Richard Monastersky reports from San Francisco at the fall meeting of the American Geophysical Union

Homing in on the longest animal

Paleontologists have started using a shotgun in the hunt for a gargantuan dinosaur dubbed Seismosaurus. The gun is part of an arsenal of sophisticated techniques scientists are now attempting to apply to paleontology.

For years, geophysicists have used remote sensing devices to locate petroleum reserves, mineral ores and other valuable deposits underground. More recently, remote sensing has helped uncover archaeological structures. But this is the first time paleontologists have used it in an attempt to locate fossils.

Seismosaurus, or "earth-shaker," is an unofficial name used to describe the huge, 140-million-year-old skeleton that David D. Gillette and his colleagues have been excavating from the desert of central New Mexico since 1985 (SN: 8/13/86, p.103). In shape, the bones resemble those from the well-known diplodocid dinosaurs but are 10 percent to 80 percent larger. The dinosaur's dimensions indicate it once reached a length of at least 120 feet, and possibly more than 140 feet, making Seismosaurus the longest animal known in Earth's history, says Gillette, who works out of Salt Lake City as Utah's state paleontologist. Other paleontologists are excavating another huge Utah diplodocid, unofficially called Supersaurus, which may also have stretched beyond 120 feet in length (SN: 4/29/89, p.261).

Since 1987, scientists from Los Alamos (N.M.) National Laboratory have conducted remote sensing tests at the Seismosaurus fossil site. Using ground-penetrating radar, magnetometers and radiation-sensing devices, they have tried to locate bones beneath about 8 feet of sandstone.

Other scientists are testing a different approach at the site. Their technique, called seismic tomography, resembles medical CAT scanning. Using a modified shotgun, the researchers send a blast of vibrations through the ground and record the diffracted vibrations with a string of receivers in a nearby borehole, says Alan J. Witten from Oak Ridge (Tenn.) National Laboratory. Through several different shots along a line, Witten and his colleagues can produce an image of buried objects that may be bones. Their technique proved successful last summer when excavations uncovered two huge Seismosaurus vertebrae in spots identified by the tomography.

Witten says he will next test the tomographic equipment by trying to locate shallow coal seams. The equipment was originally designed to track the underground spread of hazardous waste, he says.

South stays cooler in greenhouse models

A surprise has surfaced in simulations of the future climate. A new computer model, coupling the ocean with the atmosphere, suggests large portions of the Southern Hemisphere will heat up much more slowly from greenhouse warming than the rest of the globe, report Kirk Bryan, Syukuro Manabe and Ron J. Stouffer from the National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory in Princeton, N.J.

The simulations tested the climate effects of an accumulation of greenhouse gases in Earth's atmosphere from 1958 to 2058. Most strikingly, it showed that the regions in the Southern Hemisphere south of 50°S lag far behind their counterparts in the north. The Antarctic continent warms by only 2°C, and the circumpolar ocean warms even less. North of the equator, the temperature change is strongest at the pole, reaching 7°C by 2058, according to the model.

The imbalance appears to arise from strong currents in the circumpolar ocean that mix surface water with deep water. In other areas of the world, vertical mixing is much weaker and the ocean's surface layers warm as the atmosphere warms. But in the well-mixed circumpolar southern ocean, currents carry heat downward, preventing the surface layers from warming quickly, Bryan says.

To test whether their model accurately simulates ocean mixing, the researchers are checking it against actual measurements of how quickly human-made chemicals such as chlorofluorocarbons have penetrated the deep ocean. Other climate models do not show such a drastic imbalance between hemispheres, and more work is needed to explain these differences, Manabe says. The researchers also describe their results in the Dec. 7 NATURE.

Depressed ozone seen in Arctic

A recent analysis of measurements made in the Arctic stratosphere last winter suggests ozone levels were low, although it remains unclear whether human pollution deserves the blame, say Michael H. Proffitt of the National Oceanic and Atmospheric Administration's Aeronomy Laboratory in Boulder, Colo., and his colleagues.

Last month, Proffitt and co-workers reported that a new type of analysis detected a ring of depleted ozone outside the normal ozone hole over Antarctica (SN: 11/18/89, p.324). The group's preliminary analysis of data collected over the Arctic in January and early February suggests chemical reactions removed ozone from the atmosphere.

The researchers reached this conclusion by comparing ozone levels with those of nitrous oxide, which help reveal whether ozone levels are normal. Using data collected around the world to determine the standard relationship between these two chemicals, Proffitt's group found deviations from that relationship inside the Arctic vortex – a large ring of stratospheric winds encircling the pole. Inside, ozone levels were depressed in relation to nitrous oxide levels, indicating something had destroyed ozone.

Researchers involved in the airborne measurements detected elevated levels of ozone-destroying chlorine compounds inside the vortex. Proffitt says these and other measurements made during the flights may resolve whether these chemicals or natural ones lowered the ozone levels.

Peatlands as source of acid rain

Evergreens and glaciers lend southeast Alaska a pristine appeal. That's why geographer Lee F. Klinger was puzzled when he measured extremely acidic rainwater in this region. While normal rainwater has a pH about 5.6, Klinger measured values as low as 3.6 during the summers and falls of 1986 and 1987.

Other researchers have discovered acidic rainwater in remote sites and traced the acids back to sulfur compounds emitted by oceanic organisms. Klinger, who works at the National Center for Atmospheric Research in Boulder, Colo., says the oceans may offer a partial explanation of the acids, but they don't tell the whole story. Analysis of the rainwater shows that, in addition to sulfuric acid, it contains certain organic acids that can only come from land sources, he reports.

Where, then, do those acids originate? Klinger suggests peatlands as an answer. Atmospheric patterns in the area indicate that the regions with the worst acid rain lie downwind from peatlands. Klinger tested the gases emitted by peatlands and found high levels of terpenes, isoprenes and other chemicals that could serve as sources of the organic acids.

Last year, Klinger reported that acid-loving mosses hasten the death of trees, in part by acidifying their immediate environment (SN: 4/30/88, p.285). The work in southeast Alaska suggests that peatlands – abundant in mosses – kill forests over a large area by creating acid rain. This process, he says, promotes the spread of mosses and develops more peatland.