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W. C. MENDENHALL, CHIEF GEOLOGIST

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CEPHALOPODS FROM THE LOWER PART OF THE CODY SHALE OF OREGON BASIN, WYOMING

By JOHN B. REESIDE, Jr.

INTRODUCTION

It is the purpose of this paper to record the cephalopods contained in a collection of invertebrate fossils from the lower part of the Cody shale in Oregon Basin, Wyo., a topographic subdivision of the western part of the great synclinal area known generally as the Big Horn Basin. The collection was made by Edwin Binney, jr., during the course of a study of the oil and gas resources of this area and comes from secs. 6, 19, 31, and 33, T. 51 N., R. 100 W. The stratigraphic position is in a zone from 720 to 820 feet above the sandstone that forms the uppermost member of the Frontier formation as it is recognized in the region. Collections made from the Cody shale 200 feet above this sandstone and in the sandstone itself show that a closely related fauna extends down to that horizon.

The stratigraphic section in Oregon Basin is described in a published paper by Hewett [1] and in a manuscript by Binney.[2] The Cretaceous rocks include at the base the Cloverly formation, followed in succession by the Thermopolis shale, Mowry shale, Frontier formation, Cody shale, Mesaverde formation, and Meeteetse formation. Above the Meeteetse lies the Lance formation, assigned with doubt to the Tertiary; then, unconformably, the Fort Union formation, of Eocene age.

The Cody shale is 2,200 to 2,500 feet thick in Oregon Basin. In the upper 350 feet a fauna of Eagle (lower Campanian) age was collected near Shoshone River by Hewett, including such species as *Inoceramus lobatus* Goldfuss, *Scaphites hippocrepis* (De Kay), and *Scaphites aquilaensis* Reeside. A middle zone 1,200 to 1,400 feet thick has not yielded diagnostic fossils. The lower part contains the fauna listed in this paper.

Mr. W. O. Hazard made the photographs of the specimens shown in the plates, and Miss Frances Wieser retouched the figures and assembled the plates.

[1] Hewett, D. F., Geology and oil and coal resources of the Oregon Basin, Meeteetse, and Grass Creek Basin quadrangles, Wyoming: U. S. Geol. Survey Prof. Paper 145, 1926.

[2] Binney, Edwin, jr., dissertation presented to the faculty of Yale University in candidacy for the degree of Doctor of Philosophy, 1925.

THE FAUNA AND ITS RELATIONS

The fossils collected by Mr. Binney from the zone 720 to 820 feet above the upper sandstone of the Frontier formation constitute a fairly varied fauna, though many of the species are yet undescribed. The complete list is as follows:

Vermes:
- Serpula sp.

Pelecypoda:
- Inoceramus umbonatus Meek and Hayden.
  - exogyroides Meek and Hayden.
  - aff. I. acutiplicatus Stanton.
  - sp. undescribed aff. I. barabini Morton.
- Pteria gastrodes Meek.
- Ostrea sp.
- Modiola sp. undescribed aff. M. meeki Evans and Shumard.
- Pholadomya papyracea Meek and Hayden.
- Crassatellites sp. undescribed.
- Corbula nematophora Meek.

Gastropoda:
- Gyrodes conradi Meek.
- Turritella sp. undescribed aff. T. whitei Stanton.
- Anchura sp.
- Fusus sp. (sp. undescribed?).
- Fasciolaria sp. undescribed.
- Volutoderma, probably several undescribed species related to V. dalli and V. ambigua Stanton.
- Cinulia sp. undescribed aff. C. concinna Hall and Meek.
- Anisomyon sp. undescribed.

Cephalopoda:
- Eutrephoceras sp.
- Phlycticrioceras oregonense Reeside, n. sp.
- Baculites asper Morton.
  - codyensis Reeside, n. sp.
  - sp.
- Binneyites parkensis Reeside, n. gen. and sp.
- Scaphites ventricosus Meek and Hayden.
  - ventricosus var. stantoni Reeside, n. var.
  - ventricosus var. depressus Reeside, n. var.
  - ventricosus var. oregonensis Reeside, n. var.
  - ventricosus var. interjectus Reeside, n. var.
  - vermiformis Meek and Hayden.
  - vermiformis var. binneyi Reeside, n. var.
- Placenticeras pseudoplacenta Hyatt.
- Mortoniceras shoshonense Meek.
  - shoshonense var. crassum Reeside, n. var.

Crustacea:
- Balanid barnacle, young form?

At 200 feet above the upper sandstone of the Frontier formation in the NE. ¼ SE. ¼ sec. 32, T. 52 N., R. 100 W., a rudistid much like "*Radiolites*" (*Durania?*) *austinensis* Roemer was collected by Mr. Binney, and near the top of the Frontier formation as interpreted by him, in sec. 32, T. 51 N., R. 100 W., he found *Inoceramus deformis* Meek, *Inoceramus* aff. *I. acutiplicatus* Stanton, and *Pinna* aff. *P. lakesi* White.

The association of species shown in these collections from the lower part of the Cody shale and the upper sandstone of the Frontier formation identifies a faunal zone that occurs in the Niobrara formation of the Great Plains and contiguous areas; in the middle of the Mancos shale of New Mexico, Utah, and Arizona, and in the upper part of the Colorado formation of Montana. Such species as *Inoceramus umbonatus, I. exogyroides, I. deformis, Scaphites ventricosus,* and *S. vermiformis* are among the most useful guide fossils for this particular faunal zone in the Cretaceous of the Interior Province. The fossils also show that the Frontier formation as identified in the Big Horn Basin includes younger rocks than are included in the typical Frontier of Lincoln County, Wyo., where the entire formation is pre-Niobrara and probably pre-Carlile in age.

Some of the species in the present collections are notable in that they support strongly the correlation usually made of the Niobrara formation and its faunal equivalents in North America with the European Coniacian (Emscherian). The coiled *Inoceramus umbonatus* Meek and Hayden and *I. exogyroides* Meek and Hayden are very close allies of *I. involutus* Sowerby. *Phlycticrioceras oregonense* is very close to *Phlycticrioceras* ("*Ancyloceras?*") *douvillei* Grossouvre. *Mortoniceras shoshonense* Meek is close to *M. bourgeoisi* D'Orbigny.

The cephalopods described in this paper include, as the list above shows, representatives of 7 genera, under which are placed 10 species and 6 varieties. One genus is new, *Binneyites*. The species of *Scaphites* have not been minutely described before and have been in need of amplified treatment. *Mortoniceras shoshonense* has been recorded only by Meek's original description and figure but is here described and figured in detail from Mr. Binney's material and other specimens from near-by localities.

SYSTEMATIC DESCRIPTIONS OF THE CEPHALOPODS

Family NAUTILIDAE Owen

Genus EUTREPHOCERAS Hyatt

Eutrephoceras includes nautiloids with subglobose, involute shells; whorl nephritic in cross section throughout life, changing but little; umbilicus closed; siphuncle generally dorsad of the center of the whorl. Shells usually smooth except for fine longitudinal lines on the venter and growth lines parallel to the aperture. Sutures nearly straight, having shallow elements—ventral lobe, broad ventrolateral saddle, lateral lobe, second lateral saddle, umbilical lobe, and a broad, obtusely pointed dorsal lobe.

Species of this genus are not very sharply differentiated, especially in the sort of material usually available—broken internal casts. There is, however, a consistency in the form of the cross section of the whorl and the maximum size attained that permits a separation into specific groups that are limited in geographic distribution and in stratigraphic range.

Eutrephoceras sp.

Plate 1, Figures 1–4

A single small but well-preserved septate internal cast is the only representative of the genus in the collection.

Shell stout, well rounded; maximum size unknown. Stages up to 10 or 12 millimeters in diameter globose; succeeding stages to a diameter of 30 millimeters, somewhat higher but still stout. The proportions of height to width of the cross section of the whorl are as 4 to 5.

Surface of shell unknown. Sutures as in the generic description.

This small specimen, although insufficient as a basis for the founding of a new species, seems to be different from species now known in the Interior Province. From *E. dekayi* (Morton) of Meek,[3] which occurs in the upper part of the Pierre shale, it differs in proportions, the ratio of height to width of the cross section of the whorl of *E. dekayi* being 3 to 4; from *E. alcesense* Reeside,[4] of the Eagle sandstone, it differs also in the proportions of the whorl, the ratio of height to width of the cross section in *E. alcesense* being 6 to 7.

Occurrence: Cody shale, about 800 feet above base, in sec. 6, T. 51 N., R. 100 W., Wyo.

Family LYTOCERATIDAE Neumayr

Subfamily MACROSCAPHITINAE Hyatt

Genus PHLYCTICRIOCERAS Spath

This genus was proposed by Spath[5] for the reception of a group of aberrant ammonites. The specimens figured in the literature and those available to the writer leave some important features of the genus in doubt, but the characters shown indicate such differences as to deserve separation from other members of the family. Spath, indeed, proposes to make the genus the basis for a new family, Phlycticrioceratidae.

[3] Meek, F. B., Invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. Survey Terr. Rept., vol. 9, pp. 496–498, pl. 27, figs. 1, 2, 1876.

[4] Reeside, J. B., jr., The cephalopods of the Eagle sandstone and related formations in the Western Interior of the United States: U. S. Geol. Survey Prof. Paper 151, p. 7, pl. 1; pl. 2; pl. 3, figs. 1–5; pl. 5, figs. 1, 2, 1927,

[5] Spath, L. F., On new ammonites from the English chalk: Geol. Mag., vol. 63, p. 80, 1926.

Spath, in his definition, merely cites *Ancyloceras douvillei* Grossouvre as the genotype and notes the "median crest" as the distinguishing feature. The genus may be defined more fully as follows:

Shell elongated, tubular, apparently lying in a single plane with whorls widely separated; coiling irregular, parts of shell nearly straight, parts much curved. It is not yet known whether the coiling is like that of *Hamites* or like that of *Ancyloceras*. Ribs simple and bearing on the siphonal line a high, sharp tubercle and on each ventrolateral shoulder a lower, rounded tubercle; constrictions at intervals bordered by ribs larger than the other ribs. Suture has two lateral lobes, deeply bifid, and three lateral saddles, also bifid, on each side between the siphonal and antisiphonal lobes.

This genus is related to *Hamites* Parkinson in suture and form of the shell, so far as may be inferred from material in hand, but differs in the possession of the median-ventral nodes. The shell might well have the form of *Ancyloceras* D'Orbigny but differs very sharply in suture, for it has bifid instead of trifid lobes; and it differs from *Helicoceras* D'Orbigny in having the coil in a plane instead of a helicoid.

Ancyloceras? douvillei Grossouvre,[6] the genotype, from the uppermost Coniacian; probably *Hamites* cf. *H. angustus* Dixon of Schlüter,[7] which Grossouvre believed to be identical with his species; possibly *Hamites trinodosus* Geinitz[8] from Kieslingswald; and the species described below complete the list of known or possible members of the genus.

Phlycticrioceras oregonense Reeside, n. sp.

Plate 1, Figures 5–18

This species is based on nine specimens from five localities, one in Oregon Basin, four elsewhere. The three specimens from Oregon Basin are figured, and the best characterized is taken as the type. The whorl has a high pentagonal cross section with flanks and inner side flattened. Ventrolateral shoulders angular, dorsolateral shoulders rounded. The proportions of the height to width of the cross section are about as 3 to 2. Septate and unseptate fragments have the same form. Aperture unknown.

Sculpture of relatively low, straight, simple ribs, which pass entirely around the shell, inclined somewhat posteriorly as they pass outward on the whorl, weak or nearly obsolete on the inner (dorsal) side, strongest on the outer (ventral) side. The ribs are broadly rounded and about equal in width to the concave interspaces. On the ventrolateral shoulders they rise into a low, sharp circular tubercle and on the siphonal line into a high tubercle, slightly elongated parallel to the siphon. Each fifth or sixth interspace deepened to make a definite constriction, with the bordering ribs somewhat elevated above the other ribs.

This species is very close to the genotype, which seems to be more compressed and to have the constrictions at greater intervals—differences which may prove not to be of great significance when larger collections are available. No recorded American species are liable to confusion with it, for none have the median row of nodes. Of American species referred to *Ancyloceras*, as was *P. douvillei*, *Ancyloceras jenneyi* Whitfield,[9] which Hyatt[10] assigns to his genus *Exiteloceras* but which is probably a species of *Neancycloceras* Spath, has a suture similar to that of *P. oregonensis* in its bifid lobes and saddles, is similar in costation, and is coiled in a single plane but bears only two rows of nodes. *Ancyloceras tricostatum* Whitfield[11] is very different and belongs to *Didymoceras* or *Nostoceras* Hyatt.[12] *Ancyloceras? uncum* Meek and Hayden[13] is also very different and is assigned by Hyatt[14] to *Exiteloceras*.

The specific name is derived from Oregon Basin, Wyo., from which the type came.

Occurrence: Cody shale 800 feet above Frontier formation, sec. 6, T. 51 N., R. 100 W., in Oregon Basin, Wyo.; Cody shale 350 feet above base, sec. 24, T. 58 N., R. 97 W., near Frannie, Wyo., and sec. 22, T. 7 S., R. 23 E., 5 miles southeast of Bridger, Mont.; lower middle Mancos shale, NE. ¼ sec. 4, T. 19 S., R. 14 E., and 1 mile east of Desert station, Emery County, Utah.

Genus BACULITES Lamarck

Baculites includes ammonites with a minute, closely coiled initial stage, which passes quickly into a straight, staff-like stage maintained throughout the remainder of the shell and increasing slowly in diameter with age. The usual specimens available are fragments of this staff-like, gently tapering part. Cross section of whorl subtriangular, oval, or subcircular. Living chamber large; aperture with long, straight rounded extension on the siphonal side and lateral sinus. Surface smooth, or with low rounded ribs parallel to the aperture, or with nodes on the flanks. Suture with six saddles and six lobes, bifid except for the antisiphonal lobe.

[6] De Grossouvre, Albert, Les ammonites de la craie supérieure, p. 254, pl. 35, fig. 8; text figs. 88, 89, 1894.

[7] Schlüter, Clemens, Cephalopoden der oberen deutschen Kreide, p. 106, pl. 32, figs. 6, 7, 1871.

[8] Geinitz, H. B., Das Quadersandsteingebirge, pl. 3, fig. 4, 1850.

[9] Whitfield, R. P., Paleontology of the Black Hills, in Newton, Henry, and Jenney, W. P., Report on geology and resources of the Black Hills of Dakota, p. 452, pl. 16, figs. 7–9, U. S. Geog. and Geol. Survey Rocky Mtn. Region, 1880.

[10] Hyatt, Alpheus, Phylogeny of an acquired characteristic: Am. Philos. Soc. Proc., vol. 32, p. 577, 1894.

[11] Whitfield, R. P., op. cit., p. 45, pl. 15, figs. 7, 8.

[12] Hyatt, Alpheus, op. cit., p. 574.

[13] Meek, F. B., Invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. Survey Terr. Rept., vol. 9, p. 409, pl. 21, figs. 1a, 1b, 1876.

[14] Hyatt, Alpheus, op. cit., p. 577, 1894.

Baculites asper Morton

Plate 1, Figures 19–24; Plate 2, Figures 1–5

1830. *Baculites asper* Morton, Am. Jour. Sci., 1st ser., vol. 23, p. 291.

1834. *Baculites asper* Morton, Synopsis of the organic remains of the Cretaceous group in the United States, p. 43, pl. 1, figs. 12, 13; pl. 13, fig. 2.

[For complete synonymy see Reeside, J. B., jr., U. S. Geol. Survey Prof. Paper 151, p. 13, 1927.]

B. asper Morton includes small shells with broadly ovate cross section; distant, rounded nodes on the antisiphonal half of the flanks; and rather weak undulations on the siphonal side that have only faint connection with the rounded nodes. Suture relatively simple, with little-incised rounded elements.

Various forms with other characters, such as arcuate nodes, tapered cross section and more or less acute siphonal margin, compressed cross section, and large size, do not properly belong to the species, though such forms have been assigned to it by several authors. The distribution is wide, and the range of the species, in the proper application of the name, appears to be through the late Colorado and early Montana horizons (Emscherian to lower Campanian), though there is some uncertainty because of lax use of the name.

The specimens described in this paper are typical in every respect, and one of them is especially notable in preserving a complete living chamber. This is proportionately shorter than in several other species which the writer has seen but shows very well the siphonal and antisiphonal extensions of the aperture.

Baculites codyensis Reeside, n. sp.

Plate 2, Figures 6–19

This species belongs to a group of baculites marked by the possession of relatively close-set strong arcuate nodes on the antisiphonal half of the flank. Members of the group are often designated *B. anceps* Lamarck in the literature, but inasmuch as other characters of specific value are ignored in this assignment and as *B. anceps* in its proper conception is probably limited to the Maestrichtian of Europe, new names are desirable.

Shell small for the genus, the largest individuals reaching about 20 millimeters in diameter; taper comparatively rapid; cross section well rounded, ovate much as in *B. asper*. Surface shows numerous fairly prominent, arcuate nodes on the antisiphonal half of the shell, each of which corresponds to one or more ill-defined inclined ribs on the siphonal margin. The nodes are distinct on the smallest individual available for examination—5 millimeters in diameter. The suture shows relatively simple elements, rounded and little incised, with the anomalous feature that the saddle dividing the siphonal lobe is itself divided by a single, pointed marginal lobe on the siphonal line.

B. codyensis is much like *B. asper* Morton in form and size, but its close-set, arcuate nodes are quite unlike the distant rounded nodes of *B. asper*. There are individuals, however, which show a tendency toward the type of ornamentation shown by *B. asper*, and it is possible that large collections might include a series of intermediate forms connecting the two species. *B. codyensis* differs from *B. aquilaensis* Reeside [15] in its smaller size and much stouter cross section. It is not, however, as stout as *B. aquilaensis* var. *obesus* Reeside.[16] *B. anceps* var. *obtusus* Meek,[17] of a late Montana horizon, has much heavier and more prominent ribs.

Occurrence: Cody shale 800 feet above base, sec. 6, T. 5 N., R. 100 W., Wyo.; upper (Niobrara) part of Colorado formation, Cow Creek 13 miles above the mouth, in the Judith region, Mont.; middle (Niobrara) part of Mancos shale near Desert station, Emery County, Utah.

Baculites sp.

A single specimen (Yale Peabody Museum catalogue No. 6406) of a baculite larger than *B. asper* and *B. codyensis* is contained in the collection. It is much crushed, and details are not well preserved, so that it does not retain essential characters, but it seems to record the presence in the fauna of a baculite attaining a diameter of more than 30 millimeters. It was apparently smooth or nearly smooth and had a deeply dissected suture.

Another specimen (Yale Peabody Museum catalogue No. 6412), with a length of 18 millimeters and cross section measuring 8.5 by 5 millimeters, is oval but more compressed than either *B. asper* or *B. codyensis* and shows no trace of nodes or ribs. It probably represents an undescribed species, but the material in hand is not sufficient basis for a new name. The suture is like that of the two species named—of relatively simple, rounded, little-incised elements.

Family BINNEYITIDAE Reeside, n. fam.

Genus BINNEYITES Reeside, n. gen.

A single nearly complete specimen of a small ammonite from the SW. ¼ NE. ¼ sec. 6, T. 51 N., R. 100 W., in Oregon Basin, in the Cody shale 775 feet above the base, and a smaller broken specimen from sec. 24, T. 58 N., R. 97 W., near Frannie, in the Cody shale 400 feet above the base, present such a combination of characters as to deserve separation as a new genus. The features shown include a much compressed discoid shell with subparallel flanks, truncated venter bor-

[15] Reeside, J. B., jr., The cephalopods of the Eagle sandstone and related formations in the Western Interior of the United States: U. S. Geol. Survey Prof. Paper 151, p. 12, pl. 6, figs. 11–13; pl. 8, figs. 1–14, 1927.

[16] Idem, p. 12, pl. 10, figs. 1–18.

[17] Meek, F. B., Invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. Survey Terr. Rept., vol. 9, p. 406, text figs. 57–60, 1876.

dered by subangular shoulders, and very small umbilicus. Whorls with flanks smooth except for latest part of shell, which shows low falciform ribs; and with distant, elongated and inclined nodes on the ventrolateral shoulders. Suture with simple elements; ventral lobe small, first lateral saddle long and very narrow, simple; first lateral lobe broad, asymmetrically bifid; second lateral saddle broad, high, bifid; second lateral lobe long, narrow, asymmetrically bifid; other elements small, simple.

The relations of this genus are difficult to determine. The writer has in hand several specimens of a small undescribed ammonite of Turonian age that appears to be a species of *Heterotissotia* Peron.[18] The external features are exceedingly close to those of *Binneyites*, but the sutures of the two forms have nothing in common. Some of the Triassic genera, such as *Cordillerites*,[19] show some resemblance to *Binneyites*, but it is probable that the similarities are purely superficial. In this respect the genus resembles the Cenomanian *Flickia* Pervinquière,[20] which finds its closest analogues in the Triassic. For the present the writer proposes to set *Binneyites* apart in a separate family, though it may be possible in the future to connect this genus with other groups.

The genus is named for Edwin Binney, jr., who made the collection containing the genotype.

Binneyites parkensis Reeside, n. sp.

Plate 3, Figures 1–10

Adult shell much compressed, involute, discoid; flanks flat, subparallel; venter truncate, very gently arched. Earliest whorls seen, at diameter of 2 millimeters, stout, well rounded; half a whorl later, at a diameter of 3 millimeters, the flanks are flattened and the shell is a stout disk; about half a whorl later, at a diameter of 5 millimeters, the whorl is still more compressed and much like the later whorls except that the venter is well rounded and not distinctly truncate. At a diameter of about 10 millimeters the venter is bordered by subangular shoulders, which continue to the end of the shell. The proportions of the whorl are shown in the cross section of the type, Plate 3, Figure 4. The living chamber occupies more than five-eighths of the last whorl but probably very little more; it is slightly scaphitoid. Aperture not preserved, but the latest growth lines suggest that it is sigmoid, with probably a short ventral lappet. Umbilicus very small with abrupt subangular shoulder and perpendicular inner wall.

Whorls have smooth flanks from a diameter of 2 to 15 millimeters. From 15 to 26 millimeters, the last stage preserved, constituting mostly the unseptate part of the shell, low irregular ribs pass radially from the umbilicus to the middle of the flank, then curve gently forward, backward, and finally forward to the border of the venter, making a shallow sigmoid curve. On the margins of the venter low indistinct nodal swellings appear at a diameter of about 2.5 millimeters. These quickly become low elongated nodes, with the longer axis inclined forward at an angle of about 30° to the plane of coiling of the shell, and are present on all the stages seen. There are seven of these nodes on the first half of the last whorl and twelve on the latter half, each corresponding to a rib on the flank; they are more closely spaced toward the end of the shell. On the venter obscure ribs arched gently forward connect the nodes.

The adult suture shows a simple ventral lobe; a very narrow, simple first lateral saddle, in width about half that of the ventral lobe; a broad, somewhat asymmetrical and simple, bifid first lateral lobe in width 1½ times that of the ventral lobe and of equal length; a high, bifid second lateral saddle about as broad as the first lateral lobe and with several small marginal lobes; a long, narrow second lateral lobe, asymmetrically bifid, about three-fourths the width of the ventral lobe and considerably longer; remaining elements of the suture small and in a nearly straight line inclined to the radius. The suture at a diameter of 2.5 millimeters shows the ventral lobe large; the first lateral saddle about as large as the first lateral lobe and both smaller than the ventral lobe; the second lateral saddle and lobe not conspicuous. At a diameter of 4.5 millimeters the features of the suture have approached somewhat those of the adult, though the first lateral lobe is about equal in size to the ventral lobe, and the second lateral lobe is small. At a diameter of 9 millimeters the suture is very much like that of later stages except that the first lateral saddle is a bit wider proportionately.

The specific name is derived from Park County, Wyo., in which the type locality occurs.

Family COSMOCERATIDAE Zittel

Subfamily SCAPHITINAE Meek

Genus SCAPHITES Parkinson

Scaphites has been used in a broad sense by many students and made to include several rather different groups of forms. Some of these were separated as subgenera or sections long ago. Nowak[21] in recent years has again called attention to the separateness of some of the groups and proposed new names In its stricter sense *Scaphites* includes only the close relatives of *S. aequalis* Sowerby, the genotype. The am-

[18] Peron, M., Les ammonites du crétacé supérieur de l'Algérie: Soc. géol. France Mém. 17, p. 81, 1896.

[19] Hyatt, Alpheus, and Smith, J. P., The Triassic cephalopod genera of America: U. S. Geol. Survey Prof. Paper 40, p. 110, pl. 2, figs. 1–3, 1905.

[20] Pervinquière, Léon, Études de paléontologie tunisienne, pt. 1, Céphalopodes des terrains secondaires, p. 212, 1907.

[21] Nowak, Jan, Untersuchungen über die Cephalopoden der oberen Kreide in Polen, pt. 2, Die Skaphiten: Acad. sci. Cracovie Bull. internat., année 1911, sér. B, pp. 547–588, 1912; Zur Bedeutung von *Scaphites* für die Gliederung der Oberkreide: K.-k. geol. Reichsanstalt Verh., Jahrgang 1915, No. 3, pp. 56–57, 1916.

monites of this genus have the characteristic form—a normal coil of septate whorls and the last living chamber partly unrolled; whorls stout, umbilicus small, sculpture of straight ribs beginning in the umbilicus and passing with increasing height to the margin of the venter, where they split into two or more ventral ribs; there are also intercalated ventral ribs, and there may be definite nodes at the ventrolateral ends of the primary ribs; the suture consists of moderately incised elements, decreasing gradually in size from the median plane to the line of involution; lobes trifid in the earliest stages but usually bifid in the adult. Nowak called this group *Holcoscaphites*, but Parkinson's name should be retained in a restricted sense.

The writer has in another paper [22] reviewed the scaphites as a group, and to that paper the reader is referred for an extended statement.

Scaphites ventricosus Meek and Hayden

Plate 3, Figures 11–18; Plate 4, Figures 1–4

1862. *Scaphites ventricosus* Meek and Hayden, Acad. Nat. Sci. Philadelphia Proc., vol. 14, p. 22.
1876. *Scaphites ventricosus* Meek and Hayden. Meek, U. S. Geol. Survey Terr. Rept., vol. 9, p. 425, pl. 6, figs. 7, 8.
1894. *Scaphites ventricosus* (part) Meek and Hayden. Stanton, U. S. Geol. Survey Bull. 106, p. 186, pl. 44, figs. 8–9; pl. 45, fig. 1 [not pl. 44, fig. 10].
1898. *Scaphites ventricosus* (part) Meek and Hayden. Logan, Kansas Univ. Geol. Survey, vol. 4, p. 476, pl. 104, figs. 8, 9; pl. 105, fig. 1 [not pl. 104, fig. 10].
1899. *Scaphites ventricosus* Meek and Hayden. Stanton, U. S. Geol. Survey Mon. 32, p. 636.
1903. *Scaphites ventricosus* Meek and Hayden. Douglass, Carnegie Mus. Annals, vol. 2, No. 1, p. 8.

Meek's description is as follows:

Shell attaining a medium or larger size, oval, ventricose, broadly rounded over the periphery; inner turns closely involute, deeply embracing, and composing a large portion of the entire bulk; deflected portion very short; umbilicus very small and deep; aperture transversely sublunate or reniform, being deeply sinuous and but slightly disconnected from the inner turns on the inner side; surface ornamented with costae that pass nearly straight over the periphery, where they are of uniform size, excepting their gradual enlargement with the volutions, while on the sides of the last or outer volution, about every fifth or sixth one is larger and more prominent than the intermediate ones, which latter do not extend inward to the umbilical margin.

The septa, as made out from the specimen represented by our figures 8, *a*, *b* (which is believed to be the inner volutions of this species, as represented by figures 7, *a*, *b*), are provided with deeply divided lobes and sinuses. Siphonal lobe longer than wide and bearing on each side of its very slender body three branches, the two terminal of which are slightly larger than the succeeding lateral ones, and each unequally bifid and digitate; first lateral sinus as large as the siphonal lobe, very narrow at its base, and profoundly divided at its extremity into two unequal branches, of which the one on the siphonal side is larger than the other, and, like the latter, deeply bifid, with sinuous and obtusely digitate margins; first lateral lobe as wide as the siphonal lobe but somewhat shorter and provided with two nearly equal, bifurcating, and digitate terminal branches; second lateral sinus not more than half as long and little more than half as wide as the first and somewhat similarly divided and subdivided; second lateral lobe about half as long and wide as the first, but tripartite at the extremity, the divisions being nearly equal and digitate; third lateral sinus small and merely provided with two nearly equal terminal branches, with more or less sinuous margins; third lateral lobe hardly more than half as large as the second and bearing two very short, digitate terminal divisions. Between the last-mentioned lobe and the umbilicus there is a minute tridigitate lobe, very similar to the auxiliary lobe of the third lateral sinus but smaller.

The individuals here referred to this species agree very closely in form, sculpture, and suture with Meek's type specimen. Additional details of the early stages not given in Meek's description are afforded by the material in hand. The protoconch is similar to that of many other ammonites. The whorls are stout and are well rounded from the earliest stages to the end of the adult shell, the relative depression of the whorl increasing, however, in the latest stages. Up to a diameter of perhaps 3 millimeters the shell is smooth; then the ventral ribs appear as low rounded swellings passing straight across the venter, about 20 in number on the first sculptured whorl. These ventral ribs join near the umbilicus to form perhaps 10 obscure straight primary ribs. On succeeding whorls the same type of sculpture is present, though the ribs become higher and more numerous. The smaller specimen figured shows on the whorl ending at a diameter of 30 millimeters 50 ventral ribs and 19 umbilical ribs, and the larger specimen shows on the last septate whorl nearly 70 on the venter and 20 near the umbilicus. The ribs increase by forking and also by intercalation. The uncoiled living chamber bears relatively coarser ribs than the septate whorls. There is no suggestion of nodes in any of the specimens. An interesting feature of the larger specimen figured is the presence over the siphuncle of a faint rounded ridge which is continued out on the living chamber where the siphuncle is absent. The suture shows the characteristics of a normal *Scaphites* (s. s.) in that the first lateral lobe is in the earliest stages distinctly unsymmetrical, though it does not show a clearly trifid division, and then becomes symmetrically bifid. The second lateral lobe is clearly trifid at a diameter of 5 millimeters and in the later stages approaches a bifid form. The elements of the suture show a gradual decrease in size from the median plane of the shell to the line of involution both for the external and internal parts.

The characteristic features of *Scaphites ventricosus* are its stout, evenly rounded whorls, relatively fine ribs throughout the shell, and lack of nodes.

Hyatt [23] proposed to make this species the type of a new genus, *Anascaphites*, but the writer believes that

[22] Reeside, J. B., jr., The scaphites, an Upper Cretaceous ammonite group: U. S. Geol. Survey Prof. Paper 150–B, pp. 21–40, 1927.

[23] Hyatt, Alpheus, Cephalopoda, in Eastman, C. R., Textbook of paleontology by Karl von Zittel, vol. 1, p. 572, 1900.

the sequence of form, the sculpture, and the development of the suture prove it a *Scaphites* in the strict sense of the name and that *Anascaphites* must be abandoned. Hyatt did not define his group other than to cite the type species, and no one has yet accepted his usage.

The species is of widespread occurrence in the Interior Province of the Cretaceous and is one of the valuable guide fossils for late Colorado (Niobrara) time. It does not occur in beds of Benton age, as restricted to pre-Niobrara time, though Meek and others have cited it as a Benton species.

Scaphites ventricosus Meek and Hayden var. stantoni Reeside, n. var.

Plate 3, Figures 19–20; Plate 4, Figures 5–10

1894. *Scaphites ventricosus* (part) Meek and Hayden. Stanton, U. S. Geol. Survey Bull. 106, p. 186, pl. 44, fig. 10 [not pl. 44, figs. 8, 9; pl. 45, fig. 1].
1898. *Scaphites ventricosus* (part) Meek and Hayden. Logan, Kansas Univ. Geol. Survey, vol. 4, p. 476, pl. 104, fig. 10 [not pl. 104, figs. 8, 9; pl. 105, fig. 1].

This variety is proposed to include forms like that figured by Stanton in Plate 44, Figure 10, of his paper on the Colorado fauna, the original of which will serve as the type specimen for the variety. It is a more slender shell than the typical form of the species and has finer ribs, though in general aspect and in suture it is like the typical form. The last separate whorl with a maximum diameter of 40 millimeters shows 80 ventral ribs and about 25 primary ribs. None of the individuals in hand attain much more than half the size of typical *S. ventricosus*, possibly owing to the mere accidents of collecting. Should small size prove a constant feature it will form another character of the variety.

The type specimen figured by Stanton comes from Devils Slide, Cinnabar Mountain, Mont. Several specimens are in the collection from Oregon Basin and from other localities in the Interior Province of the Cretaceous.

Scaphites ventricosus Meek and Hayden var. depressus Reeside, n. var.

Plate 5, Figures 6–10

The variety is marked chiefly by the greater depression of the whorls, the shell being 52 millimeters wide at a diameter of 50 millimeters, whereas in the typical form it is 44 millimeters wide at a diameter of 50 millimeters. The living chamber is not known, but a complete shell would be as large as the typical form of the species. The ribs are fine—about 75 ventral ribs on the last whorl of the type (diameter of 50 millimeters) and 19 umbilical ribs.

Scaphites ventricosus Meek and Hayden var. oregonensis Reeside, n. var.

Plate 6, Figures 11–15

This variety is marked by possessing relatively fine and relatively sharp ribs rather than threadlike rounded ribs; on the living chamber the umbilical ribs stand high and sharp and at the margin of the venter reach their greatest height in an incipient node. It resembles somewhat in sculpture and form the geologically younger species *Desmoscaphites bassleri* Reeside,[24] which has sharp, well-developed nodes at the margin of the venter. It differs from *D. bassleri* in its stouter whorls and lack of a real node and is also different in suture. In its general aspect it is still a *S. ventricosus*. The specimens in hand are small, though this might not be a constant feature in a larger collection.

Scaphites ventricosus Meek and Hayden var. interjectus Reeside, n. var.

Plate 5, Figures 1–5

This variety is much like the type in its general aspect and in suture, but the primary ribs are relatively higher and rise into an incipient or even clearly defined node at the margin of the venter. In this character it approaches *Scaphites vermiformis* Meek and Hayden (see below), but it differs in having more numerous ribs on the venter of the living chamber—four or more to each umbilical rib—and, so far as the specimens in the writer's hands show, in attaining a larger size.

One of the specimens figured is from the banks of Missouri River, 4 or 5 miles below the mouth of Marias River, Mont.; the other is one of several specimens from Oregon Basin, Wyo.; a third locality is in the NE. ¼ NW. ¼ sec. 30, T. 56 N., R. 97 W., on the Garland anticline, Wyo.

Scaphites vermiformis Meek and Hayden

Plate 6, Figures 9–10

1852. *Scaphites vermiformis* Meek and Hayden, Acad. Nat. Sci. Philadelphia, vol. 14, p. 22.
1876. *Scaphites vermiformis* Meek and Hayden. Meek, U. S. Geol. Survey Terr. Rept., vol. 9, p. 423, pl. 6, fig. 4.
1894. *Scaphites vermiformis* Meek and Hayden. Stanton, U. S. Geol. Survey Bull. 106, p. 183, pl. 44, fig. 3.
1898. *Scaphites vermiformis* Meek and Hayden. Logan, Kansas Univ. Geol. Survey, vol. 4, p. 474, pl. 104, fig. 3.
1910. *Scaphites vermiformis* Meek and Hayden. Grabau and Shimer, North American index fossils, p. 176, fig. 1427c.

Meek's description is as follows:

Shell under medium size, ovate-subdiscoidal in form; umbilicus very small; inner regularly coiled volutions closely involute, deeply embracing, and composing a rather large portion of the entire shell; deflected part very short, so as only to be slightly disconnected from the inner turns at the aperture, which is a little contracted and quadrato-subcircular in outline, with a slightly sinuous inner margin; surface ornamented by numerous straight costae, which are rather small and nearly regular on the inner volutions but become more distant and larger, as well as much more prominent, on the inner half of each side of the body portion, where they each support a prominent node at the outer end, so arranged that those on opposite sides generally alternate; costae all passing

[24] Reeside, J. B., jr., The cephalopods of the Eagle sandstone and related formations in the Western Interior of the United States: U. S. Geol. Survey Prof. Paper 151, p. 16, pl. 21, figs. 17–21; pl. 22, figs. 8–12, 1927.

nearly straight across the periphery, on which they are of nearly uniform size, with the exception of the irregular enlargement with the whorls.

The nodes mentioned above are directed out at right angles to the sides of the shell and, like the costae, become again smaller toward the aperture. Most of the large costae bifurcate at the nodes on the body part of the shell, but their number is also increased by the intercalation of others between. Where they thus branch at the nodes on one side, the two divisions crossing over the periphery from the point of bifurcation never both connect at a node on the opposite side, but in most cases one and sometimes each division terminates between two of the nodes on the other side.

The septate portion of the only specimen of this species in the collection being highly crystalline, the structure of its septa can not be very clearly traced out. The siphonal lobe, however, can be seen to be a little longer than wide, with a rather narrow body, provided with three branches on each side, the upper pair of which are small and nearly simple, while the next pair are longer and each bifid, and the terminal pair (which are larger than the second) are each ornamented by three small pointed branchlets, or digitations, on the outer side. The first lateral lobe is somewhat irregularly tripartite, the lateral divisions being bifid and sharply digitate, while the terminal, which is not exactly central, is longer than the others, and has about five pointed digitations, or sharp, nearly or quite simple branchlets. The first lateral sinus can be seen to be deeply divided at the extremity into two nearly equal branches. The second lateral sinus can also be so far traced as to show that it is not more than about one-third as large as the first, nearly as long as wide, and regularly tripartite; and this is as far as the structure of the septa can be made out from the specimen.

This species is distinguished by the possession of coarse, rather sharp ventral ribs—two to each umbilical rib—and a row of high, sharp conical nodes along the margins of the venter of the living chamber—one node for each primary rib. It is moderately compressed and apparently a consistently small shell for the genus. The suture is not well preserved on any of the specimens available to the writer but is definitely a normal suture for *Scaphites* s. s.—bifid adult lobes and a gradual decrease in size from the median plane. It is connected with *S. ventricosus* Meek and Hayden by *S. ventricosus* var. *interjectus* Reeside, n. var. The type specimen came from the later (Niobrara) part of the Colorado formation at Chippeway Point, on Missouri River, Mont.

The species is widespread in the Interior Province of the Cretaceous and, like its frequent associate *S. ventricosus*, is one of the most useful guide fossils for late Colorado (Niobrara) time. It does not occur in beds of Benton age as now conceived, though Meek and others have cited it as a Benton form.

Scaphites vermiformis Meek and Hayden var. binneyi Reeside, n. var.

Plate 6, Figures 1–8

This variety differs from the typical form in the greater depression of the whorls and the greater length of the living chamber. Its general aspect, sculpture, and suture are essentially the same as in the typical form.

Subfamily PLACENTICERATINAE Hyatt

Genus PLACENTICERAS Meek

The writer, in another paper,[25] has discussed at some length the genus *Placenticeras*. As there defined it has the following characters:

Shell large, discoidal, involute, compressed. Whorls stout and rounded in earliest stages; at a diameter of a few millimeters becomes higher than wide in cross section, with flattened venter; all later stages to a large diameter high, compressed, with narrow channeled venter bordered by sharp continuous or nodose keels or with narrow flat venter. Very large adults of most species have compressed whorls with narrowly rounded venters, though in a few species the senile whorls are stout, even quadrate in cross section. Umbilicus narrow in typical forms, about one-seventh the diameter of the shell, with rounded shoulder, gentle inner slope in the young and steep in the later stages. Stout species have a relatively wider umbilicus. Sculpture weak; faint ribs in the very young stages and none or only low, obscure coarse ribs in the later stages. Surface marked by sigmoid striae. Tubercles when present not usually strong nor numerous. Suture in adult has three prominent lateral lobes and six or seven smaller lateral lobes.

Placenticeras pseudoplacenta Hyatt

Plate 2, Figures 20–21

1894. *Placenticeras placenta?* (part) Stanton, U. S. Geol. Survey Bull. 106, pl. 39, fig. 1 [not figs. 2, 3].
1903. *Placenticeras pseudoplacenta* Hyatt, U. S. Geol. Survey Mon. 44, p. 216, pl. 43, figs. 3–11; pl. 44.

Hyatt did not anywhere offer a real diagnosis of this species, though from his figures and casual remarks it may be deduced that he had in mind a moderately stout shell, with height of the whorl about twice the width, flanks of whorl flattened in younger stages, very gently arched in later stages; narrow umbilicus; venter moderately broad, about as in *P. planum* Hyatt and *P. stantoni* Hyatt; nodes and ribs inconspicuous or absent at all stages; suture with first three lobes and first three saddles subequal; all the parts of the suture short, very solid, and only moderately incised; fourth lateral lobe much shorter than the third.

A single fragment of a species of *Placenticeras* preserving part of three successive whorls presents characters that ally it strongly with *P. pseudoplacenta* Hyatt but also with *P. planum* Hyatt.[26] It resembles the former species in the general form and proportions of the cross section of the whorl—height about twice the width—though the flanks are a little more rounded than in the type; in the absence of tubercles; and in

[25] Reeside, J. B., jr., A comparison of the genera *Metaplacenticeras* Spath and *Placenticeras* Meek: U. S. Geol. Survey Prof. Paper 147, pp. 1–5, 1926.

[26] Hyatt, Alpheus, Pseudoceratites of the Cretaceous: U. S. Geol. Survey Mon. 44, p. 202, pl. 33, figs. 2–4; pl. 34, 1903.

the degree of incision and proportions of the suture except for the first lateral saddle, which should be nearly equal in size to the second and third saddles but is instead nearly twice as wide. It resembles the second species in the gently rounded rather than flattened flanks and in the wide first lateral saddle; it differs in the absence of tubercles, somewhat stouter whorl—ratio of height to width as 2 to 4 as against 2 to 5—and abrupt drop in size of the fourth lateral lobe with respect to the third lateral lobe.

None of the other species of *Placenticeras* are very close to this: *P. syrtale* (Morton) and its allies have prominent nodes; *P. meeki* Boehm (=*P. whitfieldi* Hyatt) and its allies have a more compressed shell and much more intricate suture, *P. placenta* (De Kay) and its allies have a suture of different proportions and greater incision.

Hyatt seems to have allowed some latitude with respect to the width of the first lateral saddle, so it seems best to assign the present specimen to *P. pseudoplacenta*. It is not the variety *occidentale* Hyatt,[27] which is like the typical form in lacking conspicuous tubercles but which has a different suture—more complicated with the lobes and saddles unequal—so much so that the writer doubts that the variety *occidentale* really belongs to the species.

Family PRIONOTROPIDAE Zittel

Genus MORTONICERAS Meek

Mortoniceras embraces ammonites with compressed discoid shells, wide umbilicus, subquadrate cross section of the whorls; external border broad, bearing a low rounded keel bordered by shallow furrows, which in turn are bordered externally by a row of elongated tubercles; ribs straight, simple or bifurcated, and ornamented by tubercles. Sutures of few elements—siphonal lobe, three lateral lobes, and antisiphonal lobe; first lateral lobe about as long as the siphonal lobe but much longer than the second and third; first lateral lobe bifid.

Meek [28] chose *Ammonites vespertinus* Morton as the genotype, believing it identical with *Ammonites texanus* Roemer. Later students accept the latter as the true genotype.

Mortoniceras shoshonense Meek

Plate 6, Figures 16–23; Plate 7, Figures 1–11; Plate 8, Figures 1–4

1876. *Mortoniceras shoshonense* Meek, U. S. Geol. Survey Terr. Rept., vol. 9, p. 449, pl. 6, figs. 3 a, 3 c, 6 b.
1894. *Mortoniceras shoshonense* Meek. Stanton, U. S. Geol. Survey Bull. 106, pp. 179, 180, pl. 43, figs. 1, 2.
1898. *Mortoniceras shoshonense* Meek. Logan, Kansas Univ. Geol. Survey, vol. 4, p. 471, pl. 103, figs. 1, 2.

Meek's original description is as follows:

Shell compressed-discoidal, with umbilicus apparently nearly or quite twice as wide as the outer whorl; volutions very narrow, with dorsoventral and transverse diameters equal, and section subquadrangular, those within scarcely one-sixth embraced by the succeeding turn; costae each mainly represented by two nodes, the inner of which is low, compressed, and elongated, so as to extend from near the umbilical margin about halfway across the sides, while the outer near the peripheral margins is more prominent, rounded, and directed laterally; keel less prominent than the row of compressed nodes on each side about halfway between it and the rounded nodes along the margins of the periphery; compressed nodes on the periphery of each inner turn covered by the succeeding volution, the inner margin of which is indented by the rounded lateral nodes of that next within.

Septa moderately approximated; siphonal lobe oblong, about once and a half as long as wide, with small, short, nearly parallel, serrated terminal branches and three or four very short, digitate and simple branchlets and points on each side; first lateral sinus wider than the siphonal lobe (which it equals in length), unequally bipartite at the anterior end, both divisions being digitate and the larger one on the siphonal side deeply bifid; first lateral lobe somewhat longer but narrower than the siphonal and having its terminal division deeply bifid and its lateral margins bearing a few very nearly simple branchlets; second lateral sinus scarcely more than half as wide as the first and much shorter on the umbilical side, unequally bifid or trifid at the end, with more or less sinuous margins; second lateral lobe only about half as long and wide as the first and trilobate, with the small middle division emarginate at the end; third lateral sinus a little shorter and narrower than the second, with a bipartite end and serrated margins; third lateral lobe nearly as long as the second but narrower and irregularly tridentate at the end; antisiphonal lobe about as long as the first lateral but narrower, with a few short nearly simple, lateral divisions and a tridentate posterior extremity.

Meek's type is a small part only of a whorl but is sufficiently well characterized to define the species, as may be seen from Meek's excellent figures.[29] The specimens from Oregon Basin and other material in the writer's hands permit the following additional details of description, which Meek's specimen did not afford:

The shell in the earliest stages has a stout discoid form but quickly becomes compressed discoid. At the earliest diameter seen, 3.5 millimeters, the whorl is subcircular in cross section. A whorl later, at a diameter of 7 millimeters, the cross section has become slightly higher than wide and still evenly rounded. A half whorl later, at a diameter of 10 millimeters, it is 4 millimeters high, 3.5 millimeters wide, and helmet-shaped. A fourth whorl later, at a diameter of 13 millimeters, it is approaching a subquadrate form. In the course of the succeeding whorl it becomes quadrate, higher than wide, a form maintained in all the later stages known—that is, up to a diameter of 150 millimeters. The umbilicus is wide through all stages—a little less than half of the diameter; umbilical wall steep, umbilical shoulder rounded but well defined. Living chamber in specimens available for examination incomplete but occupying more than a half whorl. Aperture not preserved.

The whorl at a diameter of 3.5 millimeters is smooth; at 5 millimeters the low rounded siphonal keel has

[27] Idem, p. 217, pl. 45, figs. 1, 2.
[28] Meek, F. B., Invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. Survey Terr. Rept., vol. 9, p. 448, 1876.
[29] Meek, F. B., op. cit., pl. 6, figs. 3a, 3c, 6b.

appeared; at 7 millimeters radial welts appear on the outer border of the flanks; at 10 millimeters the median keel is accompanied on each side by a faint rounded ridge, and the ventrolateral welts have become distinct rounded nodes and are connected with the umbilical shoulder by a low rounded rib. At 13 millimeters the faint ridges bordering the median keel have broken into distinct nodes—one to each rib, the ventrolateral nodes are still more distinct and the umbilical part of the rib has become more prominent and node-like. At a diameter of 18 to 20 millimeters the ventral nodes have become elongated parallel to the median keel, and the general aspect of the shell is much like that of the larger adult. In subsequent stages (up to a diameter of 150 millimeters) the high point of the umbilical node moves outward nearly to the middle of the flank and is elongated radially; the ventrolateral node is subconical; the ventral node is much elongated parallel to the keel; the keel itself becomes relatively less and less conspicuous. The ribs are simple and nearly straight at all stages; there are none intercalated and none divide. There are from 19 to 22 ribs to each whorl in the specimens in hand, the number varying but little with the stage of growth.

The external suture retains about the same proportions from the earliest stage seen, at 3.5 millimeters, throughout the later stages. There are numerous variations in small details. The first lateral lobe in the early stages has a single terminal branch but becomes blunt and rounded in the later stages.

The chief specific characters of *M. shoshonense* are the simple ribs bearing three nodes, one on the flank elongated radially, one on the ventrolateral margin and subconical, one on the venter elongated parallel to the keel. From other American species it is separated easily. *M. texanum* (Roemer)[30] and its allies, *M. lasswitzi* Yabe and Shimizu[31] and *M. roemeri* Yabe and Shimizu,[31] also *M. delawarense* (Morton)[32] and its ally, *M. omeraense* Reeside,[33] have five nodes on each rib. *M. bourgeoisi* Grossouvre var. *americana* Lasswitz[34] has a node on the middle of the flank in addition to the umbilical and ventrolateral nodes and has nothing to do with either *M. shoshonense* or *M. bourgeoisi*. Other species named by Lasswitz are likewise easily separable. *M. crenulatum* Anderson[35] does not belong to *Mortoniceras*, for it has crenulated keel, much inclined ribs, and long spines. It is possibly a *Prionotropis*. *M. worthense* Adkins[36] belongs to some other genus, probably *Inflaticeras* Stieler. *M.? vermilionense* Meek[37] is probably a *Prionotropis* and at any rate lacks the conspicuous nodes and straight ribs of *M. shoshonense*. Poorly preserved and fragmentary specimens of *Mortoniceras* collected by L. W. Stephenson from a tongue of the Austin chalk of Texas (4 miles north of Broadway, Lamar County, and 2 miles east-northeast of Savage, Fannin County) have four or five rows of tubercles and are therefore distinct from *M. shoshense*. Among European species it is closest to *M. bourgeoisi* (D'Orbigny emended by Grossouvre),[38] from which it differs in acquiring the tubercles at a much earlier stage and in the more external position of the inner tubercle, though the resemblance otherwise is very great.

Occurrence: *M. shoshonense* is known from only a small area in north-central Wyoming. Meek's type is said to have come from the head of Wind River valley and was collected by F. V. Hayden while a member of Raynolds's expedition to explore the upper Missouri country. The other specimens known to the writer all came from the northern part of Big Horn Basin, from localities near the towns of Cody, Greybull, and Frannie, Wyo.

Mortoniceras shoshonense Meek var. crassum Reeside, n. var.

Plate 8, Figures 5–15

This variety differs from the typical form in its coarser sculpture, somewhat stouter whorls, and somewhat greater involution. The general characteristics of the sculpture are the same, and there are no conspicuous differences in suture.

The specimens in hand are from the same localities as the typical form.

[30] Roemer, Ferdinand, Die Kreidebildungen von Texas, p. 31, pl. 3, figs. 1 a–c [not figs. 1 d–e], 1852.

[31] Yabe, Hisakatsu, and Shimizu, Saburo, A note on the genus *Mortoniceras:* Japanese Jour. Geology and Geography, vol. 2, p. 30, 1923.

[32] Morton, S. G., Synopsis of the organic remains of the Cretaceous group in the United States, p. 37, pl. 2, fig. 5, 1834.

[33] Reeside, J. B., jr., The cephalopods of the Eagle sandstone and related formations in the Western Interior of the United States: U. S. Geol. Survey Prof. Paper 151, p. 38, pl. 42, figs. 3, 4; pl. 43, figs. 1, 2, 1927.

[34] Lasswitz, Rudolf, Die Kreide-ammoniten von Texas: Geol. und pal. Abh., n. ser., vol. 6, Heft 4, p. 252, pl. 8, fig. 1, 1904.

[35] Anderson, F. M., Cretaceous deposits of the Pacific coast: California Acad. Sci. Proc., vol. 2, No. 1, p. 125, pl. 1, figs. 17, 18, 1902.

[36] Adkins, W. S., The Weno and Pawpaw formations of the Texas Comanchean: Texas Univ. Bull. 1856, p. 91, pl. 1, figs. 6–10, 18–19, 26; text fig. 12, 1920.

[37] Meek, F. B., Invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. Survey Terr. Rept., vol. 9, p. 450, pl. 7, fig. 2, 1876.

[38] De Grossouvre, Albert, Les ammonites de la craie supérieure, p. 73, pl. 13, fig. 2; pl. 14, figs. 2, 5, 1894.

PLATES 1–8

PLATE 1

Page

FIGURES 1–4. *Eutrephoceras* sp., inner, side, and outer views, and suture of an internal cast. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6405 2

FIGURES 5–18. *Phlycticrioceras oregonense* Reeside, n. gen. and sp 3

5–8. Outer and side views, suture, and cross section at larger end of the entirely septate cast chosen as the type. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6407.

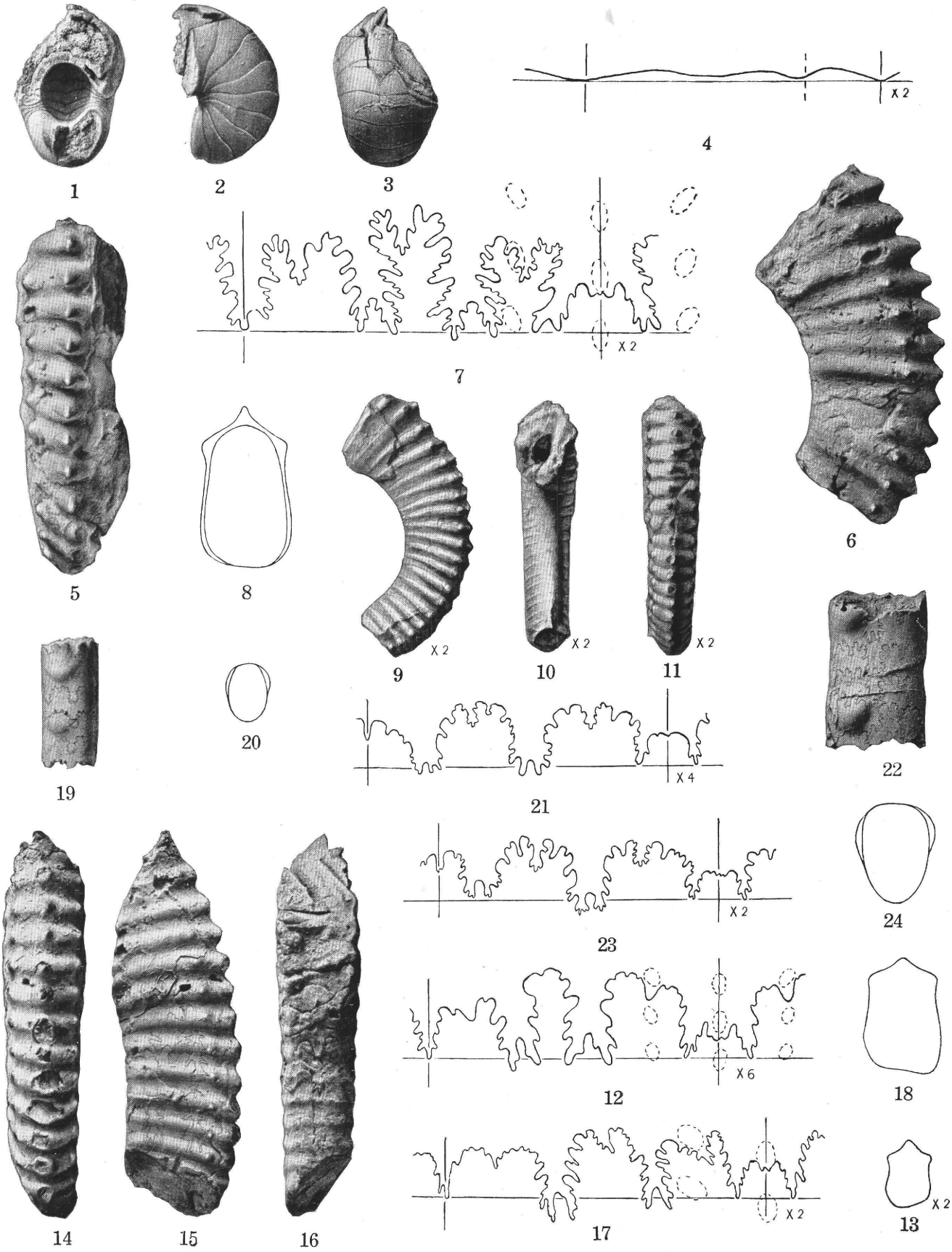
9–13. Side, inner, and outer views, suture, and cross section near smaller end of a small specimen retaining parts of the shell. Cody shale, 350 feet above base, sec. 24, T. 58 N., R. 97 W., Wyo. U. S. Nat. Mus. catalogue No. 73267.

14–18. Outer, side, and inner views, suture, and cross section at larger end of an entirely septate internal cast from same locality as the type. Yale Peabody Mus. catalogue No. 6407.

FIGURES 19–24. *Baculites asper* Morton. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6415 4

19–21. Side view, cross section, and suture of a small septate internal cast.

22–24. Side view, suture, and cross section of a large septate internal cast.



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CEPHALOPODS FROM THE LOWER PART OF THE CODY SHALE

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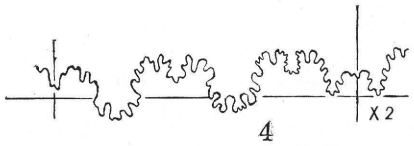

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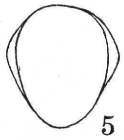

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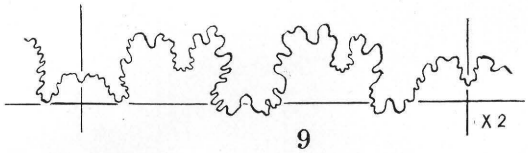

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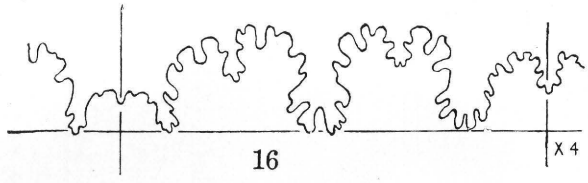

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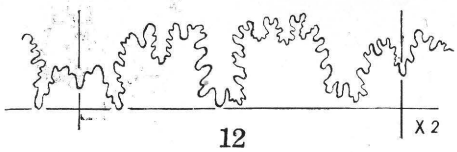

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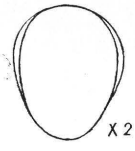

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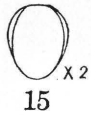

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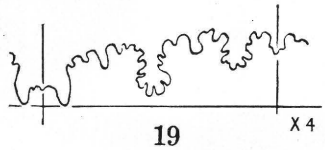

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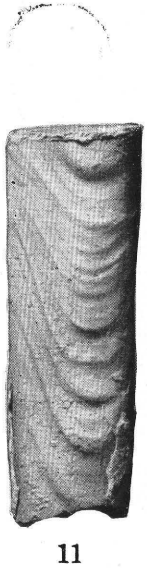

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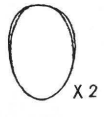

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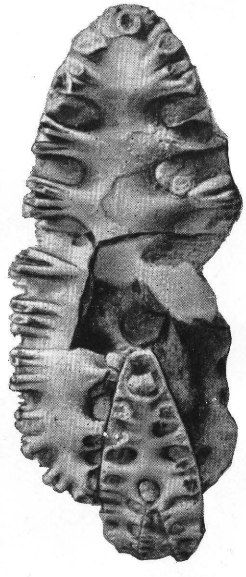

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CEPHALOPODS FROM THE LOWER PART OF THE CODY SHALE

PLATE 2

Page

FIGURES 1–5. *Baculites asper* Morton, side, siphonal, and antisiphonal views, suture, and cross section of a cast representing a complete living chamber. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6415 4

FIGURES 6–19. *Baculites codyensis* Reeside, n. sp. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6408 4

6–10. Siphonal, side, and antisiphonal views, suture and cross section of type specimen, a septate internal cast with some fragments of shell adhering.

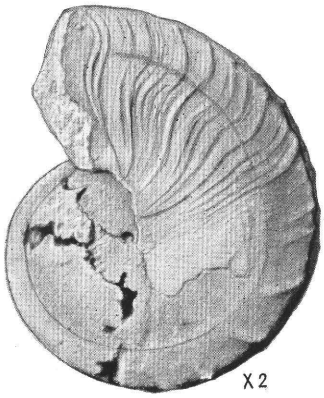
11–13. Side view, suture, and cross section of a large septate internal cast.

14–16. Side view, cross section, and suture of a septate internal cast with more closely set ribs.

17–19. Side view, cross section, and suture of a small septate internal cast.

FIGURES 20–21. *Placenticeras pseudoplacenta* Hyatt, side and end views of an internal cast. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6413 8

PLATE 3



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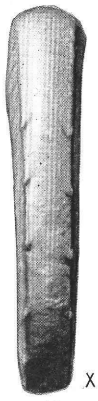

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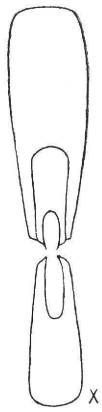

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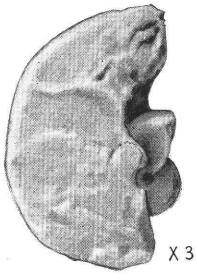

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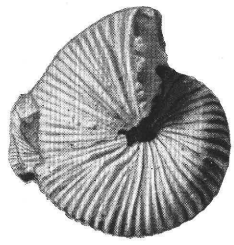

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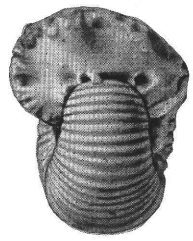

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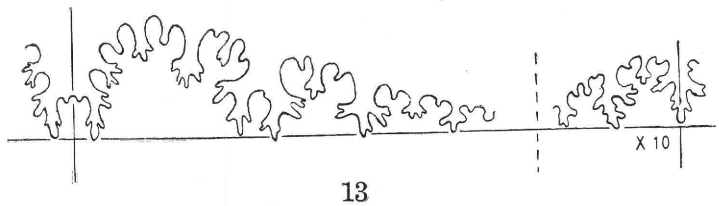

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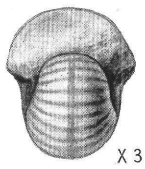

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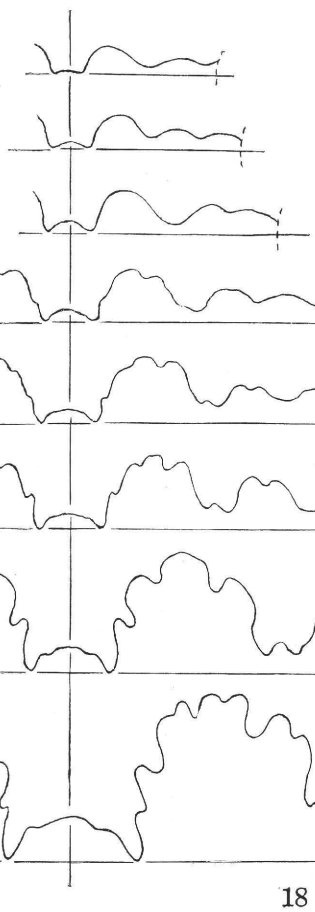

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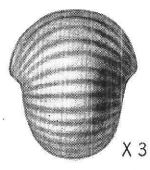

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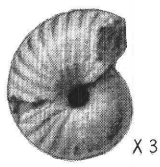

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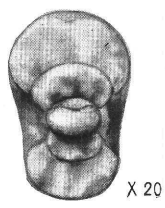

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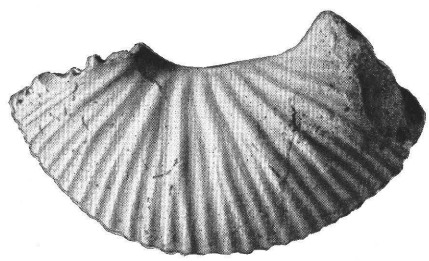

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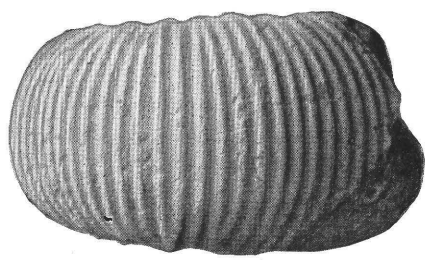

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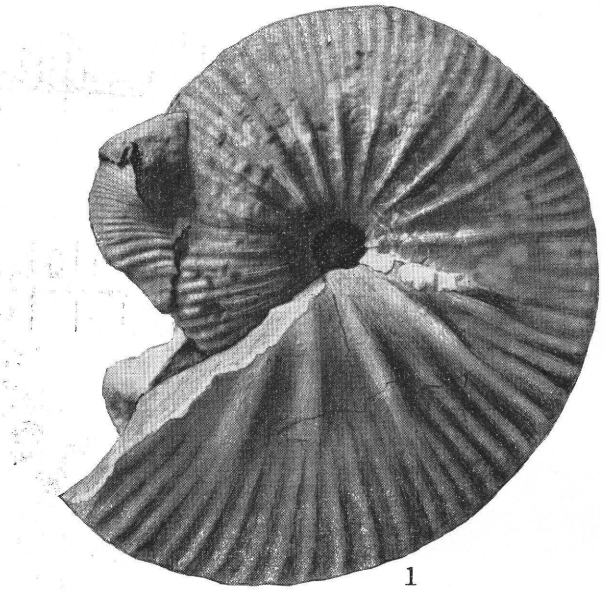
CEPHALOPODS FROM THE LOWER PART OF THE CODY SHALE



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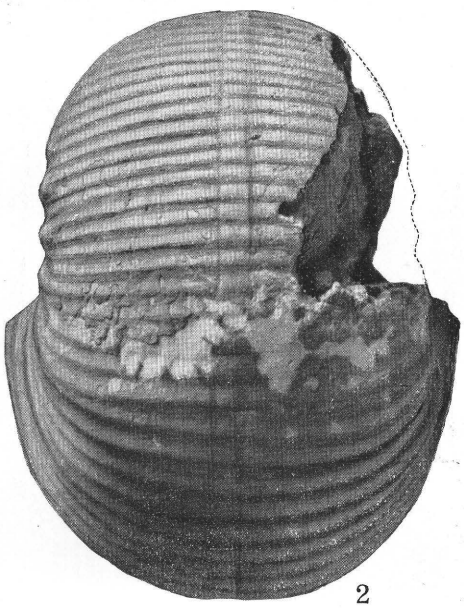

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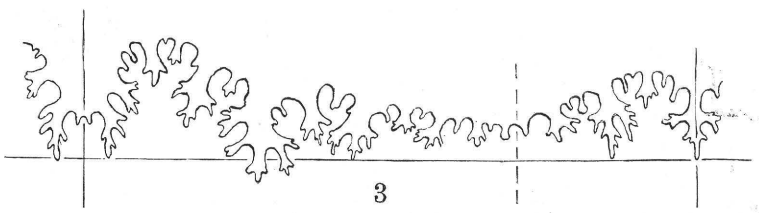

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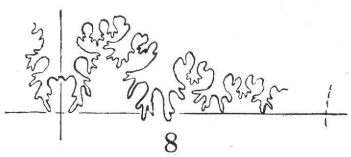

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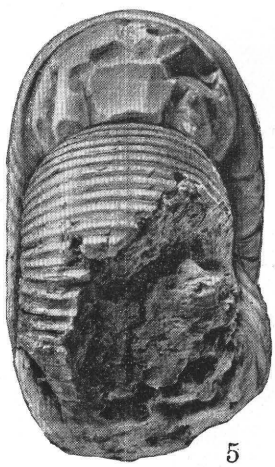

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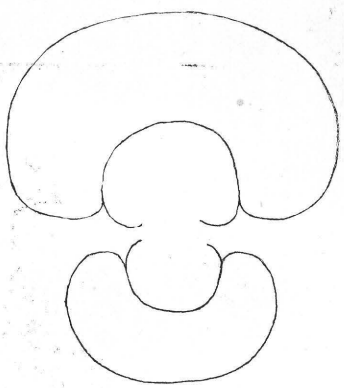

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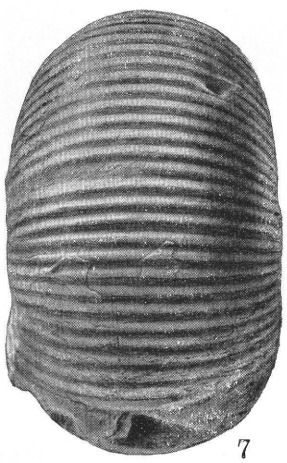

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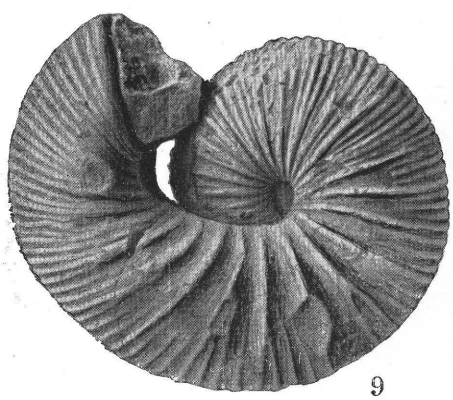

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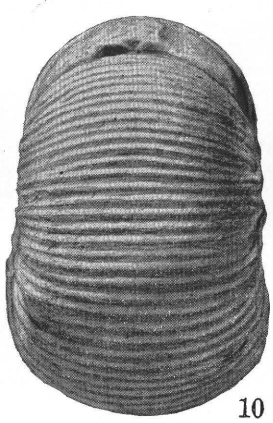

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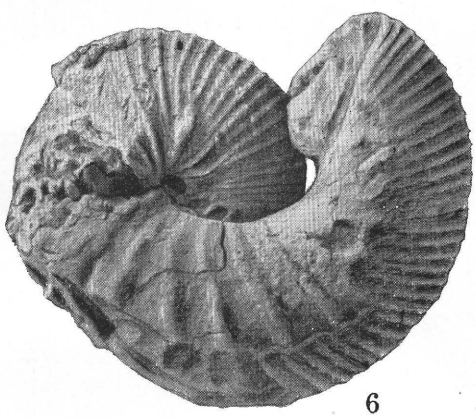

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CEPHALOPODS FROM THE LOWER PART OF THE CODY SHALE

PLATE 4

Page

FIGURES 1–4. *Scaphites ventricosus* Meek and Hayden, side and rear views, next to last suture, and cross section at 50 millimeters of an internal cast somewhat larger than Meek and Hayden's type specimen but otherwise very much like it. Cody shale, 600 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 641 ---------- 6

FIGURES 5–10. *Scaphites ventricosus* Meek and Hayden var. *stantoni* Reeside, n. var ---------- 7

5–8. Front, side, and rear views and suture of an internal cast very similar to the type specimen though not quite as fine-ribbed. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6417.

9–10. Side and front views of the type specimen. Upper part of Colorado formation at Devils Slide, Cinnabar Mountain, Mont. U. S. Nat. Mus. catalogue No. 18817.

PLATE 5

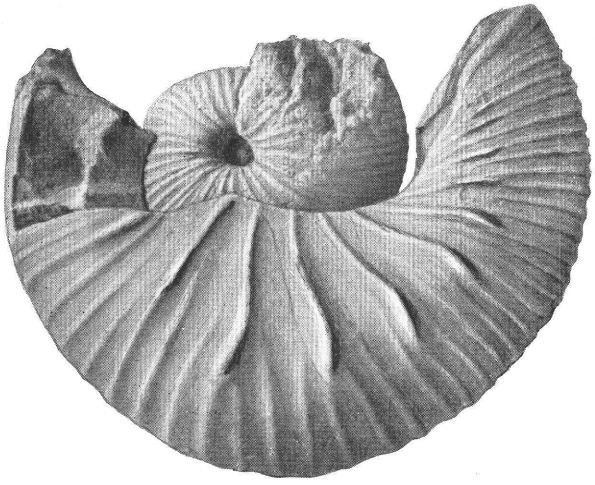
Page

FIGURES 1–5. *Scaphites ventricosus* Meek and Hayden var. *interjectus* Reeside, n. var. 7

1–4. Side and rear views, suture at diameter of 33 millimeters, and cross section through last suture of type, an internal cast. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6416.

5. Side view of an internal cast with more distinct nodes and finer ribs than the type. Upper part of Colorado formation on Missouri River 4 or 5 miles below mouth of Marias River, Mont. U. S. Nat. Mus. catalogue No. 28602.

FIGURES 6–10. *Scaphites ventricosus* Meek and Hayden var. *depressus* Reeside, n. var., side, front, and rear views, cross section, and suture of type, an internal cast. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6417 7



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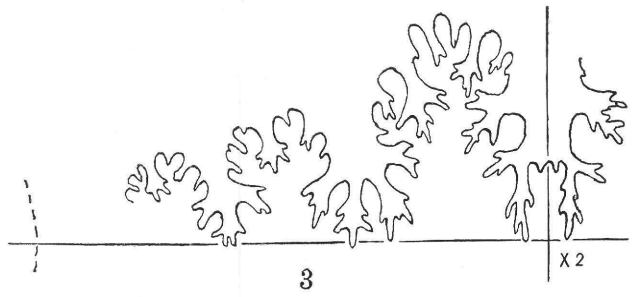

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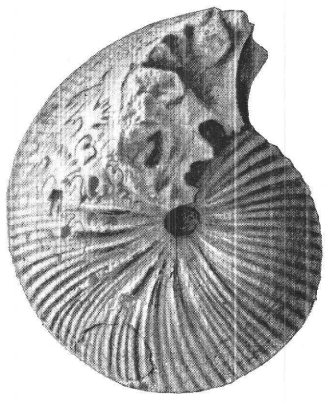

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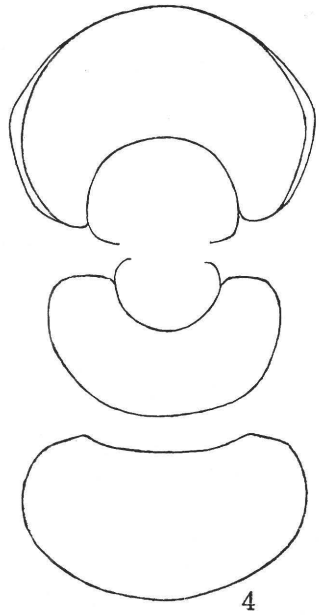

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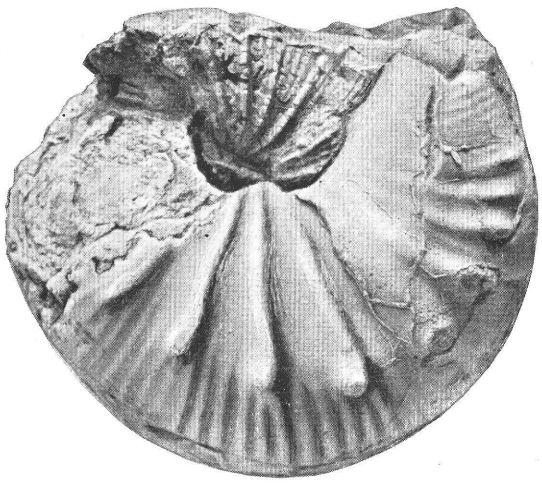

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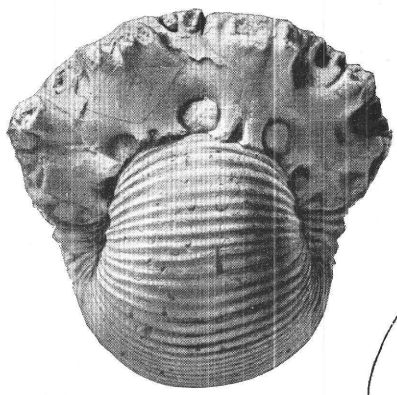

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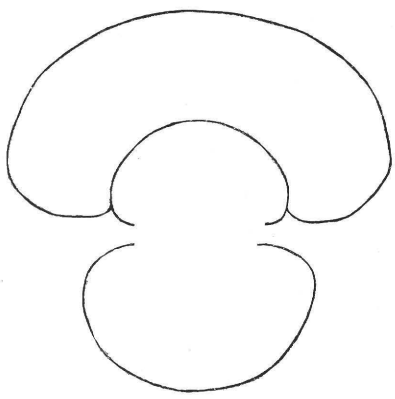

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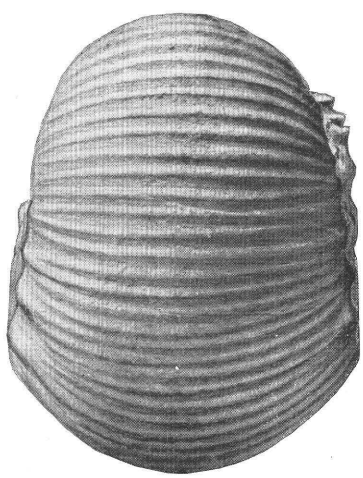

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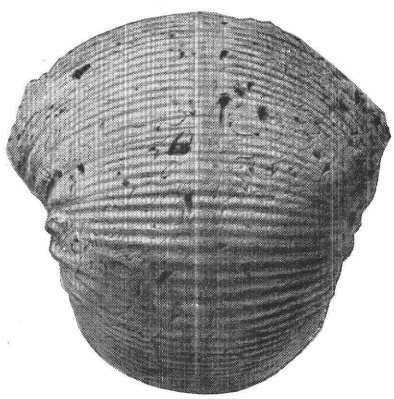

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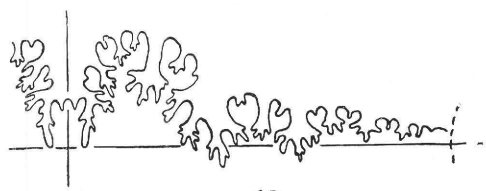

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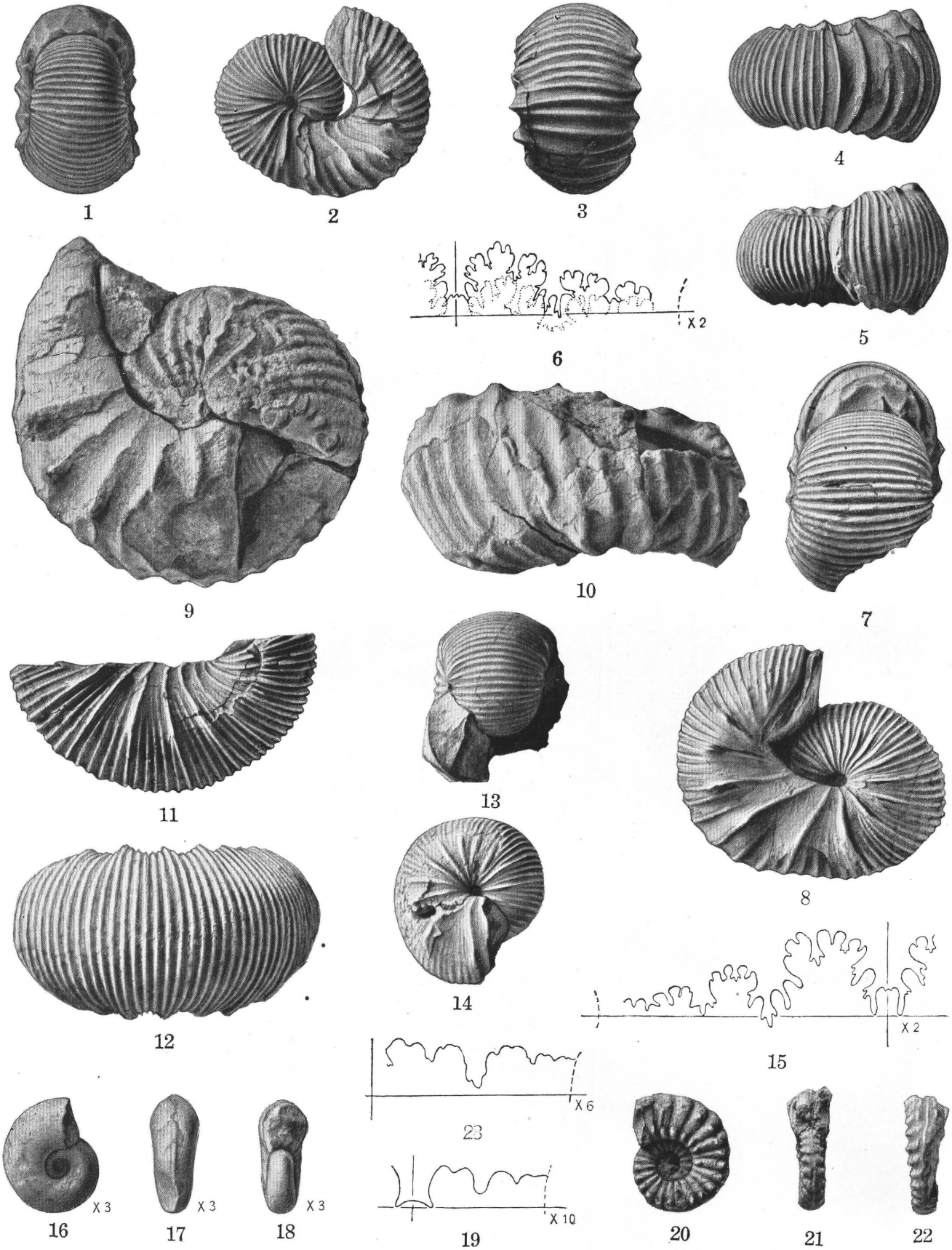
CEPHALOPODS FROM THE LOWER PART OF THE CODY SHALE



CEPHALOPODS FROM THE LOWER PART OF THE CODY SHALE

PLATE 6

Page

FIGURES 1–8. *Scaphites vermiformis* Meek and Hayden var. *binneyi* Reeside n. var. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6417 8

1–6. Front, side, rear, bottom, and top views and suture of type specimen, an internal cast retaining parts of the shell.

7–8. Front and side views of another specimen, an internal cast with parts of the shell.

FIGURES 9–10. *Scaphites vermiformis* Meek and Hayden, side and bottom view of somewhat distorted specimen. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6422 7

FIGURES 11–15. *Scaphites ventricosus* Meek and Hayden var. *oregonensis* Reeside, n. var. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Wyo. Yale Peabody Mus. catalogue No. 6411 7

11–12. Side and bottom views of type, a nearly complete cast of living chamber.

13–15. Rear and side views and suture of a cast showing the septate whorls and part of living chamber.

FIGURES 16–23. *Mortoniceras shoshonense* Meek. Lower part of Cody shale, sec. 24, T. 58 N., R. 97 W., near Frannie, Wyo. U. S. Nat. Mus catalogue No. 73269 9

16–19. Side, rear, and front views and suture of a very young stage.

20–23. Side, front, and rear views, and suture at diameter of 13 millimeters of young stage retaining much of the shell.

PLATE 7

Page

FIGURES 1–11. *Mortoniceras shoshonense* Meek 9

1–3. Side and rear views and suture at diameter of 90 millimeters of a nearly complete large individual. Upper part of Colorado group (lower part of Cody shale) near Cody, Wyo. U. S. Nat. Mus. catalogue No. 73270.

4–7. Rear, front, and side views and suture at diameter of 7 millimeters of young stage retaining much of the shell. Lower part of Cody shale, sec. 24, T. 58 N., R. 97 W., near Frannie, Wyo. U. S. Nat. Mus. catalogue No. 73269.

8–11. Rear, front, and side views and suture at diameter of 38 millimeters of specimen retaining fragments of the shell. Cody shale, 775 feet above base, central part of NW. ¼ sec. 33, T. 51 N., R. 100 W., Oregon Basin, Wyo. Yale Peabody Mus. catalogue No. 6423.

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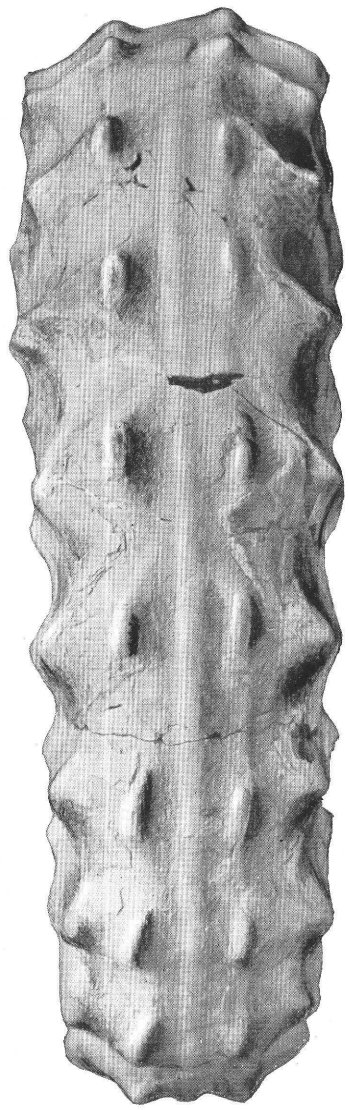

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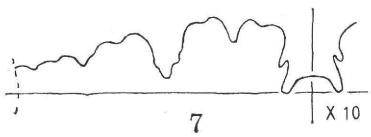

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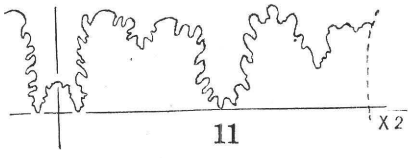

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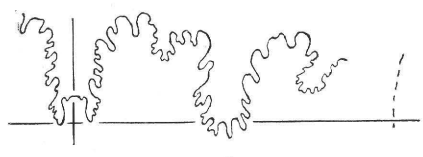

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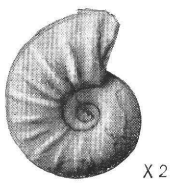

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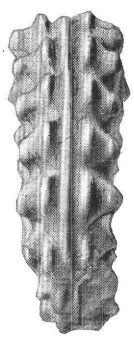

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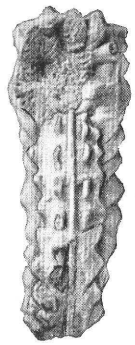

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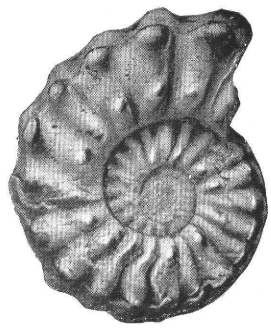

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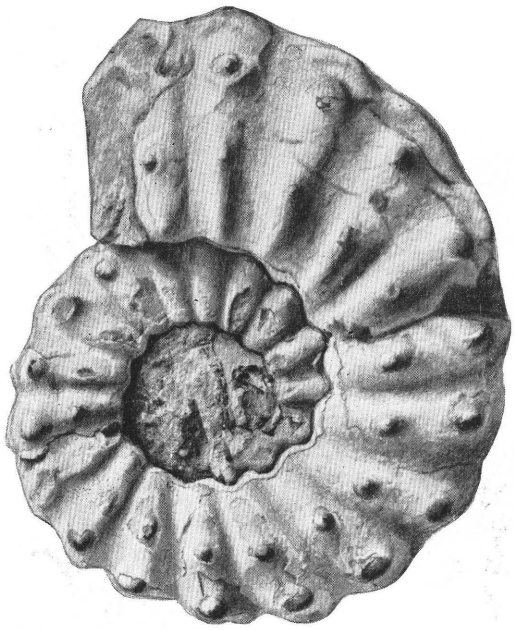
CEPHALOPODS FROM THE LOWER PART OF THE CODY SHALE



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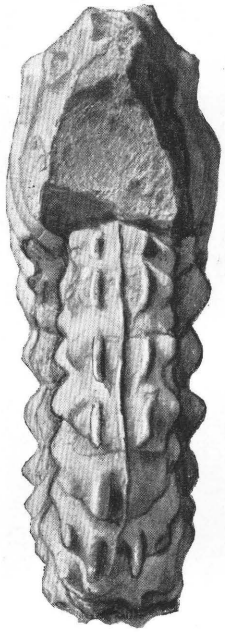

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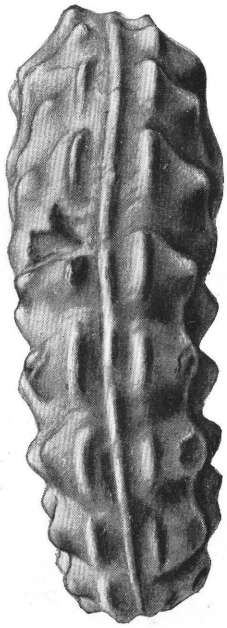

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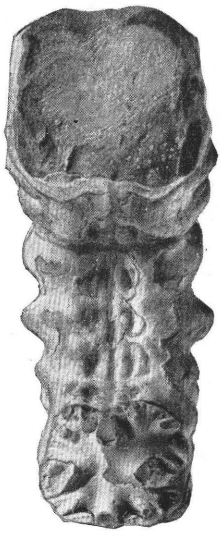

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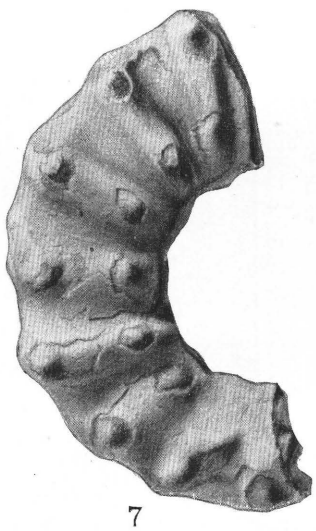

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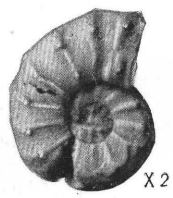

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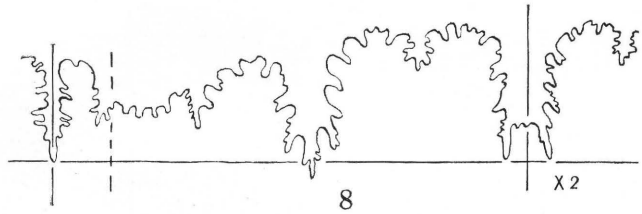

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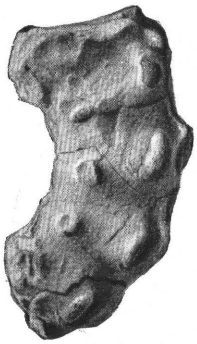

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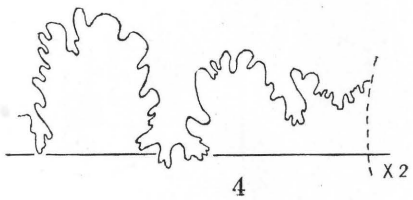

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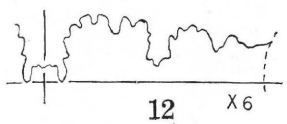

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12

CEPHALOPODS FROM THE LOWER PART OF THE CODY SHALE

PLATE 8

Page

FIGURES 1–4. *Mortoniceras shoshonense* Meek, side, front, and rear views and suture at diameter of 50 millimeters of a specimen retaining much of the shell and about the size of Meek's type specimen. The keel has been squeezed so as to appear sharp on parts of the venter. Upper part of Colorado group (lower part of Cody shale), south side of Shoshone River 3 miles east of Cody, Wyo. U. S. Nat. Mus. catalogue No. 73271 9

FIGURES 5–15. *Mortoniceras shoshonense* Meek var. *crassum* Reeside, n. var 10

5–8. Front, rear, and side views and suture at diameter of 45 millimeters of the type specimen, a part of a whorl retaining much of the shell. Lower part of Cody shale, Shoshone River 2 miles east of Cody, Wyo. U. S. Nat. Mus. catalogue No. 73272.

9–12. Rear, front, and side views and suture at diameter of 9 millimeters of a small specimen preserving much of the shell. Lower part of Cody shale, sec. 24, T. 58 N., R. 97 W., near Frannie, Wyo. U. S. Nat. Mus. catalogue No. 73273.

13. Side view of broken specimen of young stage retaining the shell. Same locality as Figures 9–12. U. S. Nat. Mus. catalogue No. 73273.

14–15. Side and rear views of an internal cast of part of a whorl. Cody shale, 800 feet above base, sec. 6, T. 51 N., R. 100 W., Oregon Basin, Wyo. Yale Peabody Mus. catalogue No. 6409.