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Aspects of Coal Geology, Northwest Colorado Plateau
Some Geologic Aspects of Coal Accumulation, Alteration, and Mining
In Western North America: A Symposium

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Ammonite Record from the Mancos Shale of the Castle Valley-Price-Woodside Area, East-Central Utah.

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ABSTRACT.—The Mancos Shale of east-central Utah contains ammonites indicative of parts of the Cenomanian, Turonian, Coniacian, Santonian, and Campanian stages of the Upper Cretaceous. Ammonite zones that have been determined are, from oldest to youngest, *Sciponoceras gracile* (Shumard), *Collignoniceras woollgari* (Mantell), *Prionocyclus hyatti* (Stanton), *Scaphites warreni* Meek and Hayden, *S. whitfieldi* Cobban, *S. preventricosus* Cobban, *S. ventricosus* Meek and Hayden, *S. depressus* Reeside, *Clioscaphites vermiformis* (Meek and Hayden), *Desmoscaphites bassleri* Reeside, and *Scaphites hippocrepis* (DeKay). Most ammonites occur in silty limestone concretions and very fine-grained calcareous sandstone concretions.

INTRODUCTION

In east-central Utah the Mancos Shale, of Late Cretaceous age, is chiefly a dark gray marine shale containing two widespread sandy units—the Ferron and Emery Sandstone Members. Hale (1972) regarded the Ferron and Emery as formations in this area and applied the name Tununk Shale to the unit beneath the Ferron, Blue Gate Shale to the shale above it, and Masuk Shale to the shale above the Emery. The Tununk, Blue Gate, and Masuk are regarded as members of the Mancos by the U.S. Geological Survey. The Mancos Shale rests rather sharply on the Lower (?) and Upper Cretaceous Dakota Sandstone and grades upward into and interfingers with the cliff-forming Upper Cretaceous Star Point Sandstone. The Mancos is less resistant than the contiguous formations, and it forms Castle Valley which is bounded by the San Rafael Swell to the east and the Wasatch Plateau to the west (Fig. 1). The Mancos Shale also forms a valley around the northern flank of the San Rafael Swell; this valley is the Price Valley of Stokes (1954, Fig. 2) and the Clark Valley of Clark (1928, Pl. 22). Spieker (1931, p. 18, 19) recorded the thickness of the Mancos as 4,150 feet (1,265 meters) in the southern part of Castle Valley and about 5,000 feet (1,524 m) in the northern part.

The Ferron Sandstone Member ranges in thickness from about 800 feet (244 m) at the southern end of Castle Valley to 75 feet (23 m) near Farnham, about 10 miles (16 kilometers) southeast of Price (Lupton, 1916, p. 31). According to Katich (1954, p. 46), the base of the member lies 650 feet (198 m) above the Dakota Sandstone in the southern part of Castle Valley and 400 feet (122 m) above it in the Farnham area. In Castle Valley the lower part of the Ferron Member is a regressive marine sandstone that contains sandstone concretions. The upper and greater part of the Ferron consists of lenticular sandstone, mudstone, and carbonaceous beds including coal beds as much as 22 feet (6.7 m) thick. Depositional environments of the member vary from open marine to deltaic plain (Hale, 1972; Cleavinger, 1974). Good photographs of the Ferron outcrops have been presented by Lupton (1916, Pls. 3, 5), Clark (1928, Pl. 2), Cleavinger (1974, Pls. 2, 3), and Rigby, Hintze, and Welsh (1974, Figs. 26, 27, 37, 38, 58, and 59).

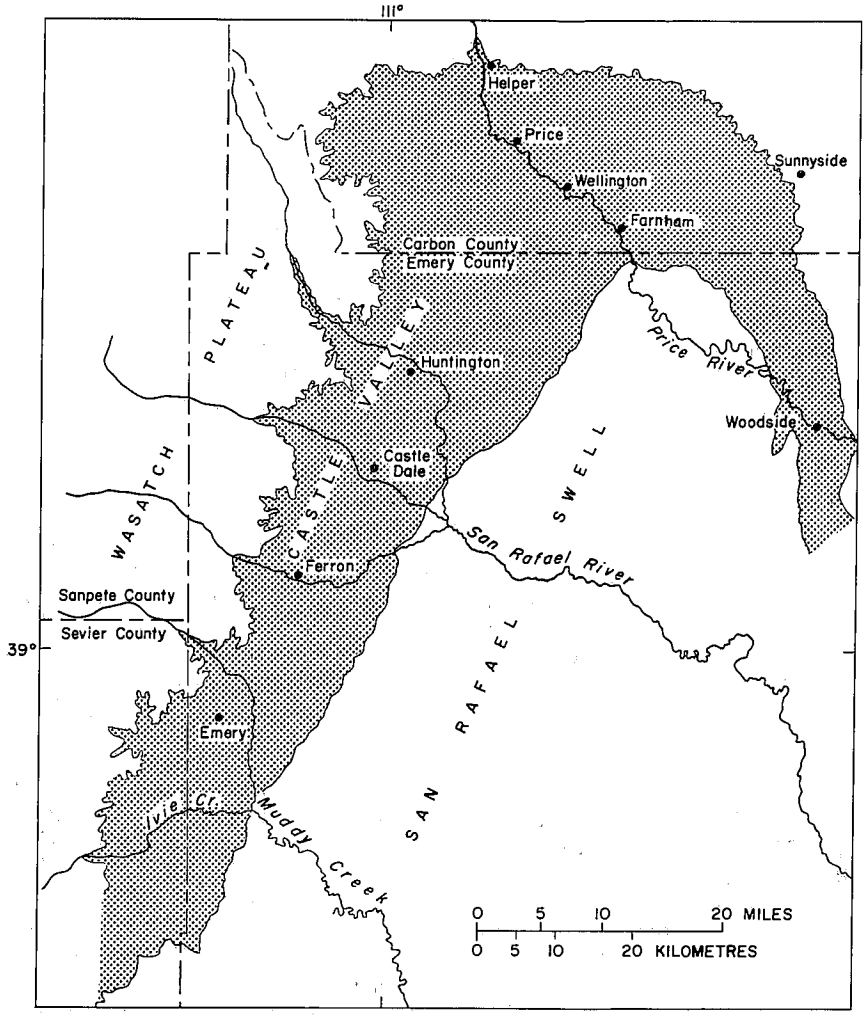

FIG. 1.—Outcrop area (patterned) of Mancos Shale in the Castle Valley-Price-Woodside area, Utah.

The Emery Sandstone Member lies 1,650-2,400 feet (503-732 m) above the Ferron Sandstone Member in Castle Valley (Spieker, 1931, p. 16). The Emery is about 800 feet (244 m) thick near the town of Emery, but north of Emery the member thins rapidly and near Ferron it splits into two sandstone tongues (Spieker, 1931, p. 20). North of Price the Emery Member grades into shale. Along its outcrop in Castle Valley the Emery seems to be entirely of shallow-water marine origin, but in the subsurface, about 20 miles (32 km) west of Price, thick coal beds are present in the middle and just below the top (Edson and Scholl, 1954, p. 90). Photographs of the member are pre-

sented in papers by Spieker (1931, Pl. 2; 1949, Pl. 1) and Rigby, Hintze, and Welsh (1974, Fig. 62).

The name Garley Canyon Sandstone Member of the Mancos Shale was proposed by Clark (1928, p. 112) for a conspicuous sandstone 160 feet (49 m) thick in an area a few miles west and north of Price. Ammonites in this sandstone are the same species as those in the lower tongue of the Emery Sandstone Member near Ferron.

Few fossils have been described or illustrated from the Mancos Shale of the Castle Valley-Price-Woodside area. The only ammonites are a few specimens described by Reeside (1932) as the new species *Barroisiceras (Alstadenites) sevierense, B. (Forresteria) forresteri,* and *B. (Harleites) castellense.* All of these are probably referable to the genus *Forresteria.* Trace fossils in the Ferron Sandstone Member were described and illustrated by Cleavinger (1974, p. 260-63, Pl. 4), and unusually large coprolites from this member were described by Balsley and Stokes (1969).

AMMONITE SEQUENCE

The oldest ammonite zone represented by the fossil record of the Mancos Shale, in the Castle Valley-Price-Woodside area, is that of *Sciponoceras gracile* of late Cenomanian age; the youngest zone may be that of *Scaphites hippocrepis* of early Campanian age. The sequence of ammonite zones for this interval of time in the western interior is as follows (zones represented by ammonite collections from the area of this report are indicated by asterisks):

Campanian
- **Scaphites hippocrepis*

Santonian
- **Desmoscaphites bassleri*
- *D. erdmanni*
- *Clioscaphites choteauensis*
- **C. vermiformis*
- *C. saxitonianus*
- **Scaphites depressus*

Coniacian
- **S. ventricosus*
- **S. preventricosus*

Turonian
- *S. corvensis*
- *S. nigricollensis*
- **S. whitfieldi*
- **S. warreni*
- **Prionocyclus hyatti*
- **Collignoniceras woollgari*
- *Mammites nodosoides*
- *Watinoceras coloradoense*

Cenomanian
- **Sciponoceras gracile*

AMMONITE RECORD

Zone of *Sciponoceras gracile* (Shumard)

This zone, of latest Cenomanian age, is known from many localities in the western interior region. *Sciponoceras gracile* has not been found in Castle Valley nor in the Price-Woodside area. The only ammonite indicative of the *S. gracile* zone in the U.S. Geological Survey's collections from Castle Valley is *Kanabiceras septemseriatum* (Cragin), which is represented by two specimens preserved in very fine-grained shaly calcareous sandstone from the base of the Mancos Shale about 8 miles (13 km) southeast of Emery at USGS Mesozoic loc. 6279, 1 mile (1.6 km) northeast of the junction of Ivie and Muddy creeks (Pl. 1, figs. 5, 6).

One of the best guides to the zone of *S. gracile* is the pelecypod *Pycnodonte newberryi* (Stanton), described originally as *Gryphaea newberryi* by Stanton (1893, p. 60, Pl. 5, figs. 1-5). This pelecypod is widely distributed in southern Utah, northeastern Arizona, western New Mexico, and southwestern Colorado. Katich (1951, p. 73) observed *P. newberryi* about 25 feet (7.6 m) above the base of the Mancos Shale in the southern part of Castle Valley, 7 miles (11.3 km) southeast of Emery, in the SE ¼ sec. 31, T. 22 S, R. 7 E. The species was not observed in Castle Valley north of Emery (Katich, 1954, p. 45) nor in the Price-Woodside area (Katich, 1956, p. 118, Fig. 1). However, *P. newberryi* is present farther south, about 9 miles (14.5 km) southwest of Green River (which is 21 miles or 33.8 km southeast of Woodside), where Rigby, Hintze, and Welsh (1974, p. 56, Fig. 40) recorded it at the base of the Mancos Shale.

Zone of *Collignoniceras woollgari* (Mantell)

Collignoniceras woollgari (Pl. 1, fig. 7), of early middle Turonian age, is known from many areas in the northern hemisphere. The species was assigned to Prionotropis by Meek (1876, p. 455) and Stanton (1893, p. 174), and it is commonly listed under this name in the older literature. Lupton (1916, p. 30) reported *Prionotropis* sp. from the Mancos Shale below the Ferron Sandstone Member in Castle Valley. *Collignoniceras woollgari* was recorded from Castle Valley by Katich (1954, p. 46) from the upper part of the Mancos below the Ferron Member. Katich's specimens were all in dark gray shale from

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EXPLANATION OF PLATE 1

FIG. 1.—Latex cast of *Prionocyclus hyatti* (Stanton) from 9 miles (14.5 km) southeast of Price (USGS 23422; USNM 220390).

FIGS. 2, 3.—*Scaphites warreni* Meek and Hayden from the Farnham area (USGS D2528; USNM 220391).

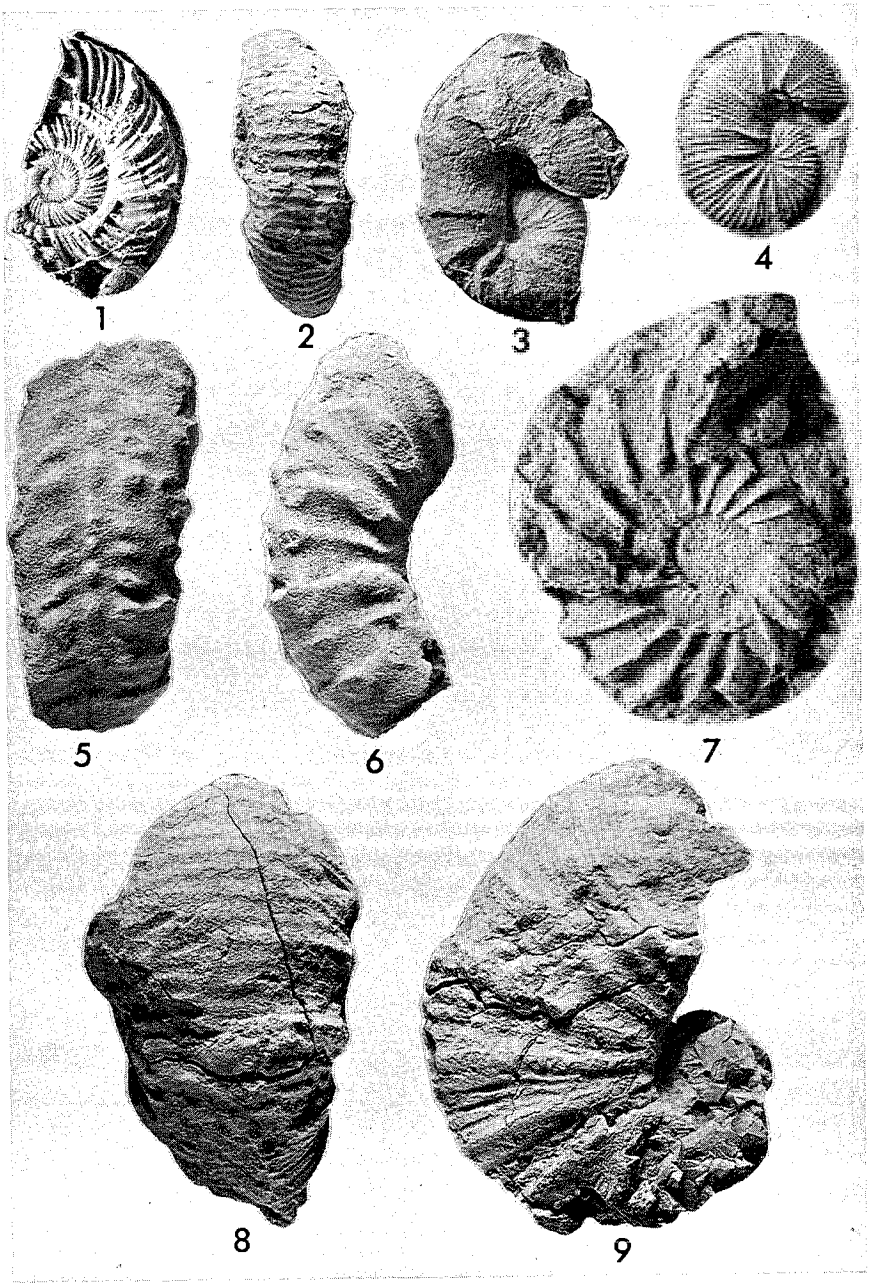
FIG. 4.—Latex cast of *Scaphites* aff. *S. whitfieldi* Cobban from 5 miles (8 km) east of Ferron (USGS D7226; USNM 222505).

FIGS. 5, 6.—*Kanabiceras septemseriatum* (Cragin) from 8 miles (13 km) southeast of Emery (USGS 6279; USNM 222506).

FIG. 7.—Latex cast of *Collignoniceras woollgari* (Mantell) from 2 miles (3.2 km) south of Green River (USGS 23949; USNM 222507).

FIGS. 8, 9.—*Scaphites preventricosus* Cobban from 7 miles (11.3 km) south-southwest of Emery (USGS 23938; USNM 222508).

All figures natural size.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localities south of Emery (Katich, 1951, p. 69-72). I am not aware of any records of the species in the rest of Castle Valley or in the area between Price and Woodside. The nearest locality of the species south of Sunnyside is that recorded by Fisher, Erdmann, and Reeside (1960, p. 27) in very fine-grained argillaceous sandstone concretions 115 feet (35 m) above the base of the Mancos Shale 5 miles (8 km) south of Woodside (USGS 23952, in the SE ¼ sec. 5, T. 19 S, R. 14 E).

Zone of *Prionocyclus hyatti* (Stanton)

In the area of this report, *Prionocyclus hyatti,* of late middle Turonian age, has been found only in the lower sandstone tongue of the Ferron Sandstone Member in the Farnham area about 9 miles (14.5 km) southeast of Price at USGS Mesozoic locality 23422, in the S½ sec. 2, T. 15 S, R. 11 E (Pl. 1, fig. 1). There the ammonite occurs in very fine-grained argillaceous sandstone concretions that contain a few *Placenticeras pseudoplacenta* Hyatt, numerous *Inoceramus howelli* White, and many other species of pelecypods and gastropods (Fisher, Erdmann, and Reeside, 1960, p. 27).

Zone of *Scaphites warreni* Meek and Hayden

In addition to *Scaphites warreni,* the ammonite *Prionocyclus wyomingensis* Meek (typical form) and the pelecypods *Inoceramus dimidius* White and *Lopha lugubris* (Conrad) are indicative of this late Turonian zone. The fauna is common in the lower part of the upper third of the Juana Lopez Member of the Mancos Shale of northwestern New Mexico and adjacent areas (Dane, Cobban, and Kauffman, 1966).

Specimens fairly typical of *Scaphites warreni* were found near the top of the Ferron Sandstone Member in the Farnham area, in the SE ¼ sec. 2, T. 15 S, R. 11 E at USGS Mesozoic locality D2528 (Pl. 1, figs. 2, 3). These were associated with *Baculites undulatus* d'Orbigny. Four miles south of Woodside *S. warreni* was recorded near the top of the Ferron Member by Fisher, Erdmann, and Reeside (1960, p. 28, loc. USGS 23956).

Fossils collected by Lyle A. Hale, Salt Lake City, Utah, include ammonites referable to *Scaphites warreni* in a broad sense. These scaphites, which are finer ribbed than typical *S. warreni,* came from the top of the Ferron Sandstone Member in the northern part of Castle Valley, 3 miles (5 km) east of Castle Dale in the SE ¼ sec. 30, T. 18 S, R. 9 E (USGS D5061). The specimens are associated with *Inoceramus dimidius* White and *Baculites undulatus* d'Orbigny.

EXPLANATION OF PLATE 2

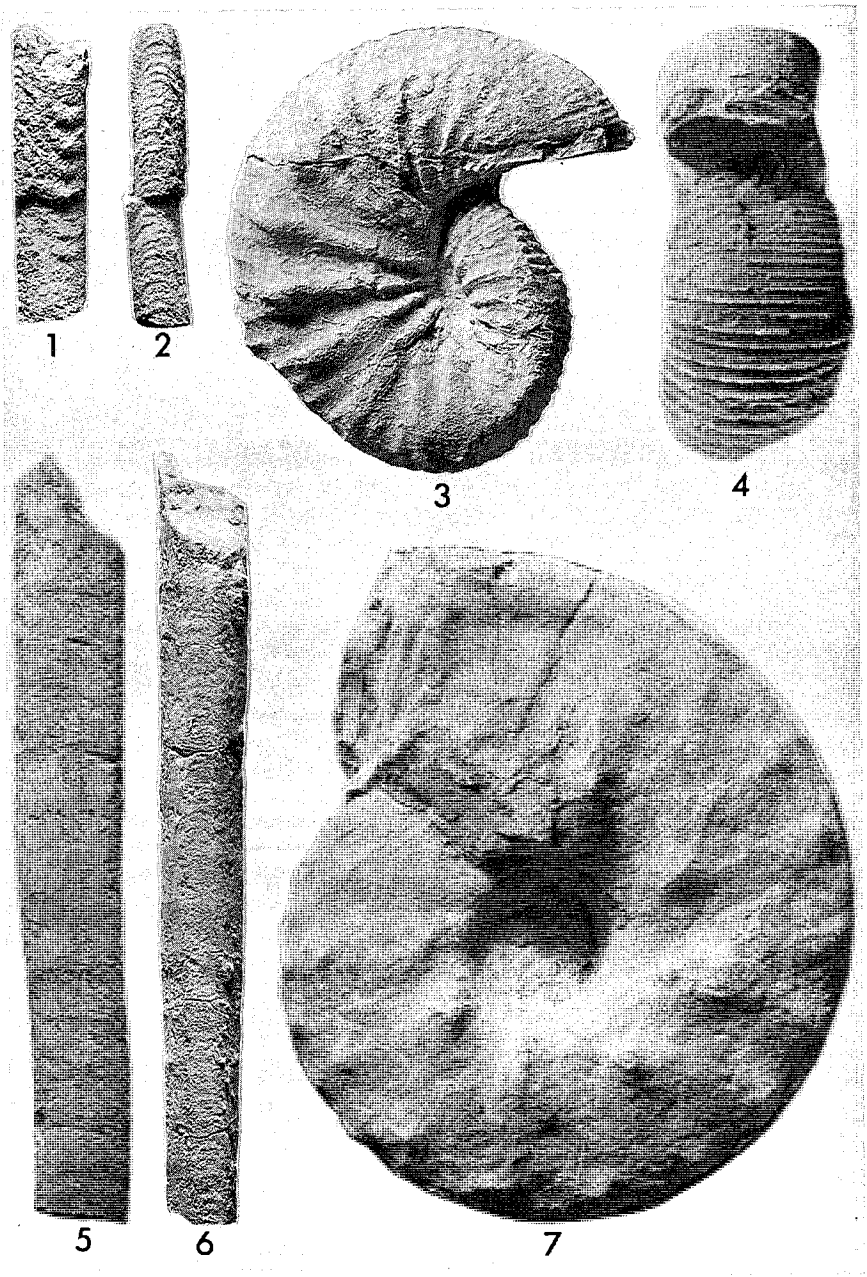
FIGS. 1, 2.—Lateral and ventral views of *Baculites codyensis* Reeside from 3 miles (4.8 km) west of Ferron (USGS D7229; USNM 222509).

FIGS. 3, 4.—*Clioscaphites vermiformis* (Meek and Hayden) from the same locality as Figs. 1, 2 (USGS D7229; USNM 222510).

FIGS. 5, 6.—*Baculites mariasensis* Cobban from 7 miles (11.3 km) south-southwest of Emery (USGS 23938; USNM 222511).

FIG. 7.—*Placenticeras* (*Stantonoceras*) *guadalupae* Roemer from the same locality as Figs. 1, 2 (USGS D7229; USNM 222512).

All figures natural size.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Scaphites ferronensis Cobban, a species closely related to *S. warreni,* was collected by E. M. Spieker near Emery (USGS 12583) from beds assigned by him to the Ferron Sandstone Member. The same species was collected by P. J. Katich from slightly above the Ferron Member 6 miles (9 km) south of Castle Dale, in sec. 26, T. 19 S, R. 8 E (USGS 22129).

Zone of *Scaphites whitfieldi* Cobban

Scaphites whitfieldi, of late Turonian age, characterizes the uppermost part of the Juana Lopez Member of the Mancos Shale and laterally equivalent rocks. Common associates of the species are *Inoceramus perplexus* Whitfield and *Prionocyclus wyomingensis elegans* Haas.

Scaphites whitfieldi and *Prionocyclus wyomingensis elegans* have been recorded (Fisher and others, 1960, Table 5) from sandy beds at the top of the Ferron Member in the Price-Woodside area, and a few feet above it near Farnham (USGS 8136, in the NW ¼ sec. 2, T. 15 S, R. 11 E; USGS 8758, in the SE ¼ sec. 9, T. 15 S, R. 12 E; USGS 8759, in the SW ¼ sec. 4, T. 15 S, R. 12 E).

Scaphites intermediate between *S. whitfieldi* and *S. warreni* were collected in Castle Valley 5 miles (8 km) east of the town of Ferron, in the NW ¼ sec. 9, T. 20 S, R. 8 E at USGS Mesozoic localities D7226 and D7227 (Pl. 1, fig. 4). The specimens were associated with *Inoceramus perplexus* and *Prionocyclus wyomingensis* in hard sandy shale a few feet above the Ferron Sandstone Member and in gray limestone concretions a litle higher in the sequence.

Zone of *Scaphites preventricosus* Cobban

Ammonites representative of this early Coniacian zone were discovered in the southern part of Castle Valley by the late Robert Forrester, Salt Lake City, in the early part of this century (Reeside, 1932, p. 17). The fossils are from gray limestone concretions in the Mancos Shale, about 100 feet (30 m) above the Ferron Sandstone Member. The reported locality (USGS 6270) is along Ivie Creek, 4 miles (6.4 km) east of Oak Spring, which is about 15 miles (24 km) southwest of Emery. Ammonites from Forrester's locality are *Baculites mariasensis* Cobban (Pl. 2, figs. 5, 6), *Allocrioceras* n. sp., *Scaphites preventricosus* Cobban (Pl. 1, figs. 8, 9), *S. impendicostatus* Cobban, *Forresteria stantoni* (Reeside), and *Placenticeras pseudoplacenta* Hyatt. *Scaphites impendicostatus* was also collected by Mr. Forrester along an irrigation canal a few miles northwest of Price (USGS 6945).

Zone of *Scaphites ventricosus* Meek and Hayden

This late Coniacian zone is represented in the area by a single specimen of *Scaphites tetonensis* Cobban, from a limestone concretion in the Mancos Shale 3 miles (4.8 km) north of Woodside, in the SW ¼ sec. 28, T. 17 S, R. 14 E (USGS 13319). According to Fisher, Erdmann, and Reeside (1960, p. 31), the specimen is from 3,200 feet (975 m) below the top of the Mancos. *Scaphites tetonensis* occurs with *S. ventricosus* in Montana and Wyoming.

Zone of *Scaphites depressus* Reeside

A common associate of *Scaphites depressus,* of early Santonian age, is *Scaphites binneyi* Reeside. *Scaphites binneyi* has been found in the Mancos

Shale at Price (USGS 11956), associated with fragments of a large *Inoceramus* that seems referable to *I.* (*Cladoceramus*) *undulatoplicatus* Roemer.

Zone of *Clioscaphites vermiformis* (Meek and Hayden)

This middle Santonian zone is known from several fossil localities in the Mancos Shale in Castle Valley and near Price. *Clioscaphites vermiformis* (Pl. 2, figs. 3, 4) has been found in the lower sandstone tongue of the Emery Sandstone Member of the Mancos Shale and in the shale unit overlying this sandstone tongue in the middle part of Castle Valley (USGS D7228, in the NW ¼ sec. 7, T. 20 S, R. 7 E; USGS D7229, in the SE ¼ sec. 12, T. 20 S, R. 6 E). Ammonites associated with *C. vermiformis* are *Baculites codyensis* Reeside (Pl. 2, figs. 1, 2) and *Placenticeras* (*Stantonoceras*) *sancarlosense* Hyatt (Pl. 2, fig. 7). These fossils occur in large orange-brown-weathering sandstone concretions 35 feet (10.7 m) above the top of the upper hogback of the Garley Canyon Sandstone Member a few miles northwest of Price in the NE ¼ sec. 1, T. 14 S, R. 9 E (USGS D7237). *Placenticeras* (*Stantonoceras*) cf. *P. sancarlosense, Baculites codyensis,* and *B. asper* Morton have been found about 150 feet (46 m) below the base of the Garley Canyon Sandstone Member 3 miles (4.8 km) northwest of Price in the SE ¼ sec. 6, T. 14 S, R. 10 E (USGS D2508), and *Placenticeras* (*Stantonoceras*) *guadalupae* Roemer has been collected from the lower sandstone bed of the Garley Canyon Member in the NW ¼ sec. 1, T. 14 S, R. 9 E (USGS 23305).

Zone of *Desmoscaphites bassleri* Reeside

An incomplete ammonite that seems referable to *Desmoscaphites bassleri* was found in the Emery Sandstone Member 5 miles (8 km) north of Price, in the NE ¼ sec. 30, T. 13 S, R. 10 E (USGS D2509). Other fossils from the locality include *Inoceramus* cf. *I. balticus* Boehm and *Placenticeras* (*Stantonoceras*) cf. *P. guadalupae* Roemer. Spieker and Reeside (1925, p. 439) reported *Placenticeras planum* and *Inoceramus lobatus* in the Emery. The inoceramid would now be classified as *Inoceramus* (*Sphenoceramus*) *patootensiformis* Seitz which ranges through the zones of *Desmoscaphites erdmanni, D. bassleri,* and *Scaphites hippocrepis.*

Zone of *Scaphites hippocrepis* (DeKay)

The uppermost part of the Mancos Shale in the Price area probably lies in the zone of *Scaphites hippocrepis.* Reeside (1927, chart facing p. 2) recorded *S. hippocrepis* and *Baculites aquilaensis* Reeside from the upper part of the Mancos Shale 4 miles (6.4 km) southeast of Woodside in the SW ¼ sec. 25, T. 18 S, R. 14 E (USGS 13324). *Baculites* cf. *B. aquilaensis* has been found about 300 feet (91 m) below the top of the Mancos 5 miles (8 km) north of Price in the NE ¼ sec. 22, T. 13 S, R. 10 E (USGS D2510).

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