# Finds undermine dating of early land life

Norwegian geologists are threatening to drench established theories about when our ancestors first pulled themselves out of the water and took over the continents. A new study of rocks from east Greenland suggests that some of the earliest fossils of vertebrates with legs are not as old as paleontologists have long thought.

"These data do not fit with our current understanding of evolution," says Ebbe H. Hartz of the University of Oslo. "If we change the ages of the fossils from east Greenland, that will trigger a domino effect on many other places because a lot of evolution has been defined by this area." Hartz and his colleagues describe their work in the August GEOLOGY.

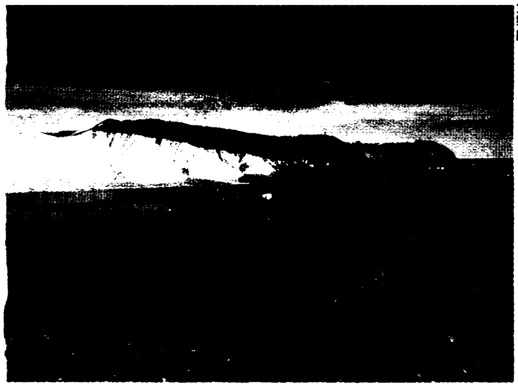
According to textbook paleontology, insects and other invertebrates retained unrivaled control of the continents until the late Devonian period, when amphibious vertebrates first hauled themselves out of the swamps (SN: 7/30/94, p. 70). These pioneers, called tetrapods, descended from fish with paired sets of fleshy fins, which at some point evolved into stout legs.

The most complete remains of primitive tetrapods hail from a sediment-filled basin in east Greenland. In 1959, geologists indirectly dated the basin as late Devonian, between 370 and 360 million years old.

This age came into question recently, when Hartz and his colleagues studied the orientation of magnetic grains embedded in rocks from the basin. The grains record the direction of Earth's magnetic field at the time the rocks solidified, indicating the site's former latitude.

According to the grains, the rocks formed when Greenland was at about 30°S—not the expected position during the Devonian, says Hartz. Instead, the findings match Greenland's position during the subsequent, Carboniferous period.

Direct dating of the radioactive elements in the rocks confirmed this younger age. Using the argon-40/argon-39 method, Hartz and his team determined that the fossil layers of the basin were less than 336 million years old. Hartz cautions that these conclusions require verification, and he is working to date other rocks from the Greenland basin.


Hartz

*How old are you now? This site in east Greenland yielded fossils of some of the most primitive vertebrates with legs.*

Paleontologists find these dates hard to accept. "I'll be dumbfounded if it's true," says Neil H. Shubin of the University of Pennsylvania in Philadelphia, who studies Devonian tetrapods in Pennsylvania.

"I'm quite convinced that this is wrong," comments Per E. Ahlberg of the Natural History Museum in London, another tetrapod investigator.

If Hartz and his colleagues are right, however, that will raise questions about the Devonian age of other early tetrapods, say paleontologists. Tetrapod fossil sites in Pennsylvania, Australia, and Russia contain fish and other animals very similar to those found in the Greenland basin, suggesting that all sites are the same age. Redating the Greenland fossils may pull many other early tetrapods into the Carboniferous as well, altering the time when vertebrates made the transition to life on land.

"If their conclusions are correct, it would suggest that the early part of the evolution of tetrapods took longer than we thought it did," says Ahlberg.

*— R. Monastersky*

# Communism in trees goes underground

Although plants don't plot to overthrow capitalist regimes, their actions demonstrate a clear communist bent. At least some species of trees seem to give according to their abilities and receive according to their needs, report Suzanne W. Simard of the Ministry of Forests in Kamloops, British Columbia, and her colleagues in the Aug. 7 NATURE.

The team showed that some trees give their neighbors carbon that they have captured from the atmosphere. An underground network of fungi collaborates in transporting the goods.

Scientists had previously found that carbon flows between plants, but they had not established whether individual plants show any overall profit or loss. To address that question, the researchers provided adjacent trees with one of two brands of carbon dioxide, each labeled with an isotope of carbon. By examining how much of the different isotopes ended up in each tree, the team could measure net transfer of the element. Birch trees, for example, gave fir trees more carbon than they got in return, the researchers observed.

The scientists discovered that shade enhances a tree's ability to receive. Because plants require energy from the sun to grab carbon dioxide from the air, they become carbon-starved when light is scarce. Birches subsidized firs that were shaded by heavy cloth canopies even more generously than firs in sunnier conditions, the team reported. Birches and firs grow together naturally, so the findings may have implications for life in the forest.

"A plant grows in the shade for long periods early in its life," says David Read of the University of Sheffield in the United Kingdom. "This study provides an explanation for how it gets what it needs."

The carbon appears to travel via a subterranean web formed by a common group of fungi. The network envelops the roots of both types of trees. Much more carbon travels between the fir and the birch, which share fungi, than between either of these trees and cedars, which associate with a different fungal group.

*Cooperation may invigorate forest communities.*

The fungi normally receive carbon—in the form of sugar—from the trees. In return, they dispense some of the nitrogen and phosphorous they scavenge from the soil. The new results suggest that fungi can donate carbon as well.

"We don't yet know how the second tree tricks the fungus into giving up carbon," says Read. "There's nothing in it for the fungus as far as we can see—at least in the short term." This scheme, however, may help the second tree survive, so the fungus may be "planning for its next meal," Read conjectures.

The fungi "even out" the carbon supply in the community, says team member David A. Perry of Oregon State University in Corvallis. "When we look above ground, we see a bunch of individuals. When we look below ground and see all the connections, that individualism becomes much less clear." This view challenges current ecosystem models, which assume that plants constantly compete with one another for resources.

"Perhaps cooperation increases the fitness of the community," says Perry. Different plants specialize, performing better with different amounts of light and moisture, he explains. If these organisms share the fruits of their labor, community members receive what they need in a wide variety of situations. *—E. Strauss*