



# THE DINOSAUR HUNTER

ON A GRAY DAY MILLIONS OF YEARS AGO, A HUGE HERD OF duckbill dinosaurs undulated like a vast green and brown oil slick across the grassless, fern-covered plain. The sound of low grunts accompanied the thunder of their footsteps, while nearby, groups of small, pack-hunting predators lurked among the stands of palms, hoping to catch one of the 25-foot-long creatures off guard. The air was spotted with volcanic plumes from the newly arisen Rocky Mountains to the west; far to the east lay a shallow sea where pterodactyls swirled and dived along a coastline lush with vegetation. Suddenly, one of the nearby volcanos exploded in a burst of hot ash and fire. Although the

panicked duckbills tried to flee, they were caught in the deadly gas and ash and entombed for eternity.

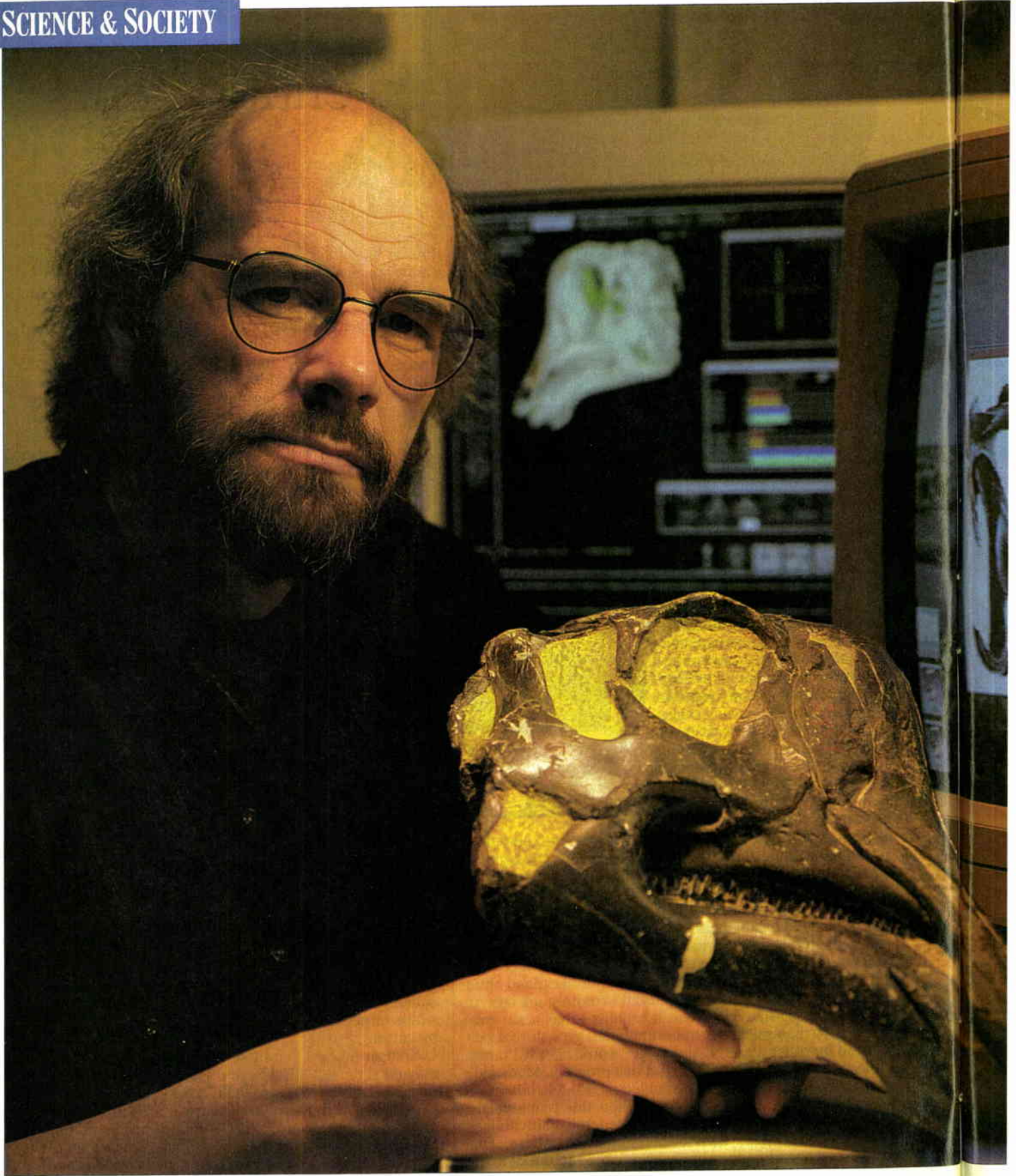
Or, at least, until Jack Horner dug them up 75 million years later. The 46-year-old paleontologist's astonishing 1982 discovery of a bone bed containing more than 10,000 duckbill dinosaur fossils is in no small part the result of his legendary dinosaur-hunting skills: One colleague describes him as "the Zen master of fossil finding." But it also has a lot to do with *where* Horner was looking. Thanks to its unique geology and history, the state of Montana and the land stretching to its north and south is where

**PARK WARDIN.**  
Paleontologist Jack Horner of Montana has unearthed more dinosaur fossils than anyone in history. "We walk the same ground that dinosaurs did," he says — as evidenced by the preserved dinosaur tracks found in Colorado (right).



many of the dinosaurs celebrated in popular culture actually made their home eons ago — and where their remains are now providing scientists with a new view of their ancient lives. It is, in short, the *real* Jurassic Park.

The sobriquet is apt. Paleontologists digging in this rich dinosaur territory have produced many of the scientific findings that form the basis of Michael



## SCIENCE & SOCIETY

Crichton's bestselling novel about an industrialist who clones dinosaurs for a modern theme park—and Steven Spielberg's film version, which opens next week. It is on these badlands of the western interior that the age-old view of dinosaurs as dimwitted, coldblooded, lumbering lizards has been transformed into a new image of smart, agile, warmblooded creatures that displayed sophisticated social behavior more akin to modern birds than to crocodiles. Even the gigantic *Tyrannosaurus rex*, a staple of monster movies, has recently been cast in a new light. A nearly complete *T. rex* skeleton just excavated by Horner suggests that the beast was far less a fearsome hunter than a smart scavenger. (In fact, like its fictional counterpart, this Jurassic Park contains dinosaurs from all three geologic epochs spanned by the dinosaur age—the Triassic, Jurassic and the Cretaceous. *T. rex* lived in the late Cretaceous, which ended 65 million years ago.)

**Kansas seas.** The fact that the real Jurassic Park is in North America's own back yard is no accident. During dinosaur times, the western interior was part of a huge coastal plain wedged between the Rockies and a shallow inland sea that flowed from the Arctic Ocean to the Gulf of Mexico. (Back then, much of Kansas was under water—which is why that state has yielded many fossils of the seafaring, highflying pterodactyls.) Along the strip of land between the sea and the mountains roamed the great "terrible lizards" whose Latinate names roll so trippingly off an 8-year-old's tongue. All the *Tyrannosaurus rex* fossils ever unearthed have been found here; the world's largest sauropods—including the long-necked, long-tailed *Apatosaurus* (né *Brontosaurus*)—lived here, as did the three-horned *Triceratops*, *Stegosaurus*, duckbills and a host of others in the dinosaur menagerie.

Although dinosaur remains have been found from Antarctica to the Arctic Circle, and from the Gobi Desert to New Jersey, the western interior is unquestionably the world's richest trove of fossils. The action of glaciers and erosion have done much of the spadework for scientists, scraping the more recent layers of dirt and rock right down to the ancient landscape. "We walk across the same ground that the dinosaurs lived on every day," says Horner.

If North America's western interior is the real Jurassic Park, Horner is its premier warden. In his novel, Crichton describes his paleontologist hero, Alan Grant, as a bearded iconoclast who measures his expeditions in cases of beer



**DINOSAUR COUNTRY.** 75 million years ago, dinosaurs roamed the plains between the Rocky Mountains and an inland sea.

### PACHYRHINOSAURUS

**Demonstrating evolution:** Fossils of horned dinosaurs show how, over millions of years, the animals changed form in response to the changing environment.

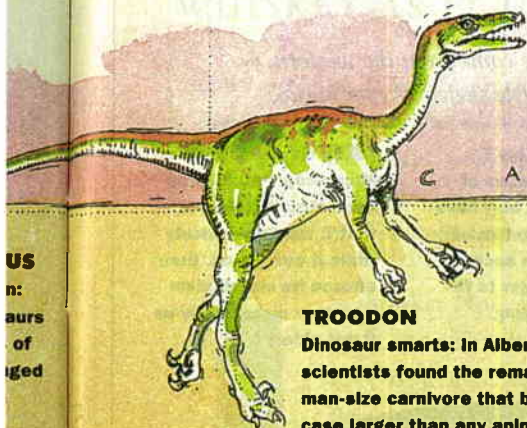
### MAIASAURA EMBRYO

**Parental care:** The remains of dozens of dinosaur eggs and nests found here suggest that some young dinosaurs, like birds, were reared in the nest by adults after they hatched.

### MAIASAURA

**Herding:** Bone beds containing more than 10,000 Maiasaura reveal that these dinosaurs roamed in gigantic herds.

askatchewan

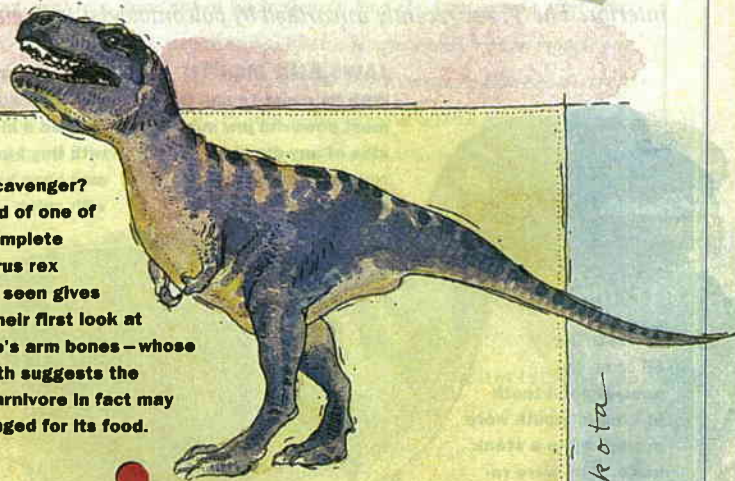


**TROODON**

**Dinosaur smarts:** In Alberta, Canada, scientists found the remains of a human-size carnivore that boasted a brain case larger than any animal then alive, making it perhaps the most intelligent of all the dinosaurs.

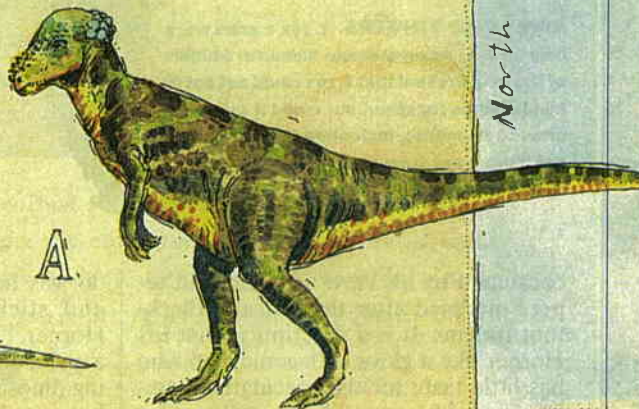
**T. REX**

**Hunter or scavenger?** A recent find of one of the most complete *Tyrannosaurus rex* fossils ever seen gives scientists their first look at the creature's arm bones — whose stubby length suggests the fearsome carnivore in fact may have scavenged for its food.



**PLANOPLOS SAURUS**

**Fossil first:** In 1854, Ferdinand Hayden discovered one of the first dinosaur fossils in North America. The Sioux dubbed Hayden "the man who picks up stones while running."

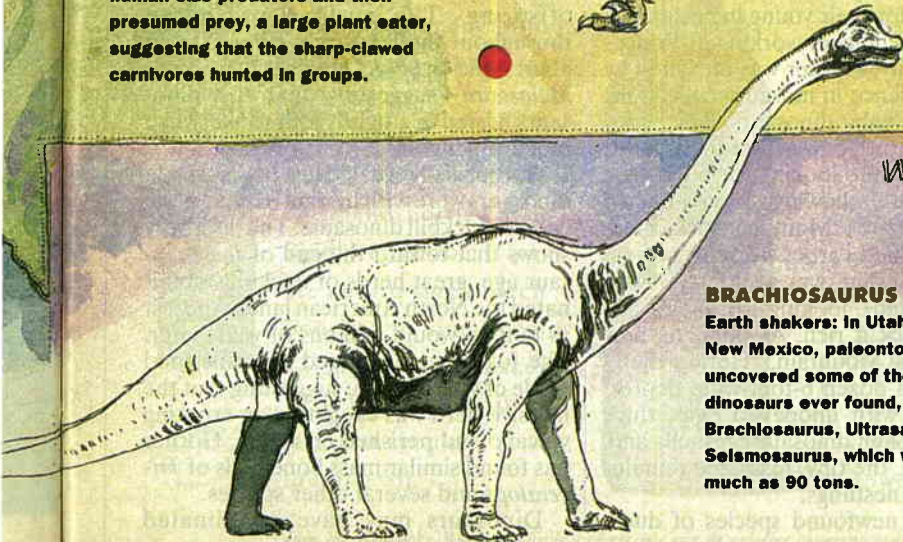


**DEINONYCHUS**

**Pack hunting:** Paleontologist John Ostrom found the remains of four nimble, human-size predators and their presumed prey, a large plant eater, suggesting that the sharp-clawed carnivores hunted in groups.

**PACHYCEPHALOSAURUS**

**Hardheaded:** Here dinosaur hunters unearthed a plant-eating dinosaur with a dome-shaped, 10-inch-thick skull. The armored pate was probably used in ritual head-butting contests among the creatures.



**BRACHIOSAURUS**

**Earth shakers:** In Utah, Colorado and New Mexico, paleontologists have uncovered some of the largest dinosaurs ever found, including *Brachiosaurus*, *Ultrasaurus* and *Selsmosaurus*, which weighed as much as 90 tons.

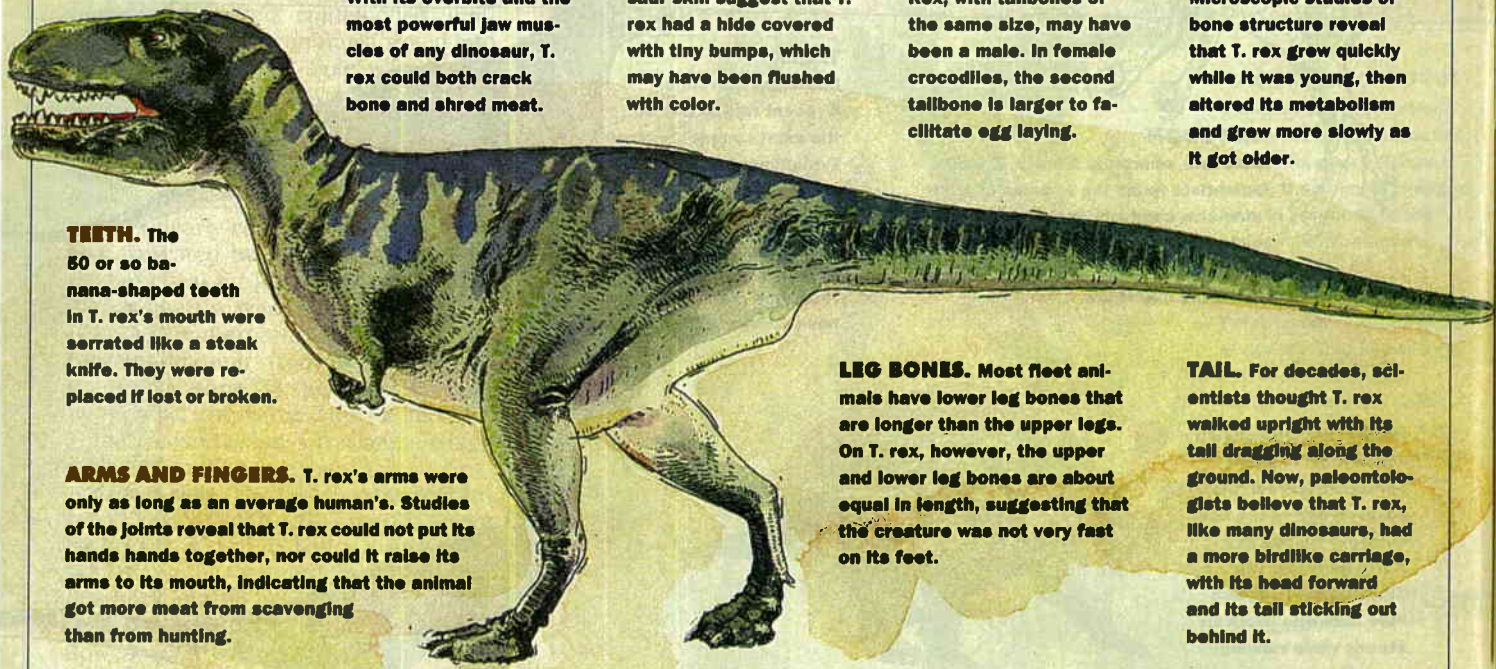
Red dots indicate major dinosaur fossil sites.

North Dakota

South Dakota

Wyoming

Only 11 skeletons of the *Tyrannosaurus rex* have ever been discovered, and all of them have come from the western interior. The *T. rex* recently unearthed by paleontologist Jack Horner is one of the most complete skeletons ever found.



**JAWS AND MOUTH**

With its overbite and the most powerful jaw muscles of any dinosaur, *T. rex* could both crack bone and shred meat.

**SKIN.** Imprints of dinosaur skin suggest that *T. rex* had a hide covered with tiny bumps, which may have been flushed with color.

**TAILBONE.** This *T. Rex*, with tailbones of the same size, may have been a male. In female crocodiles, the second tailbone is larger to facilitate egg laying.

**RATE OF GROWTH.** Microscopic studies of bone structure reveal that *T. rex* grew quickly while it was young, then altered its metabolism and grew more slowly as it got older.

**TEETH.** The 50 or so banana-shaped teeth in *T. rex*'s mouth were serrated like a steak knife. They were replaced if lost or broken.

**ARMS AND FINGERS.** *T. rex*'s arms were only as long as an average human's. Studies of the joints reveal that *T. rex* could not put its hands together, nor could it raise its arms to its mouth, indicating that the animal got more meat from scavenging than from hunting.

**LEG BONES.** Most fleet animals have lower leg bones that are longer than the upper legs. On *T. rex*, however, the upper and lower leg bones are about equal in length, suggesting that the creature was not very fast on its feet.

**TAIL.** For decades, scientists thought *T. rex* walked upright with its tail dragging along the ground. Now, paleontologists believe that *T. rex*, like many dinosaurs, had a more birdlike carriage, with its head forward and its tail sticking out behind it.

consumed by his crew and sleeps in teepees modeled after those of the Blackfoot Indians. It is a description that fits Horner like a glove. A laconic man who has little taste for the speculative flamboyance of some of his colleagues, Horner prefers to make his points with a pick and trowel. He never finished college (he later found that he suffers from dyslexia), and he wryly observes that his brain is the "hunt, poke and dig-around version issued to field scientists." But his rigorously scientific approach to dinosaur hunting has paid off. Horner has found more dinosaur fossils than anyone else in history, and his research project at the Museum of the Rockies in Bozeman, Mont., is the largest in the world. Small wonder that he was asked by Steven Spielberg to be a scientific consultant in the making of "Jurassic Park."

Horner's research doesn't stop once a fossil has been extracted from the rock, because he is looking for more than big bones. The fruits of his field work are picked over at a laboratory at the Museum of the Rockies that is equipped with CAT-scan reading computers, a microbiological bone-study lab and—Crichton, take note—newly installed DNA extraction and analysis machines. "In the past, all a paleontologist wanted to

do was find the biggest fossil he could and stick it in the museum," says Horner. "But I like to think of myself as a paleobiologist. I'm interested in seeing dinosaurs not as these big monsters, but as animals who were very successful inhabitants of this planet."

**Nesting instinct.** Horner's bucking of mainstream paleontology resulted in his first big find at Jurassic Park: He unearthed evidence that, unlike modern reptiles and very much like birds, dinosaurs cared for their young in nests. As a young lab technician working at Princeton University, Horner was intrigued by the near absence in museum collections of fossils of baby dinosaurs. The problem, he concluded, was that fossil hunters typically were looking for big bones, not tiny ones. Following up on a find of little bones in a Montana rock shop, Horner donned carpet installer's kneepads and crawled over Montana's sweltering badlands, looking for babies. He quickly struck it rich. At one site, now dubbed "Egg Mountain," Horner found more than a dozen 6-foot-wide depressions filled with unopened eggs, thick layers of broken dinosaur eggshells and, occasionally, the tiny, fossilized remains of dinosaur nestlings.

Horner's newfound species of duck-

billed dinosaur—which he christened *Maiasaura*, or "good mother lizard"—lived up to its name. The ends of some of the hatchlings' leg bones had not yet finished forming, indicating that the newborn were unable to walk. The broken bits of eggshell suggested that the clutch stayed in the nest long after they hatched, trampling the shells in the process. Horner even has found a mass of rock-hard goop that he thinks might be fossilized food the mother dinosaur gave her offspring. The nests were spaced throughout the landscape some 20 feet apart—the average length of an adult *Maiasaura*—suggesting that the dinosaurs nested in a tightly knit rookery like modern penguins.

Horner also revealed just how sociable dinosaurs were with his find of huge bone beds of duckbill dinosaurs. The discovery shows that toward the end of the dinosaur age, great herds of duckbills dominated the North American landscape just as buffalo would millions of years later. The fossils were covered in a fine mud made of volcanic ash, suggesting that the massive herd was caught by an erupting volcano and perished en masse. Horner has found similar mass bone beds of *Triceratops* and several other species.

Dinosaurs may have coordinated