Earth Sciences

Smile when you call me a dinosaur


SCIENCE

If you live in Bavaria and just happen to have a fossil of a skinny, pigeon-sized dinosaur in your basement, you might want to take another look. It could be the next specimen of the rare genus *Archaeopteryx*, the most primitive known bird — one that is helping scientists link Aves back to their reptilian ancestors. Peter Wellnhofer of the Bavarian State Collection of Paleontology and Historical Geology in Munich reports in the June 24 SCIENCE that he has identified a new *Archaeopteryx* specimen, which had been found many years ago and misidentified as the dinosaur *Compsognathus*.

This well-preserved fossil, called the "Solnhofen specimen," joins only five other known *Archaeopteryx* fossils, all of which come from a unique limestone formation in Bavaria and date back to the upper Jurassic period about 150 million years ago. The last specimen identified by paleontologists also had spent time masquerading as *Compsognathus*. Found in 1950, this fossil was not correctly identified until the early 1970s.

The new specimen is the largest of all, and there are clear impressions of feathers left in the limestone, Wellnhofer says. These feather imprints are shown as dotted lines in the sketch of the fossil above. The new find may help resolve a debate about correct classification of the smallest specimen. While most scientists have presumed this one to be a juvenile *Archaeopteryx*, some have suggested it may represent a new species or even a new genus of primitive bird.

Working with colleagues in West Germany and with Yale University's John Ostrom, Wellnhofer has just examined this small specimen though computed axial tomography, better known as CAT scanning. Within the last four years, paleontologists have started to use this advanced X-ray technique, which allows them to peer inside fossilized material without destroying the specimen. This is the first CAT scan of an *Archaeopteryx*, report the researchers in spring issue of PALEOBIOLOGY. The group has found evidence this primitive animal may have been more advanced than previously thought. In the past, investigators had agreed that in *Archaeopteryx*, the connecting bone between jaw and skull had a single lobe at the top, a feature shared by most vertebrates but not by birds. However, the CAT scan indicated that two lobes top this bone, suggesting that even the earliest known bird possessed this distinctly avian characteristic.

Did pygmy hippos make a good meal?

Archaeologists have traditionally thought that humans first occupied the Mediterranean island of Cyprus about 9,000 years ago, long after the postulated disappearance of the pygmy hippopotamus, an animal the size of a small pig that once roamed Cyprus and other islands. But signs that the animals were victims of foul play are now appearing. Through radiocarbon dating of rock flakes apparently made by humans, Alan H. Simmons of the Desert Research Institute in Reno, Nevada, has pushed the human presence on Cyprus back before 10,000 years ago, he reports in the June 9 NATURE. Moreover, the flake site contained contemporaneous bones from pygmy hippos. Because of a disproportionate number of skull pieces, Simmons suggests the site was a refuse pile and humans had something to do with the Cyprus hippo extinction.

Environment

Helping nature protect plants

Many plants produce chemicals that stunt the growth of insects. Unfortunately for farmers, most of the more effective of these chemicals are not produced by cultivated crops. But chemists at the Agriculture Department's Western Regional Research Center in Albany, Calif., are working to change that.

Anthony C. Waiss and Carl A. Elliger have found that varieties of *Physalis* (a genus including the tomatillo and cape gooseberry) and of petunia contain chemicals that can dramatically stunt *Heliothis zea* — also known, depending on the host, as tomato fruitworms, corn earworms or bollworms. The researchers extracted the active chemicals and added them to the fruitworms' diet for six days. Some of these chemicals were so potent that insects dining on them grew to just 3 to 10 percent of the weight of insects fed a pesticide-free diet.

Researchers have sought to isolate the genetic capacity to make such chemicals from plants that are related only distantly, if at all, to the cultivated crops, Waiss says, "because the further we can go away from the cultivated plant, the longer it will likely take that plant's predators to evolve resistance" to its new chemicals. But this also presents a challenge, he says, because such distantly related plants cannot be crossed using standard horticultural methods.

Their current approach — protoplast fusion — merges the contents of a cell from each selected genus, and then regenerates the hybrid. While they haven't developed a satisfactory hybrid yet, Waiss predicts it's just a matter of time. Ultimately, once the genes responsible for producing the stunting chemicals have been identified and mapped, Waiss says they can be spliced into the desired crop plant through recombinant DNA techniques. And a benefit in this approach to chemical insect control, he notes, is that the active agents should be present only in the leaves, not in the edible fruit.

Brittle plants point to ozone damage

Ozone (O_3) — the primary photochemical irritant in smog — is also a major crop hazard, costing U.S. farmers an estimated $5 billion annually in reduced yields. New research at the University of Colorado in Boulder now suggests that an early warning sign of impending smog-ozone damage is plant embrittlement.

Eight-week-old ryegrass plants were exposed to 15 parts per million ozone for 7 hours. That level, while high, is not beyond what's encountered in some ozone-polluted regions experiencing periodic high peak-exposure levels, notes Jane Bock, a plant ecologist on the project. Moreover, she points out, it is below the level needed to inflict damage that can be seen under a microscope. However, when her colleague Alan Greenberg, a materials scientist, measured the tensile properties of leaves from these plants, he found they were "predictably, more brittle" than leaves from plants unexposed to ozone, she says.

The degree of embrittlement was small but significant. The "tensile modulus," or stiffness measurement, of the ozone-exposed leaves was 19.3 percent higher (13,000 pounds per square inch) than that of unexposed leaves. Ozone-treated leaves were also 30.4 percent less ductile, required only 73.1 percent as much energy to fracture and had a breaking strength 17.5 percent smaller than unexposed leaves. Similar embrittlement also was discernible in ozone-exposed soybeans, green beans, barley and wheat.

Recent studies by others have shown that ozone-damaged plants tend to attract more insects, Bock says. One explanation that's been offered is that ozone may alter the amino acid and sugar levels in plants, making them more attractive to pests. However, Bock says, "It may also be that insects can more easily bite and tear plants affected by ozone because of their brittleness." She has begun investigating that possibility.