FROM THE NORTH SLOPE OF ALASKA

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HADROSAUR BONES have been found on the Colville River north of Umiat on the North Slope of Alaska. This find represents the first report of dinosaur bones in Alaska and their northernmost reported occurrence. The remains are not determinable below family level but are important, nonetheless, for interpretations of the paleoclimatology and paleobiogeography of the Late Cretaceous.

Besides bone fragments, reports of Alaskan Mesozoic vertebrates are scarce. Known finds are: Triassic Shublik Formation—a coelacanth fish, the paleoniscoid fish *Boreosomus* (Patton and Tailleur, 1964; Zheleznov and Okuneva, 1972), and some ichthyosaurs (Tailleur et al., 1973); Jurassic Naknek Formation—plesiosaur fragments (Martin, 1926); Lower Cretaceous Nanushuk Group—very small three-toed dinosaur or bird(?) footprints (Ahlbrandt et al., 1979); Cretaceous Corwin Formation—dinosaur tracks and skin impressions (Roehler and Stricker, 1984); and Upper Cretaceous Kennicott Formation—shark teeth (Martin, 1926); Upper Cretaceous Ignek Formation—the odontognath bird *Hesperornis* (Bryant, 1983).

The hadrosaur bones were collected in 1961 by the late R. L. Liscomb while working for Shell Oil Company. Renewed research around the Colville River led to the bones being sent to the U.S. Geological Survey in Menlo Park, where they were tentatively identified as hadrosaurian by C. Repenning. He sent the bones to the Texas Memorial Museum for further investigation, and the Shell Oil Company was kind enough to donate the bones to TMM for safekeeping. The bones were found on the Colville River at approximately 70°N, 151°W (Figure 1), and the site was relocated in 1984 by two U.S. Geological Survey field parties (C. Repenning, personal commun.). The site is easily accessible by float plane or helicopter, common means of transportation in the area, and to deter possible vandalism it is felt best not to reveal the exact location of the site. Precise locality information is on file at TMM.

The site occurs in what is mapped as undifferentiated Upper Colville Group of Late Cretaceous age, which is overlain by the Plio(?)-Pleistocene Gubik Formation (Brosgé and Whittington, 1966). Recent studies, however, have indicated Paleogene rocks in this region (Carter et al., 1977; Nelson, 1981; Marincovich et al., 1983). Pending resolution of the stratigraphy, beds underlying the Gubik Formation in the region are being referred to simply as "pre-Gubik" (Carter et al., 1977; R. V. Emmons, personal commun.). Hadrosaurs are exclusively Late Cretaceous and their presence limits the age of the pre-Gubik rocks. "This datum has allowed H. J. Clippinger to interpret somewhat contaminated pollen samples and establish a Maastrichtian or possibly Campanian age for the strata 28 feet above and 12 feet below the dinosaur bed. Foraminifera 2 feet below the bone bed indicate a shallow marine environment" (Shell Oil Company memorandum, with permission of R. V. Emmons and H. J. Clippinger).

Shell Oil Company's stratigraphic section of the locality shows the fossil bones come from a thin sandstone in pre-Gubik silty sands. Matrix still adhering to the bones is a soft, brown, sandy silt.

The bones, catalogued as TMM 42475-1, apparently represent a quick surface collection by Liscomb, and consist of fragments of limb bones, ribs, and vertebrae. The quality of preservation is remarkable. The bones are stained a dark red brown but otherwise display little permineralization, crushing, or distortion. None of the diagnostic cranial or pelvic bones were recovered, so determination below family level is not possible. Most of the bones belong to small individuals, including a juvenile in which neural arches had not yet fused to centra of the vertebrae (for example, see Figure 2.6). The proximal end

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FIGURE 1—Approximate locality of TMM 42475, hadrosaur bones from the Colville River, Alaska.

of a large tibia (Figure 2.1) indicates, however, that individuals eight to nine meters long were present. Duplicated elements and bone size indicate at least seven individuals are represented in the collection. This suggests that the deposit is a bone bed, a frequent source of abundant hadrosaurian remains. The U.S.G.S. field party in 1984 also collected a single carnosaur tooth (C. Repenning, personal commun.).

Previously the northernmost dinosaur bone known was a hadrosaur limb bone from the Peel River, Yukon Territory, at 66°N (Rouse and Srivastava, 1972; not 70°N as given in Hotton, 1980). *Arctosaurus,* a problematic bone from the Upper Triassic of Cameron Island, Bathurst Group, Arctic Archipelago, Canada, is from farther north (76.5°N) and has been referred to as a dinosaur (Galton and Cluver, 1976) but is apparently a trilophosaurid cervical vertebra (D. Baird, personal commun.). The Triassic paleolatitude of this site would be 55°N (Ziegler et al., 1983).

Dinosaur footprints, however, are known in Lower Cretaceous rocks of the Svalbard Islands at 78°N (Lapparent, 1962). While the Svalbard Islands are presently farther north than the Colville River site, continental reconstructions for the Cretaceous (Ziegler et al., 1983; C. R. Scotese, personal commun.) place the Svalbard Islands farther south, at about 63°N, in the Early Cretaceous, and the Colville River site farther north, at about 77°N, in the Late Cretaceous, thus making the Alaskan site the northernmost paleolatitude known for dinosaurs. Skin impressions are well-known for a variety of hadrosaur species (Lull and Wright, 1942), and none show any trace of an insulative covering of fur or feathers. The presence of both large and small hadrosaurs in such a northern latitude is consistent with an equable climate extending nearly to the poles, as has been suggested for the Late Cretaceous (Axelrod, 1984; Lillegraven et al., 1979).

The Late Cretaceous dinosaur faunas of western North America and Asia show a strong similarity at the family level (Gradziński et al., 1977). Currently the favored connection is a filter bridge across Beringia (Brett-Surman, 1979; Lillegraven et al., 1979) as opposed to, for example, sporadic connections through eastern North America, Greenland, and Scandinavia as suggested by Nopcsa (1934). The Alaskan dinosaur site lies on the proposed Beringia route. Future studies may show whether the Alaskan fauna is intermediate between Asian and western North American forms or not. Regardless of the dispersal route, the presence of hadro-

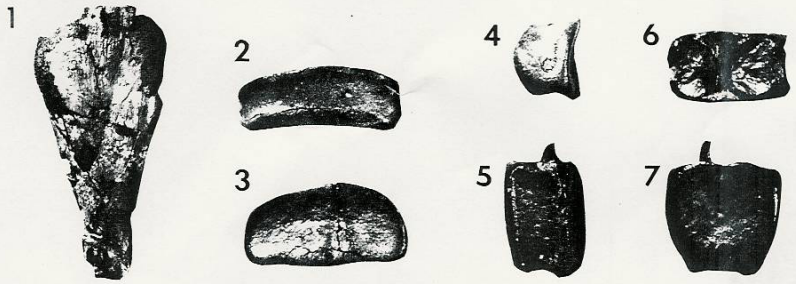

FIGURE 2—Alaskan hadrosaur bones, TMM 42475-1. *1,* proximal end left tibia, internal view, ×0.1. *2–4,* pedal phalanx III-2 or III-3, ×0.5. *2,* dorsal view; *3,* proximal view; *4,* lateral view. *5–7,* caudal vertebra, ×0.5. *5,* lateral view; *6,* dorsal view; *7,* proximal view.

saurs on the North Slope of Alaska demonstrates the ability of those animals to disperse into far northern latitudes in the Late Cretaceous.

Abbreviations.—TMM, Texas Memorial Museum, Austin, Texas; USGS, United States Geological Survey.

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REFERENCES

AHLBRANDT, T. S. ET AL. 1979. Depositional framework and reservoir-quality studies of selected Nanushuk Group outcrops, North Slope, Alaska. United States Geological Survey Circular, 794:14–31.

AXELROD, D. L. 1984. An interpretation of Cretaceous and Tertiary biota in polar regions. Palaeogeography, Palaeoclimatology, and Palaeoecology, 45:105–147.

BRETT-SURMAN, M. K. 1979. Phylogeny and palaeobiogeography of hadrosaurian dinosaurs. Nature, 277:1198–1200.

BROSGÉ, W. P. AND C. L. WHITTINGTON. 1966. Geology of the Umiat-Maybe Creek Region, Alaska. United States Geological Survey Professional Paper 303-H:H501–H638.

BRYANT, L. J. 1983. *Hesperornis* in Alaska. Paleobios, 40:8p.

CARTER, L. D. ET AL. 1977. Gubik and pre-Gubik Cenozoic deposits along the Colville River near Ocean Point. United States Geological Survey Circular, 751-B:B12–B14.

GALTON, P. M. AND M. A. CLUVER. 1976. *Anchisaurus capensis* (Broom) and a revision of the Anchisauridae (Reptilia, Saurischia). Annals of the South African Museum, 69:121–159.

GRADZIŃSKI, R., Z. KIELAN-JAWOROWSKA AND T. MARYAŃSKA. 1977. Upper Cretaceous Djadokhta, Barun Goyot and Nemegt formations of Mongolia, including remarks on previous subdivisions. Acta Geologica Polonica, 27:281–318.

HOTTON, N., III. 1980. An alternative to dinosaur endothermy: the happy wanderers, p. 311–350. *In* R. D. K. Thomas and E. C. Olson (eds.), A Cold Look at the Warm-Blooded Dinosaurs. American Association for the Advancement of Science Selected Symposium, 28.

LAPPARENT, A. F. DE. 1962. Footprints of d nosaur in the Lower Cretaceous of Vestspits bergen-Svalbard. Norsk Polarinstitutt—Årbok 1960:14–21.

LILLEGRAVEN, J. A., M. J. KRAUS AND T. M. BOWN 1979. Paleogeography of the world of the Me sozoic, p. 277–308. *In* J. A. Lillegraven et al (eds.), Mesozoic Mammals: The First Two-third of Mammalian History. University of Califor nia Press, Berkeley.

LULL, R. S. AND N. E. WRIGHT. 1942. Hadro saurian dinosaurs of North America. Geologica Society of America Special Papers, 40, 242 p.

MARINCOVICH, L., JR., E. M. BROUWERS AND D M. HOPKINS. 1983. Paleogeographic affinities and endemism of Cretaceous and Paleocene marine faunas in the arctic. United States Geological Survey Circular, 911:45–46.

MARTIN, G. C. 1926. The Mesozoic stratigraphy of Alaska. United States Geological Survey Bulletin, 776, 493 p.

NELSON, R. E, 1981. Paleoenvironments during deposition of a section of the Gubik Formation exposed along the lower Colville River, North Slope. United States Geological Survey Circular, 823-B:B9–B11.

NOPCSA, F. B. 1934. The influence of geological and climatological factors on the distributions of non-marine fossil reptiles and stegocephalia. Quarterly Journal of the Geological Society of London, 90:76–140.

PATTON, W. W. AND I. L. TRAILLEUR. 1964. Geology of the Killik-Itkillik Region, Alaska. United States Geological Survey Professional Paper 303-G:409–500.

ROEHLER, H. W. AND G. STRICKER. 1984. Dinosaur and wood fossils from the Cretaceous of the Corwin Formation in the National Petroleum Reserve, North Slope of Alaska. Journal of the Alaska Geological Society, 4:35–41.

ROUSE, G. E. AND S. K. SRIVASTAVA. 1972. Palynological zonation of Cretaceous and early Tertiary rocks of the Bonnet Plume Formation, northeastern Yukon, Canada. Canadian Journal of Earth Sciences, 9:1163–1179.

TAILLEUR, I. L., G. C. MULL AND H. A. TOURTELOT. 1973. A skeleton in Triassic rocks in the Brooks Range foothills. Arctic, 26:79–81.

ZHELEZNOV, A. A. AND T. M. OKUNEVA. 1972. Triasovaya sistema: Severo-Vostochnyy region, Kolvillskiy basseyn sedimentatisii, p. 251–253. *In* V. N. Vereshchagin (ed.), Geologiya Severo-Vostochnoy Azii, Tom II, Stratigrafiya i Paleogografiya. Izddanja Nedra, Leningrad Otdelenie, Leningrad.

ZIEGLER, A. M., C. R. SCOTESE AND S. F. BARRETT. 1983. Mesozoic and Cenozoic paleogeographic maps, p. 240–252. *In* P. Brosche and J. Sündermann (eds.), Tidal Friction and the Earth's Rotation II. Springer-Verlag, Berlin.

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