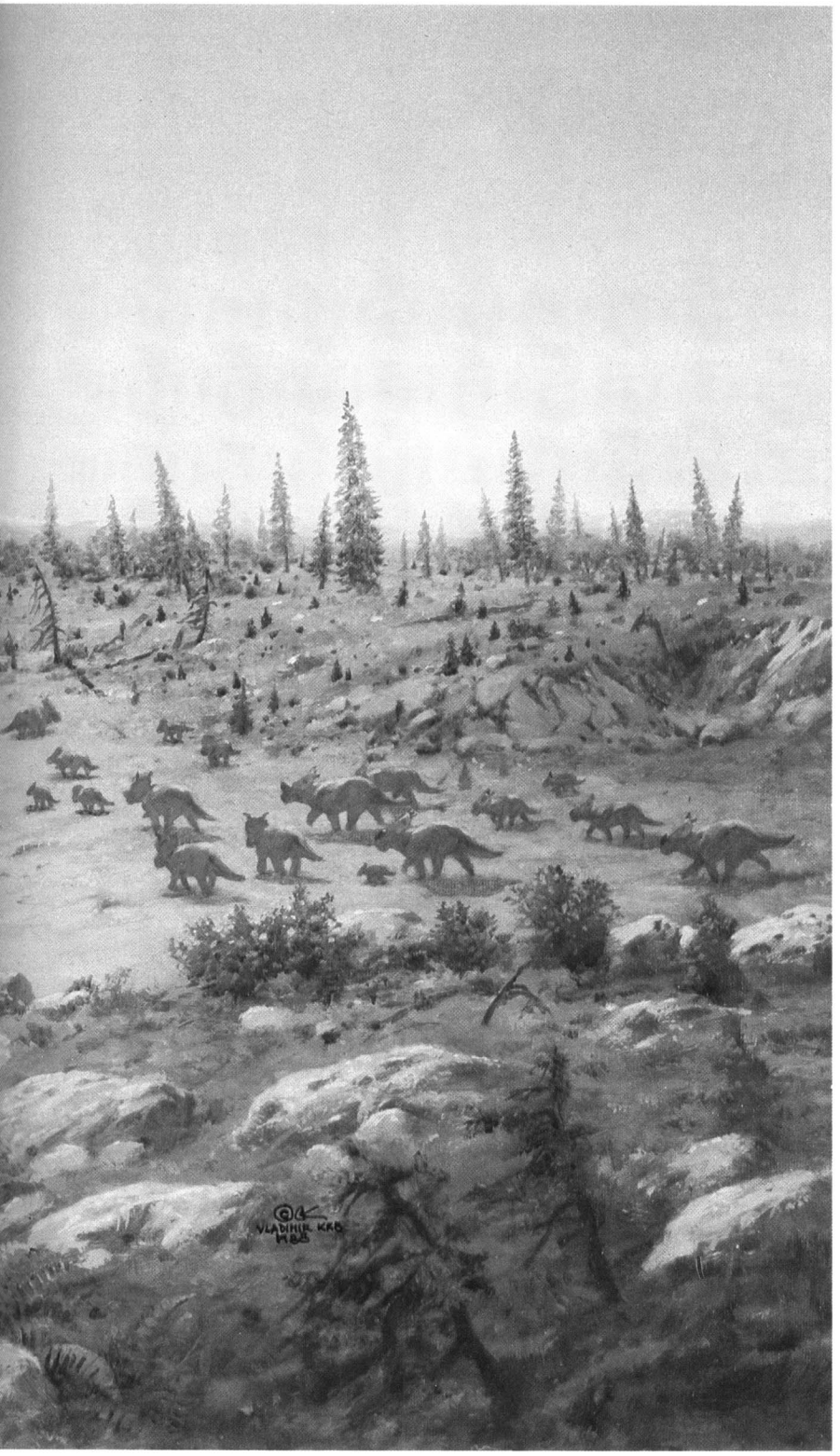
# Long-distance Dinosaurs

**Natural Hisotry 6/89**
**pp.60-65**

*Annual migrations may have taken some dinosaurs to the Arctic—and beyond*

by Philip J. Currie



In 1977, a huge, jumbled accumulation of bones was found in Dinosaur Provincial Park in southern Alberta, Canada. Most bone beds in the province contain remains of all the species that lived in the region at the time the bones were buried. But this find was different. Almost all of the fossils in it belonged to *Centrosaurus apertus,* a dinosaur that lived in the late Cretaceous period, some 75 million years ago. This rhinolike dinosaur, a relative of *Triceratops,* was equipped with a nose horn and a thick, rugged neck frill adorned with lobes. Two bony "hooks" arched forward from the back of the frill.

Work started on the *Centrosaurus* bone bed in 1979, and after nine full field seasons and with less than a third of the bed excavated, the remains of at least eighty animals have been recovered. If the unexcavated portion contains the same concentration of bone, a conservative estimate would be that two hundred and fifty *Centrosaurus* males, females, and young died in this spot. The sizes of the animals and evidence of rapid bone burial, as well as the great preponderance of one species, suggest that the bone bed was formed by the sudden, simultaneous death of a herd.

Paleontologists have essentially ignored Alberta's bone beds, choosing instead to excavate the region's many display-quality skeletons. Yet valuable ecological data have been disclosed by bone beds in other parts of the world. Some of these other finds also seem to record catastrophes that befell single-species herds. And since the *Centrosaurus* discovery, bone beds dominated by hadrosaurs (duck-billed dinosaurs) have also been found within the provincial park; they too may prove to have been scenes of mass death. In Montana, a huge hadrosaur bone bed being excavated by John Horner, of the Museum of the Rockies, may prove to contain fossils of more than 10,000 animals.

The destruction of herding animals by natural causes—floods, forest fires, or disease—is still a common occurrence. Caribou, bison, wildebeest, and other large herbivores often perish in single events, sometimes with the loss of thousands of lives. In 1984, a herd of caribou migrating in northern Quebec tried to cross a

*Young ankylosaur siblings, about to be suffocated, fight for breath during a desert sandstorm. This painting is based on evidence from a fossil site in China.*

flooded river, and more than 9,000 animals drowned.

Why did some dinosaurs gather into groups? A herd of several thousand or even several hundred dinosaurs, each weighing more than two tons, would have devastated any habitat it occupied for very long, much as elephants do when they wander into cultivated fields. In the case of the Montana hadrosaurs, herding was at least partly related to breeding and rearing young at a specific site. Today, one of the main reasons animals gather in herds is to migrate. And in some cases, herding in the Cretaceous period may have been related to cyclic migrations to feeding areas.

The theory that certain dinosaurs migrated, proposed as early as 1928 by Frederick von Huene, was more fully developed by Nicholas Hotton III, of the Smithsonian Institution, in a 1980 article with the intriguing title, "An Alternative to Dinosaur Endothermy: The Happy Wanderers." Today the idea has gained wide acceptance by paleontologists as more evidence is collected.

In terms of both numbers and diversity, Dinosaur Provincial Park is one of the richest sites in the world for late Cretaceous dinosaur fossils. More than thirty-five species, all roughly contemporaneous, have been uncovered in the park's environs. Such a concentration of large species is unparalleled in the temperate regions of the modern world, and coexistence of such species would seem improbable. Could large numbers of hadrosaurs, such as *Lambeosaurus* and *Corythosaurus*—which were similar in size, anatomy, and numbers, and which may have competed for the same food resources—have lived in the same area at the same time? The answer may be that they didn't; instead they may have shared the neighborhood for limited periods or occupied it at different times of the year. In other words, many of the fossils found in Alberta and Montana may be the remains of animals that were passing through en route to other destinations. If so, where were they heading?

Some species of dinosaurs uncovered in Alberta have also been found as far south as Texas. In general, however, the farther south one goes in North America, the fewer the dinosaurs—both in number and kind. This apparent trend may merely reflect the random preservation of fossils or random discoveries. But Alberta and Montana may indeed have been hospitable habitat for an unusually diverse group of dinosaurs, possibly because the region was at the southern limit of some migration routes.

Discoveries of fossils of *Pachyrhinosaurus,* another horned dinosaur of the Cretaceous, hint at how far large herbivores might have ranged. In 1945 one *Pachyrhinosaurus* bone bed was found in southern Alberta at fifty degrees north latitude. In 1986, staff of Alberta's Tyrrell Museum of Palaeontology started to excavate a second bone bed of this animal 450 miles farther north. A year later, on a joint expedition of the University of California at Berkeley and the University of Alaska, J. H. Hutchison of Berkeley discovered a *Pachyrhinosaurus* skull in the Alaskan Arctic, greatly extending the known range of the species. The Alaska find is fully


2,000 miles from the southernmost site. Could a dinosaur have traveled that far and back in a year?

Today, wildebeests can migrate a thousand miles a year, and caribou almost double that. Dinosaurs, being much larger, longer-limbed creatures than either of these ungulates, should have been able to travel even farther. Based on measurements made on the Peace River Canyon trackways in British Columbia, we know that ornithopod dinosaurs ambled along at three to five miles an hour, but were capable of much higher speeds. (The known extrapolated dinosaur speed record is held by a bipedal carnivore that moved at twenty-five miles per hour.) Even in low gear, a dinosaur could have covered 2,000 miles within two months if it walked twelve hours a day. *Pachyrhinosaurus* herds, then, were quite capable of moving between southern Alberta and Alaska on an annual cyclic migration. But whether they did is yet to be proved.

Other dinosaurs are now known to have visited the "land of the midnight sun," and recent excavations have revealed that several dinosaur species lived in Australia on land that was within the Antarctic Circle during the early Cretaceous. And in 1986 Argentine scientists discovered armored dinosaur remains in Antarctica itself. Although for much of the earth's history, polar regions were considerably warmer than they are today, then—as now—the sun did not rise in the dead of winter and plant life was dormant until spring. Oxygen isotope studies suggest that these areas were sometimes cold enough for snow to fall, but the oceans and inland seas remained open, moderating the climate and providing moisture year-round. During the summer months, with up to twenty-four hours of sunshine each day, the polar regions would have been almost lush. Dawn redwood and the maidenhair tree—now restricted to more southerly latitudes—prospered in the Arctic in the time of the dinosaurs. Nonetheless, even the most adaptable dinosaurs would have been hard pressed to find enough food to keep them near the poles during the winter. Some may have hibernated or gone into periods of reduced activity, even as 1,500-pound bears do today. Others might have remained active throughout the winter night and subsisted on seeds, dried leaves, other plant remnants, or other animals. But most large animals probably regrouped and headed south again as winter approached.

While we'll never have the opportunity to put radio transmitters around the necks of dinosaurs to track their movements, high-latitude dinosaur sites can provide indirect evidence of the animals' travels and timing. For example, if the hadrosaurs bred only once a year at one end of the migration range, then the babies would have reached a certain size before they arrived at the other end of the range. If this is correct, we should eventually be able to demonstrate differences between the age mixes of herds unearthed in Alberta and those excavated in Alaska.

Today, during its brief, sunny summers, the Arctic hosts many millions of breeding birds (the dinosaurs' current representatives on earth). Great congregations of caribou trek from the boreal forests to the

*Herds of* Pachyrhinosaurus *may have migrated thousands of miles to summer grounds in the Arctic.*

tundra to bear their young. Whales, seals, and other marine mammals are drawn to the rich arctic waters. The milder Cretaceous Arctic might also have teemed with life as megaherds of hadrosaurs and horned dinosaurs annually arrived from Alberta and other points south. But the polar regions may not have been the terminus for some of the migrants, and our new knowledge of their traveling capacity raises a further possibility. Did the dinosaurs take the next step? Did they migrate between continents?

During at least part of the Cretaceous, the Arctic was a connecting point between North America and Asia. Such a land bridge would have allowed an interchange of dinosaurs between the two great land masses. Intercontinental migration, or dispersal, could have come about as migrating animals extended their trek or if their usual migratory pathway was in some way disrupted. The fossil evidence strongly supports the existence of two-way dinosaur invasions, since almost every family of dinosaur known from Cretaceous rocks of North America also has representatives in Asia.

The documentation of this interchange is a major objective of the Dinosaur Project, a joint Chinese-Canadian undertaking that I have worked with for the past three years. Teams of scientists are working in the field in the arctic islands of Canada, in China, and in Alberta. The work in China has concentrated on the changes in dinosaur faunas and habitats from the Jurassic (about 200 to 140 million years ago) through the Cretaceous (140 to 65 million years ago).

In Xinjiang in northwestern China, we collected dinosaurs from the mid-Jurassic, about 165 million years ago. (Among the finds are two new species of large carnivorous dinosaurs and a gigantic sauropod with neck vertebrae more than five feet long and ribs up to twelve feet long.) In general the differences between the Jurassic faunas of China and North America seem to indicate that the continents were isolated in the Jurassic, and early Cretaceous sites in Inner Mongolia have produced abundant skeletons and footprints that suggest that intercontinental migration was still not in evidence 125 million years ago.

But by the late Cretaceous, the faunal similarities are pronounced. The differences that do exist seem to be related to differences in the paleoecosystems being sampled. Most of the rich North American collecting areas were once relatively wet, coastal lowlands, but most sites we are now working on in Central Asia turn out to have had very dry climates in the Jurassic and Cretaceous, when the dinosaurs lived there. Therefore, we do not expect to find the same species in both places. Iren Dabasu, the first site in Central Asia that produced dinosaurs for the American Museum in 1922, is closer to a typical North American late Cretaceous environment. Only with a lot more fieldwork will we understand the animals, the environment, or even the time period represented by this locality. Meanwhile, we have begun to identify late Cretaceous paleoecosystems in Alberta and Montana that parallel those in China.

So far, Bayan Manduhu in Inner Mongolia (now a part of the People's Republic of China) has proved to be the best area for comparing late Cretaceous dinosaur faunas. Asian sites similar to Bayan Manduhu have recently been described as lake deposits, suggesting that the dinosaurs living beside those lakes should resemble those found on the coastal lowlands of Alberta. But a study of the sediments by Tom Jerzykiewicz, of the

© by Vladimir Krb 1989

Geological Survey of Canada and a member of the 1971 Polish-Mongolian Expedition, clearly shows that Bayan Manduhu was as much of a desert during the Cretaceous as it is now. One site in particular vividly illustrates how arid Central Asia was 75 million years ago. In the summer of 1988, we found five fossilized baby ankylosaurs, or armored dinosaurs, each about four feet long, clustered together on the downwind side of an ancient sand dune. Angled at about thirty degrees, the dune would have been relatively unstable. The young, buried deep enough to have suffocated, may have been seeking protection from one of the many sandstorms that still ravage the region. The babies near the top of this little pile were eaten by a small predatory dinosaur, *Velociraptor,* which left some of its loose teeth behind as a calling card. On our last day at this site, we found a sixth baby ankylosaur on the same dune but more than twenty feet away from the others. When we return to Bayan Manduhu this year, we intend to extend the quarry to see how many more individuals may have died there. We believe that the dune's contents are most likely a single family of *Pinacosaurus,* and that the young were siblings from the same clutch that stayed together as they were growing up. This habit of gregariousness may also have some bearing on herding and migration.

When the five years of jointly sponsored expeditions to China, Alberta, and the Arctic end, we will have added a few more pages to the history of the dinosaurs. At least some of the differences in the faunas of North America and Asia have already been explained by analysis of the ancient environments. New dinosaurs will be described, our knowledge of the timing of intercontinental contacts will be refined, and we will know more about the place and time of origin of some groups of dinosaurs. As the panorama of Cretaceous life in the Northern Hemisphere unfolds, we will no doubt continue to learn things that will make us marvel ever more at its complexity. The key to understanding the dinosaurs' success and even their ultimate downfall may lie in part with their migrations across the north. □