# Earth Science

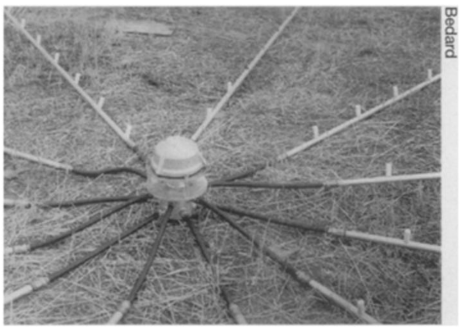
## A sound way to spot tornadoes

Atmospheric scientist Alfred J. Bedard Jr. and his colleagues were fine-tuning an avalanche-detecting system in June 1995 when their microphones picked up a strange rumble coming from the nearby Colorado plains. Only later, after checking measurements made by a Doppler weather radar, did Bedard realize that the avalanche apparatus had captured the first clear evidence that tornadoes generate low-frequency sound.

A researcher with the National Oceanic and Atmospheric Administration (NOAA) in Boulder, Colo., Bedard has since identified 27 tornadoes with the avalanche system. He hopes to take the sound sensors to Oklahoma for an in-depth test of their ability to detect twisters soon after they form. "If all this holds together, we feel it could be an extremely valuable tool that would be complementary to Doppler weather radar," says Bedard, who also teaches at the University of Colorado in Boulder. "I think it's potentially very promising," comments Joseph H. Golden, senior meterorologist with NOAA in Washington, D.C.

Looking something like a 50-foot octopus, each acoustic sensor has an array of long, outstretched arms designed to capture low-frequency vibrations called infrasound. The system picks up tornado sounds in the range of 1 to 5 hertz, which falls below the threshold for human hearing. Bedard hypothesizes that these vibrations come from the vortices as they repeatedly expand and contract, creating pressure waves in the air.

Bedard and his colleagues plan to explore the mechanism behind tornado sounds, using small-scale twisters generated in a laboratory water tank. These mini-vortices of water emit a loud screech that provides a model of the infrasound produced by real tornadoes, says Bedard.



Bedard

*Infrasound sensor shows promise in tornado detection.*

## What the dinosaurs left behind

When most paleontologists visit the Two Medicine Formation in Montana, they keep their eyes open for the bones of herbivorous dinosaurs, which populated this region 75 million years ago. Karen Chin, however, has something less glamorous on her mind. The graduate student from the University of California, Santa Barbara seeks the fossils of the feces excreted by those plant-munching behemoths of the Cretaceous period.

From her studies of the rock-solid scat, Chin has managed to paint a detailed picture of the ancient ecology that connected dinosaurs and insects in a tight food web. She and her colleague Bruce D. Gill of Agriculture Canada in Ottawa report on their work in the recently issued June Palaios.

Most studies of fossilized dinosaur feces, or coprolites, have focused on the easily recognizable, torpedo-shaped droppings from carnivorous and omnivorous species. In contrast, Chin and Gill reported the discovery of coprolites from herbivorous dinosaurs. Ranging in size from small cobblestones to basketballs, these blocks contain broken-up pieces of conifers.

Tunnels running through the coprolites record the activity of beetles that scavenged the dinosaur dung, suggest the researchers. If their interpretation is correct, these burrows would represent the earliest known evidence of dung consumption by beetles. This discovery would overturn previous speculation that dung-eating beetles evolved alongside the large mammalian herbivores, long after the extinction of the dinosaurs, suggest Chin and Gill.

## The original Arkansas Traveler

Anyone still disappointed about the outcome of the U.S. Civil War may welcome news of an earlier, more successful secession. A continental fragment of the southern United States apparently broke loose and roamed the seas nearly 500 million years ago. The rebellious strip eventually found a home in the Argentine Precordillera, a region in what is now central South America.

Two geologists, recognizing similarities between rocks and fossils from Argentina and from Texas and Arkansas, identified the origin of this well-traveled region, which is 200,000 square kilometers.

"We know where it came from and where it ended up," says William A. Thomas of the University of Kentucky in Lexington. "That's the unique aspect." Thomas and his colleague Ricardo A. Astini of the University of Córdoba in Argentina report their discovery in the Aug. 9 Science.

In particular, limestone deposits in Texas and Arkansas match those found in Argentina. Moreover, the exotic South American landmass contains fossils of organisms that inhabited part of ancestral North America, a continent known as Laurentia, more than 500 million years ago. The researchers also found younger fossils typical of the ancestral South American continent, Gondwana. These led them to surmise that the breakaway strip wandered the oceans for 70 million years before settling into its new neighborhood.

The Argentine Precordillera broke off from Laurentia when an oceanic ridge to the east of the strip shifted westward, the researchers report. Caught on the new ridge's slope, the mini-continent slid into and across the now-extinct Iapetus Ocean. After attaching to South America, the strip was compressed when the Andes Mountains emerged to its east.

Thomas and Astini's explanation is largely acceptable to geologists, says Warren Huff of the University of Cincinnati's geology department. "The fossil evidence argues for it." The length of the voyage, however, is still open to debate.

Earthquakes from the cracks left by the rift, reminders of the ancient rebellion, still trouble the Midwest.

## Soil seen as missing sink

Over one-quarter of the gas emitted by fossil fuel combustion is missing from the atmosphere, confounding scientists' efforts to model climate change. New findings suggest that some of it may be under our feet.

"Soil is where it's at," says Jeffrey Andrews of Duke University in Durham, N.C. Speaking at the annual meeting of the Ecological Society of America last month, he reported that trees take large amounts of carbon dioxide from the air and pump it into the ground. Andrews suggests that the carbon dioxide eventually leaches into groundwater; this prevents it from quickly reentering the atmosphere, where it could exacerbate global warming (SN: 2/13/93, p. 100).

"I applaud him," says Peter Curtis of Ohio State University in Columbus. "It's a potentially important new mechanism to account for missing carbon in the atmosphere." If Andrews' finding holds up, the subsurface may offer fertile ground for researchers trying to find the missing carbon sink.

Working at a forest reserve in North Carolina, Andrews dug samples 1 meter below loblolly pine trees that had been sprayed with one and a half times the normal amount of carbon dioxide. The gas usually makes up 3 percent of the soil's composition, but it reached 4 percent under the dosed trees. A stable isotope of carbon dioxide acted as a marker of the gas.

"It's not leaving the carbon cycle," says Andrews. "It's going into a more slowly cycling pool." If correct, these results indicate that forests pumping carbon into groundwater could account for 20 percent of the missing carbon dioxide. Trapped in the groundwater, it can remain stable for thousands of years.