Paleontology

Richard Monastersky reports from Lawrence, Kan., at the annual meeting of the Society of Vertebrate Paleontology

Rare fossils of enigmatic amphibian

What limbless land vertebrate has a name that sounds like the inhabitants of an Italian island?

Don't despair if the word caecilian fails to come to mind. Even biologists know relatively little about these blind, burrowing amphibians, most of which spend their lives underground and are easily mistaken for worms. Paleontologists have an even sketchier understanding of the creature's evolution, because the entire fossil record of ancient caecilians has long consisted of only two small vertebrae.

Researchers now report finding a rich cache of ancient caecilian bones that offers an unprecedented look at the early development of these animals. The fossils, found in northeastern Arizona, date to the Jurassic period (about 175 to 180 million years ago) and are some 100 million years older than the other known caecilian remains, report Farish A. Jenkins Jr. of Harvard University and Denis M. Walsh of the University of London.

Containing bones from at least six individuals, the Arizona find includes skulls, vertebrae and, most surprisingly, limb bones. Modern caecilians show no trace of legs even during the earliest phase of the life cycle. But their Jurassic relatives apparently had functional limbs. Because those limbs were unusually small in proportion to total body size, Jenkins surmises that the ancient caecilians also burrowed underground. "Already by Jurassic times, caecilians were beginning to lose their limbs," he says. The Jurassic animals were about 4 centimeters long, he estimates, whereas modern caecilians can reach lengths of more than 1 meter.

Unlike modern forms, which are nearly or completely sightless, the Jurassic caecilians apparently had well-developed eyes, says Jenkins. The ancient burrowers also used tentacles — as do living species — to help guide them through their dark world. No other known vertebrate has tentacles, says Jenkins.

Paleontologists have long debated the origins of these cryptic amphibians. Some argue that caecilians evolved from a group of early amphibians called microsaurs, developing separately from frogs and salamanders. Others maintain that all three amphibian groups are more closely related. Unfortunately, says Jenkins, the Arizona fossils "don't necessarily solve the problem over caecilian origins, at least not now."

The scoop on dino droppings

Karen Chin has been ruminating on a particularly murky paleontological question: Whatever happened to the scat from huge plant-munching dinosaurs? Researchers have many examples of fossilized feces from dinosaurs, but almost all of these so-called coprolites come from meat-eaters. Chin now reports that she has identified potential examples of herbivorous dinosaur droppings.

The geology graduate student from the University of California, Santa Barbara, studied irregular blocks of black rock containing fossilized plant material. The blocks, whose widths range up to 30 centimeters, come from a geologic formation in Montana that has yielded numerous bones of the duck-billed dinosaur *Maiasaura*. Most of the plant fragments are less than 3 cm long, with their edges rough and angular as if cut into pieces. Chin proposes that the plant remains are droppings from *Maiasaura*.

Such blocks could represent fossilized peat rather than fecal material, she notes. But she rejects that hypothesis for these specimens because the semiarid environment of the region at that time was not conducive to peat formation. Moreover, she says, the blocks appeared in isolated groups rather than in expansive peat-like deposits.

If they are coprolites, the finds offer clues to what *Maiasaura* ate. Some of the embedded plant material came from the cyprus-like conifer trees that lived at the time. Chin suggests that such remains previously went unrecognized as coprolites because they don't have the characteristic spindle shape of meat-eaters' feces. She notes, however, that scat from many mammalian herbivores assumes a blocky shape after it dries and cracks.

Chin plans to test her hypothesis by checking the specimens for sterol compounds and evidence of feces-inhabiting microorganisms — telltale signs that the plant material went through an animal's digestive tract.

Parasites that plagued ancient gators

After two years spent delving into the excrement of prehistoric alligators, Karl J. Reinhard has found something that may herald a new movement in paleontology. The University of Nebraska-Lincoln researcher has identified the first North American evidence of parasitic eggs in fossil animal dung.

While examining 10,000-year-old feces from south Florida, Reinhard found parasite eggs in 12 of 28 specimens. The eggs represent five or six species of parasites, including a type of nematode and several species of flukes.

South American researchers have made many advances in paleoparasitology, but so far the specialty has been slow to catch on in North America, notes Reinhard. Intensified investigation in this field, he says, could help researchers trace the evolution of parasites and their distribution around the world.

Divining dinosaur diversity

How many types of dinosaurs lived during the 160-million-year span when these beasts ruled the Earth? No one knows the true answer because many dinosaurs remain to be discovered and some may never come to light. Nonetheless, a paleontologist has tackled the question by studying the known groups, and his calculations point to a surprisingly low level of dinosaur diversity.

Researchers have described about 550 dinosaur genera over the last 170 years, with the rate of new discoveries accelerating greatly during the last two decades. Since 1970, scientists have identified about six new genera each year, or a total of 40 percent of all known dinosaurs, says Peter Dodson of the University of Pennsylvania in Philadelphia. Because many of the classifications are redundant, Dodson estimates that scientists currently know of only about 285 distinct genera. About 75 percent of those come from the United States, Mongolia, China, Canada, England and Argentina, he says.

Using these figures and an estimate of how long each genus survived, Dodson projects that only about 1,000 dinosaur genera ever existed. He expected a much larger number because these mammoth reptiles flourished for an extremely long span of time.

Careful estimates of dinosaur diversity can aid in studies of their extinction at the end of the Cretaceous period, about 65 million years ago. While some scientists think a meteorite impact killed the dinosaurs off suddenly, others say the extinctions occurred gradually over several million years due to climatic change or other factors. Dodson says his diversity figures do not support the gradual die-off theory.

In the future, he predicts, excavators will find most new dinosaur genera in Mongolia and Argentina, which hold promising reserves of unexplored rocks from the days of the dinosaurs. And he calculates that paleontologists will unearth almost all of the still-undiscovered genera within the next 200 years.

"By the year 2200, we'd better find a new occupation," he quips.