Out of Africa: Clues to dinosaur evolution

Paleontologists searching remote reaches of the Sahara have discovered the remains of two new species of dinosaurs that may help solve the mystery of how these reptiles evolved and when the continents separated. Paul C. Sereno of the University of Chicago led the team of researchers that uncovered the findings on a 4-month expedition to central Niger in 1993. They describe their discovery in the Oct. 14 SCIENCE.

Sereno's team found the remains of a meat-eating dinosaur, known as a theropod, that stretched 27 feet from head to tail and the partial skeleton of a four-legged, plant-eating dinosaur known as a sauropod. According to Sereno, both lived approximately 130 million years ago, during the Cretaceous period.

The researchers named the theropod *Afrovenator abakensis* and suggest that it resembles *Allosaurus*, a dinosaur that roamed North America about 150 million years ago. The new sauropod also may be related to a North American dinosaur of that period, *Camarasaurus*. The sauropod remains unnamed, awaiting the excavation of a more complete skull, Sereno explains.

What are these relatives of North American dinosaurs doing in the Sahara? In search of the answer, Sereno turned to the prevailing idea of how the continents separated. This theory holds that a supercontinent known as Pangaea covered most of Earth 300 million to 200 million years ago.

Pangaea began fragmenting into northern (Laurasia) and southern (Gondwana) landmasses about 180 million years ago; further separation of these landmasses into continents followed. With this in mind, Sereno expected African dinosaurs from 130 million years ago to look quite different from their northern counterparts yet similar to their contemporaries on the partially connected South American continent.

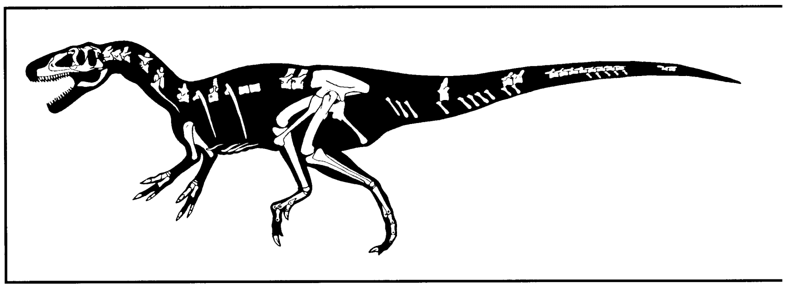
His team discovered the opposite. The African dinosaurs bear a closer resemblance to species from North America, Asia, and Europe, which made up the northern landmass, than to species found in South America.

"This means multiple theropod and sauropod groups had evolved and spread worldwide before the northern and southern landmasses had completely separated," Sereno says. "The presence of these dinosaurs may indicate that the southern landmass was not isolated [from Laurasia] for as long as we previously thought and that the continents may have been connected longer than most people think."

Other researchers, while acknowledging the importance of Sereno's findings, view his ideas about the timing of continental separation with caution.

"The good news is that Sereno and his team found such a reasonably complete dinosaur specimen in Africa," says Philip J. Currie of Canada's Royal Tyrrell Museum of Palaeontology in Drumheller, Alberta. "There is so little we know about meat-eating dinosaurs in Africa that this is an important first step in putting the story together."

— A.C. Brooks



New theropod Afrovenator abakensis *(preserved bones in white silhouette) is the most complete skeleton of a Cretaceous carnivore ever found in Africa.*

SCIENCE

Storing holograms with a new polymer

Technological dreams of a cheap plastic material that can store an optical pattern yet allow rerecording with another image have for years beckoned like a siren. While crystalline materials partly filling the bill do exist, they are expensive, fragile, and cumbersome to use.

Now, Klaus Meerholz, a materials scientist at the University of Arizona in Tucson, and his colleagues report a new photorefractive polymer that comes the closest so far to overcoming these hurdles. Speaking at last week's meeting of the Optical Society of America in Dallas, Meerholz described fabricating a polymer with "a diffraction efficiency approaching 100 percent." A description of this work appears in the Oct. 6 NATURE.

This new material, derived from poly(*N*-vinylcarbazole), is "suitable for immediate application in areas such as dynamic holographic storage and optical information processing," Meerholz reports.

To produce a hologram, two beams of light overlap in a substance that diffracts light, Meerholz explains. The beams "interfere with each other and create a pattern. That pattern contains the information of the hologram."

Under the influence of an electric field, charge carriers moving within the new polymer create light and dark regions, based on how the material diffracts light. The material then stores that optical pattern by locking the charges into place, Meerholz says.

"To read it out, you shine another light beam through it. In places where little information is stored, the diffraction is weak and most of the light passes through. But in the places where much information is stored, the diffraction is strong, so an image is projected back as a diffracted light pattern," Meerholz adds. "That is information you can read."

The importance of the new polymer lies mostly in its high efficiency. "All of these materials absorb a little bit of energy in generating charge carriers," says Meerholz. "So you always lose some light. What's interesting about this material is that its efficiency is close to. . . 100 percent. With that kind of efficiency, you can store a lot of information in a very small space, which is what people have been shooting for."

According to W.E. Moerner, a researcher at IBM's Almaden Research Center in San Jose, Calif., the new material's performance is "remarkable."

"Until the past few years, all materials showing the photorefractive effect were inorganic crystals," he says. "Work going back to the mid-1960s has demonstrated that [such materials] could, in principle, be used for optical-processing, holographic, optical-limiting, phase conjugation, and storage applications. But their use has not become widespread, partly because of the difficulty and expense of growing and doping" the crystals.

"Part of the polymer's beauty is that you just need a little bit to make it work," says Meerholz. "We think we can make tiny structures with a light source on a single wafer and have it all fit into a portable device."

In its present incarnation, the new polymer has one key weakness: It only maintains an image's integrity for a few days. But Meerholz says his team is working to develop the material's long-term storage capacity.

Ironically, one of the polymer's best features is its reversibility. "You can store a hologram today," says Meerholz, "then erase it tomorrow and record another one — without any processing."

— R. Lipkin