Late Cretaceous dinosaurs from the Denver Basin, Colorado

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ABSTRACT

Late Cretaceous dinosaurs have been known from the Denver Basin, Colorado, since the mid-1860s. Most of the fossils are scrappy, although several fragmentary skeletons are known. Most recently discovered specimens are the result of salvage work at construction sites in the Denver metropolitan area. Dinosaurs from the Denver Basin include *Triceratops*, *Torosaurus*, *Edmontosaurus*, *Thescelosaurus*, *Edmontonia*, *Pachycephalosaurus*, *Tyrannosaurus*, a dromaeosaurid, and *Ornithomimus*. All of these taxa are also known from the Lance, Hell Creek, and Scollard Formations to the north and are known collectively as the Lancian fauna. Thus, these Late Cretaceous dinosaurs from Colorado are the southeastern-most extension of the Lancian fauna. Furthermore, there may be ecological segregation of some taxa based on their facies distribution, with *Thescelosaurus* and *Torosaurus* restricted to the wetter lowlands and *Ornithomimus* and possibly *Pachycephalosaurus* to the better drained uplands.

KEY WORDS: Dinosauria, Late Cretaceous, Laramie Formation, lower Denver Formation, Theropoda, Ornithopoda, Pachycephalosauria, Neoceratopsia, Ankylosauria.

INTRODUCTION

Dinosaurs were first reported from Upper Cretaceous strata of the Denver Basin, Colorado, in 1867 (see below). Since then, dinosaurian fossils have been found at a variety of sites in the Laramie, Arapahoe, and Denver Formations (Fig.1; Appendix 1). The latter two, along with the Dawson Arkose, are referred to collectively as the D1 sequence by Raynolds (this issue). Most of the localities occur in construction sites in the Denver metropolitan area, and their discovery usually occurs from surface disturbance by earthmoving equipment. Because of this, many of the specimens are damaged, and associated material is scattered. Nevertheless, several significant localities have been discovered (Appendix 1).

HISTORY OF DISCOVERIES

Fossil vertebrates from the Denver Basin played an important role in the historical debate on the age of the "Lignite" deposits of the central and western United States. As Hayden (1874, p. 27) noted, "The main question, then, is this: Are the vertebrate paleontologists, Cope and Marsh, justified in regarding the entire Lignite group as Cretaceous from the evidence furnished by the vertebrate remains?" For a history of the "Great Lignite Debate," see Waage (1975). These vertebrates include some from the Denver Basin and are among the earliest dinosaurs discovered in the American West.

Some of the first discoveries were made in 1873 by Edward D. Cope, who was part of the U.S. Geological and Geographical Survey of the Territories led by Ferdinand V. Hayden. The route of the expedition included eastern Colorado, where Cope collected specimens at two places along Bijou Creek on the east side of the Denver Basin (Cope, 1874a), although the exact localities are unknown (Cross, 1896: 244). The material was scrappy, yet Cope (1874a) named three new species of dinosaurs without description: *Cinodon arctatus* (Fig. 2), *Polyonax mortuarius* (Fig. 3), and *Agathaumas milo*. He described the material in his next report (Cope, 1874b), changing the spelling of *Cionodon* and describing the material of *A. milo* under the name *Hadrosaurus occidentalis* (see Cope, 1875). Hatcher (1907) considered all of these taxa as hadrosaurian and ceratopsian nomina dubia.

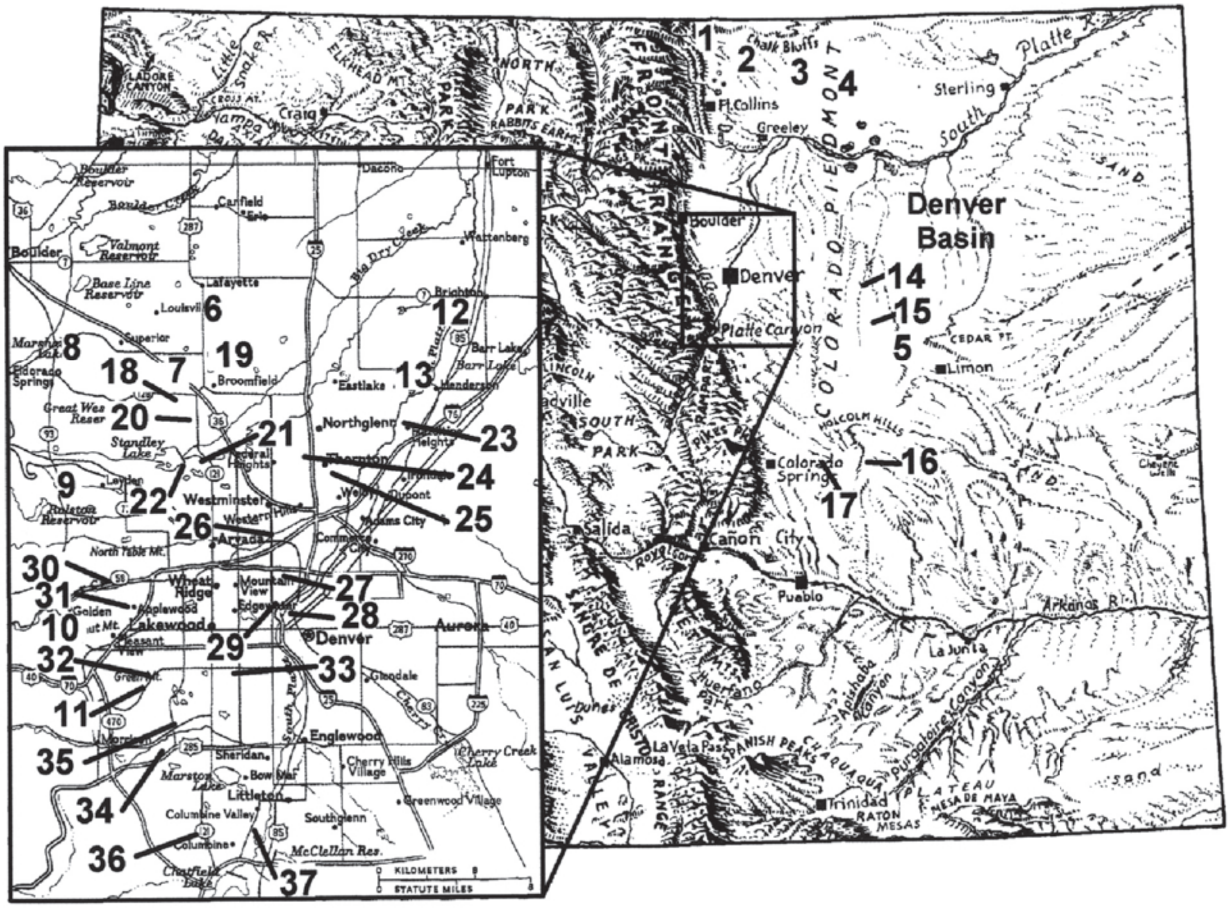


Figure 1. Upper Cretaceous dinosaur localities in Denver Basin (landform map modified from Raisz, 1957). See Appendix 1 for locality numbers and included taxa.

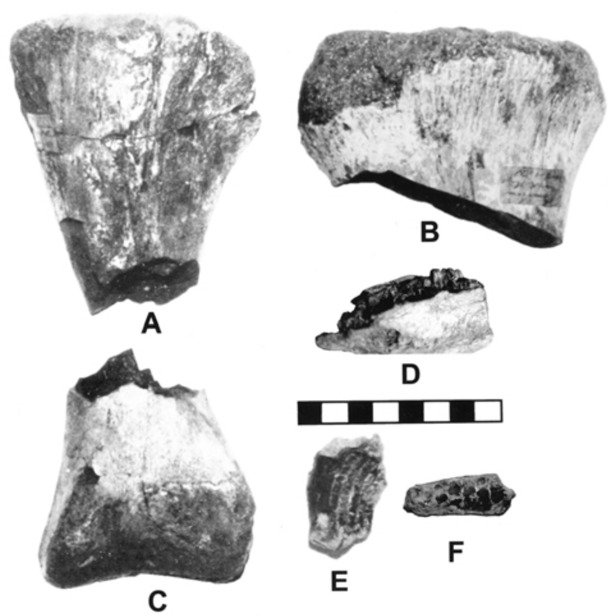


Figure 2. (Caption on facing page.)

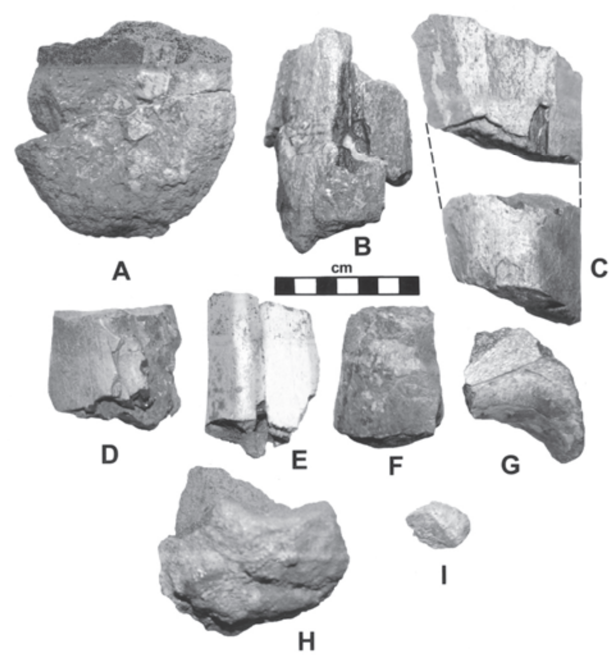


Figure 3. (Caption on facing page.)

Dinosaur bones from what would later be identified as Upper Cretaceous strata in the Denver area were first mentioned in a letter from Edward L. Berthoud to Othniel C. Marsh, Yale University, dated December 6, 1873, "We have now in Golden City I find from my notes of 1867–68 a fossil bone [word unclear] that was discovered... when digging a well — at 45 feet in depth a fossil lower jaw fragment with cutting teeth of a ruminant [sic] was sent to Smithsonian Mus in 1867 — . Since that time enormous bones have been dug out at from 33 to 50 feet in depth..." Among the specimens was apparently a ceratopsian horn core as he mentions in the same letter, "I have written to Prof. Lesquereux in reference to the fossil tusk?" Elsewhere, fossil bones had apparently accumulated as lag on the surface for many years as implied by Berthoud's comment, "I have also found 5 miles NE from Golden another bone bed. . . ." Although Berthoud apparently did not send these specimens to Marsh, he did send a tooth (Fig. 4), which he first mentioned in a letter to Marsh (June 20, 1874), "Included is a rough sketch of a splendid saurian tooth that Prof. Lakes of Jarvis had gave me yesterday = it comes from our S Table Mt. . . ." The tooth was briefly mentioned by Cannon (1906), "...found many years ago by Prof. A. Lakes near the southwest end of South Table Mountain at Golden. . . . These teeth probably belonged to a large species of the theropodous dinosaur like *Laelaps aquilungius* Cope. . . ." This tooth, illustrated for the first time in Figure 4, represents the first discovery of what would later be known as *Tyrannosaurus rex*.

Berthoud apparently also found numerous bones eroding in a gully on the southwestern slope of South Table Mountain, for he wrote "I have found something like two wheel barrow fulls of bones, but nothing perfect enough to warrant sending them to you for identification" (August 21, 1874). Cannon (1888) apparently knew of this site and reported a large theropod jaw (*Tyrannosaurus*?),

Figure 2, facing page, left panel. Some of first dinosaur specimens to be described from Denver Basin include these of holotype of *Cionodon arctatus* (AMNH 3951), described by Cope (1874a). Specimens were collected along Bijou Creek. ***A*** and ***B***, proximal ends of metatarsals; ***C***, distal end of metatarsal III; and ***D***, ***E***, ***F***, maxillary fragments. Compare with Cope (1875) pl. 1, pl. 2 figs. 1-4. Scale in cm.

Figure 3, facing page, right panel. Another holotype by Cope (1874a) from Bijou Creek is *Polyonax mortuarius* (AMNH 1568). ***A***, dorsal centrum; ***B***, bone fragment; ***C***, fibula (misidentified as a horn by Hatcher, 1907); and ***D–I***, bone fragments. Compare with Cope (1875) pl. 2 figs. 3–5, pl. 3 figs. 1–4. Scale in cm.

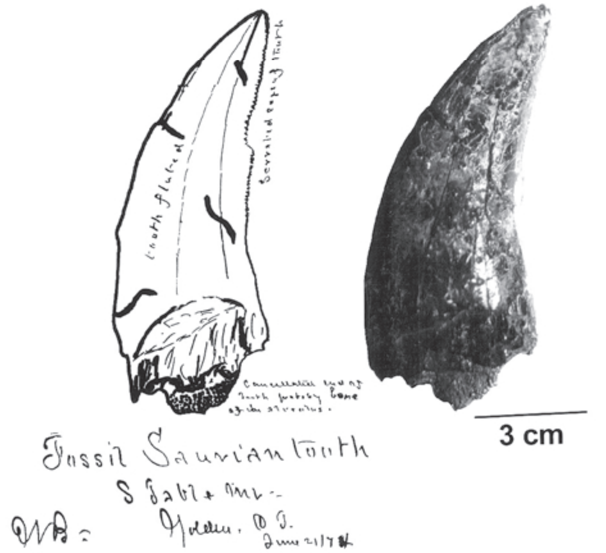


Figure 4. The first known specimen of what can now be identified as *Tyrannosaurus rex* is a tooth collected from Denver Formation at South Table Mountain. It was first mentioned and sketched in a letter from Edward Berthoud to O. C. Marsh dated June 20, 1874. Specimen is now at Yale Peabody Museum (YPM 4192).

scutes (ankylosaur?), and large limb fragments ". . . having a flattened oval cross section . . ." (ceratopsian femora) among the material. The whereabouts of this material is unknown. It is possible that the theropod jaw belonged to the tooth Berthoud had sent to Marsh. Berthoud continued to collect for several more years, sending an occasional fossil to Marsh, but he was superseded by George Cannon, Whiteman Cross, and George Eldridge starting in 1881, during the first study of the geology of the Denver Basin (Emmons et al., 1896). Some of the richest sites were in the numerous ravines feeding into the South Platte River (Cannon, 1888) and on the then barren flanks of Green Mountain.

Concerning these specimens, Cross (1896, p. 226) later wrote, "The collection of this material extended over a number of years. The fossils obtained were for the most part isolated bones or fragments, and all or nearly all of them were sent to Prof. O.C. Marsh for examination." Marsh identified some of the early material sent to him as *Stegosaurus* (Cannon, 1888), apparently on the mistaken belief that the fragments of grooved horn cores were *Stegosaurus* tail spikes. It was not until he received the famous pair of horn cores attached to the frontals that he concluded that some of the specimens were of extinct bison (Fig. 5). He therefore named the horns *Bison alticornis* in 1887 and concluded a Pliocene age for the strata. Given that ceratopsians were unknown at the time, such a mistake is understandable. Marsh (1889) corrected the mistake later, but referred to the horns as *Ceratops alticornus*. It was Hatcher (1907) who assigned the specimen to *Triceratops*.

The location for the holotype *"Bison" alticornis* has been reported as from Green Mountain (e.g., Osborn 1916; Lewis, 1960), despite Marsh (1887, p. 324) writing, "The locality of the type specimen is on the banks of Green Mountain Creek, near Denver, Colo." Cross (1888, p. 132) wrote that it was found ". . . in a bank of typical Denver sandstone in the Windsor addition to the Town of Highland." Highland is a former town that occupied the high ground on the west side of the South Platte River, opposite its confluence with Cherry Creek; it is now part of Denver and is extensively developed (Fig. 1, Loc. 29).

Other bones from the Brighton area (Fig. 1, Locs. 12–13) collected by Eldridge were identified by Marsh as a mixture of *Stegosaurus* and *Bison,* a conclusion unacceptable to Cannon (1888, p. 143). Cross (1896) reported the material as coming from the Arapahoe Formation. Among the material was a nasal horn core that Marsh (1889) named *Triceratops galeus*. The specimen was figured by Hatcher (1907), who considered it a ceratopsian nomen dubium, although noting that it most closely resembles that of *Torosaurus*.

Cannon (1890) recovered a partial hindleg of a theropod from the Denver Formation south of Green Mountain (Fig. 6; Fig. 1, Loc. 35). The specimen was sent to Marsh (1890), who named it *Ornithomimus velox*. Cannon (1906) later reported that ceratopsian bones were found along Little Dry Creek where Federal Boulevard crosses over the railroad tracks (Fig. 1, Loc. 26). He also reported that an *Edmontonia* tooth was found near Berkeley Bluffs (Fig. 1, Loc. 27).

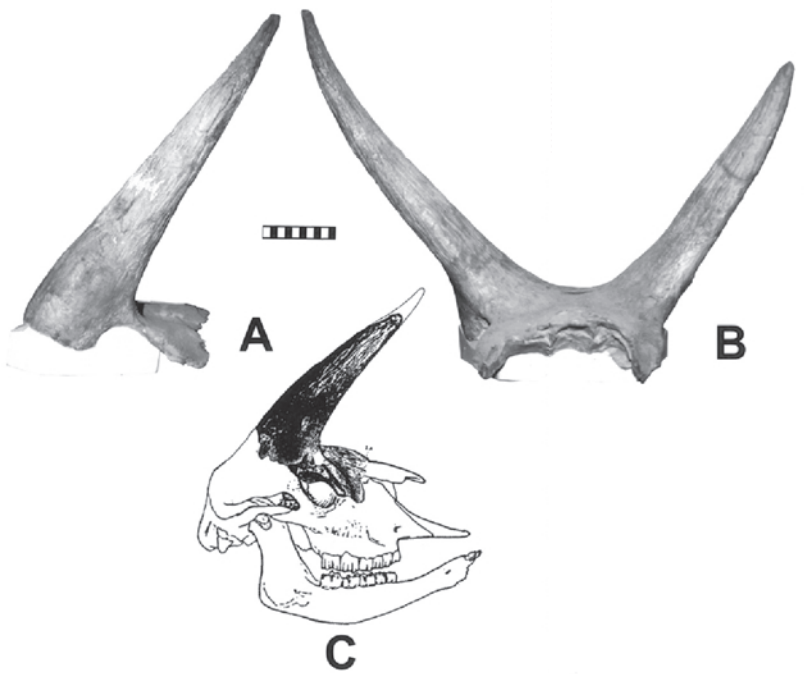


Figure 5. Famous "*Bison*" *alticornis* horn cores from bluffs along South Platte River, opposite confluence with Cherry Creek in lateral (***A***) and anterior (***B***) views. Had Marsh attempted to reconstruct the horns as bison, the skull would have looked as in ***C***.

Dinosaurian fossils, consisting mostly of isolated ceratopsian bones, were found elsewhere in the Denver Basin during the making of the state geological map in the 1920s. However, a fragmentary *Triceratops* skeleton was found in the Laramie Formation near Briggsdale (Toepelman, 1926; Carpenter, 1979; Fig. 1, Loc. 4). A pair of *Edmontosaurus* maxillae was recovered from the Laramie Formation along Owl Creek (Fig. 7; Fig. 1, Loc. 3) in northern Colorado by amateur paleontologist Asa Maxson (Toepelman, 1935; Lull and Wright, 1942; Carpenter, 1979). Dane and Pierce (1936) reported a partial hadrosaur femur from the southern end of East Bijou Creek, and parts of a ceratopsian (referred to *Triceratops*) were retrieved from the head of Black Squirrel Creek near the southern end of the Denver Basin (Fig. 1, Loc. 16).

Roland Brown (1943) reported finding ceratopsian remains, which he called *Triceratops*, from Jimmy Camp Creek (Fig. 1, Loc. 17) just east of Colorado Springs. A partial ceratopsid skeleton was also excavated by the Colorado School of Mines in 1971 along State Highway 58 on the flanks of North Table Mountain (Fig. 8; Fig. 1, Loc. 30). This specimen was recently transferred to the University of Colorado Museum. Other fragments of a ceratopsian skeleton were collected by the University of Colorado Museum in 1975 from the southern shores of Stanley Lake (Fig. 1, Loc. 22). Additional dinosaur material, including teeth, was collected by the University of Colorado Museum in the late 1970s from

Figure 6. Left distal end of tibia and foot of holotype of *Ornithomimus velox* (YPM 542) from Denver Formation; anterior (***A***), posterior (***B***); tibia in lateral view (***C***). Scale in cm.

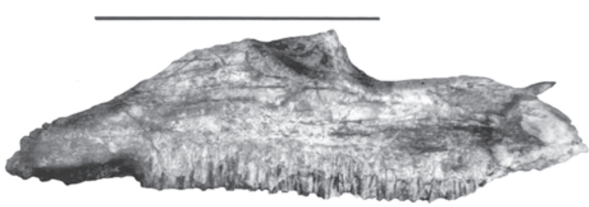


Figure 7. Left maxilla of *Edmontosaurus* sp. (UCM 18953) from Laramie Formation. Scale bar = 10 cm.

north of Briggsdale (Fig. 1, Loc. 4). Among the specimens is a nearly complete *Triceratops* skull (Figs. 9, 10; Fig. 1, Loc. 4) now on display at the Greeley Court House. The Denver Museum of Natural History collected a partial *Torosaurus* skeleton from near Leyden (Fig. 11; Fig. 1, Loc. 9), which is the southeastern-most known occurrence of this taxon. Lockley and Hunt (1995) reported footprints, *Ceratopsipes*, from the Laramie Formation in Golden, believed to be those of ceratopsians (Fig. 12; Fig. 1, Loc. 10). In addition, they provided a summary of dinosaur tracks from the Laramie Formation exposed in abandoned clay pits along the westernmost edge of the Denver Basin.

Beginning in the early 1990s, the Denver Museum of Natural History began salvage work at construction sites in the Denver metropolitan area. The first specimen recovered was a partial *Tyrannosaurus rex* skeleton (Figs. 13, 14) found by Charles Fickle at a housing development in Littleton (Fig. 1, Loc. 36). Soon afterwards, Alan Nolan reported discovery of bones at another housing development in Westminster (Fig. 1, Loc. 20). This site, Oak Place, has yielded the most diverse fauna from the Denver Formation. Since that time, we have recovered abundant dinosaurian specimens, mostly ceratopsian, from Arvada, Westminster, and especially in the Broomfield area.

PREVIOUS SUMMARIES OF DINOSAUR FAUNAS

Whitman Cross (1896) presented a taxonomic list of dinosaurs by lithostratigraphic unit, noting several taxa from the Arapahoe Formation (Table 1). Most of these specimens are thought to be at the National Museum of Natural History, but we have been unable to locate them. O. C. Marsh (1896a) provided a more detailed summary of the dinosaurs from the Denver Basin (Table 1); however, the review was not restricted to Upper Cretaceous dinosaurs, nor just to those of the Denver Basin. Carpenter (1979) presented a summary of the dinosaurs from the Laramie Formation (Table 1) and illustrated for the first time several previously mentioned specimens (e.g., the *Triceratops* specimen mentioned by Toepelman, 1926).

Since that last review, much material has been collected from both the Laramie and Denver Formations, but most of it remains unknown to the scientific community. Therefore, some of the more important specimens are described and illustrated below. Numerically, most of the specimens are from the Denver Formation, but this may be a collecting bias because most construction has occurred on the Denver Formation. A brief preliminary summary of this more recent salvage work done by us was presented by DiCroce et al. (1998).

In the section below, the lithostratigraphic names Arapahoe and Denver Formations are used for the nonmarine strata of the Denver Basin rather than the sequence term D1 advocated by Raynolds (this issue). Our reason is that the formations better reflect the depositional (i.e., facies), hence ecological, environments of the Late Cretaceous in the Denver Basin. The importance of this in paleoecological and provinciality studies of dinosaur distribution has been discussed by Lehman (1987, 2001). We further examine the distribution of Maastrichtian dinosaurs in the Denver Basin below.

INSTITUTIONAL ABBREVIATIONS

AMNH	American Museum of Natural History, New York, NY
CMNH	Carnegie Museum of Natural History, Pittsburgh, PA
CU-MWC	Colorado University track collection, Museum of Western Colorado, Grand Junction, CO
DMNH	Denver Museum of Nature & Science (formerly Denver Museum of Natural History), Denver, CO
FMNH	Field Museum of Natural History, Chicago, IL
NSM PV	National Science Museum, Tokyo, Japan
UCM	University of Colorado Museum, Boulder, CO
USNM	United States National Museum (National Museum of Natural History), Washington, DC
YPM	Yale Peabody Museum of Natural History, New Haven, CT
USGS	U.S. Geological Survey, Denver, CO

Figure 8. Ceratopsian pelvic bones (UCM 68914) from Denver Formation. Right ilium lacking most of preacetabular blade in dorsal (***A***), lateral (***B***), medial (***C***), and ventral (***D***) views. Left pubis in lateral (***E***) and medial (***F***) views. Right ischium in medial (***G***) and lateral (***H***) views. Scale bar = 10 cm.

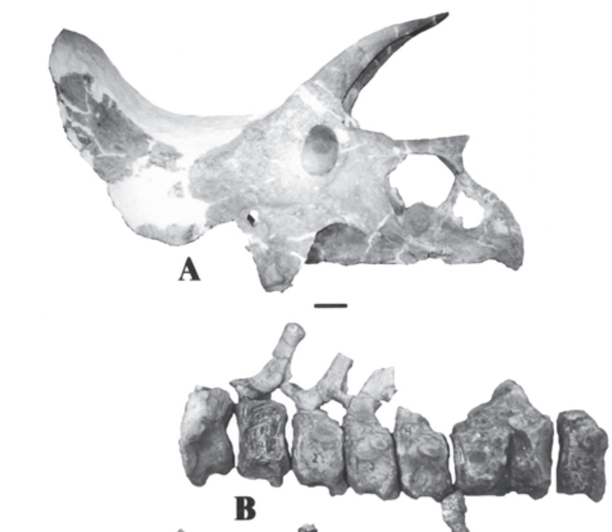


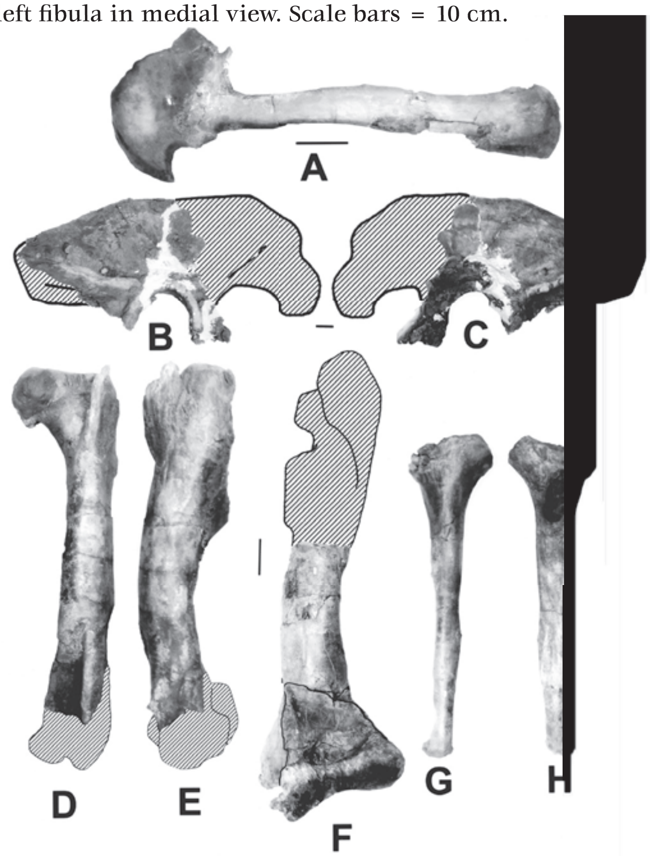
Figure 10. Fossils of *Triceratops horridus* from Laramie Formation after preparation (uncataloged; Weld County Court House). Skull in right lateral view (***A***), mid-caudal vertebrae in left lateral view (***B***), left pubis (***C***), and right partial ischium (***D***). Scale bars = 10 cm.

Figure 9, below. First complete skull of *Triceratops* from Colorado (uncataloged). It was found with partial skeleton in Laramie Formation. See Figure 10 for prepared specimen.

Figure 11, left. Fossils referred to *Torosaurus* sp. (DMNH 17060), formerly known as Leyden *Triceratops*. Left dentary in lateral (***A***) and medial (***B***) views. Left coracoid (***C***), and left scapula (***D***). Crushed left humerus in anterior (***E***), and posterior (***F***) views. Right pubis (***G***) and ischium (***H***). Scale bar = 10 cm.

Figure 12. Cast of ceratopsian pes track *Ceratopsipes goldenensis* (CU-MWC 220.6) from Laramie Formation. Track measures 38 cm long, 55 cm wide.

Figure 13, below. Postcrania of Littleton specimen of *Tyrannosaurus rex* (DMNH 2827). ***A***, scapulo-coracoid; ***B***, left ilium in medial view; ***C***, left ilium in lateral view; ***D***, left femur in anterior view; ***E***, left femur in lateral view; ***F***, astragalus and distal end of tibia; ***G***, left fibula in lateral view; and ***H***, left fibula in medial view. Scale bars = 10 cm.



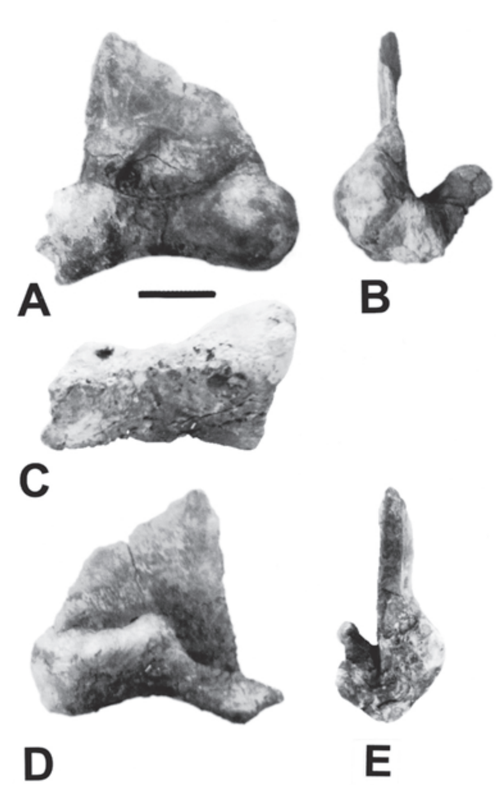


Figure 14. Astragalus of the Littleton specimen of *Tyrannosaurus rex* (DMNH 2827) in anterior (***A***); medial (***B***); ventral (***C***); posterior (***D***); and lateral (***E***) views. Scale bar = 10 cm.

Table 1. Principal summaries of dinosaurs from Denver Basin.

Formation	Cross, 1896	Marsh, 1896 Ceratops Beds	Carpenter, 1979	This Study
Denver	*Ornithomimus velox*	*Ornithomimus velox*		*Ornithomimus velox*
	Claosaurus annectens	*Claosaurus annectens*		*Dromaeosaurus* sp.
	Ceratops alticornis	*Ceratops alticornis*		*Tyrannosaurus rex*
	Triceratops horridus	*Triceratops galeus*		hadrosaurid indet.
		Triceratops horridus		*Pachycephalosaurus* sp.
				Triceratops horridus
				ceratopsid indet.
				nodosaurid indet.
Arapahoe	*Claosaurus annectens*			ceratopsid indet.
	Ceratops montanus			
	Ceratops alticornis			
	Triceratops galeus			
Laramie			dromaeosaurid indet.	*Dromaeosaurus* sp.
			Tyrannosaurus rex	*Tyrannosaurus rex*
			Thescelosaurus sp.	*Thescelosaurus* sp.
			Edmontosaurus sp.	*Edmontosaurus* sp.
			Triceratops horridus	*Triceratops horridus*
			Triceratops sp.	*Triceratops* sp.
				Torosaurus sp.
				Edmontonia sp.

SYSTEMATIC PALEONTOLOGY

Suborder THEROPODA
Family ORNITHOMIMIDAE
Ornithomimus velox
Figure 6

Material.—YPM 542 cotype left distal end of tibia, metatarsals II–IV, phalanges I-1–3, YPM 548 cotype metacarpals I–III (Denver Formation, Loc. 35); DMNH 33300 manus claw (Denver Formation, Loc. 19); UCM 3539 phalanx (Denver Formation; Loc. 27); UCM 47633 distal caudal (Denver Formation, Loc. 27); and USGS D902 manus claw (Denver Formation?; Loc. 15).

Description and discussion.—The type material was briefly described by Marsh (1890; see also 1896a, 1896b), with additional comments about the taxon by Osborn (1916), Russell (1972), and DeCourten and Russell (1985). As a whole, the limb material is proportionally more gracile than other ornithomimids such as *Garudimimus* or even *Struthiomimus*. Additional specimens, primarily unguals, have been found elsewhere in the Denver Basin, but only from the Denver Formation. DMNH 33300 is a nearly complete ungual, 40 mm long.

Family DROMAEOSAURIDAE
***Dromaeosaurus* sp.**

Material.—DMNH 34594 tooth (Denver Formation, Loc. 17); DMNH 44386 tooth (Denver Formation, Loc. 20); UCM 38743 tooth (Laramie Formation, Loc. 4); UCM 38754 tooth (Laramie Formation, Loc. 4); UCM 38755 tooth (Laramie Formation, Loc. 4); UCM 42323 tooth (Laramie Formation, Loc. 1); UCM 42324 tooth (Laramie, Loc. 1); and UCM 68917 tooth (Denver Formation, Loc. 34).

Description and discussion.—Small theropod teeth are tentatively referred to *Dromaeosaurus* based on their overall size, shape, and denticle pattern (where preserved).

Family TYRANNOSAURIDAE
Tyrannosaurus rex
Figures 4, 13, 14

Material.—DMNH 2827 three teeth, left scapulo-coracoid, ribs, distal caudal, partial left ilium, left femur, right partial tibia, right fibula, right astragalus (Denver Formation, Loc. 36); DMNH 32825 tooth (Denver Formation, Loc. 20); DMNH 32825 tooth (Denver Formation, Loc. 21); UCM 36303 tooth (Denver Formation, Loc. 22); UCM 38804 tooth (Laramie Formation, Loc. 4); and YPM 4192 tooth (Denver Formation, Loc. 32).

Description and discussion.—As discussed above, a large tooth (YPM 4192) collected from South Table Mountain is one of the first dinosaur specimens recovered in the Denver Basin. Although originally unnamed, the tooth is now referred to *Tyrannosaurus rex*.

The most important specimen of *Tyrannosaurus rex* from the Denver Basin is the partial skeleton found by Charlie Fickle at a housing development in Littleton. The skeleton was completely disarticulated and scattered, and unfortunately it was damaged by earthmoving equipment. Several large teeth with their roots were found, indicating that the teeth had slipped from their alveoli. The scapula and coracoid are co-ossified (Fig. 13*A*), although the suture is traced as a ridge. Their combined length is 106 cm, of which 82 cm is scapula. The distal end of the scapular blade is not expanded dorsally as in the holotype, CMNH 9380 (see Osborn, 1906, fig. 6*B*), but more closely resembles that of FMNH PR 2081 (see Carpenter and Smith, 2001, fig. 9.2). The coracoid is 39.5 cm tall. The ilium is missing all of its pre-acetabular blade but is estimated to have been 185 cm long (Fig. 13*B*, *C*). The femur is also damaged, lacking its distal end, but is estimated to have been about 111 cm long (Fig. 13*D*, *E*). The shaft has collapsed into the medullary cavity along most of its length so that no minimal circumference can be measured. Almost half of the proximal part of the tibia is missing, but it is estimated to have been about as long as the femur (Fig. 13*F*).

The fibula of *Tyrannosaurus rex* has not been described before, but it is generally similar to that of *Tyrannosaurus baatar* (Maleev, 1974). DMNH 2827 is 87.2 cm long and has a long, slender, straight shaft that is subtriangular in cross-section at mid-shaft. The proximal end is expanded, especially posteriorly (Fig. 13*G*, *H*). The proximal end is crescentic in dorsal view. This dorsal surface is sloped medially to accommodate the distal fibular condyle of the femur. On the medial side of its proximal end is a large oval fossa that has a sharp dorsal rim. The fossa shallows distally and no sharp border is present marking its end. The fossa has a shallow, triangular platform just below its dorso-posterior rim. Most of the medial side of the shaft is rugose for ligaments binding the bone to the tibia. The scar for the M. biceps femoralis on the anterior face just above mid-shaft is very rugose and sub-oval.

The most significant element of DMNH 2827 is an astragalus found associated with the tibia (Fig. 13*F*, 14). Welles and Long (1974) described what they thought was the astragalus of *Tyrannosaurus rex*, but which Carpenter (1992) demonstrated as a right quadrate. The astragalus of *Tyrannosaurus rex* is illustrated here in detail for the first time (Fig. 14). It measures 28.8 cm across the anterior surface of the distal condyles, and it has a maximum height of 30.8 cm. The ascending process is not as tall proportional to its width as in *Gorgosaurus* (see Lambe 1917), which has one of the few tyrannosaurid astragali described. The process is almost as tall as it is wide (as measured just above the condyles) and forms an acute, almost right triangle. The process is situated oblique to a vertical plane through the distal condyles. A groove is present along the lateral surface of the process to accommodate the fibula (Fig. 14*E*). A large fossa is present at the base of the process between the dorsal surfaces of the condyles (Fig. 14*A*). The fossa is rugose and probably housed the robust collateral ligament under which the tendons for the foot extensors passed. The distal condyles are asymmetrical, the medial one being considerably larger than the lateral one (Fig. 14*A*). Furthermore, the medial condyle extends farther anteriorly than the lateral one (Fig. 14*C*) as in most theropods. Posteriorly, there is a deep groove at the base of the ascending process to accommodate the distal end of the tibia. The posterior part of the astragalus is tall (Fig. 14*B*, *E*) and extends partially onto the posterior side of the tibia, thus ensuring a tight union. Laterally, there is a fossa to accommodate the calcaneum.

The teeth referred to *Tyrannosaurus* have a crown basal width that is almost equivalent to crown basal anteroposterior length.

genus and species indet.

Material.—DMNH 20646 teeth (Laramie Formation, Loc. 9); DMNH 27742 tooth (Denver Formation, Loc. 20); DMNH 33302 tooth (Denver Formation, Loc. 20); DMNH 33352 phalanx (Laramie Formation, Loc. 8); DMNH 3335 vertebral centra (Laramie Formation, Loc. 8); DMNH 34594 tooth (Denver Formation, Loc. 21); UCM 38060 tooth (Denver

Formation, Loc. 37); UCM 42325 tooth (Laramie Formation, Loc. 1); UCM 42322 tooth (Laramie Formation, Loc. 1); footprints DMNH 8582 (Laramie Formation, Loc. 8); and specimen not collected (Laramie Formation, Loc. 10).

Description and discussion.—The teeth include the form taxa, *Aublysodon* (UCM 38060) and *Paronychodon* (UCM 42322). The validity of both taxa remains questionable. Most of the other material is too fragmentary to identify more specifically. The footprints were briefly described by Lockley and Hunt (1995).

Suborder ORNITHISCHIA
Family THESCELOSAURIDAE
***Thescelosaurus* sp.**

Material.—UCM 38757, 38758 teeth (Laramie Formation, Loc. 4).

Description and discussion.—These teeth were previously described by Carpenter (1979) as cheek teeth. No new information is available for them.

Family HADROSAURIDAE

The vast majority of the hadrosaur specimens from the Laramie and Denver Formations cannot be identified below family level. At least two genera, *Edmontosaurus* and *Anatotitan*, are known from the coeval Lance and Hell Creek Formations making it impossible to refer the mostly fragmentary specimens from the Denver Basin to either genus. An exception is a pair of maxillae, described below.

cf. *Edmontosaurus* sp.
Figure 7

Material.—UCM 18953 pair of maxillae (Laramie Formation, Loc. 2).

Description and discussion.—A pair of hadrosaur maxillae is referred to *Edmontosaurus* sp. rather than *Anatotitan* because the ascending process of the maxilla is above the midpoint of the tooth row in *Anatotitan*; it is anterior to the midpoint in *Edmontosaurus*. Furthermore, the ratio of the length of the maxilla to the maximum height is greater in *Anatotitan* than in *Edmontosaurus*. These maxillae were mentioned previously by Toepleman (1935), Lull and Wright (1942), and Carpenter (1979).

Hadrosaurid genus and species indet.
Figures 2 and 15
Agathaumas milo Cope, 1874a
Cionodon arctatus Cope, 1874a

Material.—AMNH 3951 (type of *Cionodon arctatus*) maxillary fragment, dorsal vertebrae, metatarsal III distal end, metatarsal IV proximal end (Laramie Formation, exact locality unknown, but believed to be Bijou Creek); DMNH 29475 tooth (Denver Formation, Loc. 20); DMNH 32828 tooth (Denver Formation, Loc. 20); DMNH 34341 tooth (Denver Formation, Loc. 20); DMNH 44600 right pubis (Denver Formation, Loc. 14); UCM 38059 tooth (Denver Formation, Loc. 37); UCM 42326 tooth (Laramie Formation, Loc. 1); UCM 42327 tooth (Laramie Formation, Loc. 1); UCM 43654 right femur (Laramie Formation; Loc. 3); UCM 437372 vertebrae (Laramie Formation, Loc. 6); USNM 7623 ungual (Denver Formation, Loc. 17); and footprints (Laramie Formation, Loc. 9, 10).

Description and discussion.—Cope named *Agathaumas milo* in 1874a, but he did not provide a description of the material. Later, Cope (1874b) described the material under *Hadrosaurus occidentalis.* As Cope admitted, the material is very fragmentary, and his description is too incomplete for identification beyond family level. The material cannot be located now in the American Museum of Natural History. The holotype of *Cionodon arctatus* is also very fragmentary. It was figured by Cope (1875) and here in Figure 2. The material is clearly hadrosaurian, but little else can be added to Cope's original description. Lull and Wright (1942) suggested that *C. arctatus* was ". . . evidently from the watershed between the South Platte River and Lodge Pole [sic] Creek, Colorado." However, the strata here are mostly mid-Tertiary in age (mostly the Upper Eocene–Lower Oligocene White River Formation) and are exposed as a broken line of cliffs just south of the Colorado–Wyoming border. Furthermore, Cope (in

Figure 15. Right femur of subadult hadrosaurid (UCM 43654) in anterior (***A***) and medial (***B***) views from Laramie Formation. Scale bar = 10 cm.

Cross, 1896) stated that the specimen came from Bijou Creek. The Laramie Formation along Bijou Creek is covered by a wide mantle of Quaternary sediment. It is not exposed until just north of Deer Trail, along East Bijou Creek, where it extends south for 60 km. Either the specimen came from this stretch of the Laramie, or the specimen actually came from the Denver Formation exposed along one of the other drainages, such as south of Strasburg.

A hadrosaur pubis was found in 2001 near Strasburg in the Denver Formation (Loc. 14). The prepubic process is damaged and the postpubic process is incomplete. The prepubic process is estimated to be over 48 cm long. The femur (Fig. 15) was collected by amateur paleontologist Asa Maxson in the early 1930s. It is 90 cm long, suggesting that it belongs to a subadult individual.

Footprints believed to be of hadrosaurs have been described by Lockley and Hunt (1995) from the lower part of the Laramie Formation, which Weimer (1973) has interpreted as delta plain deposits. The prints are of different sizes indicating that their makers were individuals of different ages.

Family PACHYCEPHALOSAURIDAE

cf. *Pachycephalosaurus* sp.

Figure 16

Material.—DMNH 32649 portion of skullcap (Denver Formation, Loc. 20).

Description and discussion.—A portion of thickened parietal is all that is present of the skull roof (Fig. 16). The bone is very dense, making identification as pachycephalosaurid certain. The outer surface is moderately grooved; no nodes are present on the specimen, indicating that the fragment is not from the periphery of the skull.

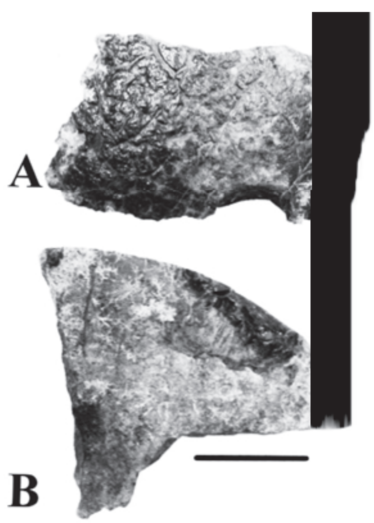


Figure 16. Fragment of *Pachycephalosaurus* (DMNH 32649) dome in dorsal (***A***) and lateral (***B***) views from Denver Formation. Scale bar = 5 cm.

Family CERATOPSIDAE

Three genera of neoceratopsians are known from the Maastrichtian of the Western Interior: *Triceratops*, *Diceratops,* and *Torosaurus* (Forster, 1996; however, see Lehman, 1987). In addition, *Triceratops* is represented by two species: *T. horridus* and *T. porosus.* Unfortunately, the differences between all the taxa are best expressed in the skulls, making it difficult, and in many instances impossible, to identify isolated elements from the Denver Basin to even the generic level. A few notable specimens are described below.

Triceratops horridus

Figures 9 and 10

Material.—Currently uncataloged (formerly UCM 41777) skull, right dentary, 2 dorsal vertebrae, rib fragments, 10 caudal vertebrae, both ischia, left pubis(Laramie Formation, Loc. 4); and UCM 38473 nasal horn core, partial vertebrae, left humerus, right coracoid, scapula fragment, phalanges, brow horn core fragment, rib fragments (Laramie Formation, somewhere near Loc. 4).

Description and discussion.—A nearly complete skull is on display at the Weld County Court House in Greeley, Colorado. It was found resting on its right side (Fig. 9) in overbank deposits of the Laramie Formation. The skull is about 1.5 meters long, with an orbit 11.25 cm long anteroposteriorly and 15 cm vertically; the longest horn measures 45 cm. The frill is incomplete and is restored in plaster (Fig. 10*A*). The skull has the elongated rostrum and anteriorly curved horns characteristic of *T. horridus* as defined by Forster (1996). Postcranial material includes a few dorsals and mid-caudals (Fig. 10*B*), rib fragments, and left pubis and partial ischium (Fig. 10*C*, *D*). Two of the caudals are pathologically co-ossified. Despite the relatively small size of the skull, the animal is an adult as indicated by fusion of the neural arches to their centra.

cf. *Torosaurus* sp.

Figures 8 and 11

Material.—DMNH 17060 left dentary with articular, splenial, left scapula and coracoid, cervical, posterior dorsal, sacrum, anterior caudal, posterior caudal, ribs, left humerus, partial ilium, ilium fragment, right pubis, right ischium, fibula fragment, metatarsal (Laramie Formation, Loc. 9).

Description and discussion.—This ceratopsian specimen is tentatively referred to *Torosaurus* on the basis of the elongated humeral shaft below the deltopectoral crest (Fig. 11*E*, *F*) and elongated posteromedial process of the coracoid (Fig. 8*C*; compare Johnson and Ostrom, 1995, figs. 12.3-12.6, Hatcher et al., 1907, fig. 64-66, and Figs. 11*C*, *E*, *F*). Unfortunately, the frill, which has the most diagnostic features, is not present. If the identification is correct, this is the first record of *Torosaurus* in Colorado. Much of this specimen is illustrated because little *Torosaurus* material has been figured before.

The dentary is complete and retains all of the teeth, although some of them have slipped partially out of their alveoli (Fig. 11*A*, *B*). The dentary is 63.5 cm long and the tooth row 47.3 cm. The articular is wedged between the tooth row and coronoid process. The vertebrae resemble those of other large neoceratopsians, such as *Triceratops* (Hatcher et al., 1907), so are not figured. The scapula is proportionally short compared to dentary length, being about the same length (63 cm). In *Triceratops*, the dentary is apparently 75 percent the length of the scapula based on a skull and articulated skeleton (NSM PV20379). The scapula is 35 cm tall just posterior to the glenoid. The coracoid is nearly complete and has a distinct ventromedial projection (see Johnson and Ostrom, 1995, fig. 12.5) that is not seen in *Triceratops*. It is 27.3 cm long and over 43 cm tall.

The humerus is crushed, thereby distorting the deltopectoral crest and the medial humeral tuberosity (Fig. 11*E*, *F*). The humerus has a midline length of 60 cm, is 37 cm wide proximally, and 28 cm wide distally. The pubis is missing its postpubic process, but otherwise it is relatively complete, although much covered with plaster of Paris. The ischium is missing both the proximal and distal ends.

Ceratopsid genus and species indet.

Figures 3, 8, and 17

Polyonax mortuarius Cope, 1874a
Bison alticornis Marsh, 1887
Ceratops alticornis Marsh, 1889
Triceratops alticornis Hatcher, 1907
Ceratops montanus Marsh, 1888
Triceratops galeus Marsh, 1889

Material.—AMNH 3950 dorsal centra, caudal centra, rib fragment, fibula fragment (holotype of *Polyonax mortuaris*; Laramie Formation, East Bijou Creek); DMNH 2823 horn core, vertebra fragment (Denver Formation, Loc. 19); DMNH 25914 braincase (Denver Formation, Loc. 18); DMNH 25915 braincase, horn core fragment, frill fragment, dentary fragment with teeth (Denver Formation, Loc. 20); DMNH 27743 tooth (Denver Formation, Loc. 20); DMNH 27744 tooth (Denver Formation, Loc. 20); DMNH 29951 tooth (Denver Formation, Loc. 20); DMNH 33301 tooth (Denver Formation, Loc. 20); DMNH 33351 horn core, squamosal fragment (Laramie Formation, Loc. 8); DMNH 34291 left mandible (Denver Formation, Loc. 20); DMNH 34391 dentary, parietal fragment with base of horn core, left squamosal fragment (Denver Formation, Loc. 20); DMNH 34392 section of horn (Denver Formation, Loc. 20); DMNH 34595 radius? fragment (Denver Formation, Loc. 21); DMNH 44392 braincase (Denver Formation, Loc. 18); UCM 68914 right articular, posterior dorsal, neural spine, rib fragments, left humeral shaft, right partial ilium, right ischium, distal end of left ischium, left pubis (Denver Formation, Loc. 31); UCM 13746 horn core (Laramie Formation, Loc. 3); UCM 13749 horn core (Laramie Formation, Loc. 3); UCM 36398 humeral shaft, femoral shaft, rib fragments (Denver Formation, Loc. 22); UCM 42328 teeth (Laramie Formation, Loc. 1); UCM 43699 braincase (Laramie Formation, Loc. 2); UCM 47634 dentary fragment (Denver Formation, Loc. 27); UCM 47635 tooth (Denver Formation, Loc. 27); USNM 2410 nasal horn core (holotype of *Triceratops galeus*; Arapahoe Formation, Loc. 11); USNM 4739 pair of frontals and horn cores (holotype of "*Bison*" *alticornis*) Denver Formation, Loc. 29); and USNM uncataloged (Arapahoe Formation, Locs. 21, 22).

Description and discussion.—The bulk of the ceratopsian remains from the Denver Basin cannot be identified below family level. Most of the specimens indicate large, hence adult individuals. For example, the nearly complete dentary, DMNH 34391, is 52 cm in length and has 24 alveoli. A fragment of the predentary is present and is slightly curved, measuring 9.5 cm in length.

The material Cope (1874a) named *Polyonax mortuaris* from the eastern part of the Denver Basin is

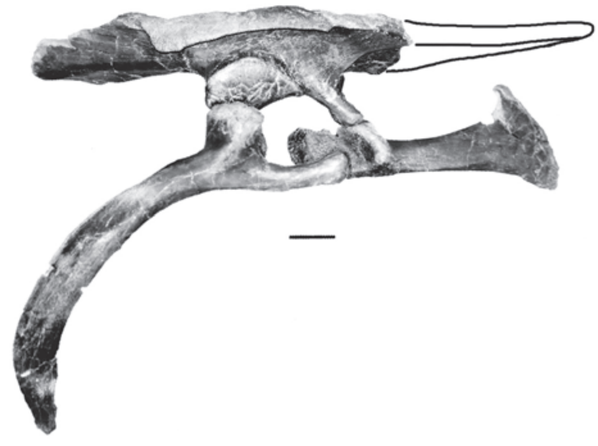


Figure 17. Restored pelvis of the ceratopsian shown in Figure 8 in right lateral view (pubis reversed). Scale bar = 10 cm.

badly abraded and fragmented. In his review of the ceratopsians, Hatcher (1907) concluded that none of the material can be assigned to any of the known ceratopsian taxa, a point with which we concur. Marsh (1888) tentatively referred some bones from Colorado, which Lull (1907) identified as from the Arapahoe Formation as belonging to *Ceratops montanus* (these are uncataloged USNM specimens). Lull (1907) noted that the referral is improbable because of the vast age difference between the Judith River and the Arapahoe Formations. He further noted that the material is too fragmentary for positive identification.

Two holotypes of Marsh are also among the indeterminate ceratopsians. Marsh (1889) named *Triceratops galeus* for a nasal horn core collected from the Arapahoe Formation (Loc. 13). Hatcher (1907) noted that the specimen closely resembles that of the *Torosaurus*, but Lull (1933) noted that it also resembles that of a *Triceratops* skull, AMNH 5116 (compare Hatcher, 1907, fig. 111 with Forster, 1996, fig. 4*A*). He therefore considered *T. galeus* a nomen dubium, a point with which we concur. Another holotype is the famous pair of brow horn cores originally named by Marsh as *Bison alticornis*, but later referred by him (Marsh, 1889) to *Ceratops alticornis*. More recently, the specimen has been referred to *Triceratops* (Hatcher, 1907; Lull, 1907; Lull, 1933; Ostrom and Welnhofer, 1986), although Forster (1996) noted that the horns cannot be assigned to *Triceratops* with certainty, a conclusion independently reached here. The horns most certainly could belong to *Diceratops* or *Torosaurus* as readily as to *Triceratops*.

A partial ceratopsian skeleton was collected from the flanks of South Table Mountain (Fig. 8) by the Colorado School of Mines. The specimen has since been transferred to the University of Colorado Museum. The specimen includes pelvic material, which allows a composite restoration to be made (Fig. 17). The pelvis is rather small compared to those in the Smithsonian collections from the Lance Formation.

Ceratopsipes goldenensis

Figure 12

Material.—CU-MWC 220.1 pes track (Laramie Formation, Loc. 10); CU-MWC 220.2 pes track (Laramie Formation, Loc. 10); CU-MWC 220.3 manus track (Laramie Formation, Loc. 10); CU-MWC 220.5 manus track (Laramie Formation, Loc. 10); CU-MWC 220.6 pes (Laramie Formation, Loc. 10); and footprints (Laramie Formation, Loc. 10).

Lockley and Hunt (1995) identified quadrupedal tracks from the lower part of the Laramie Formation as ceratopsian (genus unknown), an identification that seems reasonable because the tracks appear to be too large for ankylosaurs (Fig. 12).

Family NODOSAURIDAE
cf. *Edmontonia* sp.

Figure 18

Material.—DMNH 25915 scute (Denver Formation, Loc. 20); DMNH 39036 scute (Denver Formation, Loc. 18); DMNH 44389 tooth (Denver Formation, Loc. 20); and UCM 7572 partial basicranium (Laramie Formation, Loc. 2).

Description and discussion.—The basicranium was found by the Colorado Geological Survey, although the collecting date is not known. It was briefly described and illustrated by Carpenter and Breithaupt (1986) as one of the few specimens of Maastrichtian nodosaurids. The specimen has the characteristic crescentic occipital condyle, which projects posteroventrally from a moderately long neck (Fig. 18). The main body of the basicranium includes the basioccipital and a portion of the basisphenoid. The floor of the braincase is preserved, but it lacks any meaningful detail about the various cranial foramina.

Both the scute and tooth more closely resemble those of the nodosaurid genus *Edmontonia* than those in the contemporary *Ankylosaurus*.

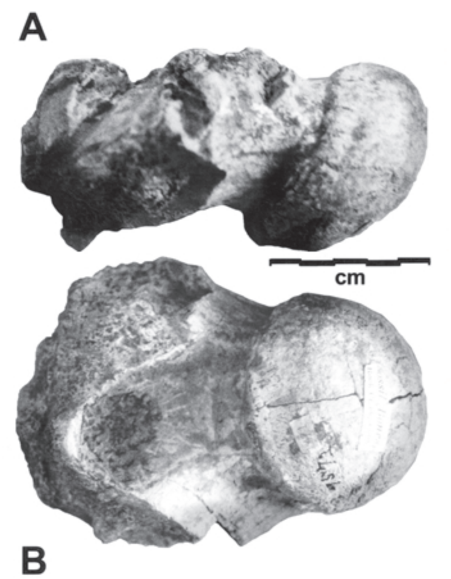


Figure 18. Basicranium of *Edmontonia* sp. (UCM 7572) in left lateral (***A***) and ventral (***B***)views, from Laramie Formation.

DISCUSSION

Since the discovery of dinosaur remains in the Denver Basin in 1867, a large collection of specimens has been made. Unfortunately, most of these are fragmentary, making identification difficult. Only three partial skeletons are known, *Tyrannosaurus rex*, *Triceratops horridus,* and *Torosaurus* sp. Cross (1888) and Cannon (1888) implied that exposures of Upper Cretaceous nonmarine strata were extensive in the western part of the Denver Basin during the late 1800s, but they have since grown over. Although abundant bone was found, no articulated or semiarticulated specimens were found. This suggests a considerable passage of time between death and burial of the specimens. Indeed, the widely scattered condition of the *Tyrannosaurus* skeleton supports this view. Semiarticulated specimens have been found only in the delta plain environment of the Laramie Formation at Locality 9 and in the more distal part of the basin at Locality 4.

Numerically, ceratopsian material is the most abundant dinosaurian fossil found, suggesting that they dominated the Maastrichtian dinosaur fauna of the Denver Basin. This interpretation is supported by the numerical superiority of ceratopsian footprints over those of other dinosaurs reported by Lockley and Hunt (1995). As Lehman (1987, 2001) has noted, the dinosaurs of the Denver Basin are the southernmost part of the *Triceratops*-dominated Maastrichtian or Lancian fauna.

In addition, not all of the dinosaurs within the Denver Basin are evenly distributed among the formations (Table 1), suggesting some ecological segregation of the dinosaurs under different environmental settings. The Laramie Formation has been interpreted as originating on a complex of delta plain, interspersed swamps, and a broad coastal plain of low fluvial energy (Weimer, 1978). *Torosaurus* and *Thescelosaurus* are apparently restricted to the Laramie, hence probably had a preference for the low coastal environment. The conglomeratic Arapahoe Formation thins and grades eastward, marking a major pulse of Rocky Mountain tectonism. This more upland environment has yielded a low diversity fauna. Although the number of specimens recovered from the Arapahoe is low, it is dominated by ceratopsians, probably *Triceratops* and/or *Diceratops*. The Denver Formation also thins and grades towards the east, but in the Denver metropolitan area it is coarse, suggesting that parts of it may represent an intermediate setting between the upland environment of the Arapahoe Formation and the coastal environment of the Laramie and distal Denver Formations. *Ornithomimus* and possibly *Pachycephalosaurus* are restricted to this better drained environment of the Denver Formation. This lateral environmental-ecological gradient and associated dinosaur faunas are interpretively illustrated in Figure 19.

CONCLUSIONS

Over a hundred years of collecting dinosaurs in Upper Cretaceous strata of the Denver Basin has revealed a diverse dinosaur fauna that is most similar to that of the Lance and Hell Creek Formations in Wyoming, Montana, and South Dakota. The numerical dominance of ceratopsians indicates that the Denver Basin dinosaurs are the southernmost extension of the *Triceratops* fauna of the northern Western Interior. The stratigraphic distribution of the taxa indicates that the Denver Basin fauna is not homogenous, but apparently reflects an ecological gradient from uplands to the west to low coastal plain to the east. Further work is needed, however, to test this hypothesis.

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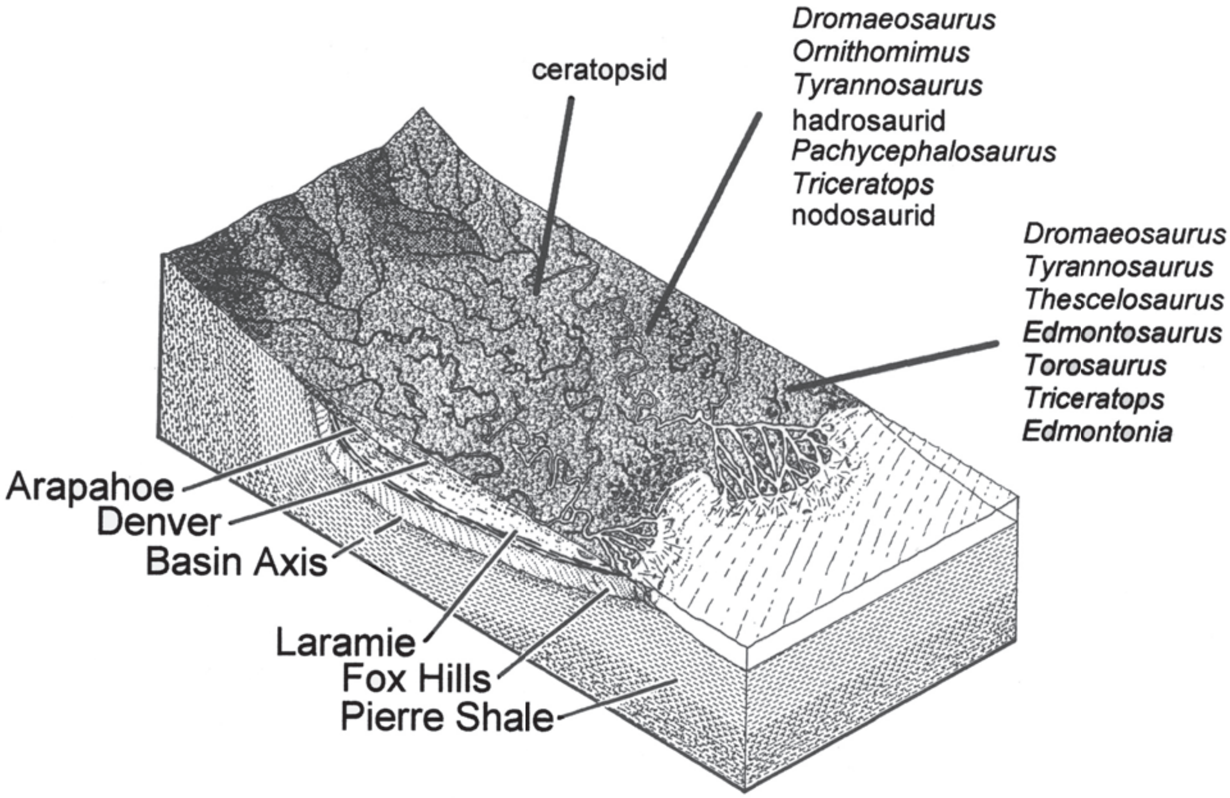

Figure 19. Oblique, schematic restoration of western part of Denver Basin during late Maastrichtian. Laramie Formation is inferred to be a distal lowland (coastal, delta plain, swamp); Denver Formation as distal upland/proximal lowland; and Arapahoe Formation as proximal upland relative to mountain front. Distribution of dinosaurs as controlled by environment is inferred based on locations in formations.

Mary Ann Turner (Peabody Museum of Natural History); and Peter Robinson and Paul Murphey (University of Colorado Museum). Microfilms of the Marsh Correspondences were made available by the Texas Tech University Library. Finally, review comments by Tom Lehman (Texas Tech University) and Dale Russell (University of North Carolina) are appreciated.

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Appendix 1 (continued on next page). Localities containing dinosaurian fossils in Denver Basin, Colorado. Strata in reverse stratigraphic order. See Figure 1 for plot of localities. Precise locality information on file at University of Colorado Museum, Denver Museum of Nature & Science, Yale Peabody Museum, and National Museum of Natural History. Some sites are no longer accessible due to construction. Some sites were recorded but specimens were too scrappy for collection; these are added for completeness. Locality numbers given where available (many sites have no number).

Strata and Locality Name	Locality Number	Taxa
Laramie Formation		
1. Natural Fort	UCM 78193	dromaeosaurid gen. and sp. indet.
		hadrosaurid gen. and sp. indet.
2. Owl Creek	UCM 80013	*Edmontosaurus* sp.
		hadrosaurid gen. and sp. indet.
		ceratopsid gen. and sp. indet.
3. Pawnee		ceratopsid gen. and sp. indet.
4. Briggsdale	UCM 77062 &	*Dromaeosaurus* sp.
	UCM 82029	*Tyrannosaurus* cf. *T. rex*
		Thescelosaurus cf. *T. neglectus*
		hadrosaurid gen. and sp. indet.
		Triceratops horridus
5. East Bijou Creek		hadrosaurid gen. and sp. indet.
		ceratopsid gen. and sp. indet.
6. Hamilton Farm	UCM 81062	hadrosaurid gen. and sp. indet.
7. Hunter-Douglas		ceratopsid gen. and sp. indet.
8. Marshall	DMNH 871	dinosaur gen. and sp. indet. (tracks)
9. Leyden Gulch	DMNH 1282	theropod gen. and sp. indet.
		Torosaurus cf. *T. gladius*
		hadrosaurid (tracks)
10. School of Mines		theropod gen. and sp. indet. (tracks)
		hadrosaurid gen. and sp. indet. (tracks)
		Ceratopsipes goldenensis (tracks)
Arapahoe Formation?		
11. Hoff-Schroeder	DMNH 1087	ceratopsid gen. and sp. indet.
12. Brighton		ceratopsid gen. and sp. indet.
13. Henderson		*Torosaurus*? sp. (*"Triceratops galeus"* holotype)
Denver Formation		
14. Plains Conservation		hadrosaur gen. and sp. indet.
15. Deer Trail		*Ornithomimus* cf. *O. velox*
16. Ellicott UCM 83096		ceratopsid gen. and sp. indet.
17. Jimmy Camp Creek	UCM 79013	ceratospid gen. and sp. indet.
18. Westmoor Golf Course	DMNH 2366-	ceratopsid gen. and sp. indet.
	DMNH 2371	
19. Bowling	DMNH 1738	*Ornithomimus* cf. *O. velox*
		ceratopsid gen. and sp. indet.
20. Oak Place	DMNH 1513	dromaeosaurid gen. and sp. indet.
		Tyrannosaurus cf. *T. rex*
		hadrosaurid gen. and sp. indet.
		Pachycephalosaurus sp.
		ceratopsid gen. and sp. indet.
		Edmontonia sp.
		ankylosaur gen. and sp. indet.

Appendix 1 (continued from previous page).

Strata and Locality Name	Locality Number	Taxa
21. Promontory Pointe	DMNH 1927	dromaeosaurid gen. and sp. indet.
		Tyrannosaurus cf. *T. rex*
		hadrosaurid gen. and sp. indet.
		ceratopsid gen. and sp. indet.
22. Standley Lake		*Tyrannosaurus* cf. *T. rex*
		ceratopsid gen. and sp. indet.
23. High Pointe Village		ceratopsid gen. and sp. indet.
24. Huron		ceratopsid gen. and sp. indet.
25. North Hills		ceratopsid gen. and sp. indet
26. Little Dry Creek		dromaeosaurid gen. and sp. indet.
		tyrannosaurid gen. and sp. indet.
		Triceratops sp. (*"T. alticornis"*holotype)
27. Berkeley Bluffs	UCM 82031	dromaeosaurid? gen. and sp. indet.
		Ornithomimus cf. *O. velox*
		ceratopsid gen. and sp. indet.
		Edmontonia? sp.
28. Coors Field	DMNH 892	dinosaur gen. and sp. indet.
29. Confluence (former town of Highland)		*Triceratops* sp. = *T. alticornis* (holotype)
30. North Table Mtn.		dromaeosaurid gen. and sp. indet.
		ceratopsid gen. and sp. indet.
31. South Table Mtn.		dinosaur gen. and sp. indet.
		theropod gen. and sp. indet.
32. Green Mtn.		ceratopsid gen. and sp. indet.
33. Kountze Lake		ceratopsid gen. and sp. indet.
34. Mt. Carbon		ceratopsid gen. and sp. indet.
35. Bear Creek		*Ornithomimus velox* holotype
36. Littleton	DMNH 612	*Tyrannosaurus rex*
37. Sante Fe	UCM 77284	theropod gen. and sp. indet.
		hadrosaurid gen. and sp. indet.