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VERTEBRATE BIOSTRATIGRAPHY OF THE MORRISON FORMATION NEAR CAÑON CITY, COLORADO

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The stratigraphic distribution of vertebrates in Morrison Formation was examined in the Garden Park Paleontological Resource Area, near Cañon City, Colorado. Tentatively, two biozones are recognized and named for the sauropods *Haplocanthosaurus* and *Camarasaurus*, the two most easily recognized taxon in the biozones. The lower *Haplocanthosaurus* biozone is characterized by amioid and ceratodontiform fishes, the turtle *Dinochelys*, the crocodilomorph *Eutretauranosuchus*, the dinosaur *Haplocanthosaurus*, and the mammal *Docodon*. The upper *Camarasaurus* biozone is characterized by the crocodilomorph *Hallopus* and the dinosaur *Camarasaurus*. The turtle *Glyptops* and the crocodilomorph *Goniopholis* are abundant in both biozones.

The two biozones roughly correlate to lithology and sediment color, and are thus easily recognizable in the field. This correlation suggests some paleoenvironmental control. At present the two biozones are restricted to the Garden Park Paleontological Resource area.

Keywords: Vertebrates; Stratigraphy; Biozones

INTRODUCTION

One hundred and seventeen years of collecting vertebrates in the Morrison Formation of Garden Park, north of Cañon City, Colorado (Fig. 1), has produced specimens throughout the unit (Fig. 2; see Monaco, this volume). The most recent work by the Denver Museum of Natural History began in 1990 in association with the Bureau of Land Management (BLM) and the Garden Park Paleontological Society (GPPS). The purpose of this multi-partner arrangement was to assess the paleontological resources on

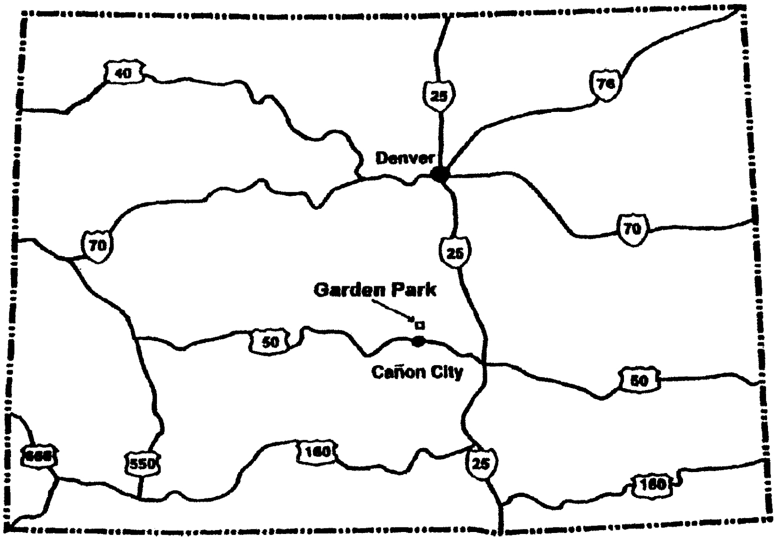

FIGURE 1 Location of Garden Park, Colorado.

BLM lands in the Garden Park area. This information will be used by the GPPS to build a visitor center within Garden Park.

Old sites in Garden Park were relocated using unpublished letters, notes, photographs, and accession records. The letters include those of David Baldwin, Frederick Brown, Marshall P. Felch, Oramel W. Lucas, Benjamin Mudge, and Samuel Williston to Othneil Charles Marsh (Yale Peabody Museum archives), William H. Utterback to John B. Hatcher (Carnegie Museum of Natural History archives), and Dall Deweese and Frank Kessler to Alfred Bailey (Denver Museum of Natural History archives). An unpublished journal of J.W. Lambuth provided some information about specimen he collected and sent to O.C. Marsh and E.D. Cope from sites in the Temple Canyon area west of Cañon City. Also used were the field notes of Edward Drinker Cope (American Museum of Natural History archives), the accession records at the Yale Peabody Museum, and the photographic collection at the Denver Museum of Natural History.

STRATIGRAPHIC SETTING OF GARDEN PARK

The sedimentology and stratigraphy of the Garden Park Paleontological Resource (GPPA) area is presented in detail elsewhere (Lindsey and

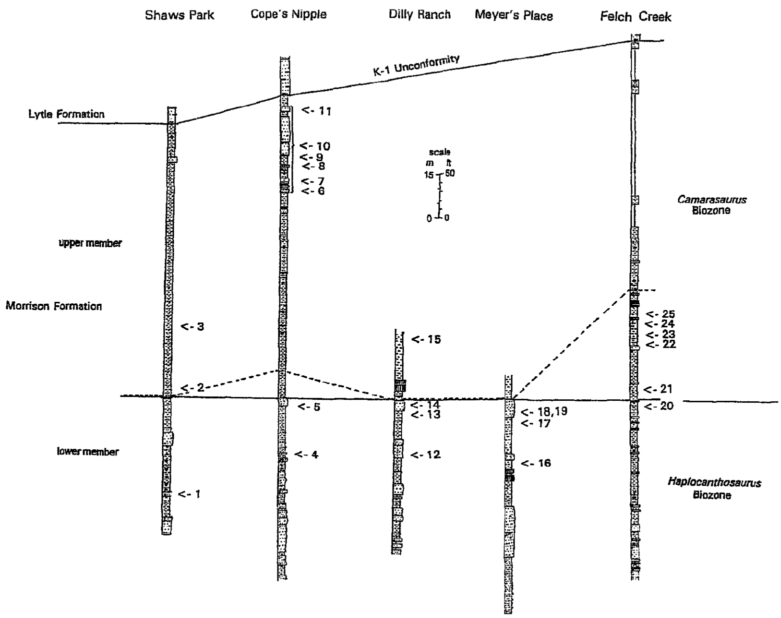

FIGURE 2 Stratigraphic distribution of vertebrate localities in the Garden Park area. Numbers correspond to Fig. 2 and Appendix 1.

Carpenter in preparation). Only a summary is presented here in order to discuss the vertebrate biostratigraphy. The Morrison Formation in the GPPA is bracketed between the J5 and K1 unconformities. The J5 separates the Morrison (including the Ralston Creek Formation) from the underlying Triassic Lykins Formation, and the K1 separates the Morrison from the overlying Upper Cretaceous Lytle Formation of the Dakota Group (Peterson and Turner, this volume).

The Morrison can be informally divided into two members based on color and lithology. The lower member consists predominantly of pastel gray–green, illitic mudstones and off-white to pastel green sandstones. Sandstones makes up 13–41% of the lower member in the measured sections. The upper member consists predominantly of purple to reddish or maroon mudstones that are smectitic in the lower portion, mixed illectic/kaolinite in the upper portion. Tabular sheets of reddish white to yellowish sandstone mostly occur in the upper portion. These sandstones make up about 3–20% of the measured sections.

For convenience, the contact between the lower and upper members is placed at the illite–smectite clay change boundary, which is the lowermost occurrence of smectite in the upper member. This contact is thus easily recognizable in the field. As shown elsewhere (Peterson and Turner, this volume), this smectite is believed to be synchronous in the Colorado Plateau, Front Range and Wyoming. In the GPPA, mass movement is common at this smectite contact, especially along Four Mile Creek.

BIOSTRATIGRAPHY OF VERTEBRATES

The vertebrate localities in the GPPA are presented in Appendix 1. The geographical distribution of these sites is presented in Fig. 2, and their stratigraphic distribution in Fig. 3. With a few exceptions, many of the microvertebrate taxa are reported here for the first time.

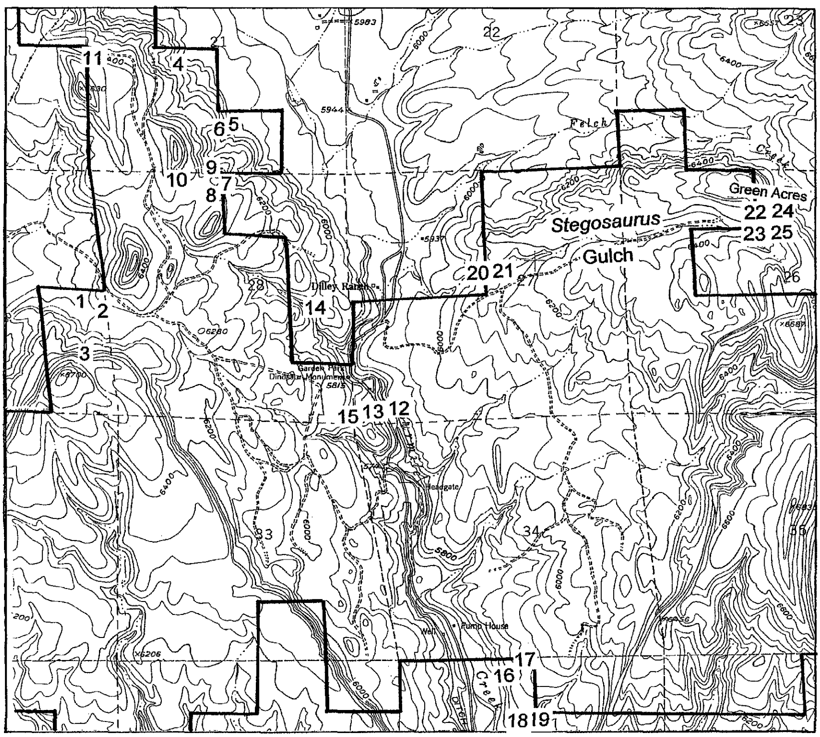

FIGURE 3 Geographical distribution of vertebrate localities in the Garden Park Paleontological Resource Area (delineated by heavy boundary line). Numbers correspond to Fig. 2 and Appendix 1.

Fish

Fishes are rare in the Morrison Formation and are described elsewhere (see Kirkland, this volume). In the GPPA, fish include an unidentified fish known from centra, an unnamed amioid (jaw material), and the lungfish *Ceratodus guntheri* (tooth plates). These fishes are only known from Felch Quarry 1 (loc. 15) and the Small Quarry (loc. 21), and straddle Peterson's clay change boundary.

Amphibians

Amphibians from the Morrison Formation are known from Quarry Nine at Como Bluffs (Hecht and Estes, 1960; Evans and Milner, 1993) and Dinosaur National Monument (see Henrici, this volume). In Garden Park, a fragment of a distal humerus of a frog is known from the Lindsey Quarry (loc. 22) in the lower part of the upper member (Fig. 2).

Non-dinosaurian Reptiles

Turtle shell fragments are some of the most common vertebrate fossils from the Morrison. In Garden Park, as elsewhere in the Morrison, *Glyptops plicatus* shell fragments with their characteristic raised ridges and tubercles are common throughout the formation. Less common is the smooth shell of *Dinochelys whitei* from the Small Quarry (loc. 21) at the base of the upper member (Appendix 1, Fig. 2).

Lizards are known from the Morrison (Prothero and Estes, 1980; Evans and Chure, this volume), but are not common. In Garden Park, a partial maxillary and dentary are known from the Small Quarry (loc. 21) at the base of the upper member (Appendix 1, Fig. 2). The lizard-like sphenodonts are also rare in the Morrison (Fraser and Wu, this volume). In Garden Park, they are known from two sites near the bottom of the upper member (Appendix 1, Fig. 2). One, *Opisthias* (loc. 22) has laterally compressed teeth, while the other, *Eilenodon* (loc. 25) has C-shaped teeth that are set perpendicular to the long axis of the jaw.

Crocodiles are very common in the Morrison, especially their shed teeth. Several genera and species are known (Chure and others, this volume), of which *Eutretauranosuchus delfsi*, *Goniopholis felchi*, and *Goniopholis lucasi* are known from Garden Park (Appendix 1, Fig. 2). *Eutretauranosuchus* is a small, rare crocodile represented by only two specimens from the lower member (locs. 13, 15). *Goniopholis* is much more widely distributed, occurring throughout the Morrison as shed teeth or isolated scutes. Two species, *G. felchi* (from loc. 15) and *G. lucasi* (from loc. 9) have been named from the GPPA on the basis of skulls, but have not been adequately distinguished from each other. The terrestrial crocodilomorph *Hallopus victor* was one of the first vertebrates named by Marsh (1877) from Garden Park. Originally identified as a dinosaur, its true crocodilomorph affinity was not recognized until restudied by Walker (1970). Only a single specimen is known (loc. 7) and for many years its exact stratigraphic position was problematic (Ague and others, 1995).

A single pterosaur, *Kepodactylus grandis*, is known from the Small Quarry (Appendix 1, Fig. 2). It is a very large pterodactyloid with an estimated wing span of 2.5 m (Harris and Carpenter, 1996).

Dinosaurs

Sauropods. Sauropod dinosaurs are especially common in the Morrison Formation and their presence almost characterizes the formation. In Garden Park, sauropods occur throughout the Formation, from about four meters above the base to about three meters below the top (Appendix 1, and Fig. 2). The most common genus in the lower member is the cetiosaurid *Haplocanthosaurus* (Appendix 1). It is most abundant at Felch Quarry 1, where it makes up more than 40% of the sauropod specimens; elsewhere in Garden Park it occurs as solitary individuals. *Haplocanthosaurus* has not been found in the upper member, perhaps showing that it was replaced ecologically by another sauropod, *Camarasaurus*, which does occur there. *Brachiosaurus* is known only from Felch Quarry 1 making it of limited biostratigraphic utility (Appendix 1). *Diplodocus* is also known from Felch Quarry 1, and two other sites in the lower member (Appendix 1, Fig. 2). *Apatosaurus* is present in the Felch Quarry, and in one of Cope's quarries (see McIntosh, this volume), thus it is ranges throughout the Morrison (Appendix 1, Fig. 2). The giant diplodocid *Amphicoelias fragillium* occurs with *Camarasaurus* in the upper Member, whereas *Amphicoelias altus* occurs stratigraphically higher, about 3 m below the top of the Morrison (Appendix 1, Fig. 2).

Camarasaurus is the most abundant sauropod in the upper member (Appendix 1). Two species are present in the GPPA. *Camarasaurus grandis* occurs low in the upper member in an area called Green Acres and the Small Quarry (Fig. 2, Appendix 1, Locs. 21, 22), while *C. supremus* occurs high in the upper member in the vicinity of Cope's Nipple (Fig. 4). *Amphicoelias latus* was named by Cope (1877) for material from the "Oil

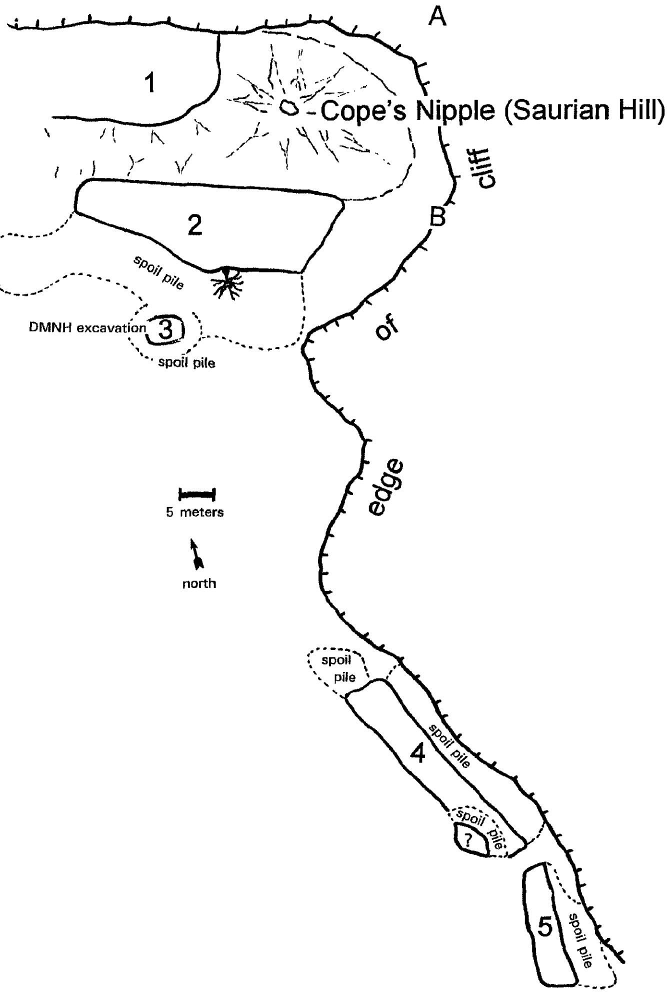

FIGURE 4 Brunton and tape map of the Lucas quarries in the vicinity of Cope's Nipple. 1, Quarry I, *Camarasaurus supremus* (holotype); 2, Quarries II, III, *Camarasaurus supremus* (see photograph in Monaco, this volume), *Morosaurus laticollis*, *Hypsirhophus trihedrodon*, *Hypsirhophus* sp., *Amphicoelias altus*, *Amphicoelias fragillimus*, *Epanterias amplexus*, *Camarasaurus leptodirus*; 3, *Camarasaurus supremus* (Denver Museum of Natural History excavation) (Quarry V of Cope's notes?); 4, Quarries IV and V? (alternative position), 2 femora, 5, Quarries VI and VII, *Amphiceolias* sp., *Camarasaurus supremus*; (A) Oberlin College *Amphicoelias latus*; (B) *Hallopus victor* (holotype). *Nanosaurus agilis* (holotype) apparently came from somewhere on Cope's Nipple based on correspondence of Mudge to Marsh.

tract" (McIntosh, this volume), which is in the vicinity of Locality 19 (see Appendix 1). This places the specimen stratigraphically much lower than *C. supremus* and about the same level as *C. grandis*. Because of this lower occupance Osborn and Mook's (1921) synonymy of *A. latus* with *C. supremus* may not be correct. The caudals are stated to have deeply concave articular faces, which is similar to the condition seen in the *C. grandis* from Green Acres. It therefore seems more likely that the holotype of *A. latus* should be synonomized with *C. grandis*.

Theropods. Carnivorous dinosaurs occur in both the lower and upper members (Appendix 1, Fig. 2). The ceratosaur *Elaphrosaurus* is known from two sites immediately above and below the contact of the lower and upper members (Appendix 1, Fig. 2). If correctly identified, Garden Park is still the only occurrence of this genus outside Africa. The small theropod *Coelurus* is represented by a pair of pubes from Felch Quarry 1, i.e., from near the top of the lower member (Appendix 1, Fig. 2). The holotype is a partial skeleton from Como Bluffs, Wyoming.

Large theropods, especially *Allosaurus*, are better represented by specimens in Garden Park than small theropods. *Allosaurus* ranges from high in the lower member to high in the upper member (Appendix 1, Fig. 2). Most of the skeletal material from Felch Quarry 1 was described by Gilmore (1920), including a nearly complete articulated skeleton (see also Evanoff and Carpenter, this volume). The specimen from the upper member (Appendix 1, Fig. 2) was called *Epanterias amplexus* by Cope (1878), but it is indistinguishable from *Allosaurus*.

Another large theropod from Garden Park is *Ceratosaurus nasicornis* from the Felch Quarry 1 in the lower member (Appendix 1, Fig. 2). This skeleton was described in detail by Gilmore (1920). Elsewhere, *Ceratosaurus* is known from the several areas in western Colorado and eastern Utah (Chure and others, this volume). Recently, the distinctive humerus of *Torvosaurus* cf. *T. tanneri*, was found in the lower member (Appendix 1, Fig. 2). This species was originally described from the Dry Mesa Quarry, and is also known from Dinosaur National Monument (Britt, personal communication) and Como Bluffs (as *Edmarkia rex*, Bakker *et al.*, 1992).

Bipedal ornithischians. The holotype of *Nanosaurus agilis* (considered nomina dubia by Sues and Norman, 1990) was reported by Benjamin Mudge (letter to O.C. Marsh, August 15, 1877) as coming "from the sandstone about ten feet above the big saurian [i.e., *Camarasaurus supremus*] he [Oramel Lucas] is now taking out..." This places the type locality high in the upper member of the Morrison Formation at the Nipple. It is remarkable that so primitive an ornithischian should be found so high in the Morrison. At present no other material referable to *N. agilis* has been found.

Ornithopods are also present in Garden Park, but are not common. *Dryosaurus altus* is known from Felch Quarry 1 and from the Small Quarry. Both occurrences are immediately above and below the contact of the lower–upper members (Fig. 2). The eggshell *Prismatoolithus*, may be those of *Dryosaurus* because their occurrence with embryonic *Dryosaurus* bones at the Uravan Locality (Hirsch, 1994; however, see Bray and Hirsch, this volume). Whole *Prismatoolithus* eggs and eggshells occur at four localities in Garden Park. Two localities are high in the lower member and the other two low in the upper member (Appendix 1, Fig. 2). Embryonic bones have been found at Egg Gulch, one of the lower localities.

Another ornithopod, *Othneilia*, is known from the Felch Quarry 1, the Valley of Death (badlands below Cope's Nipple) and the Small Quarry, all immediately above and below the contact of the lower–upper members and very near each other stratigraphically. Finally, the large ornithopod *Camptosaurus* is present at one of Cope's Quarries and was named by him *Brachyrophus altarkansanus* (Appendix 1, Fig. 2). *Camptosaurus* also may be present at the Felch Quarry, although positive identification must await a restudy of the material.

Armored dinosaurs. Armor-plated stegosaurs are well represented in Garden Park. The most important specimens include three skeletons of *Stegosaurus stenops*, all from immediately above and below the contact of the lower and upper members (Appendix 1, Fig. 2; see Carpenter, this volume). A second species, *S. armatus*, is also present high in the lower member at Felch Quarry 1 (Appendix 1, Fig. 2). A stegosaur, *Hypsirhophus discurus*, was named by Cope (1878) for a mid-dorsal (> 47 cm tall, neural spine incomplete), caudal neural spine (31 cm as preserved), rib fragment and two distal caudal centra (AMNH 5731) from high in the upper member near Cope's Nipple (Appendix 1, Figs. 2 and 5). The genus is tentatively accepted as valid pending a more detailed review of *Stegosaurus* currently underway by Cliff Miles and me. The following differences are noted in the dorsal compared with one in *Stegosaurus stenops*: much larger size (about a third larger than the *S. stenops* from Felch Quarry 1), circular fossa between postzygapophyses (vertical groove in *S. stenops*), ridge extending from base of postzygapophyses to neural canal (absent in *S. stenops*, groove in *S. armatus*), and a D-shape horizontal cross-section of the neural arch between the neural canal and zygapophysis (cross-section is square and slightly biconcave on anterior and posterior sides in *S. stenops*) (differences in cross-section first noted by Paul Sereno).

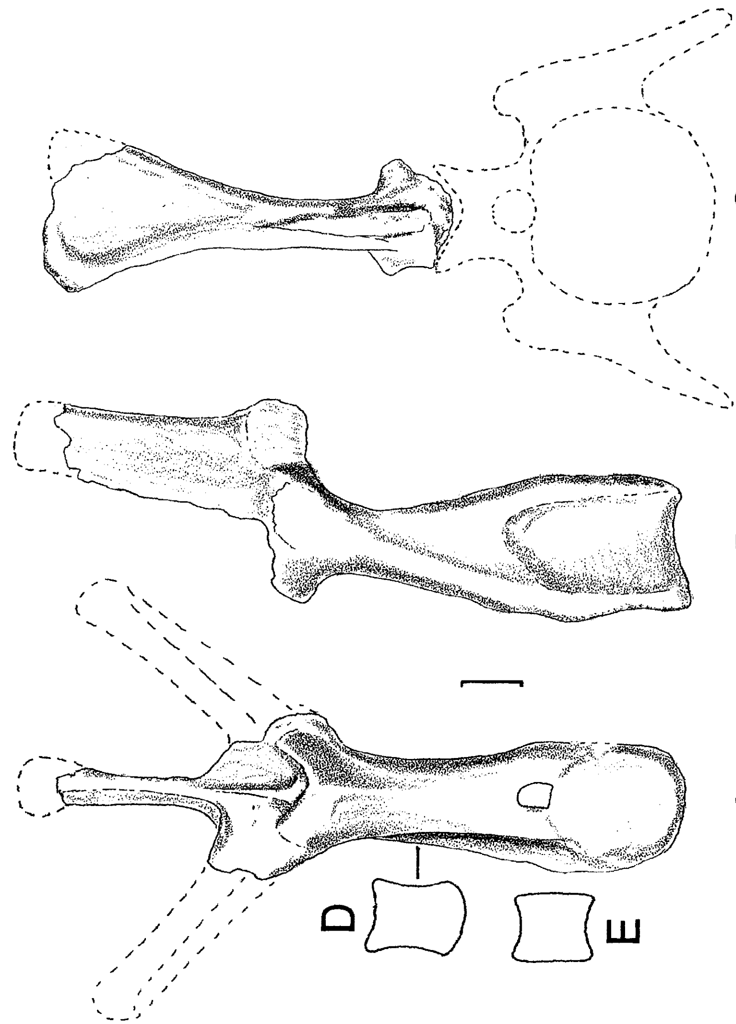

FIGURE 5 Holotype material of *Hypsirhophus discus* (AMNH 5731). Dorsal in anterior (A) and left lateral (B) views. Caudal neural spine in anterior view (C). Cross-section of neural arch at about midway between neural canal and zygapophyses (D), compared with *Stegosaurus stenops* (E); anterior is towards bottom. Note D-shaped cross-section of *Hypsirhophus discus*.

Another armored dinosaur from Garden Park is a nodosaurid ankylosaur (?*Mymoorapelta*) from the Small Quarry in the base of the upper member (Appendix 1, Fig. 2; see Kirkland and others, this volume).

Mammals. Three localities have produced mammalian remains, all in the lower member and lower part of the upper member. The specimens include the holotype *Kepolestes coloradensis* and *Docodon* sp. from Felch Quarry 1, *Docodon* sp. and dryolestid n. g., n. sp. from the Small Quarry, and a multituberculate (now lost) from the Lindsey Quarry (Appendix 1, Fig. 2). As yet no mammals have been found in the upper member of the Morrison.

DISCUSSION

The stratigraphic distribution of vertebrate localities in Garden Park is presented in Fig. 2. Only *Goniopholis*, *Apatosaurus*, *Haplocanthosaurus*, *Camarasaurus*, *Allosaurus*, and *Stegosaurus* are known from both the lower and upper members. However, only *Haplocanthosaurus* and *Camarasaurus* are abundant enough in both the lower and upper members to be useful biostratigraphically. As a result, two sauropod biostratigraphic zones (= Opel Zones) are recognized, a lower *Haplocanthosaurus* biozone, and an upper *Camarasaurus* biozone. Bakker's (1990) assertion that there are four dinosaur zones at Garden Park cannot be substantiated. Furthermore, whether these two biostratigraphic zones can be recognized elsewhere in the Morrison remains to be determined.

The two Zones do not appear to be environmentally controlled because *Camarasaurus* is found in what are interpreted as wet and dry facies. The wet facies is characterized by fluvial sandstones and invertebrate-rich lacustrine limestones, an abundance of aquatic vertebrates (especially turtles and crocodiles) and crawfish burrows. In contrast, the dry facies has much less sandstone, very few lacustrine limestones, and few aquatic vertebrates or trace fossils. This scarcity of aquatic body fossils does not appear to be due to taphonomic loss in an acidic environment because of absence of dissolution features on dinosaur bones or the few turtle bones (see Fiorillo, this volume). In addition, crawfish burrows and other traces of aquatic invertebrates are very rare in the sandstones of the upper member, whereas they are extremely abundant in the lower member (see Hasiotis and Demko, this volume). Because these animal traces would not be destroyed by the acidic conditions, their absence in the upper member is believed to show a real absence of these organisms. Although it is possible that the fluvial waters during deposition of the upper member were too acidic for these creatures, a more probable cause was a drying of the local environment, an interpretation at odds with the presence of kaolinite in the upper member (Lindsey and Carpenter, in preparation).

Correlation of the Morrison Formation with that on the Colorado Plateau by Peterson and Turner (this volume) suggests that most of the lower member of the Morrison in Garden Park is equivalent to the Salt Wash Member on the Colorado Plateau. The abundance of the primitive sauropod *Haplocanthosaurus* in the lower member indirectly supports this interpretation, although it is also known from a few rare specimens from higher in the Morrison in Wyoming (McIntosh, personal communication). If the lower member is equivalent to the Salt Wash, then Felch Quarry 1 is in strata equivalent to the topmost part of the Salt Wash Member, or to the bottom of the Brushy Basin Member because the Peterson-Turner clay change occurs just above the Felch Quarry (Fig. 2, Peterson, personal communication). A radiometric date of 150.3 ± 0.26 reported by Kowallis and others (this volume), which is about the age for the bottom of the Brushy Basin Member, was taken 18–20 m above the level of Felch Quarry 1 near the level of loc. 22 (Fig. 2). That the Felch Quarry is stratigraphically so much lower chronostratigraphically to strata equivalent to bottom of the Brushy Basin Member would suggest that the Felch Quarry lies in Salt Wash equivalent strata.

Another method of correlation is based on the alleged gigantism of the dinosaurs that supposedly marks the top of the Morrison Formation at Garden Park and elsewhere (Bakker, 1990). But gigantism is not restricted to the top of the Morrison even in Garden Park as noted by Felch who reported excavating at Quarry 1 a very large *Allosaurus*, "twice as large" as another skeleton (USNM 4734) he had collected earlier. Indeed, a posterior dorsal illustrated life-size by him is 22 cm wide (Felch letter to Marsh, June 6, 1887), placing it in the size range of the recently named *Saurophaganax*. A similar vertebra of USNM 4734, also from the Felch Quarry, is only 12.7 cm wide. The vertebra and other material, including a femur, ischium, pubis, other vertebrae, and foot bones mentioned by Felch are not listed in Gilmore (1920) and their whereabouts remain unknown. Nevertheless, very large theropods are clearly not restricted to the top-most part of the Morrison. Among sauropods, it is true that the *Camarasaurus* specimens from the Cope quarries are large (maximum femur length 180 cm). This is only 16% longer than the maximum femur length (154.5) known from the stratigraphically lower Dinosaur National Monument (McIntosh, personal communication). Furthermore, Dry Mesa Quarry, which has produced several very large sauropods (i.e., "*Supersaurus*" and "*Ultrasauros*", see Jensen, 1985a,b), occurs well below the top of the Brushy

Basin Member (Peterson, personal communication; Richmond and Morris, this volume). Therefore, statements that gigantism culminates Morrison times are unwarranted and large size cannot be used to correlate quarries in the Morrison.

Finally, contrary to Dodson and others (1980), *Camarasaurus* and *Diplodocus* do occur as solitary individuals. Both are known from single, partial skeletons in the upper member (see Appendix 1) of Garden Park, including all the specimens of *C. supremus* (see McIntosh, this volume).

CONCLUSIONS

The Morrison Formation along Four Mile Creek in Garden Park, Colorado, can be subdivided informally into two members. Most of the body and trace fossils occur in the lower member, including aquatic vertebrates and invertebrates. The rarity and low diversity of aquatic animals in the upper member, suggests that the environment was drier than during deposition of the lower member.

Despite the abundance of vertebrates from the Garden Park area, only two sauropods are abundant enough to have any biostratigraphic significance. These two sauropods form a lower *Haplocanthosaurus* Opel Zone and an upper *Camarasaurus* Opel Zone. These zones are only applicable within Garden Park, because the sauropod *Haplocanthosaurus* is poorly known outside Garden Park where it occurs at stratigraphically higher levels in Wyoming (McIntosh, personal communications). Whether the two Opel zones can be recognized in other areas around Cañon City remains to be determined. Current research about 10 km south, at Temple Canyon, is just now underway. The Morrison in this area cannot be divided into the two informal members used in Garden Park. A large (several square km) lacustrine deposit occurs near the middle of the formation. It is composed of about 50 cm of laminated, kerogen rich micrite and dolomicrite. Plant and fish remains are present, although rare; a large holostean (lower jaw 11 cm long) is represented by three disarticulated skulls. Dinosaur bones from the area were collected in the 1880s–1890s by J.W. Lambuth and sent to Marsh and to Cope (Lambuth, unpublished journal). Only one of the quarries has been relocated, although the where abouts of this material is unknown.

Acknowledgments

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Jack McIntosh was generous with information on sauropods. Fred Peterson, U.S.G.S., graciously provided his stratigraphic columns for Shaws Park, Cope's Nipple, a portion of Dilly Ranch, and Felch Creek sections. Walter Meyer granted access to his land and was generous with his locality information. Finally, most of the land in this study is under the care of the Bureau of Land Management; the work was conducted under BLM permit C-49819(c). This paper is dedicated to all those who assisted in the work in Garden Park, especially the many volunteers from the Denver Museum of Natural History.

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APPENDIX 1.

Taxonomy of the Garden Park area. Numbers correspond to localities shown on Figs. 2 and 3. *denotes holotype.

1. Sauropod
    - Sauropoda
        - *Haplocanthosaurus* sp.
    - Theropoda
        - indeterminant (small)
2. Theropoda
    - footprint
3. Theropoda
    - *Allosaurus* sp.
4. Theropoda
    - footprint
5. Valley of Death
    - Chelonia
        - *Glyptops plicatus*
    - Sauropoda
        - *Diplodocus* sp.
    - theropod footprint
    - Ornithopoda
        - *Othnielia rex*
6. Jennings and Johnson Locality
    - Crocodilia
        - *Hallopus victor* *
7. Cope's Nipple (Saurian Hill)
    - Cope's Quarry 1
        - Sauropoda
            - *Camarasaurus supremus* *
        - Theropod
            - *Laelaps trihedrodon* nomen dubium (= *Allosaurus*?)
    - Cope's Quarry 2
        - Sauropoda
            - *Morosaurus laticollis* * nomen dubium (= *Apatosaurus* sp.)

Cope's Quarry 3
Sauropoda
Amphicoelias altus nomen dubium (= *Camarasaurus supremus*)
Amphicoelias fragillimus *
Camarasaurus leptodirus * nomen dubium (= *Camarasaurus supremus*)
Theropoda
Epanterias amplexus * nomen dubium (= *Allosaurus*?)
Hypsirophus discurus *
Cope's Quarry 4
Ornithopoda
Symphyrophus musculosus * nomen dubium (= *Goniopholis*?)
Cope's Quarry 5
Sauropoda
Camarasaurus sp.
Cope's Quarry 6
Sauropoda
Camarasaurus sp.
Cope's Quarry 7
Sauropoda
Amphicoelias altus
Camarasaurus sp.

8. Lucas's Site
Crocodile
Goniopholis lucasii *
Ornithopoda
Nanosaurus agilis *

9. The Fort
Cope's Quarry 8
Sauropoda
Camarasaurus supremus

10. Localities (exact levels unknown)
Cope's Quarry 9
Sauropoda?
Cope's Quarry 10
Sauropoda?
Cope's Quarry 11
Sauropoda?
Cope's Quarry 13
unidentifiable bone

Cope's Quarry 14
Sauropoda
Amphicoelias latus nomen dubium (= *Camarasaurus supremus*)
11. Cope's Quarry 12
Sauropoda
Amphicoelias altus *
12. Cleveland Museum Quarry
Chelonia
Glyptops plicatus
Crocodilia
Eutretauranosuchus delfsi *
Sauropoda
Haplocanthosaurus delfsi *
13. Egg Gulch
Ornithopoda Eggs
Prismatoolithus coloradensis
Ornithopoda
Dryosaurus? sp.
14. Felch Quarry 1.
Dipnoi
Ceratodus guntheri
Chelonia
Glyptops plicatulus
Crocodilia
Eutretauranosuchus sp.
Goniopholis felchi *
Sauropoda
Apatosaurus sp.
Brachiosaurus sp.
Diplodocus longus *
Haplocanthosaurus priscus *
Haplocanthosaurus utterbacki * nomen dubium (= *H. priscus*)
Theropoda
Allosaurus fragilis *
Ceratosaurus nasicornis *
Coelurus agilis
Elaphrosaurus sp.
Labrosaurus ferox * nomen dubium (= *Allosaurus*?)
Ornithopoda
Dryosaurus altus

Othnielia rex
Stegosauria
Stegosaurus stenops *
Stegosaurus armatus
Felch Quarry 2
Sauropoda
Diplodocus longus
Theropoda
genus indeterminant
Ornithopoda
"*Laosaurus*" sp.
15. Tim's Egg Site
Ornithopoda Eggs
Prismatoolithus coloradensis
16. Meyer Site 1
Crocodilia
Goniopholis sp.
Sauropoda
indeterminant
Theropoda
Allosaurus sp.
Meyer Site 2
Theropoda
Torvosaurus cf. *T. tanneri*
17. Meyer Site 3
Sauropoda
Diplodocus sp.
18. Kenny's *Stegosaurus*
Stegosauria
Stegosaurus cf. *S. stenops*
19. Cope's Quarry 15 (Oil Tract) approximate position
Sauropoda
Amphiceolias latus * (= *Camarasaurus* sp.)
20. Kessler's Quarry
Chelonia
Glyptops plicatus
Crocodilia
Goniopholis sp.
Theropoda
Allosaurus sp.

Ornithopoda
  indeterminant
Stegosauria
  Stegosaurus stenops

21. Small's Quarry
  Osteichthys
    genus indeterminant
  Dipnoi
    Ceratodus guntheri
  Chelonia
    Glyptops plicatus
    Dinochelys? sp.
  Sauria
    genus indeterminant
  Pterosauria
    Kepodactylus grandis *
  Crocodilia
    Goniopholis sp.
  Sauropoda
    Apatosaurus excelsus
  Theropoda
    Elaphrosaurus sp.
    indeterminant
  Ornithopoda
    indeterminant
    Dryosaurus altus
  Stegosauria
    Stegosaurus stenops
  Ankylosauria
    ?*Mymoorepelta* sp.
  Mammalia
    Docodon sp.
    dryolestid n. g., n. sp.

22. Lindsey Quarry (DMNH)
  Amphibia
    Anuran indeterminant
  Sphenodonta
    Opisthias sp.
  Chelonia
    Glyptops plicatus

Sauropoda
Camarasaurus grandis
Theropoda
Allosaurus fragilis
Ornithopoda
indeterminant
Mammalia
multituberculate
23. Deweese Quarry (DMNH)
Sauropoda
Diplodocus longus
24. Greg's Bone
Stegosauria
Stegosaurus sp.
25. Dave's Jaw
Sphenodonta
Eilenodon sp.

Exact levels unknown (Green Acres)
Lucas's site
Sauropoda (possibly one of the taxa listed under Cope below)
Felch's site
Sauropoda

Cope's unknown localities (added for completeness)
turtle
Glyptops plicatulus *
Sauropoda
Caulodon diversidens * nomen dubium (= *Camarasaurus* sp.)
Caulodon leptoganus * nomen dubium (= *Camarasaurus* sp.)
Apatosaurus sp.
Ornithopoda?
Tichosteus lucasanus * nomen dubium (= ornithopod?)
Tichosteus aequifacies * nomen dubium (= *Glyptops*?)
Brachyrophus altarkansanus * nomen dubium (= *Camptosaurus* sp.)
Stegosauria
Hypsirophus seeleyanus * nomen dubium (= *Stegosaurus* sp.)