Paleontological Inventory and Assessment
of the Southeastern Portion of the Royal Gorge
Resource Area, Central Colorado
Bureau of Land Management

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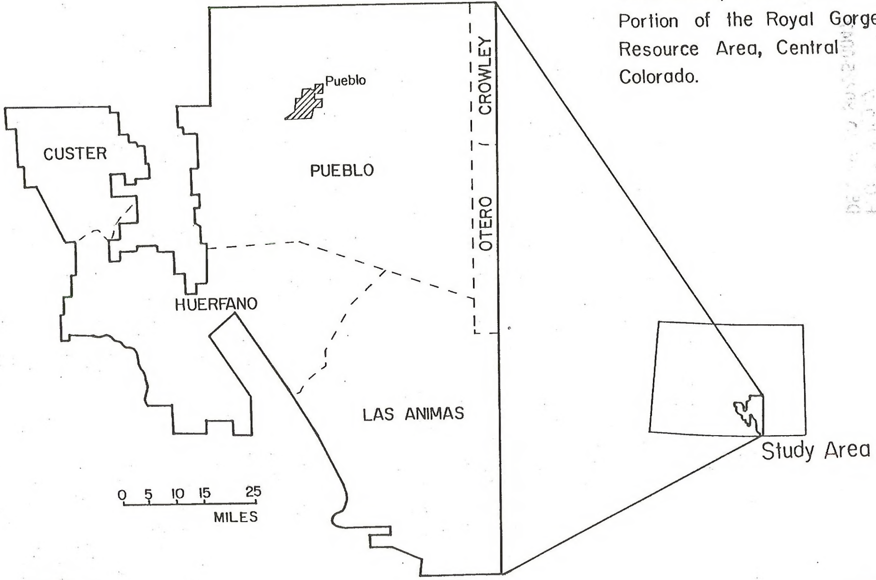

Introduction

This study is the result of Bureau of Land Management contract No. 4112-1173 CO-050-PP2-15, providing for a paleontological inventory and assessment of the southeastern portion of the Canon City Resource Area (see Map of the Study Area). Work was begun on May 6, 1982 and was completed on February 15, 1983. The results of the study are to be used primarily for planning purposes. It is hoped that the information contained within this report will be of use in the recognition, assessment, and mitigation, if necessary, of land use conflicts arising where fossil remains of significant scientific value may be impacted.

Specification for this inventory and assessment call for the classification of all Federal surface and mineral lands within the southeastern Canon City Resource Area into three categories which recognize the scientific value and importance of fossil remains. The classification is as follows:

Class 1-a: Immediate detailed study follow-up is needed. Fossils of scientific interest are exposed on the surface, or are very likely to be discovered with detailed field work in the area. This classification is to be used for site-specific localities having scientifically significant fossils.

Class 1-b: Other areas having a high potential for scientifically significant fossils (Morrison Formation, etc.). In these areas, a paleontological evaluation will be done by the geologist, on a case-by-case basis, prior to any surface-disturbing activities. These evaluations will change this classification to Class 1-a, Class 2, or Class 3, as appropriate.

Class 2: There is evidence of fossilation, but the presence of fossils of scientific value has not been established, and is not anticipated. Detailed study may be desirable in the future for the evaluation of all types of fossil collecting. This classification may be used in identifying recreational values in fossils.

Class 3: Little likelihood of finding fossils of use. No further considerations of fossils necessary unless future discoveries require a change of classification.

Most of the formations in the study area have produced fossils either within the area or elsewhere in the region and vicinity. Empahsis was placed on existing localities and on the likelihood and importance of additional fossil material being discovered in a given formation in the study area. The criteria upon which the classifications were made are rarity of occurrence, amount of study a species or group has undergone, and scientific significance. A high percentage of the fossil-bearing formations are designated as Class 2 and these are shown on the key maps as green. Those areas designated as 1-b are shown in red, and Class 3 designations are shown in brown. There are no 1-a designations. Due to restricted map resolution on small tracts of Bureau of Land Management (BLM) land, when a Class 1 and Class 2 formation are present the entire area is colored Class 1. When Class 2 and Class 2 formations are present in a small area, and if no fossils are known and field observation provided insufficient data, the color is based on the formation with the greatest percentage of area.

Field work was conducted for the purpose of locating existing sites, to determine the extent of exposure of a given formation, and to determine the proximity of Federal mineral lands to formation outcrops. Fossil remains in the study area represent a variety of biotic groups including marine and terrestrial vertebrates and invertebrates, plants, and some trace fossils. In general, the study area is varied lithologically and in the flora and fauna recovered.

References to genera and species listed in the text have been reported as they appeared in the literature. No attempt has been made to revise the taxonomy. The bibliography includes references that were not cited in the text nor specifically pertinent to the study area. These references do, however, suggest what resources may be found in the study area but have not yet been reported.

We would like to acknowledge the assistance of the following people: Kevin Anderson and Roger Underwood of the BLM Office in Canon City, and Kenneth Carpenter, Mary Maas, and Peter Robinson of the University of Colorado Museum in Boulder. While we are grateful for the assistance of these people, we remain entirely responsible for the information and recommendations presented in this report.

Geology

The Southeastern Portion of the Royal Gorge Resource Area includes the southern part of the Wet Mountain Valley, Huerfano Park, and a portion of the southern Great Plains. The Wet Mountain Valley is bounded on the west by the Sangre de Cristo Mountains and on the east by the Wet Mountains.

The Wet Mountains are the eastern-most range of the Rocky Mountains. They are located south of Canon City and trend in a northwest-southeast direction. The mountains are formed of Precambrian granite. The eastern flank is similar to that of the front range except that it contains more faults in the sedimentary layers. At their southern-most extent the mountains plunge into the plains. The western slope of the Wet Mountains is covered by debris from the mountains and Cenozoic lava flows.

The Sangre de Cristo Mountains extend 150 miles from Salida to New Mexico. The central portion of the eastern slope is composed predominantly of late Paleozoic rocks. These are folded and faulted but are not metamorphosed. The rocks are mostly continental but some marine sediments are also present (Tischler, 1963). Sandstones, shales, and conglomerates are present, and some layers are fossiliferous. The northern end of the Sangre de Cristos consists of Precambrian igneous and metamorphosed rocks. South of La Veta, past the Spanish Peaks, are the peaks of the Culebra Range. The Spanish Peaks themselves are the center of a large system of radiating dikes. These igneous intrusives were part of Cenozoic volcanic activity, and the dikes are very thick in the Minturn area.

Huerfano Basin consists of sediments which were deposited rapidly from the Upper Cretaceous through the Oligocene. However, late Cretaceous and earliest Tertiary sediments are missing, and deposition was discontinuous from the late Eocene into the Oligocene. The marine sediments of the Great Plains were primarily deposited by the Cretaceous Sea, followed by latest Tertiary terrestrial deposits.

List of Formations

Quaternary	Alluvium
Tertiary	Devil's Hole Formation Farisita Formation Huerfano Formation Cuchara Formation Poison Canyon Foramtion
Upper Cretaceous	Raton Formation Vermejo Formation Trinidad Formation Pierre Shale Niobrara Formation Carlile Shale Greenhorn Limestone Graneros Shale
Lower Cretaceous	Dakota Sandstone Purgatoire Formation
Jurassic	Morrison Formation Ralston Creek Formation Entrada Sandstone
Pennsylvanian-Permian	Minturn Formation Kerber Formation Sharpsdale Formation Fountain Formation Sangre de Cristo Formation
Permian-Triassic	Lykins Formation
Devonian-Mississippian	Williams Canyon Limestone Hardscrabble Limestone Beulah Limestone
Ordovician	Fremont Limestone Harding Sandstone

Ordovician

Harding Sandstone (Middle Ordovician)

The Harding Sandstone consists of a basal thin-bedded conglomerate a middle shale, and an upper thin-bedded to massive sandstone with red siltstone or shaly siltstone (Sweet, 1961). It rests on Precambrian rocks in the study area, and reaches a maximum depth of 186 feet. The only outcrop of Harding Sandstone in the area is near Beulah.

There are two localities in the study area (see Appendix I). They have produced mainly conodonts and invertebrates (Sweet, 1954 and 1955). In general, however, the Harding megafauna is dominated by molluscs. The sediments also contain possible sponges, trilobites, and brachiopods all of which are not very well preserved. The conodonts are well preserved, varied, and are useful in correlation. The only vertebrates found are the primitive fish Astaspis, Eriptychius, and Dictyorhabis (Johnson, 1934; Sweet, 1961 - see Table 1). Based on the common invertebrate fauna, its poor preservation, and on the usefulness of the conodonts in correlation, this formation is designated as Class 2.

Fremont Limestone (Middle and Upper Ordovidian)

The Fremont Limestone is a pink to tan buff, crystalline grandular dolomite which weathers to pits and cusps. The formation outcrops near Beulah where it is 10 to 20 feet in depth. It thins to the south.

There is one known locality in the study area (Appendix I). Inforamtion as to what species have been produced by this site is

Table 1: Species of the Harding Formation.

Porifera?
- *Cictyorhabdus priscus*

Brachiopoda
- *Lingula attenuata*
- *Lingula huronensis*
- *Lingula (Glossina) hurlbuti*

Gastropoda
- *Ecculiomphalus contiguus*
- *Liospira* sp.

Pelecypoda
- *Ctenodonta* spp.
- *Cyrtodonta* sp.
- *Modiolopsis* sp.
- *Othodesma* sp.
- *Vanuxemia rotundata*

Cephalopoda
- *Kionoceras* sp.
- *Ormoceras pollacki*
- *Ormoceras*? sp.

Nautiloidea
- *Orthoceras multicameratum*
- *Utoceras* cf. *U. gleneyriense*

Trilobita
- *Isalaux canonensis*
- *Tornquistia* sp.

Vertebrata
- *Astraspis desiderata*
- *Eriptychius americanus*

Conodonta
- *Amorphognathus lingualis*
- *A. ramosa*
- *Chirognathus admiranda*
- *C. Aequidentata*
- *C. alternata*
- *C. cultidactyla*
- *C. deformis*
- *C. delicatula*
- *C. dubia*

Table 1 continued.

C. duodactyla
C. eucharis
C. gradata
C. idonea
C. maniformis
C. monodactyla
C. multidens
C. parallela
C. plana
C. tenuidentata
C. unguliformis
C. vulgaris
C. spp. undet.
Coleodus delicatus
C. simplex
Cordylodus concinnus
C. plattinensis
C. sp.
Curtognathus calcyculoides
C. limitaris
Cyrtoniodus complicatus
Dichognathus brevis
Erismodus abbreviatus
E. radicans
E. simplex
E. typus
Lonchodus spinuliferus
Microcoelodus asymmetricus
M. expansus
M. magnicornis
M. simplex
M. unicornis?
Mixoconus primus
Neocoleodus breviconus
Oistodus curvatus
Ozarkodina concinna
O. pauperata
O? sp.
Paltodus sp.
Phragmodus primus
Polycaulodus bidentatus
P. cornulatus
P. peculiaris
P. reversus
P. tridentatus
Prionognathus ordovicicia

Table 1 continued.

Ptiloconus compressus
P. gracilis
P. tortus
Scolopodus brevis
Scyphiodus sp.
Steroconus gracilis
S. plenus
S. robustus
Subcordylodus rectileatus
S. sinuatus
Trichonodella deformis
T. pumila
T. recurva

not available. The Fremont Formation in Colorado, however, has produced brachiopods, sponges, eichinoderms, gastropods, cephalopods, trilobites, and corals (Brainerd, Baldwin, and Keyte, 1933; Johnson, 1934; Sweet, 1955 and 1961 - Table 2). The formation is designated as Class 2.

Table 2: Species from the Fremont Formation.

Cephalopoda
- Actinoceras sp.
- Beloitoceras accultum
- B. sp.
- Cyclendoceras cylindricum
- Cyrtoceras sp.
- Endoceras SP.
- Ephippiorthoceras formosum
- E. sp.
- Gomphoceras sp.
- Kionoceras sp.
- Lambaeoceras sp.
- Lituites sp.
- Neumatoceras sp.
- Ormoceras sp.
- Orthoceras formosum
- Problillingsties bessleri
- Spyroceras sp.

Corals
- Calapoecia sp.
- Halysites catenulatus
- H. gracilis
- H. sp.
- Paleofavosites sp.
- Paleophyllum thomi
- Saffordophyllum franklini
- Streptelasma cf. S. rusticum
- S. sp.
- Zaphrentis sp.

Nautiloidea
- Allumettoceras sp.
- Charactoceras canyonense
- Cyrtogomophoceras contractum
- Diestoceras occidentale
- D. walcotti
- Fayettoceras? canyonense
- Fremontoceras loperi
- Nanno walcotti
- Neumatoceras? sp.
- Richardsonoceras?subcuneatum

Table 2 continued.

Brachiopoda

Hebertella sinuata
Lepidocyclus capax
L. sp.
Palesiomys bellilamellosus
Plaesiomys proavita
Rhychotrem (Lepidocyclus?) argenturbicum
R. capax
Sinorthis subquadrata
Strophomena spp.
Zygospira modesta?

Gastropoda

Bucannella sp.
Helicotoma sp.
Lophospira perforata
Trochonema umbilicatum

Porifera

Recptaculites cf. *R. arcticus*
R. owenii

Pelycopoda

Modiolopsis sp.

Trilobita

Ceraurinus icarus

Devonian-Mississippian

Beulah Limestone (Mississippian)

The Beulah Limestone is a predominantly pink to red stained or white to buff finely oolitic limestone. It contains concentrations of reddish-yellow dense chert and pyrite in its upper-most layers. It also contains traces of red sandy chert. The Beulah Limestone overlies the Hardscrabble Limestone. The type section outcrops as the upper ledge in cliffs north and west of Beulah (Appendix I), and reaches a thickness of 53 feet. The cross-stratified, sandy, crinoidal, oolitic, lime grainstones , and quartz and feldspar sand grains suggest a nearshore, high-energy deposit.

The fossils from the Beulah Limestone are limited. They include several invertebrate species such as the brachiopod *Koninckopora minuta*, *Eoendothyranopsis pressa* and *Calcisphera laevis*, forams, and the algae *Aocygalia* (Ramirez, 1974). The Beulah is designated Class 2 as more study is needed in this formation.

Hardscrabble Limestone (Middle Mississippian)

The Hardscrabble Limestone is a light buff to dark brown finely crystalline to dense limestone. Lower layers contain pink-gray-white dolomite and dolomite limestone. Tan to brown chert is present locally. Upper layers are a dense red-orange chert with medium-sized oolites. At Beulah and Hardscrabble Creek the base is marked by a thin bed of conglomeratic limestone, 40 to 124 feet thick. The type locality is exposed in Custer County (S½ Sec. 11, T.22S., R.69W.). The Hardscrabble rests unconformably on the Williams Canyon Limestone.

Fossils present in the Hardscrabble are limited and include crinoids, brachiopods, ostracodes, foraminifera, and calcispheres (Ramirez, 1974). Spirifers are also present and common. The formation is designated Class 2 as it needs more study.

Williams Canyon Limestone (Upper Devonian to Lower Mississippian)

The Williams Canyon Limestone is a pink to red stained, white to buff fine oolitic limestone. Upper layers contain red to yellowish dense chert and pyrite with traces of red sandy chert. It forms a continuous upper ledge in cliffs north and west of Beulah. The formation is approximately 53 feet thick.

Fossils have been reported from the Williams Canyon but they are limited to scarce. Ramirez (1974) suggested that this scarcity or lack of fossils is one of the characteristics of a supratidal environment. As with the other formations of this group, the Williams Canyon is designated Class 2 as it requires more study.

Permian-Triassic

Lykins Formation (Permian and Triassic)

The Lykins Formation is a red, thin-bedded siltstone and sandy shale with some dolomite, limestone, and gypsum. It reaches a maximum thickness of about 180 feet near Colorado Springs. The Lykins is restricted in its outcrop and the only exposures in the study area occur in Fort Carson.

Fossils are rare. A fish has been reported from near Canon City and the lower Lykins contains Permian invertebrates, particularly brachiopods. The formation is designated as Class 2.

Pennsylvanian-Permian

Sangre de Cristo Formation (Pennsylvanian-Permian)

The Sangre de Cristo Formation is a thick sequence of red arkosic sandstones and conglomerates interbedded with siltstone, shales, and thin limestones. Within the study area, conglomerates contain fragments from 2½ to 3 inches in diameter. Further north, the conglomerate material increases in diameter. The Sangre de Cristo unconformably overlies the Minturn Formation, and it reaches a thickness of 9,000 feet.

No fossils are known from the study area. Out of the study area, however, the Sangre de Cristo produces brachiopods, fish, amphibians, reptiles, and some floral specimens (Vaughn, 1972; White, 1912 - Table 3). This formation is designated as Class 2. It is important as it provides us with the first knowledge of late Pennsylvanian North American tetrapods west of eastern Kansas (Vaughn, 1972).

Fountain Formation - Pennsylvanian-Permian)

The only outcrop of the Fountain Formation in the study area is near Beulah. It overlies the Beulah Limestone and is generally a thin to thick irregularly bedded coarse-grained arkose and conglomerate. Red and maroon are the predominant colors of the sediments. There are local thin beds of shale, limestone, and dolomite. The sediments are considered to be coalescing alluvial fans from the ancestral Rocky Mountains.

Fossil remains are not plentiful nor varied. They include brachiopods, bryozoans, crinoids, plants, ostracodes, and

TABLE 3: Species for the Sangre de Cristo Formation.

Brachiopoda

Dictyoclostus sp.

Elasmobranch fish

Amphibia

Coloraderpeton brilli, n. gen and sp.

Large embolomere

Several small rachitomes

Reptilia

Desmatodon hesperis

Edaphosaurus aff. *E. raymondi*

E. cf. *E. raymondi*

Trichecaton howardinus

Ophiacodont

Flora

Callipteris sp.

Macrostachya?

Odontopteris subcrinulata

Psygmophyllum cf. *P. cureifolium*

Rhabdocarpes dyaicus

Sigillariostrobus mastatus

Walchi cf. *W. imbricata*

W. cf. *W. piriformis*

conodonts (Brill, 1952; Finlay, 1907; McLaughlin, 1947 and 1952 - Table 4). Although none of these fossils have been found in the study area, the area is designated Class 2 as more study is needed.

Sharpsdale Formation (Pennsylvanian)

The Sharpsdale Formation was described by Bolyard (1956) as the Deer Creek Formation. Chronic (1958) stated that that name was preoccupied and substituted the term Sharpsdale. DeVoto et al. (1971) also use the name Sharpsdale. The formation is a dark red arkosic sandstone, siltstone, and shale with gray limestones in the upper zone. It gradationally overlies the Kerber Formation in the study area, and reaches a thickness of 900 feet. The sediments were deposited in an arid climate as alluvial fans and plains with occasional marine transgressions.

Fossils from the Sharpsdale localities (see Appendix I) in the study area include foraminifera, brachiopods, gastropods, corals and ostracodes (Bolyard, 1959; Brill, 1952; DeVoto et al., 1971; Gwinn, 1958 - Table 5). The area is designated a Class 2.

Kerber Formation (Pennsylvanian)

The Kerber Formation consists of light gray to grayish-yellow quartz sandstones and conglomerates in the study area. In other areas it is composed of dark, carbonaceous or coaly shale and sandstones. It rests unconformably on Precambrian crystalline rocks and reaches a thickness of 104 feet. The upper contact with the overlying Madera Formation is obscured by soil along

Table 4: Species of the Fountain Formation.

Ostracodes
- *Amphissites congruens*
- *A. robustus*
- *A. wapanuckensis*
- *Bairdia hoxbarensis*
- *B. oklahomaensis*
- *Cavellina* cf. *C. fittsi*
- *Geisina arcuata*
- *Glyptopleura* aff. *G. coryelli*
- *Healdia formosa*
- *Hollinella kellettae*
- *Kirkbya clarocarinata*
- *Microparaparchites brazoensis*
- *M. cornutus*
- *Monoceratina ardmorensis*
- *Polytylites wapanuckensis*
- *Pseudoparaparchites* sp.

Conodonts
- *Cavusgnathus flexa*
- *C. giganta*
- *Idiognathodus* aff. *I. claviformis*
- *I. delicatus*
- *I. lobatus*
- *I. magnificus*
- *Polygnathodella ouachitensis*
- *Spathodus minutus*
- *Streptognathodus cancellosus*
- *S.* sp., undes.

Brachiopoda
- *Chonetes* sp.
- *Dalmanella testudinaria*
- *Dityoclostus* sp.
- *Orbiculoidea manhattanensis*

Flora
- *Lepidodendron aculeatum*
- *L. obovatum*

Misc.
- Fragments of bryozoans, corals and echinoderms

Table 5: Species of the Sharpsdale Formation.

Brachiopoda

Cleiothyridina orbicularis
Composita subtilita
Dictyoclostus protlockianus
Lissochonetes geinitzianus
Marginifera muricatina
M. cf. *M. muricatina*
Neospirifer cameratus
N. cf. *N. latus*
Orbiculoidea capuliformis
Spirifer cf. *S. occidentalis*
S. cf. *S. opimus*
S. rockymontanus

Gastropoda

Bellerophon sp.
Meekospira peracuata var. *choctawensis*

Coelenterata

Caninia sp.
Syringopora multattenuata

Foraminifera

Fusulinella devexa

Ostracodes

the entire extension of the Kerber Formation (Okumura, 1979). The abundant plant material, coal beds, and channel sandstones all suggest deposition in non-marine coastal plains, swamps, and mudflats.

Bolyard (1956) reported no diagnostic fossils from the Kerber. Okumura found no fossils in the sandstone but did find fragmentary brachiopods (Neospirifer sp. and Composita sp.) in the conglomerate. The specimens were fragmentary and difficult to separate from the rock. The formation is Class 2. It is not suitable for public collecting due to the scarcity of fossils and the nature of the matrix (hard) in which they are found.

Minturn Formation (Pennsylvanian)

The Minturn Formation is a white to light gray and greenish-gray sandstone containing conglomerates, siltstones, black shales, limestones, and some gypsum. It has a gradational contact with the underlying Sharpsdale Formation, and it reaches a thickness of about 3,000 feet near La Veta Pass. Depositional environments varied from marine to non-marine coastal plains and deltas. The Minturn Formation contains three members. However, the Whiskey Creek Pass Member is the only fossiliferous member.

There are four known localities in the Minturn (Appendix I). Fossils collected from these localities and the Minturn in general include plants, trilobites, corals, sponges, fusilinids, gastropods, bivalves, brachiopods, and forams (Berg, 1967; Bolyard, 1959; Brill, 1952; Munger, 1959; Tischler, 1963 - Table 6). The fauna

Table 6: Species of the Minturn Formation.

Coelenterata
- Caranina sp.
- Fenestella cf. F. placida
- Lophophyllidium conoideum
- Pseudozaphrentoides lepidus
- Rhombopora lepidodenderoides
- Subcoretepora sp.

Brachiopoda
- Antiquatonia portlockiana
- Chanetina flamingi
- Cleiothyridina orbicularis
- Composita cf. ovatus
- C. subtilita
- Derbyia cf. D. crassa
- D. cf. D. crassa var. richmonda
- Desmoinesia muricatina
- Dictyoclostus coloradoensis
- D. harmosanus
- D. portlockianus
- Dielasma bovidens
- Echinocanchus samipunctatus
- Fusitinia rockymontanus
- Hustadia mormoni
- Juresania nebrascensis
- Limproductus af. L. prattenianus
- Lingula sp.
- Linoproductus meniscus
- Marginifera haydenensis
- M. ingrata
- M. wabashensis
- M. sp.
- Mesolobus mesolobus
- Neospirifer cameratus
- N. chronici
- N. dunbari
- N. cf. N. triplicatus
- Orbiculoden capuliformis
- Phricodothyris perplexus
- Punctospirifer kentuckyensis
- Schuchertella sp.
- Spirifer occidentalis
- S. cf. S. rockymontanus
- Wedekindellina

Gastropoda
- Anomphalus? sp.
- Bucanopsis sp.
- Gasseletina? sp.
- Glabrocingulum sp.

Table 6 continued.

- Goniasma copei
- Ianthinopsis paludaeformis
- I. regularis
- Meekospira peracuta var. choctawensis
- Pharkidonatus sp.
- Pictyceras sp.
- Piocazyga sp.
- Strabeus? sp.
- Trachydomia nadosa
- T. whitei
- T. sp.
- Worthenia tabulata

Bivalvia

- Allorisma terminale
- Astartella concentrica
- Aviculopecten occidentalis
- A. sp.
- Corrallites? sp.
- Cypricardina carbonaria
- Nucula? sp.
- Nuculana attenuata, n. sp.
- Nuculopsis girtyi

Octracoda

- Bythocypris sp.
- Cavellina cf. C. pulchella
- Hastifaba pervulata
- Jonesina arcuata
- Sulvella sulcata

Bryozoa

- Fenestella cf. F. placida
- Polypora sp.
- Rhombopora lepidodenderoides
- Sulcoretepora sp.

Bellerophontida

- Cymatospira montfortianus
- Euphemites carbonarius
- E. nodocarinatus
- Pharkidonotus percarinatus

Trilobita

- Amerura sangamonensis
- Ditomopyge parvulus
- D. sp.

Table 6 continued.

Corals
- *Caninia torquia*
- *C.* sp.
- *Chaeteras* cf. *C. favosus*
- *Lophophyllidium conoideum*
- *Pseudozaphrentoides lepidus*
- *P.* cf. *P. lepidus*
- *Stereostylus* cf. *S. cages*
- *Syringopora* sp.

Foraminifera
- *Fusulina distenta*
- *F. novamexicana*
- *F. rockymontana*
- *F. socorroensis*

Arthropoda
- *Ditomopyge* sp.

Crinoidea
- *Erisocrinus typus*
- *Schistocrinus ovalis*
- *Ulocrinus* sp.

Flora
- *Calamites* sp.
- *Lepidodendron*

is varied and relatively abundant. The formation is designated as Class 2.

Jurassic

Jurassic Sediments

Outcrops of Jurassic formations occur in the study area near Beulah, in the far northeastern corner of Pueblo County, around the Greenhorn Anticline, and on the eastern flanks of the Sangre de Cristo Mountains. They also occur in the canyons of the major rivers flowing into the Arkansas River. Total thickness of these outcrops is about 350 feet.

Entrada Sandstone (Jurassic)

The Entrada Sandstone is an upper Jurassic formation that is comprised of gray to buff, thick- to massive-bedded, fine- to medium-grained quartzose sandstone. The grains are frosted and cross-bedding occasionally occurs. The Entrada unconformably overlies the Sangre de Cristo Formation. The depositional environment is at least partially eolian. No fossils have been reported from this formation in the study area. Footprints have been found, however, near Grand Junction. The formation is designated as Class 3 based on the scarcity or complete lack of fossil remains.

Ralston Creek Formation (Jurassic)

The Ralston Creek Formation is comprised of yellow to gray limestone, silty calcareous shales, and fine-grained sandstone with gypsum and jasper as characteristic components. It overlies the Entrada Formation, and it reaches a thickness of approximately 30 feet. Few exposures are seen in the study area.

No fossils have been reported from the study area. However, Scott (1963) reported freshwater gastropods and algae from the Ralston Creek Formation along the Front Range. The formation is designated Class 3 due to the lack of fossil material.

Morrison Formation (Upper Jurassic)

The Morrison Formation consists of variegated shales, claystones, and siltstones. The common colors are gray, red, buff, and greenish-gray. It also contains fine-grained pink-gray sandstones. The Morrison overlies the Ralston Creek Formation and reaches a thickness of 200 to 300 feet. The depositional environment was one of a lowland floodplain with freshwater lakes and low energy streams.

No fossils have been reported from the study area but elsewhere the formation contains significant dinosaur remains. It also contains freshwater molluscs and fish, crocodiles, turtles, lizards, birds and terrestrial molluscs (Branson, 1935; Carpenter, pers. comm.; Stose, 1912 - Table 7). The Morrison is designated as Class 2. It requires more study based on the amount of vertebrate remains that have been recovered from the formation elsewhere.

Table 7: Species of the Morrison Formation.

Plantae
- *Aclistochara bransoni*
- *A. complanata*
- *A. latisulcata*
- *Araucarioxylon* sp.
- *Obtusochara madloni*
- *Praechara voluta*
- *P. symmetrica*
- *Sellatochara obovata*

Bivalvia
- *Unio felchi*
- *U. iridoides*
- *U. lapilloides*
- *U. macropisthus*
- *U. stewardi*
- *U. toxonotus*

Gastropoda
- *Amplovalvata cyclostoma*
- *A. scabrida*
- *Lymnaea ativuncula*
- *L. morrisonensis*
- *L. consortis*
- *Mesauriculstra accelerata*
- *M. morrisonensis*
- *M. m. ovalis*

Ostracoda
- *Darwinula leguminella*
- *Cypris purbeckensis*
- *Metacypris bradyi*
- *M. forbesi*
- *M. whitei*

Osteichthyes
- *Ceratodus guntheri*

Chelonia
- *Glyptops plicatulus*

Crocodylia
- *Eutretauranosuchus delfsi*
- *Goniopholis felix*

Table 7 continued.

Dinosauria
- *Allosaurus fragilis*
- *Apatosaurus* *sp.*
- *Camarasaurus supremus*
- *Ceratosaurus nasicornis*
- *Coelurus agilis*
- *Diplodocus longus*
- *Haplocanthosaurus priscus*
- *H. utterbackii*
- *Labrosaurus ferox*
- *Othniela rex*
- *Stegosaurus armatus*?
- *S. stenops*

Mammalia
- *Docodon* sp.
- *Kepolestes coloradoensis*

Lower Cretaceous

Purgatoire Formation

The Purgatoire Formation consists of white to buff cross-bedded sandstones with thin beds of black shale and dark gray shale (Johnson, Wood, and Harbour, 1958). It lies disconformably over the Morrison Formation. The Purgatoire is divided into two members, the lower Lytle and the upper Glencairn Shale.

The Lytle Member is a white to gray massive coarse-grained conglomeratic sandstone. The grains are composed of quartz and chert. The upper Glencairn Shale Member consists of dark shales and siltstones interbedded with thin brown sandstones (Cobban, 1956). Thin beds of coal are sometimes present.

No fossils have been reported from the study area but marine invertebrates including bivalves and ammonites have been found along the Front Range (Scott, 1963; Stose, 1912: Waage, 1953). In the upper portion of the Glencairn foraminifera, sponge spicules, and a bivalve species have also been found (Waage, 1953). Fossils found are early Cretaceous but at least part of the Purgatoire is thought to be Jurassic. Based on the invertebrate species which have been collected from the Purgatoire in the immediate region, and on the need to further refine the age of the formation, more study is needed. The formation is designated as Class 2. A species list for the Purgatoire Formation is found in Table 8.

Dakota Sandstone (Lower to Upper Cretaceous)

The Dakota Sandstone is exposed in the study area as cliffs in

Table 8: Species of the Purgatoire Formation.

Ammonoidea
- Acanthoceras sp.
- Prionotropis sp.
- Turrilites sp.

Bivalvia
- Avicula sp.
- Cardium kansasense
- Cyprimera sp.
- Gryphaea corrugata
- Inoceramus comancherus
- I. fragilis
- Leda sp.
- Leptosolen conradi
- Ostrea quadriplicata
- O. sp.
- Pecten? sp.
- Pholadomya cf. sancti-sabae
- Protocardia multilineata
- P. texana
- P. sp.
- Tapes sp.
- Trigonia emoryi
- T.? sp.

Brachiopoda
- Lingula sp.

Gastropoda
- Turritella seriation-granulata
- T. whitei

Vertebrata
- osteichthyes, indet.

river canyons and as hogbacks around the Wet and Sangre de Cristo Mountains. The formation is a massive fine to medium gray quartz sandstone that weathers to a rusty brown. It generally forms two ledges separated by thin black carbonaceous shales. The Dakota is the accumulation of strandline deposits of the advancing Cretaceous Sea, and it unconformably overlies the Purgatoire Formation. It ranges in thickness, in the study area, from 225 to 350 feet.

There are no recorded fossil sites within the study area. However, remains from outside the area include trace fossils, plants, and foraminifera (Chamberlain, 1976; Cobban, 1956; Gilbert, 1897; Stose, 1912; Waage, 1953 - Table 9). Dinosaur footprints have also been found in the hogback near Morrison in the southeast section of Colorado (P. Robinson, pers. comm.).

Table 9: Species of the Dakota Formation.

Plantae

- *Sterculia lugubris*
- ?*Sequoia reickenbacki*

Animalia

- *Arenicolites*
- *Asterosoma-Teichichnus*
- *Chomatichnus*
- *Chondrites*
- *Cochlichnus*
- *Corophoides*
- *Diplocraterion*
- *Ophiomorpha*
- *Phycosiphon*
- *Planolites*
- *Rhizocorallium*
- *Rosselia*
- *Scoyenia*
- *Skolithos*
- *Teichichnus*
- *Terebellina*
- *Thalassinoides*
- *Trichichnus*

Upper Cretaceous

Graneros Shale (Lower and Upper Cretaceous)

The graneros Shale was deposited by the advancing upper Cretaceous Sea and lies conformably on the Dakota Sandstone. It is typically dark gray to black non-calcareous shale with thin layers of bentonite. The Thatcher Limestone Member rests between lower and upper shale members (Kauffman, 1977). It is a dense, dark gray limestone that weathers to a rusty brown. The Graneros Shale ranges in thickness from 105 to 380 feet.

Fossils are uncommon in the lower Graneros and consist mostly of forams, fish parts, and worm burrows (Scott, 1969b; Stose, 1912). The upper portion of the shale has a more varied faunal assemblage. The ammonite Acanthoceras is common (Scott, 1969b). Bivalves and gastropods are also represented (Johnson, 1930a) and forams are abundant (Eicher, 1965). Table 10 lists the species collected from the Graneros. There are many known localities within the study area (Appendix I). The Graneros Shale is designated as Class 2 due to the abundance of species and the many localities found within the study area.

Greenhorn Limestone (Upper Cretaceous)

The Greenhorn Limestone conformably overlies the Graneros Shale. It is more resistant than the Graneros and forms ridges or ledges where they are both exposed. The Greenhorn is made up of alternating beds of dense gray limestone and light gray calcareous shales. Three members are recognized. They are, oldest to youngest, the Lincoln

Table 10: Species List for the Graneros Shale.

Ammonoidea

Acanthoceras amphibolum
A. granerosense
A. johsoncerum
A. muldoonense
A. cf. A. rhotomagense
A. cf. A. tarranttense
A. wintoni
A. sp.
Arisoceras cf. A. plicatile
Boressiakoceras compressum
B. cf. B. orbiculatum
B. sp.
Calycoceras gilberti
C. (Conlinoceras gilberti
C. leonense
C. sp. A.
C. sp.
?C. sp.
Coilopeoceras novimexicanum
Desmoceras sp.
D. (Pseudouhligella) sp.
Epengonoceras dumbli
Eumophaloceras cf. E. cunningtoni
E. lonsdalei
E. cf. E. lonsdalei
Forbesiceras? sp.
Idiohamites sp.
Johnsonites sulcatus
Mammites sp.
Prionotropis sp.
Stomohamites cf. S. simplex
Stomohamites sp.
Tarrantoceras notatile
T. startoni
Turrilites actus americanus
T. (Euturrilites) scheuchzerianus
T. (E. sp.
T. sp.

Table 10 continued:

Bivalvia
- Anomia
- Arca sp.
- Breviarca sp.
- Camptonectes
- Coibula nematophora
- Crassatellia excavata
- Exogyra columbella
- E. sp.
- Gryphaea newberry
- Inoceramus belvuensis
- I. cf. I. belvuensis
- I. eulessarus
- I. fragilis
- I. rutherfordi
- I. sp.
- Leda sp.
- Limatula sp.
- Lucina sp.
- Nuculama? sp.
- Ostrea beloiti
- O. cf. O. beloiti
- O. congesta
- O. noctuensis
- O. soleniscus
- O. sp.
- Pecten (Comptonectes) cf. P. cavanus
- P. sp.
- Plicatula arenaria
- Veniella mortoni

Foraminifera
- Lenticulina gaultina
- Praebulinina wyomingensis
- Trochommina apricarius
- T. gatesensis
- T. rutherfordi mellariolum
- Verneuilinoides perplexus

Gastropoda
- Actaeon sp.
- Arrhhoges modesta
- Cinulia sp.
- Diploconcha? sp.
- Turritella cf. T. thompsonia
- T. whitei
- T. sp.

Limestone, the Hartland Shale and the Bridge Creek. All members are fossiliferous.

The Lincoln Limestone Member consists of a bentonite layer and a very thin calcarenite bed composed of broken shells of Ostrea beloiti. Overlying these, the main Lincoln sediments are calcareous shales and some thin layers of bentonite (Scott, 1963 and 1969b). Two faunal zones are present in the Lincoln Limestone Member. The lower zone is characterized by Inoceramus rutherfordi and Ostrea beloiti. Associated ammonites are Acanthoceras amphibolum and Turrantoceras and Turrilites species. The upper zone is characterized by Inoceramus pictus and Ostrea elegantula, and associated ammonite Calycoceras canitaurinum (Scott, 1963). Foraminifera are abundant (Scott, 1969b).

The Hartland Shale Member is composed mainly of gray fissile calcareous shale with calcarenite, limestone, and bentonite layers (Scott, 1963, 1969b). Fossil fragments are abundant, however, well preserved specimens are rare (Scott, 1969b). Inoceramus pictus and Calycoceras species are most diagnostic of this level. Thalmaninella greenhornensis has also been identified (Scott, 1963). Fossil shells of forams are abundant (Scott, 1969b).

The Bridge Creek Limestone Member contains gray, hard, finely crystalline limestone beds separated by thicker beds of bluish-gray calcareous shale (Scott, 1963, 1969b). Fossils are abundant and diverse in the limestone beds; they are also present in the shale beds but more difficult to recover (Scott, 1969b). The Bridge Creek is divided into three faunal zones. The lower zone is characterized by Inoceramus pictus and the associated ammonites Sciponoceras gracile, Allocrioceras pariense, Kanabiceras septemseriatum, and Metiococeras whitei. The fish species Apsopelix sauriformis is also present. The middle zone contains Inoceramus pictus and a Kanabiceras species. The upper zone contains Inoceramus labiatus and the ammonites Mammites nodosoides and a Baculites species. A more complete species list is given in Table 11.

The Bridge Creek Limestone Member of the Greenhorn Limestone represents the maximum transgression of the Cretaceous Sea in the Western Interior during Greenhorn deposition (Kauffman et al., 1969). It is interesting to note that Eicher (1969) estimated the sea depth at 3,000 feet based on slope measurements and microbiotas while Hattin (1975) and Kauffman (1977) estimated it at a maximum of 300 to 660 feet based on sedimentary features and macrobiotas.

There are many known localities in the Greenhorn Limestone (Appendix I). The formation is given a Class 2 designation based on its rich fauna and its stratigraphic correlations.

Carlile Shale (Upper Cretaceous)

The Carlile Shale gradationally overlies the Greenhorn Formation, reaching a maximum thickness of 250 feet. It is divided into four members which are, oldest to youngest, Fairport Chalky Shale Member, Blue Hill Shale Member, Codell Sandstone Member, and Juana Lopez Member.

The Fairport Chalky Shale Member consists of pale yellowish-brown, light olive gray, or gray shales, and it weathers to clayey calcareous

Table 11: Species List for the Greenhorn Limestone.

Ammonoidea

Acanthoceras amphibolum
A. coloradoense
A. cf. *A. coloradoense*
A. granerosense
A. kanabense
A. muldoonense
Allocrioceras annulatum
A. pariense
Ampakalistes colligoni
Anisoceros sp.
Baculites calamus
B. gracilis
B. cf. *B. yokoyamai*
B. sp.
Belemnitella baculus
Calycoeras canitaurinum
C.? canitaurinum
C. (Conlinoceras) gilberti
C. leonense
C. cf. *C. naviculare*
C. sp.
C.?sp.
Choffaticeras pavillieri
C. sp.
C.? sp.
Collignoniceras woollgari
C. sp.
C. ? sp.
Fagesia sp.
Heliococeras corrugatum
H. pariense
Hemiptychoceras reesidei
Kanabiceras puebloense
K. septemseriatum
K. sp.
Mammites nodosoides wingi
M. nodosoides
M. sp.
Metiococeras cf. *M. defordi*
M. sp.
Neoptychites cf. *N. cephalstus*
Pachydisaus sp.
Prionotropis loevianus
P. sp.
Puebloites corrugatus.
P. greenhornensis
P. spiralis
P. sp.

Table 11 continued.

Pseudocalyoceras dentonense
P. sp.
Radiolites sp?
Scaphites sp.
Sciporioceras gracile
S. sp.
Stomohamites cf. S. simplex
S. sp.
S.? sp.
Tarrantoceras sp.
Tragodesmoceras bassi
Turrilites sp.
Vasoceras (Greenhornoceras) birchbyi
V. birchbyi
Watinoceras coloradoense
W. reesidei
Worthoceras gibbosum vermiculum
W. gibbosum
W. vermiculum

Bivalvia
Anomia sp.
Camptonectes sp.
Corbula hanabensis
C. nematophora
Dorax cuneata
D. oblonga
Entollium sp.
Exogyra cf. E. boveyensis
E. laeviuscula
Inoceramus flavus
I. ginterensis
I. labiatus
I. labiatus var. subhercynica
I. labiatus var.
I. pictus
I. cf. I. pictus
I. rutherfordi
I. subconvexus
I. sp.
Modolia multilinigera
Mytiloides labiatus
Nucula sp.
Ostrea alta
O. beloiti
O. congesta
O. sp.
O. sp.?

Table 11 continued.

Pheloptera sp.
Phelopteria
Pholadeomya papyracea
Pteria sp.
Pynodonte newberryi
Syncyclonema sp.

Chondrichthyes
Ptychodus sp.

silt. Fossils are abundant and well known although many are often preserved only as impressions in shale and calcarenite beds. They include bivalves, ammonites, and forams (Dane, Pierce, and Reeside, 1936; Eicher, 1966; Eicher and Worstell, 1970; Kauffman and Pope, 1961; Scott, 1969b - Table 12).

The Blue Hill Shale Member is a black, fissile, non-calcareous shale which contains sandy shale and large calcareous concretions. Fossil remains, which are uncommon and poorly preserved, contain ammonites, bivalves including a large species of oyster, many gastropods, and forams (Eicher, 1966; Kauffman and Pope, 1961; Scott, 1969b - Table 12).

The Codell Sandstone Member is exposed as a resistant cliff or ledge in many places. It is a light colored, yellowish to gray fine-grained sandstone with some concretions. It is highly bioturbated and sometimes cross-bedded. The Codell Sandstone contains aboundant and well known fossil material including ammonites, bivalves, and gastropods (Kauffman and Pope, 1961; Scott, 1969b). Bryozoans, annelids, echinoids, crustaceans, and vertebrates occur as minor faunal elements (Kauffman and Pope, 1961). Forams are present but not nearly as abundant as in the Fairport and Blue Hill Members (Eicher, 1966). The gastropod *Pugnellus fusiformis* is especially abundant, forming 52 to 91 percent of the fauna in any one lens in Huerfano Park (Kauffman and Pope, 1961). It is also abundant in all Codell Sandstone outcrops of the Western Interior from Canon City southward and is used as a geographic indicator

Table 12: Species List for the Carlile Shale.

Ammonoidea

Bacculites sp.
Collignoniceras hyatti (poorly preserved and rare)
Collignoniceras woollgari
Crionotropis woollgari
Haminea truncata
Placenticeras pseudoplacenta
Prionocyclus macombi
P. wyomingensis
P. woolgani
Prionotropsis hyatti
P. woollgari
Scaphites carlilensis
S. larvaeformis
S. warreni
S. whitfieldi

Bivalvia

Anatina lineata
Anomia subquadrata
Arca sp.
Avicula gastrodes
Cardium pauperculum
C. sp.
Cassidulus stantoni
Corbulanem atophora
Crassostrea soleniscus
Cubitostrea malachitensis
C.? malachitensis
Cymbophora emmonsi
Ensis? sp.
Exogyra suborbiculata
Gervillia propoleura
Inoceramus cuvieri
I. costellatus
I. dimidius
I. aff. I. dimidius
I. flaccidus
I. fragilis
I. gilberti
I. howelli
I. labiatus
I. cf. I. labiatus
I. perplexus
I. sp.
Lopha bellaplicata novamexicana

Table 12 continued.

Lucina juvensis
Mactra emmonsi
M. huerfanensis
M. sp.
Mytiloides labiatus
M. hercynicus
M. subhercynicus
M. latus
Ostrea bentonensis
O. congesta
O. aff. O. congesta
O. lugubris
O. malachitensis
O. sp.
Pheloptera sp.
Pholadomya coloradoensis
Pinna petrina
Solemya obscura
Tellina whitei
Trigonarca obliqua
Veniella mortoni
Yoldia subelliptica

Gastropoda
Actaeon propinquus
Cancellaria malachitensis
Fasciolaria utahensis
Fusus venenatus
Gryphaea sp.
Gyrodes conradi
G. depressa
Liopistha concentrica
Pugnellus fusiformis
Pyropsis coloradoensis
Ringicula angusta, n sp.
Ringicula codellana, n. sp.
R. sp.
Turritella whitei
T. sp. aff. T. whitei
Volutoderma cumbiera
V. dalli
V. gracilis
V. placatula
V. willistonii
Xenophora simpsoni
Gastropod sp.

Table 12 continued.

Foraminifera

- Ammobaculites macellus
- Ammomarginulina perimpexus
- Clavihedbengella simplex
- Gaudryina bentonensis
- G. spiritensis
- Gavelinella dakotensis
- Globotruncana marginata
- Haplophragmoides howandense
- H. kirkii
- Hedbergella delrioensis
- H. planispira
- Heterohelix globulesa
- Lenticulina karsasensis
- Lunatriella spirifera
- Miliammina ischnia
- Neobulimina albertensis
- Planulina kansasensis
- Praeglobotruncana renzi
- P. stephani
- Pseudoclavulina haetata
- Reophax inordinatus
- RUgoglobigerina? aprica
- Saccammina alexanderi
- Spiroplaetammina acostai
- Texlukeria? sp.?
- Trochammina ribstonensis
- T. wickendeni
- Trochamminoides apricarius
- Valvulineria loetterlei
- Foram. spp.

Chondrichthyes

- Odontoaspis macrota
- Plicatolamna arcuata
- Ptychodus whipplei
- Scapanorhynchus raphiodon
- Squalicnap falcatus

Annelida

- Serpula plana
- Annelid spp.

Crustacea

- Stramentum sp.

(Kauffman, pers. comm.). In addition the Codell Sandstone is noted for the variety of sharks teeth found in the lag concentration on the top of the member (P. Robinson, pers. comm.).

The Juana Lopez Member is a light gray shaly fine-grained sandstone containing lenses of calcarenite with a petroliferous odor. Fossils are abundant and include ammonites, bivalves, fish scales and teeth, and fucoids (Table 12).

Specific localities within the Carlile Shale are listed in Appendix I. Cobban (1956), Scott (1964), and Stose (1912) provided species lists for the Carlile Shale which outcrops in the study area and in the immediate vicinity (southeastern Colorado).

Niobrara Formation (Upper Cretaceous)

The Niobrara Formation outcrops extensively in the study area. It reaches a maximum thickness of approximately 700 feet and is considered to be a deep offshore marine deposit. The Niobrara has two members. The oldest is the Fort Hays Limestone Member, and the youngest is the Smoky Hill Member.

In the study area, the Fort Hays Limestone Member is comprised of light gray to yellow chalky limestones interbedded with their chalky shale and a thin layer of bentonite. The sediments are resistant and form ridges and cliffs. This member is thin, reaching a thickness of 40 feet. It is disconformable with the underlying Carlile Shale (Scott and Cobban, 1964). Fossils consist of *Ostrea congesta*, three *Inoceramus* species, and rare fragments of ammonites. There are three faunal zones based on the *Inoceramus* species. Forams are also present (Hills, 1900).

The overlying Smoky Hill Member consists of light gray chalky shales and thin limestones which weather to a characteristic yellow orange (Scott and Cobban, 1964). The outcrops are less resistant than the Fort Hays and form gentle slopes. This member reaches thicknesses of approximately 500 to 700 feet in the study area. Fossil remains are more varied than in the Fort Hays limestones. The Smoky Hill is divided into seven units each containing different associations of ammonites and bivalves (Scott and Cobban, 1964). Species for the entire Niobrara Formation are listed in Table 13. Appendix I lists the several localities that are found in the study area.

Pierre Shale (Upper Cretaceous)

The Pierre Shale gradationally overlies the upper member of the Niobrara Formation. In the Walsenburg area and in Huerfano Park the Pierre reaches a thickness of approximately 2,000 feet. Two unnamed members, an upper sandstone and a lower dark shale, are recognized in this area. Five members have been described in the vicinity of Pueblo (Scott, 1969b). Thay are, oldest to youngest, a transition member, Apache Creek Member, Sharon Springs Member, Rusty Zone, and Tepee Zone.

The transition member consists of buff and gray shales and thin fossiliferous sandstones and limestones. In the lower part of the member fossils occur as impressions. It is characterized by fish scales, smooth baculites, and the bivalve Inoceramus simpsoni. The upper portion of the transition zone is characterized by a weakly

Table 13: Species List from the Niobrara Formation.

Ammonoidea
- Baculites asper
- B. codyensis
- B. cf. haresi
- B. sp. (smooth)
- B. sp. (smooth, small)
- B. sp.
- Barroisiceras (Forresteria) hobsoni
- Clinoscaphites choteauensis
- C. saxitonianus
- C. vermiformes
- Haresiceras placentiforme
- H. sp.
- Neocrioceras, n. sp.
- Placenticeras planum
- Prionocycloceras? sp.
- Protexanites shoshonensis
- Pseudobaculites sp.
- Radiolites austinensis
- Scaphites binneyi
- S. depressus
- S. d. var. stantoni
- S. hippocrepsis
- S. ventricosus
- Stantonoceras pseudocostatum
- Texanites americanus

Arthropoda
- Stramentum haworthi

Bivalvia
- Anomia subquadrata
- Corbula nematophora
- Inoceramus confertim-annulatus?
- I. cordiformes
- I. deformis
- I. erectus
- I. involutus
- I. cf. patootenis
- I. cf. perplexus
- I. platinus
- I. undulatoplicatus
- I. stantoni
- I. umboratus
- I. sp.
- I. (volviceramus involutus
- Lucina sp.

Table 13 continued.

Ostrea congesta
O. soleniocus

Gastropoda
Turritella whitei

Crustacea
Tracks of small crustaceans

Miscellaneous
Fish scales and teeth
Shark teeth

Foraminifera
Globigerina sp.
Textularia sp.

ribbed baculite (Baculites aff. B. obtusus), the bivalve Inoceramus aff. I. cycloides, fragments of the chirocentrid fish Ichthyodectes and plant fragments (Scott, 1969b).

The Apache Creek Member consists of dark gray shales with thin lenses of fine-grained sandstones. Concretions are abundant in several layers, and in some form persistent ledges that are easily correlated in different localities (Scott, 1969b). Well-preserved fossils are rare. A weakly ribbed species of Baculites, earlier than B. obtusus, and Inoceramus agdjakendensis characterize this member. The skull and some vertebrae of a mosasaur identified as Platycarpus cf. P. crassartus by Edward Lewis of the U.S.G.S. was found approximately six miles north of Pueblo (Scott, 1969b).

The Sharon Springs Member is comprised of hard black fissile shales with many large septarian concretions. The member contains abundant fossils and is divided into five baculite zones. Fossils include several ammonite and baculite species, bivalves, many of which are found in the limestone concretions. In addition, parts of a mosasaur were uncovered, and a plesiosaur, Polycotylus latipinnis, was collected from the lower part of the member (Cobban and Scott, 1964: Scott, 1969b).

The Rusty Zone is a dark gray shale containing ironstone and limestone concretions (Scott, 1969b). A lower shale unit contains very little fossil material, while there are abundant fossils in the upper part (Griffiths, 1949; Scott, 1969b). The Rusty Zone can be divided into three baculite zones (Scott, 1969b).

The Tepee Zone consists of olive gray shales with limestone concretions, ironstone concretions, and large masses of limestone.

The zone gets its name from the conical shape of the limestone masses in the area (Scott, 1969b). Fossils are abundant and diverse, and the strata are broken down into four ammonite zones. The zones are characterized by an association of ammonites and bivalves peculiar to each zone (Scott, 1969b).

The Pierre Shale has been divided into faunal zones also, some of which are equivalent with those of its members (Scott, 1963; Scott and Taylor, 1974b, Washburn, 1910). Scott (1963) provides a compreshensive stratigraphic distribution of Pierre fossils by ammonite zones. These zones and their characteristic faunas have been widely used in correlating Pierre sediments both within and out of the study area.

There are many known localities in the Pierre Shale within the study area. These are listed in Appendix I. The species that have been collected from the Pierre Shale are listed in Table 14. The Pierre is given a Class 2 designation.

Trinidad Formation (Upper Cretaceous)

The Trinidad Formation sandstones intertongue with the pro-deltaic sands of the upper Pierre Shale in the Walsenburg vicinity of the study area. It exhibits depositional characteristics of a deltaic front, a channel, and a beach and dune. Maximum thickness reached by the Trinidad Formation is 300 feet; it thins to the southeast. These sandstones are buff to gray, fine-to medium-grained, and slightly arkosic. Some thin tan to gray silty shales are present. The formation outcrops as steep ledges.

Table 14: Species List for the Pierre Shale.

Ammonoidea

Acanthoscaphites nodosus var. plenius
A. n. var. brevis
A. n. var. quadrangularis
Acanthoscaphies sp.
Anapachydiscus complexus
Baculites asperiformes
B. aff. asperiformes
B. baculus
B. claviformes
B. clinolobatus
B. compressus
B. eliasi
B. grandis
B. gregoryensis
B. jenseni
B. mclearni
B. obtusus
B. obtusus (early form)
B. aff. obtusus
B. ovatus
B. ovatus var. haresi
B. perplexus
B. pseudovatus
B. reesidei
B. rugosus
B. scotti
B. undatus
B. older sp.
Delawarella danei
Didymoceras cheyennense
D. nebrasense
D. stevsoni
Discoscaphites cf. abyssinus
D. cheyennensis
D. conradi
D. mandanensis
D. cf. nicolleti
D. sp.
Exiteloceras jenneyi
E. oronense
Hamites sp.
Helioceras sp.
Heteroceras nebrascense
H. sp.
Hoploscaphites gilli
H. nodosus
H. sp.

Table 14 continued.

Menuites sp.
Nostoceras sp.
Placenticeras intercalcare
P. meeki
P. placenta
Oxybeloceras crassum
O. sp.
Scaphites nodosus
Solenoceras crassum
S. mortoni
S. cf. *mortoni*
Sphenodiscus lenticularis
Trachyscaphites praespiniger
Turrulites sp.

Nautiloidea
Eutrephoceras dekayi
E. sp.

Bivalvia
Anisomyon borealis
Anomia raetiformis
Crassatella sp.
Cucullae sp.
Cymbophora canonensis
C. holmesi
Inoceramus agdjakendensis
I. altus
I. balchii
I. barabini
I. convexus
I. aff. *I. cycloides*
I. incurvis
I. oblongus
I. perenuis
I. proximus
I. sagensis
I. saskachewanensis
I. simpsoni
I. subcircularis
I. subcompressus
I. subaevis
I. tenuilineatus
I. typicus
I. vanuxemi
I. sp.

Table 14 continued.

Lingula sp.
Lucina occidentalis
Lucina sp.
Mactra canonensis
M. gracilis
M. sp.
Nucula cf. *N. fibrosus*
N. larimerensis
N. planimarginata
N. sp.
Ostrea falcata
O. inornata
O. patina
O. pellucida
O. plumosa
Panopaea berthoudi
Phelopteria linguaeformis
P. sp.
Pinna lakesii
Pteria nebrascana
P. sp.
Solemya bilix
Syncyclonema nigida
Tellina seitula
Thracia gracilis
Variella humilis
Volsella meekii

Gastropoda
Anchura americana
Anisomyon borealis
A. centrale
A. patelliformis
Capulus spangeri
Fasciolaria ?cf. *F. cheyennensis*
F. culbertsoni
Gyrodes abyssina
G. crenata
Margarita nebrascersis
Turritella sp., probably new
Volutoderma clatworthyi
V. sp.

Ostracoda
Yoldia evansi
Y. scitula
Y. sp.

Table 14 continued.

Coleoidea
Belemnitella bulbosa

Scaphopod
Dentalium gracile

Foraminifera
Robulus sp.

Trace Fossil
Ophiomorpha

Annelida
Serpula? sp.

Osteichtyes
Ichtyodectes sp.

Reptilia
Platycarpus cf. *P. crassartus*
P. sp.
Prognathodon crassartus
Trinacromerum sp.
Tylosaurus proniger

Fossil remains are not abundant. Pillmore and Maberry (1976) cited several trace fossils of which Ophiomorpha is the most abundant. It can be used to identify the Trinidad. Lee (1922) reported marine invertebrates, predominantly bivalves and leaves, from this formation. Fischer (1980) stated that many of the species listed by Lee (1917) as Trinidad fauna probably belong to the upper Pierre.

There are no known localities from this formation. Those species mentioned above are listed in Table 15. The formation is designated as Class 2.

Vermejo Formation (Upper Cretaceous)

The Vermejo Formation is composed of a repetative sequence of buff, gray, and dark gray siltstones, buff, gray, and gray-green slightly arkosic sandstones, black carbonaceous silty shale, and numerous coal beds. It rests conformably on the Trinidad Formation. It reaches a maximum thickness of 500 feet and thins from Walsenburg to the southeast. Johnson and Wood (1956) interpret the Vermejo sediments as a delta plain deposit. Haun and Weimer (1960) noted that an erosional interval was created at the top of the Vermejo by an initial phase of the Laramide Orogeny in the late Cretaceous.

The fossil plant remains of the Vermejo Formation have received much study. Fisher (1980) noted that Knowlton's (1917) work on the Vermejo flora is the primary source of information although his taxonomy has been extensively revised. Among the angiosperms

Table 15: Species List for the Trinidad Formation.

Bivalvia
- *Anomia*? sp.
- *I. barabini*
- *I. sagensis*
- *Lucina*
- *Mactra warreniana*
- *M.* sp.
- *Ostrea pellucida*
- *O.* sp.
- *Panopaea*? sp.
- *Tellina scitula*
- *T.* sp.

Holothursidea
- *Avicula nebrascana*

Reptilia
- *Mosasaurus* sp.

Trace fossils
- *Asterosoma*
- *Aulichnites*
- *Desmograpton*
- *Diplocraterion*
- *Ophiomorpha*
- *Teichichnus*
- *Thallassinoides*
- fucoid impressions

Miscellaneous
- Leaves of land plants

in Knowlton's flora are fig, willow, magnolia, grape, walnut, oak, laurel, sycamore, beech, honeysuckle, and palm. The gymnosperms include confiers, cypress, fir and fern. Clarke (1966) described fossil pollen from the Vermejo, and Scott and Taylor (1974b) mentioned brackish water marine invertebrates. These remains suggest a non-seasonal, temperate to subtropical climate. The Vermejo flora is listed in Table 16. There are two known localities in the study area (Appendix I). The Vermejo is designated as Class 2 and may be suitable for public collecting is properly managed.

Raton Formation (Upper Cretaceous)

The Raton Formation consists of a basal layer of thin sandy quartz and chert-pebble conglomerate. Above this basal layer lie alternating beds of buff, gray, and olive gray arkoses, sandstones, siltstones, silty shales, and numerous coal beds. These lithologies reflect deposition in swamps, rivers, and floodplains. The Raton reaches a maximum thickness of 1,700 feet but in some areas it is less than 100 feet. The Raton, Vermejo, and Trinidad deposits are exposed on the eastern edge of the northern Raton Basin and record the regression of the late Cretaceous Sea and the resultant environmental change from pro-deltaic to fully terrestrial channel and flood plain deposition.

Fossil remains from the Raton Formation in Colorado have been studied by Knowlton (1917) and revised by Brown (1962). Fischer (1980) noted that the flora contained oak, walnut, cottonwood, sycamore, magnolia, ferns, and palms. The flora is present

Table 16: Species List for the Vermejo Formation.

Flora
- *Abietites dubius*
- *Artocarpus dissecta*
- *Brachyphyllum* cf. *B. macrocarpum*
- *Chondrites bulbosus*
- *C. subsimplex*
- *Calerpites incrassatus*
- *Asplenium*? *coloradense*
- *Cupressinoxylon coloradense*
- *Canna magnifolia*
- *Credneria protophylloides*
- *Colutea speciosa*
- *Celtrus*? sp.
- *Cissites panduratus*
- *Diospyros*? *leei*
- *Ficus haddeni*
- *F. leei*
- *F. minima*
- *F.*? *starkvillensis*
- *F. praetrinervis*
- *F. speciosissima*
- *F. wardii*
- *F. gigantea*
- *Fraxinum*? sp.
- *Geinitzia formosa*
- *Hedera rotundifolia*
- *Myrica torreyi*
- *Pteris russellii*
- *P. erosa*
- *P.*? sp.
- *Populus neomexicana*
- *Phaseolites minutus*
- *Pterospermites undulatus*
- *P. wardii*
- *P. nervosus*
- *Paleoaster inquirenda*
- *Phyllites aurantiacus*
- *P. leei*
- *P. nanus*
- *P. populoides*
- *P. rosaefolius*
- *P. sapindus*
- *P. walsenburgensis*
- *P. vermejoensis*
- *P. ratonensis*

Table 16 continued.

Quercus gardneri
Rosellinites lapideus
Rhamnus salicifolius
Sequoia reichenbachi
S. obovata
Sabal montana
S.? ungeri
Salix gardneri
S. plicata
S. sp. A and sp. B
Sterculia coriacea
Taxodium? sp.
Viburnum anomalinervus
V. montanum
V. crassum
V. rhamnifolium
Vitis? sp.
Woodwardia crenata
Widdringtonia? complanata
Zizyphys palurifolius

Liriodendron alatum
Sparganium? sp.

throughout the formation except for the basal conglomerate. It is interesting to note that the Cretaceous-Paleocene boundary is defined by changes in the paleoflora as it is not lithologically discernable.

There are no known fossil localities in the study area. The species list for the Raton Formation is found in Table 17. The formation is designated as Class 2 based on the important floral remains. It might be possible to develop some judicious plan for public collecting.

Table 17: Species List for the Raton Formation.

Flora

Allantodiopsis erosa
Blechnum anceps
Dryopteris lakesi
Lastrea goldiana
Anemia elongata
Isoetites horridus
Alismaphyllites grandifolius
Chamaedora danae
Paleoreodoxites plicatus
Sabal grayana
Sabal imperialis
Sabal powelli
Carya antiquorum
Juglans berryana
Castanea intermedia
Artocarpus lessigiana
Ficus affinis
Ficus artocarpoides
Ficus minutidens
Ficus planicostata
Ficus uncata
Platanus nobilis
Platanus raynoldsi
Laurophyllum caudatum
Laurophyllum perseanum
Laurus socialis
Persea brossiana
Nymphaea leei
Cercidiphyllum articum
Magnolia berryi
Magnolia magnifolia
Magnolia regalis
Magnolia rotundifolia
Eucommia serrata
Prunus coloradensis
Staphylea minutidens
Acer fragile
Rhamnus goldiana
Zizyphys fibrillosus
Cissus marginata
Cissites rocklandensis
Vitis olriki
Pterspermites cordatus
Nyssa alata
Apocynophyllum lesquereauxi

Table 17 continued.

Phyllites _pagoensis_
Carpolithes _spinosus_
Palmocarpon _commune_
Palmocarpon _compossitum_
Roots with Rootlet scar pits
Fossil wood

Tertiary

Poison Canyon Formation (Paleocene)

The Poison Canyon Formation outcrops in Huerfano Park and southeast of Walsenburg in the northern portion of the Raton Basin. Lithologically the formation is composed of alternating beds of buff to red massive arkosic sandstones and conglomerates. Large boulders attest to increased uplift of the source areas to the south- and northwest (Tweto, 1980). Thin beds of shale and coal lenses are occasionally present. The underlying Raton Formation grades vertically and horizontally into the Poison Canyon. This intertonguing indicates a period of contemporaneous deposition. The Poison Canyon may also overlie the Vermejo or Pierre Formations due to a variable erosional interval.

Poison Canyon fossils are not common. Some well preserved plant remains are found in coal lenses. Briggs and Goddard (1956) described these plants as a tropical flora. Lee (1917) lists several species which he stated were collected from the Poison Canyon Formation. Fischer (1980) suggested that some of the specimens may have come from the Raton but noted that the flora of lower Poison Canyon is almost indistinguishable from that of the upper Raton.

There are no known localities within the study area. Those species reported for outlying areas are listed in Table 18. The formation is designated Class 2.

Table 18: Species List for the Poison Canyon Formation.

Flora

Cornus studeri?
Euphorbocarpum richardsoni
Ficus richardsoni
Lauries socialis
Magnolia laurifolia
Palmocarpon sp.
Platanus guillemae
Rhamnus cleburni
Zizyphus fibrillosus

Cuchara Formation (Eocene)

The Cuchara Formation outcrops from West Spanish Peak north to Huerfano Park. It consists of red, pink, and white thin to massive sandstone and thin red and tan shales. The Cuchara unconformably overlies the Poison Canyon Formation in most cases but may also overlie older formations back to the Pierre Shale. It reaches a maximum thickness of 5,000 feet in the center of the Raton Basin. These are basin-fill sediments derived from Paleozoic and younger rocks exposed by the San Luis uplift to the west.

Fossils of the Cuchara Formation include creodonts, condylarths, pantodonts, carnivores, primates and perissodactlys (Robinson, 1960, 1963, 1966 - Table 19). The formation is important scientifically and is designated as Class 1-b. There are several known localities in the study area and these are noted in Appendix I.

Huerfano Formation (Middle to Late Eocene)

The Huerfano Formation occurs south and west of West Spanish Peak and in Huerfano Park where it weathers to a badlands topography. The sediments consist of variegated maroon, gray, and green shales, and red, white, and tan sandstone. The latter sandstone is near the base of the formation and forms resistant cliffs in some places. The Huerfano unconformably overlies the Cuchara, Poison Canyon, and Pierre Formations, and in some places intertongues laterally with the Cuchara. It reaches a maximum thickness of 2,000 feet

The Huerfano Formation in Huerfano Park has produced a variety of vertebrate fossils. These include rodents, marsupials, primates

Table 19: Species List for the Cuchara Formation.

Carnivora
Didymictis cf. D. protenus

Condylarthra
Hyopsodus wortmani
Phenacodus intermedius

Creodonta
Sinopa cf. S. vulpecula

Pantodonta
Coryphodon sp.

Perissodactyla
Hyracotherium sp. either H. angustidens or H. vasacciense
Lambdotherium popoagicum

Primates
Cynodontomys knightensis

carnivores, condylarths, artiodactyls, and perissodactyls Robinson, 1966). The localities in this area are considered scientifically significant. Kihm and Middleton (1980) noted that the fossils collected in the park are transitional between the Wasatchian and Bridgerian. P. Robinson (pers. comm.) returns to Huerfano Park about every other year to collect. The Huerfano Formation is designated as Class 1-b based on its importance to paleontology. Those species which have been collected from localities that lie within the park (Appendix I) are listed in Table 20.

Farisita Formation (Middle Eocene to ?Oligocene)

The Farisita Formation is exposed on the south and west side of the West Mountains in Huerfano Park. Outcrops are discontinuous and scarce in the study area. Lithologically this formation is composed of coarse buff conglomerates and siltstones. The conglomerates are poorly sorted and cemented. Precambrian clasts, from pebble size to boulders 8 feet in diameter, indicate resurgent uplift in the adjacent Wet Mountains. The Farisita reaches a thickness of up to 1,200 feet.

Farisita fossils are uncommon and poorly preserved (Johnson, 1959; Robinson, 1966). The Farisita unconformably overlies the Huerfano Formation and, where erosion has taken place, successively older formations back to the Precambrian. The Farisita also intertongues with the Huerfano Formation in Huerfano Park (Robinson, 1966). Fossils collected by Robinson (1966) date the Farisita in Huerfano Park as Eocene. However, within the study area the Farisita also extends

Table 20: Species of the Huerfano Formation.

Marsupialia
- *Peratherium* cf. *P. comstockii*

Insectivora
- *Apatemys* lg. sp.
- *A.* sm. sp.
- *Diacodon* or *Paleictops* sp.
- *Nyctitherium* cf *N. velox*
- *Palaeictops bicuspis*
- *Scenopagus edenensis*
- *S. priscus*
- *Talpavus* cf. *T. nitidus*

Primates
- *Absarokius noctivagus nocerai*
- *Cynodontomys scottianus*
- *C. scottianus?*
- *Huerfanius rutherfordi*
- *Loveina zephyri*
- *Microsyops lundeliusi*
- *Notharctus nunienus*
- *Phenacolemur jepseni simpsoni*
- *Shoshonius cooperi*

Tillodontia
- *Esthonyx acutidens*
- *Trogosus grangeri*
- *T. hillsi*

Taeniodonta
- *Stylinodon* sp.

Edentata
- *Metacheiromys* sp.

Rodentia
- *Leptotomus costilloi*
- *L. grandis*
- *L. parvus*
- *Microparamys* sp. B
- *Paramys copei copei*
- *P. excavatus gardneri*
- *Reithroparamys huerfanensis*
- *Thisbemys nini*

Carnivora
- *Didymictis altidens*
- *D.* cf. *D. protenus*
- *D. vancleveae*
- *Miacis* cf. *M. parvivorus*
- ?*Oodectes herpestoides*
- *Oxyaena* cf. *O. lupina*

Table 20 continued.

Sinopa cf. *S. strenua*
Uintacyon cf. *U. asodes*
Viverravus gracilis
V. sicarius
Vulpavus asius

Creodonta
Patriofelis paulus
?P. sp.

Condylartha
Hyopsodus paulus
H. walcottianus
Phenacodus wortmani

Dinocerata
Bathyopsis cf. *B. fissidens*

Pantodonta
Coryphodon sp.

Perissodactyla
Eotitanops borealis
E. minimus
Helaletes cf *H. nanus*
?*Heptodon* sp.
Hyrachyus modestes
Hyrachotherium craspedotum
H. vasacciense
Lambdotherium popoagium
Palaeosyops fontinalis
Xenicohippus osborni

Artiodactyla
Antiacodon pygmaeus huerfanensis
Bunophorus cf. *B. macropternus*
Diacodexis chacensis
D. cf. *secans*

Eocene sediments and these beds are generally figured to be younger. Fossil remains would be helpful in dating the Farisita Formation. The area is designated as 1-b. Those fossils that have been collected are listed in Table 21 and the known localities in the study area are noted in Appendix I.

Devil's Hole Formation (?Miocene)

The sediments of the Devil's Hold Formation consist of waterlaid volcanic rocks which contain pebbles of Precambrian gneiss and schist (Johnson and Wood, 1956). It varies in thickness from 25 to 1,300 feet. Outcrops in the study area occur only in the north-central part of Huerfano Park.

Fossils are rare. The only reported specimen is the gastropod *Helix*? cf. *H*.? *leidyi* from the collections of the University of Colroado Museum. The Devil's Hole Formation is designated Class 3.

Table 21 : Species list for the Farisita Formation.

Amblypoda
Coryphodon sp.

Artiodactyla
Bunophorus macropterrus

Carnivora
Viverravus gracilis

Condylarthra
Hyopsodus walcottianus

Edentata
Metacheiromys sp.

Perissodactyla
?*Heptodon* sp.
Hyracotherium sp.
Lambdotherium sp.

Primates
Cynodontomys scottianus

Quaternary

Quaternary Deposits

Quaternary deposits consist of alluvial sands and gravels, and occur in stream channels and valley flats throughout the study area. Due to variable lithologies, descriptions and ages of strata are not possible without field studies and/or associated fossils.

Vertebrates of Pleistocene to Holocene age are reported randomly throughout the study area. They include proboscideans, horses, camels, bison, edentates, and rodents (Carpenter and Boston, 1980) They are not a predictable part of any certain formation and are therefore not classified in this report. It should be noted, however, that even though vertebrate fossil sites are not abundant, and specimens are poorly preserved, they can be useful for age determination and every effort should be made to see that the proper agencies are notified of new discoveries. These deposits are provisionally designated Class 3 where they outcrop on BLM land. Table 23 is a list of species found in Quaternary deposits.

Table 22: Species List for Quaternary Deposits

Artiodactyla
- *Bison latrifrons*
- *Bison* sp.
- *Camelops* sp.
- ?*Ovibos* sp.

Edentata
- *Paramylodon* sp.

Perissodactyla
- *Equus* sp.

Proboscidea
- *Mammut* sp.
- *Mammuthus columbi*
- *M. imperator*
- *M. jeffersoni*
- *M.*, n. sp.

Rodentia
- *Cynomys hibbardi?*
- *Spermophilus* sp.

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Appendix I: Localities Within the Study Area.

Location	Reference	Fossils	Depository
Harding Formation			
NW¼ Sec. 5, T.23S., R.68W. Pueblo County	Sweet 1955	Conodonts	Ohio State Univ.
NE¼ Sec. 5, T.23S., R.68W, Pueblo County	Sweet 1954	–	Univ. Co. Mus. Iowa State Univ.
Fremont Limestone			
NE¼ Sec. 5, T.23S., R.68W. Pueblo County	"	–	Univ. Co. Mus. Iowa State Univ.
Beulah Limestone			
NW¼ NE¼ Sec. 4, T.23S., R.68W. Pueblo County			
Sharpsdale Formation			
*E½ Sec. 23, SW¼ Sec. 24, T.27S., R.72W. Huerfano County	Bolyard 1959	Invertebrates Brachiopods	Univ. Co. Mus.
SE¼ Sec. 21, T.28S., R.70W. Huerfano County	"	Invertebrates Fusulinids Brachiopods	"
Minturn Formation			
SE¼ Sec. 21, T.28S., R.70W. Huerfano County	"	Invertebrates Brachiopods	"
East of saddle between Horn Peak and Little Horn Peak Huerfano County	"	"	"

*Localities which are on BLM land

Appendix I continued.

Location	Reference	Fossils	Depository
Minturn Formation continued			
*SW¼ Sec. 9, T.27S., R.71W. Huerfano County	Bolyard 1959	Invertebrates	Univ. Co. Mus.
*Sec. 9, T.26S., R.71W. Huerfano County	Bolyard 1959	Invertebrates	Univ. Co. Mus.
Graneros Shale			
NW¼ SE¼ SE¼ Sec. 36, T.20S., R.66W. Pueblo County	Cobban & Scott 1972	Ammonites	U.S. Geol. Surv. U.S. Nat'l. Mus. Univ. Texas
SW¼ NW¼ NW¼ SW¼ Sec. 30, T.20S., R.65W. Pueblo County	"	"	"
SE¼ NW¼ SW¼ Sec. 20, T.20S., R.65W. Pueblo County	"	"	"
NE¼ SW¼ SW¼ Sec. 20, T.20S., R.65W. Pueblo County	"	"	"
SE¼ NW¼ SW¼ Sec. 20, T.20S., R.65W. Pueblo County	"	"	"
NW¼ SW¼ Sec. 20, T.20S., R.65W. Pueblo County	"	"	"
SW¼ Sec. 30, T.20S., R.65W. Pueblo County	"	"	"
SW¼ SW¼ Sec. 20, T.20S., R.65W. Pueblo County	"	"	"
NW¼ SW¼ Sec. 20, T.20S., R.65W. Pueblo County	"	"	"

Appendix I continued.

Location	Reference	Fossils	Depository
Graneros Shale continued			
SE¼ SW¼ Sec. 30, T.20S., R.65W. Pueblo County	Cobban & Scott 1972	Ammonites	U.S. Geol. Surv. U.S. Nat'l. Mus. Univ. Texas
NW" SE¼ SW¼ Sec. 30, T.20S, R.65W. Pueblo County	"	"	"
NE¼ Sec. 34, T.21S., R.68W. Pueblo County	"	"	"
NW¼ NE¼ Sec. 34, T.21S., R.68W. Pueblo County	"	"	"
NW¼ NE¼ Sec. 34, T.21S., R.68W. Pueblo County	"	"	"
SE¼ NE¼ SW¼ SW¼ Sec. 23, T.22S., R.67W. Pueblo County	"	"	"
NW¼ SE¼ SW¼ Sec. 23, T.22S., R.67W. Pueblo County	"	"	"
NW¼ SE¼ SW¼ Sec. 23, T.22S., R.67W. Pueblo County	"	"	"
NW¼ NW¼ Sec. 18, T.22S., R66W. Pueblo County	"	"	"
NW¼ SE¼ SW¼ Sec. 23, T.23S., R67W. Pueblo County	"	"	"
Secs. 25 & 26, T.23S., R.66W. Pueblo County	"	"	"

Appendix I continued.

Location	Reference	Fossils	Depository
Graneros Shale continued			
Sec. 35, T.23S., R.66W. Pueblo County	Cobban & Scott 1972	Ammonites	U.S. Geol. Surv. U.S. Nat'l. Mus. Univ. Texas
	"	"	
NE¼ Sec. 13, T.24S., R.65W. Pueblo County	"	"	"
N½ Sec. 10, T.29S., R.60W. Pueblo County	"	"	"
Sec. 31 or 32, T.20S., R.65W. Pueblo County	Scott	Ammonites	U.S. Geol. Surv.
E½ Sec. 25, T.20S., R.66W. and W½ Sec. 30, T.20S., R.65W. Pueblo County	Eicher 1965	Foraminifera	Univ. Co. Mus.
SE¼ Sec. 5, T.27S., R.68W. Huerfano	"	"	"
SC½ Sec. 3, T.29S., R.60W. Las Animas County	Kauffman et al. 1969	Invertebrates	U.S. Nat'l. Mus Univ. Mich.
NW¼ Sec. 31, T.28S., R.59W. Las Animas County	"	"	"
NW¼ Sec. 31, T.28S., R.59W. Las Animas County	"	"	"
Greenhorn Limestone			
SE¼ NE¼ Sec. 18, T.18S., R.67W. Pueblo County	Cobban & Scott 1972	Ammonites	U.S. Geol. Surv. U.S. Nat'l. Mus. Univ. Texas

Appendix I continued.

Location	Reference	Fossils	Depository
Greenhorn Limestone continued			
SW¼ Sec. 20, T.18S., R.66W. Pueblo County	Cobban & Scott 1972	Ammonites	U.S. Geol. Surv. U.S. Nat'l. Mus. Univ. Texas
Sec. 2, T.19S. R.66W. Wild Horse Park Pueblo County	"	"	"
NE¼ SE¼ SE¼ SE¼ Sec. 35, T.20S., R.66W. Pueblo County	"	"	"
NW¼ Sec. 25, T.20S., R.66W. Pueblo County	"	"	"
SW¼ NE¼ Sec. 25, T.20S., R.66W. Pueblo County	"	"	"
NE¼ SE¼ NW¼ Sec. 25, T.20S., R.66W. Pueblo County	"	"	"
NE¼ SW¼ NE¼ Sec. 25, T.20S., R.66W. Pueblo County	"	"	"
NE¼ SE¼ NW¼ Sec. 25, T.20S., R.66W. Pueblo County	"	"	"
SW¼ SE¼ SE¼ Sec. 35, T.20S., R.66W. Pueblo County	"	"	"
SE¼ SE¼ Sec. 35, T.20S., R.66W. Pueblo County	"	"	"
SW¼ SE¼ SE¼ Sec. 35, T.20S., R.66W. Pueblo County	"	"	"

Appendix I continued.

Location	Reference	Fossils	Depository
Greenhorn Limestone continued			
SW¼ NW¼ Sec. 25, T.20S., R.66W. Pueblo County	Cobban & Scott 1972	Ammonties	U.S. Geol. Surv. U.S. Nat'l. Mus. Univ. Texas
NE¼ SW¼ NE¼ Sec. 35, T.20S., R.66W. Pueblo County	"	"	"
SE¼ SW¼ SE¼ Sec. 35, T.20S., R.66W. Pueblo County	"	"	"
NE¼ NE¼ NE¼ Sec. 35, T.20S., R.66W. Pueblo County	"	"	"
SW¼ T.20S., R.65W. Pueblo County	"	"	"
C of N½ N½ Sec. 31, T.20S., R.65W. Pueblo County	"	"	"
NW¼ SE¼ SW¼ Sec. 30, T.20S., R.65W. Pueblo County	"	"	"
SE¼ SE¼ SW¼ Sec. 30, T.20S., R.65W. Pueblo County	"	"	"
NW¼ SW¼ Sec. 30, T.20S., R.65W. Pueblo County	"	"	"
SW¼ NW¼ SE¼ Sec. 30, T.20S., R.65W. Pueblo County	"	"	"
SE¼ SE¼ SW¼ Sec. 30, T.20S., R.65W. Pueblo County	"	"	"

Appendix I continued.

Location	Reference	Fossils	Depository
Greenhorn Limestone continued			
SE¼ NW¼ Sec.30, T.20S., R.65W. Pueblo County	Cobban & Scott 1972	Ammonites	U.S. Geol. Surv. U.S. Nat'l. Mus. Univ. Texas
E of C of SW¼ Sec. 30, T.20S., R.65W. Pueblo County	"	"	"
SW¼ NE¼ NE¼ Sec. 21S., R.66W. Pueblo County	"	"	"
NE¼ NE¼ Sec. 2, T.21S., R.66W. Pueblo County	"	"	"
SW¼ NE¼ NE¼ Sec. 2, T.21S., R.66W. Pueblo County	"	"	"
SE¼ SW¼ NE¼ Sec. 2, T.21S., R.66W. Pueblo County	"	"	"
SW¼ NW¼ NW¼ Sec. 1, T.21S., R.66W. Pueblo County	"	"	"
SW¼ NW¼ NW¼ Sec. 1 and NE¼ NE¼ Sec. 2, T.21S., R.66W. Pueblo County	"	"	"
NW¼ NW¼ Sec. 1 and NE¼ NE¼ Sec. 2, T.21S., R.66W Pueblo County	"	"	"
SW¼ NE¼ Sec. 2, T.21S., R.66W. Pueblo County	"	"	"
NW¼ NW¼ NW¼ Sec. 1, T.21S., R.66W. Pueblo County	"	"	"

Appendix I Continued.

Location	Reference	Fossils	Depository
Greenhorn Limestone continued			
NE¼ SE¼ NE¼ Sec. 2, T.21S., R.66W. Pueblo County	Cobban & Scott 1972	Ammonites	U.S. Geol. Surv. U.S. Nat'l. Mus. Univ. Texas
NW¼ SW¼ NW¼ Sec. 1, T.21S., R.66W. Pueblo County	"	"	"
NE¼ SE¼ NW¼ Sec. 2, T.21S., R.66W. Pueblo County	"	"	"
NE¼ SE¼ NE¼ Sec. 2, T.21S., R.66W. Pueblo County	"	"	"
NW¼ NW¼ NW¼ Sec. 1, T.21S., R.66W. Pueblo County	"	"	"
NE¼ SE¼ NE¼ Sec. 2, T.21S., R.66W. Pueblo County	"	"	"
NW¼ SW¼ NW¼ Sec. 1, T.21S., R66W. Pueblo County	"	"	"
NW¼ NW¼ Sec. 6, T.21S., R.65W. Pueblo County	"	"	"
SE¼ NW¼ Sec. 23, T.22S., R.65W. Pueblo County	"	"	"
SE¼ NE¼ Sec. 36, T.24S., R.67W. Pueblo County	"	"	"
NE¼ NE¼ NE¼ Sec. 32, T.25S., R.61W. Pueblo County	"	"	"

Appendix I continued.

Location	Reference	Fossils	Depository
Greenhorn Limestone continued			
Sec. 26?, T.27S., R.62W. Las Animas County	Cobban & Scott 1972	Ammonites	U.S. Geol. Surv. U.S. Nat'l. Mus. Univ. Texas
NW¼ Sec. ?, T.28S., R.60W. Las Animas County	"	"	"
NW¼ NW¼ NE¼ Sec. 35, T.20S., R.60W. Las Animas County	"	"	"
NE¼ NW¼ Sec. 13, T.30S., R.60W. Las Animas County	"	"	"
SW¼ SE¼ Sec. 15, T.30S., R.60W. Las Animas County	"	"	"
NW¼ NE¼ Sec. 2, T.21S., R.66W. Pueblo County	Eicher 1966	Foraminifera	Univ. Co. Mus.
SE¼ SW¼ Sec. 30, T.20S., R.65W. Pueblo County	"	"	"
NE¼ NW¼ Sec. 31, T.20S., R.65W. Pueblo County	Scott	Invertebrates	U.S. Geol. Surv.
Carlile Shale			
NW¼ NW¼ Sec. 30, T.20S., R.65W. Pueblo County	Eicher 1966	Foraminifera	Univ. Co. Mus.
SW¼ SW¼ Sec. 35, T.20S., R.66W. Pueblo County	"	"	"
NW¼ NW¼ Sec. 25, T.20S., R.66W. Pueblo County	"	"	"

Appendix I continued.

Location	Reference	Fossils	Depository
Carlile Shale continued			
SW¼ SE¼ Sec. 31, T.20S., R.65W. Pueblo County	Eicher 1966	Foraminifera	Univ. Co. Mus.
NW¼ NE¼ Sec. 2, T.21S., R.66W. Pueblo County	"	"	"
*S½ NW¼ Sec. 28, T.26S., R.71W. Huerfano County	Kauffman & Pope 1961	Bivalves Ammonites	Univ. Mich. Mus. Paleo.
*SW¼ Sec. 26, T.26S., R.71W. Huerfano County	"	Ringicula	"
SW¼ Sec. 30, T.20S., R.65W. and Pueblo County	Eicher & Worstell 1970	Heterohelicid	Univ. Co. Mus.
Secs. 31-34, T.28S., R59W. Las Animas County	Kauffman et al. 1969	Invertebrates	U.S. Nat'l. Mus. Univ. Mich. Mus.
Secs. 28, 29, or 30, T.28S., R.60W. Las Animas County	"	"	"
*NW¼ Sec. 5 and NE¼ Sec. 6, T.27S., R.68W. Huerfano County	"	"	"
*SW¼ SE¼ Sec. 26, T.26S., R.71W. Huerfano County	"	"	"
Niobrara Formation			
Sec. 1, T.32S., R.62W. Las Animas County	Cobban 1951	Invertebrates	U.S. Geol. Surv.
NE¼ NW¼ Sec. 20, T.20S., R.65W. Pueblo County	Scott 1964	Inoceramus	U.S. Geol. Surv. or U.S. Nat'l. Mus.

Appendix I continued.

Location	Reference	Fossils	Depository
Niobrara Formation continued			
NE¼ NE¼ Sec. 26, T.20S., R.66W. Pueblo County	Scott 1964	Rudistid	U.S. Geol. Surv. or U.S. Nat'l. Mus.
E½ Sec. 32, T.20S., R.65W. Pueblo County	"	*Inoceramus* *Ostrea* *Barroisiceras*	"
NE¼ SW¼ Sec. 5, T.21S., R.65W. Pueblo County	"	*Prionocycloceras*	"
SE¼ SE¼ Sec. 11, T.21S., R.65W. Pueblo County	"	"	"
NE¼ Sec. 32, T.20S., R.65W. Pueblo County	"	*Inoceramus* *Ostrea*	"
SW¼ NW¼ SW¼ Sec. 4, T.21S., R.65W. Pueblo County	"	*Inoceramus*	"
NW¼ Sec. 26, T.18S., R.66W. Pueblo County	"	"	"
NW¼ SW¼ NE¼ Sec. 26, T.20S., R.66W. Pueblo County	"	"	"
SW¼ NW¼ Sec. 16, T.20S., R.65W. Pueblo County	"	*Inoceramus* *Baculites* *Haploscapha*	"
NE¼ Sec. 32 and NW¼ Sec. 33, T.20S., R.65W. Pueblo County	"	The above plus *Ostrea*	"
NE¼ NE¼ Sec. 23, T.21S., R.66W. Pueblo County	"	*Scaphites*	"

Appendix I continued.

Location	Reference	Fossils	Depository
Niobrara Formation continued			
SE¼ NW¼ Sec. 16, T.20S., R.65W. Pueblo County	Scott 1964	Inoceramus	U.S. Geol. Surv. or U.S. Nat'l. Mus.
SE¼ NW¼ SW¼ Sec. 4, T.21S., R.65W. Pueblo County	"	Inoceramus Ostrea	"
SE¼ NW¼ Sec. 33, T.20S., R.65W. Pueblo County	"	Inoceramus Phlycticrioceras	"
SW¼ NE¼ Sec. 61, T.20S., R.65W. Pueblo County	"	Inoceramus	"
SE¼ NW¼ Sec. 16, T.20S., R.65W. Pueblo County	"	Inoceramus Baculites Pseudobaculites	"
NE¼ NE¼ Sec. 32, T.20S., R.65W. Pueblo County	"	Spiral burrows	"
NW¼ SE¼ Sec. 9, T.20S., R.65W. Pueblo County	"	Inoceramus Baculites	"
SE¼ NE¼ SW¼ Sec. 5, T.20S., R.65W. Pueblo County	"	Inoceramus	"
NW¼ SW¼ NW¼ Sec. 21, T.20S., R.65W. Pueblo County	"	Inoceramus Spiral burrows	"
NE Corner Sec. 8, T.20S., R.65W. Pueblo County	"	Inoceramus	"
NE¼ SE¼ NW¼ Sec. 16, T.20S., R.65W. Pueblo County	"	Neocrioceras Inoceramus	"

Appendix I continued.

Location	Reference	Fossils	Depository
Niobrara Formation continued			
NW¼ Sec. 28, T.20S., R.66W. Pueblo County	Scott 1964	Inoceramus	U.S. Geol. Surv. or U.S. Nat'l. Mus.
NW½ Secs. 33, 34, and 35, T.20S., R.65W. Pueblo County	"	Inoceramus Ostrea	"
SW¼ NE¼ SW¼ Sec. 10, T.20R., R.65W. Pueblo County	"	Inoceramus Ostrea, Baculites Clioscaphites	"
NW¼ NW¼ Sec. 27, T.20S., R.65W. Pueblo County	"	Inoceramus	"
NE¼ SW¼ Sec. 10, T.20S., R.65W. Pueblo County	"	Inoceramus Baculites Clioscaphites	"
NE¼ SW¼ SW¼ Sec. 3, T.20S., R.65W.	"	Inoceramus Anomia, Baculites Clioscaphites	"
NE¼ SW¼ Sec. 10, T.20S., R.65W. Pueblo County	"	Inoceramus Anomia	"
MW¼ Sec. 25, T.18S., R.66W. Pueblo County	"	Inoceramus, Anomia Lucina, Baculites Clioscaphites	"
SW¼ NW¼ Sec. 10, T.20S., R.65W. Pueblo County		Inoceramus, Baculites Clioscaphites	"
NE¼ SW¼ NW¼ Sec. 21, T.20S., R.65W. Pueblo County	"	Inoceramus, Pteria Ostrea, Baculites Clioscaphites	"

Appendix I continued.

Location	Reference	Fossils	Depository
Niobrara Formation continued			
NW¼ SE¼ Sec. 9, T.20S., R.65W. Pueblo County	Scott 1964	*Inoceramus*, *Pteria* *Ostrea*, *Baculites* *Clioscaphites*	U.S. Geol. Surv. or U.S. Nat'l. Mus.
SE¼ SW¼ Sec. 21, T.20S., R.65W. Pueblo County	"	*Inoceramus* *Baculites* *Scaphites*	"
NW¼ SE¼ Sec. 9, T.20S., R.65W. Pueblo County	"	The above plus *Protexanites*	"
SE¼ NW¼ Sec. 16, T.20S., R.65W. Pueblo County	"	*Inoceramus* *Baculites*, *Scaphites*	"
NW¼ SE¼ Sec. 9, T.20S., R.65W. Pueblo County	"	*Scaphites*	"
NW¼ Sec. 35, T.20S., R.65W. Pueblo County	"	*Inoceramus*	"
NE¼ SW¼ SW¼ Sec. 3, T.20S., R.65W. Pueblo County	"	*Inoceramus*, *Ostrea* *Baculites*, *Clioscaphites*	"
NW¼ NE¼ NW¼ Sec. 15, T.20S., R.65W. Pueblo County	"	*Inoceramus*, *Ostrea* *Clioscaphites*	"
NE¼ NW¼ NW¼ Sec. 15, T.20S., R.65W. Pueblo County	"	"	"
NW¼ SW¼ NW¼ Sec. 36, T.20S., R.65W. Pueblo County	"	*Inoceramus*, *Baculites* *Stramentum*	"
NW¼ SE¼ NE¼ Sec. 15, T.20S., R.65W. Pueblo County	"	*Inoceramus*	"

Appendix I continued.

Location	Reference	Fossils	Depository
Niobrara Formation continued			
SE¼ SE¼ Sec. 34, T.20S., R.65W. Pueblo County	Scott 1964	*Inoceramus*	U.S. Geol. Surv. or U.S. Nat'l. Mus.
SE¼ NW¼ Sec. 15, T.20S., R.65W. Pueblo County	"	"	"
NW¼ NE¼ Sec. 22, T.20S., R.65W. Pueblo County	"	*Inoceramus*, *Ostrea*	"
SW¼ NW¼ SE¼ Sec. 10, T.20S., R.65W. Pueblo County	"	"	"
SW¼ Sec. 34, T.19S., R.65W. Pueblo County	"	*Inoceramus*	"
NW¼ SE¼ Sec. 10, T.20S., R.65W. Pueblo County	"	*Inoceramus*, *Baculites* *Ostrea*	"
NW¼ SW¼ NW¼ Sec. 36, T.20S., R.65W. Pueblo County	"	*Inoceramus*, *Baculites* *Stramentum*	"
NW¼ SW¼ Sec. 10, T.20S., R.65W. Pueblo County	"	*Clioscaphites* *Scaphites*	"
NE¼ SW¼ NW¼ Sec. 23, T.23S., R.59W. Otero County	Cobban et al. 1962	*Haresiceras*	"
18 miles west of Pueblo near Carlile Springs on Arkansas River Pueblo County	Stanton 1893	Invertebrates	U.S. Nat'l. Mus.
SW¼ SE¼ Sec. 26, T.206S, R.71W. Huerfano County	Kauffman et al. 1969	Invertebrates	U.S. Nat'l. Mus. Univ. Mich. Mus.

Appendix I continued.

Location	Reference	Fossils	Depository
Pierre Shale			
3 miles SE Trinidad Las Animas County	Lee, 1917	Invertebrates	U.S. Nat'l. Mus.
1 mile NE Trinidad Las Animas County	"	"	"
2 miles NE Trinidad Las Animas County	"	"	"
Sec. 25, T.32S., R.64W Las Animas County	"	"	"
2 miles N Trinidad Las Animas County	"	"	"
1 3/4 miles E Monson ?	"	"	"
2¼ miles E Monson ?	"	"	"
NW¼ Sec. 10, T.20S., R.65W. Pueblo County	Cobban, 1958	*Baculites*	U.S. Nat'l. Mus.
SE¼ Sec. 15, T.20S., R.64W. Pueblo County	"	"	"
NE¼ NW¼ SE¼ Sec. 12, T.19S., R.65W. Pueblo County	Cobban & Scott 1964	Cephalopods	U.S. Nat'l. Mus.
W½ NW¼ Sec. 125, T.19S., R.65W Pueblo County	"	"	"
NE¼ NW¼ SE¼ Sec. 26, T.19S., R.65W. Pueblo County	"	*Tachyscaphites*	"

Appendix I continued.

Location	Reference	Fossils	Depository
Pierre Shale continued			
SW¼ NE¼ SE¼ Sec. 8, T.20S., R.64W. Pueblo County	Cobban & Scott 1964	Cephalopods	U.S. Nat'l. Mus.
N½ SE½ SE¼ Sec. 11, T.19S., R.65W. Pueblo County	"	"	"
SW¼ SE¼ Sec. 36, T.29S., R.65W. Huerfano & Las Animas Counties	Russel, 1967	Mosasaur	Royal Ontario Mus.
SE¼ NW¼ Sec. 15, T.20S., R.65W. ?	Fischer, 1980	Invertebrates	U.S. Geol. Surv. or U.S. Nat'l. Mus.
NW¼ SE¼ Sec. 16, T.29S., R.65W. ?	"	"	"
NW¼ NW¼ Sec. 30, T.32S., R.63W. ?	"	"	"
SW¼ NE¼ Sec. 6, T.33S., R.63W. ?	"	"	"
SE¼ SE¼ Sec. 7, T.33S., R.63W. ?	"	"	"
SE¼ SE¼ Sec. 20, T.33S., R.63W. ?	"	"	"
Trinidad Sandstone			
½ mile E Pryor Mine near Rouse ?	Lee, 1917	Invertebrates	U.S. Nat'l. Mus.

Appendix I continued.

Location	Reference	Fossils	Depository
Vermejo Formation			
Gray Creek ?	Lee, 1917	Invertebrates	U.S. Nat'l. Mus.
SE¼ SE¼ Sec. 23, T.27S., R.67W. ?	Fischer, 1980	Vertebrates	U.S. Geol. Surv. or U.S. Nat'l. Mus.
NE¼ NE¼ Sec. 9, T.29S., R.69W. ?	"	"	"
SE¼ NE¼ Sec. 34, T.33S., R.65W. ?	"	"	"
Raton Formation			
SW¼ NW¼ Sec. 9, T.27S., R.67W. ?	Fischer, 1980	Vertebrates	U.S. Geol. Surv. or U.S. Nat'l. Mus.
NE¼ NE¼ Sec. 16, T.29S., R.69W. ?	"	"	"
Poison Canyon Formation			
SW¼ NE¼ Sec. 35, T.29S., R.69W. ?	Fischer, 1980	Vertebrates	U.S. Geol. Surv. or U.S. Nat'l. Mus.
Cuchura Formation			
SW¼ Sec. 19, T.29S., R.67W. Huerfano County	Robinson, 1960	*Sinopa*	Yale Peabody Mus.
Secs. 16, 17, 20, 21, T.28S., R.68W. Huerfano County	Robinson, 1963	Vertebrates	Yale Peabody Mus. Univ. Co. Museum
NE¼ NW¼ SW¼ Sec. 20, T.27S., R.69W. Huerfano County	"	*Lambdotherium*	"

Appendix I continued.

Location	Reference	Fossils	Depository
Huerfano Formation			
SW¼ SW¼ Sec. 21, T.26S., R.69W. Huerfano County	Robinson, 1966	Vertebrates	Univ. Co. Mus. Yale Peabody Mus. Am. Mus. Nat.Hist.
E½ SW¼ Secs. 2 & 3, T.26S., R.70W. Huerfano County	"	"	"
SE¼ Sec. 33, T.26S., R.69W. and NC Sec. 4, T.27S., R.69W. Huerfano County	"	"	"
SE¼ SW¼ Sec. 1, T.26S., R.70W. Huerfano County	"	"	"
NC Sec. 12, T.26S., R.70W. Huerfano County	"	"	"
*NW¼ Sec. 33, T.26S., R.69W. Huerfano County	"	"	"
NW¼ NW¼ Sec. 21, T.28S., R.68W. Huerfano County.	"	"	"
NW¼ Sec. 12, T.26S., R.70W. Huerfano County	"	"	"
*SE¼ SW¼ Sec. 29, T.26S., R.69W. Huerfano County	"	"	"
E½ Sec. 1, T.26S., R.70W. Huerfano County	"	"	"
NW¼ Sec. 20, T.27S., R.69W. Huerfano County	Locality Files	Vertebrates	Univ. Co. Mus.

Appendix I continued.

Location	Reference	Fossils	Depository
NE¼ NE¼ NE¼ Sec. 10, T.27S., R.68W. and SW¼ SW¼ SW¼ Sec. 2, T.27S., R.68W. Huerfano County	Locality Files	Vertebrates	Univ. Co. Mus.
NW¼ NW¼ Sec. 2, T.27S., R.69W. Huerfano County	"	"	"
*NE¼ Sec. 35, T.26S., R.71W. Huerfano County	Locality Files	Foraminifera	Univ. Co. Mus.
SW¼ Sec. 4, T.27S., R.68W. Huerfano County	"	"	"
NC Sec. 12, T.26S., R.70W. Huerfano County	Simpson, 1968	Peritherium	Univ. Co. Mus.?
Secs. 14, 15, & 16, T.26S., R.70W. Huerfano County	Robinson, 1966	Vertebrates	Univ. Co. Mus.?
C Sec. 31, T.25S., R.69W. Huerfano County	"	"	"
SE¼ Sec. 26, T.25S., R.70W. Huerfano County	"	"	"
*Sec. 11, T.27S., R.69W. Huerfano County	"	"	"
*Sec. 25, T.25S., R.71W. Huerfano County	"	"	"
*Sec. 30, T.25S., R.70W. Huerfano County	"	"	"

Appendix I continued.

Location	Reference	Fossils	Depository
Farisita Formation			
Sec. 17 or 18, T.26S., R.60W. Huerfano County	Robinson, 1966	Vertebrates	Univ. Co. Mus.?
Miscellaneous Formations			
Graneros to Upper Pierre			
Secs. 24 & 25, T.20S., R.66W. Pueblo County	Scott, 1964	Invertebrates	U.S. Geol. Surv. or U.S. Nat'l. Mus.
Secs 32 to 36, T.20S., R.65W. Pueblo County	"	"	"
Secs. 14, 23, 25, & 35, T.19S., R.65W Pueblo County	"	"	"
Secs. 2, 10, 15, 16, & 21, T.20S., R.64W. Pueblo County	"	"	"
Secs. 9, 10, & 35, T.19S., R.64W. Pueblo County	"	"	"
Dakota-Graneros Transition			
NW¼ Sec. 3, T.29S., R.60W., SE¼ Sec. 34, T.28S., R.60W., and SW¼ Sec. 35, T.28S., R.60W. Las Animas	Kauffman et al. 1969	Invertebrates	U.S. Nat'l. Mus. Univ. Mich. Mus.
NE¼ SE¼ Sec. 5, T.27S., R.68E. Huerfano County	"	"	"
*SE¼ Sec. 34 to NW¼ SW¼ Sec. 34, T.26S., R.68W. Huerfano County	"	"	"

Appendix I completed.

Location	Reference	Fossils	Depository
Miscellaneous Formations continued			
Graneros to Greenhorn			
Secs. 3 to 6 & 15 to 18, T.29S., R.59W. Las Animas County	Kauffman et al. 1969	Invertebrates	U.S. Nat'l. Mus. Univ. Mich. Mus.
Dakota to Niobrara			
S½ Sec. 4, T.27S., R.68W. Huerfano County	"	"	"
*S½ Sec. 5 & N½ Sec. 8, T.27S., R.68W. Huerfano County	"	"	"
Carlile Shale to Niobrara			
NW¼ Sec. 5 & NE¼ Sec. 6, T.27S., R.68W. Huerfano County	"	"	"
Greenhorn to Niobrara			
*SW¼ SE¼ Sec. 26 to NW¼ Sec. 35, T.26S., R.71W. Huerfano County	"	"	"