions were made to prevent insects from picking up the sap.

EPA has not specified criteria for laboratories and greenhouses, but the agency says tests are to be conducted in facilities designed to prevent dispersal of microbes. “We don’t regard a tree as a con-

tained facility,” says Steven Schatzow of EPA.

In the next month, EPA plans a “full investigation of all allegations involving AGS,” Schatzow told the House hearing. The agency will conduct “an audit of AGS records and facilities,” he says. “The agency has no evidence at this time to suggest that the AGS data are invalid or to call into question the agency’s finding that a limited field test would not result in any foreseeable risk to human health or the environment.”

The House committee questioned both Bedbrook and Schatzow about a statement obtained from a former AGS technician suggesting that the testing procedure for the rooftop trees was not adequate and that damage to the trees was not reported to EPA. Bedbrook said he could not explain the details of the testing procedure because he is not a plant pathologist. “But I have no question about the validity of the results reported to EPA,” he says. Schatzow says that if the EPA investigation provides evidence that Frostban is a plant pathogen, EPA may withdraw or alter its permit. —J. A. Miller

A starry origin for sandy compounds

Silicon is the most abundant element in the surface of the earth; silicates are the most abundant compounds there. Silicate dust also pervades interstellar space, and silicates are common in such things as meteorites and comets. The origin of silicon and silicates, like that of other elements and many compounds, must lie somehow in the stars or in processes associated with stars. Now, for the first time, astronomers have found an exploding star—a nova—that produces silicates. This nova is a star of unusually large mass for a white dwarf and so is likely to cause some changes in the generally accepted theory of stellar evolution.

Most novae, which are periodically exploding white dwarf stars, produce carbon dust. According to infrared spectroscopy done by Robert Gehrz of the University of Minnesota in Minneapolis and Gary Grasdalen of the University of Wyoming in Laramie, this nova is rich in silicon, magnesium, neon and oxygen. In the constellation Vulpecula, it is designated nova Vulpecula 1984, number 2.

Novae are supposed to be located in close binary systems with more or less ordinary stars for their companions. The very strong gravity of the white dwarf draws material from the companion. As this material falls on the surface of the white dwarf, it builds up an unstable condition that eventually triggers an explosion. This cycle repeats after a period of centuries or longer.

The nova explosion spews material from the white dwarf into space. It generates a shock wave moving outward from the star. Gehrz believes that the silicate compounds are made in this shock wave, but he says the silicon itself has to come from inside the white dwarf. A white dwarf that produces silicon is unique. Most of them operate on a cycle that makes carbon, oxygen and nitrogen.

To produce silicon, it seems that this white dwarf has to be much more massive than white dwarfs are expected to be, and that poses a challenge to stellar evolution theory. According to theory, a white dwarf is one of the things a star should become at the end of its life, but that particular fate should come only to fairly small stars, those the size of the sun or less. A star more than two or three times the sun’s mass should undergo a supernova explosion and become a neutron star.

This silicon-producing white dwarf has to be about 15 times the sun’s mass. If a white dwarf that size can exist, it presents a serious challenge to the theory, or, in Gehrz’s words, “severely constrains it.”

— D.E. Thomsen

The ‘wetter’ side of hominid tools

Some of the oldest known tools manufactured by human ancestors, dated at 2 million to 2.5 million years old, have been discovered in a rain forest in Zaire. The nearly 300 quartz tools, found with a number of animal bones and teeth, indicate that humans did not originate solely in the dry savannas of eastern Africa, according to investigators who uncovered the artifacts last summer.

The Zaire fieldwork was led by Noel T. Boaz of the Virginia Museum of Natural History in Martinsville, John W.K. Harris of the University of Wisconsin in Milwaukee and Alison S. Brooks of George Washington University in Washington, D.C. They described the find last week at the National Geographic Society in Washington, D.C., one of several organizations that funded the expedition.

“This is the first indication of early hominids [direct ancestors of modern humans] in Africa’s Western Rift Valley,” says Boaz. “We expect to find remains of *Homo habilis* in the same deposits when we return this summer.”

The dense vegetation and rain forests of the Western Rift Valley begin in Zaire and stretch to the Atlantic Ocean. Only two other sites yielding hominid tools, both in Ethiopia in the arid savannas of the Eastern Rift Valley, are thought to be older than the Zaire site. They are considered to be 2.3 to 2.6 million years old.

Tools uncovered at the Zaire site are simple cobbles, flakes and cores similar to the tools at the Eastern Rift sites, says Harris. It is too early to tell whether they were used to kill animals or butcher carcasses, he adds.



Noel T. Boaz (left) and John W.K. Harris study a number of stone tools found in Africa last summer.

The absence of volcanic rock at the site makes precise dating difficult, but animal species found in the same sediments provide clues to the time the bones were deposited. Remains include those of pigs, antelopes, giraffes, elephants and an ancient three-toed horse.

“This discovery tells us that reconstructions of the human story in Africa have been biased toward sites in the dry areas of eastern and southern Africa,” says Brooks. “A significant part of the story is in wetter environments.”

Furthermore, she adds, a number of other sites representing early human ancestors have been located within 10 miles of the excavation. Brooks estimates that the sites date from almost 1.5 million years ago to about 20,000 years ago.

— B. Bower