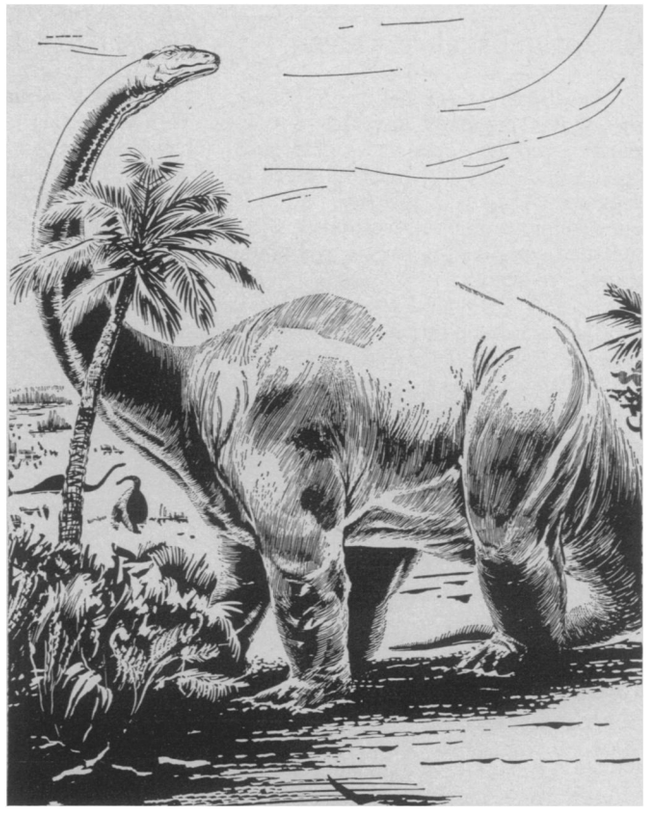
Swamp-dweller or landlubber?

A new study disputes the traditional view that Brontosaurus was semi-aquatic; other paleontologists disagree.



Drawing: Barton A. Wright from "The Age of Dinosaurs in Northern Arizona."

Since no written records exist to tell us what the world was like 150 million years ago, scientists can only draw inferences from what evidence remains. This evidence, unfortunately, is sparse and often ambiguous, and convincing, reasonable but vastly different conclusions can be drawn from the same material.

Through the years paleontologists have evolved a picture of the appearance and habits of various dinosaurs, based on their anatomy and environment and the location of their bones and tracks. In such reconstructions members of the sauropod suborder, giant herbivores with long necks and tails, such as the *Brontosaurus*, have almost invariably been presented as swamp-dwelling semiaquatic animals.

One reason for this, points out the noted paleontologist Dr. Edwin H. Colbert of the Museum of Northern Arizona, is the location of the nostrils high on the skull. He believes that the giant sauropods often waded in deep water where they would be safe from predators, thrusting their heads above the surface to peer about and to breathe.

The brontosaurs' weak jaws and weak peg-like teeth, he maintains, suggest a diet of soft aquatic plants.

A young Yale University paleontologist, however, now maintains that the anatomy of the brontosaurs points clearly to a life on land.

In many aquatic reptiles, Dr. Robert T. Bakker writes in the Jan. 15 NATURE, the nasal openings are very small, often low on the side of the face. In contrast, he says, the brontosaurs' are quite large and placed high on the skull. Living creatures with a nasal structure most closely resembling that of brontosaurs, he says, are terrestrial animals, such as ground iguanas.

Brontosaur teeth often show severe wear, suggesting that the animals fed on coarse vegetation, Dr. Bakker says. Grinding of tough food, he adds, could have occurred in an internal powerful gastric mill like that of crocodiles. In fact, he says, masses of small stones have been found among the ribs of some dinosaurs, including one sauropod.

The general morphology of the brontosaurs, he continues, is closer to that of the land-dwelling elephant than to that of the semiaquatic hippopotamus.

Most modern aquatic tetrapods, says Dr. Bakker, have a long, broad chest and short legs, but both brontosaurs and elephants have very deep chests and relatively long legs. The brontosaur's backbone has several features associated with the support of the body on dry ground, features poorly developed in hippos.

The hippo's legs are strongly flexed at the knee and elbow. Elephants, in contrast, have very straight, columnar legs, which permit their great weight to be carried more directly by the bones. Brontosaur limbs are very similar, the paleontologist says.

Likewise, since hippos have to get around in muddy terrain, Dr. Bakker continues, their digits are longer and more spreading than those of elephants. Brontosaur toes, he says, were very short, and footprints show that they were encased in an elephant-like pad. "It is difficult to imagine," he concludes, "how sauropods could travel on marshy terrain with such compact feet."

The brontosaur's long neck, like that of a giraffe, enabled it to reach a greater vertical range of vegetation, he believes.

The diversity of sauropods also argues for terrestrial habits, he says, since freshwater lakes and rivers offer less opportunity for adaptive radiation than terrestrial habitats, and many genera of sauropods have been discovered.

Finally, he points out, there is no evidence that sauropods fled to the water to escape predators. He believes that these dinosaurs would have been fully capable of defending themselves on land by lashing their long tails or crushing attackers underfoot.

But Dr. Bakker does not touch upon what many authorities believe to be the most convincing evidence for aquatic habits of brontosaurs.

Near Glen Rose, Texas, is an impressive display of dinosaur footprints. As brontosaurs walked along, their enormous tails left drag marks in the dirt. But in the Glen Rose trackway, there are deeply implanted brontosaur tracks with no trace of tail marks. This can only mean, says Dr. Colbert, that the animals were walking in water just deep enough to float their tails.

At another spot, footprints of smaller members of a herd of sauropods appear shallower than would be expected. This means, Dr. Colbert says, that they were partially buoyed up by water.

Another paleontologist, Dr. Nicholas Hotton of the Smithsonian's National Museum of Natural History, describes a spot where the tracks of a sauropod become progressively shallower until the rear tracks disappear entirely and eventually only the toes of the front feet remain. "What other possible explanation can there be for these tracks," he demands, "than that the animal was getting into deeper water?"

These tracks and others like them, Dr. Colbert believes, are conclusive evidence that the brontosaurs were indeed semiaquatic. Furthermore, both he and Dr. Hotten point out that the brontosaur could have been aquatic and still have the adaptive features of the elephant that are necessary to support its enormous weight on land.

Dr. Hotten concludes that Dr. Bakker is correct in saying that the brontosaurs' morphology would permit them to move about on land, but, he says, "we also have strong evidence that they spent a lot of time in the water." □