

# ILLUSTRATED GUIDE TO BIOSTRATIGRAPHICALLY IMPORTANT CRETACEOUS MACROFOSSILS, WESTERN INTERIOR BASIN, U.S.A.

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The ammonite - bivalve zonation of the Western Interior Cretaceous basin is widely recognized as one of the most refined biostratigraphic systems yet developed in the Mesozoic. Zonal durations averaging 0.25 - 0.33 MY per zone, and reaching 0.1 MY per zone in restricted intervals, have been defined and widely traced through the basin (durations calculated from generalized radiometric scale; see Kauffman, 1977, this volume, and references therein). Extremely rapid evolution among many groups of ammonites and bivalves enhances this assemblage zonation; one or more widespread taxa are restricted to individual zones through most of the biostratigraphic system. It is remarkable that, despite rapid rates of evolution, many of the primary zonal taxa for the Cretaceous of the Western Interior also have exceptional biogeographic spread. This is especially true among inoceramid and certain ostreid bivalves, (*Lopha*, *Exogyra*) and many groups of ammonites (e.g. Scaphitidae, Acanthoceratidae, Baculitidae). Most bivalve and many ammonite indices occur also in the North Temperate regions of Europe, allowing detailed intercontinental correlation; individual species commonly range further to other continents. Widespread biogeographic dispersal was apparently accomplished through long-lived planktonic larvae among bivalves, distributed on currents in Cretaceous oceans and epicontinental seas, and through adult mobility in ammonites. Wide dispersal of taxa is more common during eustatic rise and transgressive maxima in the Cretaceous, and intracontinental or regional correlation is enhanced. Later regressive and early transgressive periods are more commonly characterized by geographically restricted biotas, including many endemics, and represent times of lower intercontinental correlation potential. Further refinement of this system, based at present upon simple assemblage and concurrent range zones, is being attempted by means of composite assemblage zonation utilizing diverse groups and following the methodology of Kauffman (1970).

The principal biostratigraphic indices among Western Interior Cretaceous macrofauna have been illustrated primarily in a series of important ammonite monographs by Cobban (1951a,b, 1953, 1958a, 1962a,b, 1964, 1969), Cobban and Scott (1964, 1972), and Scott and Cobban (1964); these data are partially summarized by Cobban and Reeside (1952), Cobban (1958b), Gill and Cobban (1966), Jeletzky (1968), Kauffman (1975), and Kauffman, Cobban, and Eicher (1977), among others.

Inoceramid and ostreid bivalves of primary importance in Cretaceous biostratigraphy of this basin are summarized by Kauffman (1966, 1975) and illustrated in Kauffman, Cobban and Eicher (1977) and Scott and Cobban (1964) for the Albian - Santonian sequence. Many other works, such as those of D. E. Hattin (see references throughout volume) contain plates of assemblages characterizing individual stratigraphic units. Most of these systematic studies deal with a single group of taxa, or strata of restricted age range.

Despite these many works, there is to date no illustrated guide to the biostratigraphic indices of the United States Western Interior, such as compiled for Canada by Jeletzky (1968, 1970). The plates which follow this introduction are an attempt to achieve this on a relatively limited basis, in available space, utilizing illustrations of taxa as originally figured in the published works listed earlier, and in addition the works of Stanton (1894), Meek (1876), Haas (1949), Elias (1933), and Cobban (1953). Robert W. Scott has kindly provided Plate 1 (new), and W. A. Cobban provided two of the ammonite plates. The principal purpose of this suite of plates is to develop a field guide to common, biostratigraphically significant macrofossils for the central part of the Western Interior basin, many of which might be collected during the course of the field trip. Diverse mollusks, especially bivalves, are applied to Albian biostratigraphy; ammonites and bivalves of the families Inoceramidae and Ostreidae are of equal importance in zonation of Cenomanian through Santonian strata; ammonites of the families Baculitidae, Scaphitidae, and Nostoceratidae clearly provide the most sophisticated means of zoning younger strata. Inoceramids have not yet been studied in detail for most of the American Santonian, Campanian, and Maastrichtian. When researched, they will doubtless supplement the ammonites more extensively in uppermost Cretaceous biostratigraphy.

It is our eventual aim to produce a more expansive version of this guide, utilizing the best available specimens for all biostratigraphically significant taxa, including microfossils, and providing systematic diagnoses and evolutionary summaries. Space limitations here permit only the most critical taxa to be shown among macrofaunas. Until this is completed some years hence, the following illustrations and those presented by Jeletzky (1970) for the northern part of the basin will hopefully provide the biostratigrapher

and field geologist with assistance in identifying the most important biostratigraphic indices and correlating zones throughout the Western Interior basin.

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## PLATE 1 UPPER ALBIAN MOLLUSKS, SOUTHERN WESTERN INTERIOR BASIN (see page 228)

- Fig. 1, 2. *Brachidontes nonbifurcus* Scott, Kiowa Formation, Saline County, Kansas (Loc. S2).  
1. LV of holotype KU500067 (X4). 2. Anterior view of LV (X5).
- Fig. 3. *Breviarca angulata* Scott, RV (KU50048) (X6). Kiowa Formation, Kiowa County, Kansas (Loc. K1-8).
- Fig. 4, 5. *Crassostrea kiowana* (Twenhofel), interior and exterior view of LV (KU50007) (X1).  
Kiowa Formation, Kiowa County, Kansas (Loc. K3-7).
- Fig. 6, 7. *Corbula? smolanensis* (Twenhofel and Tester), RV interior (KU500281a) and LV exterior (KU500303b) (X6). Kiowa Formation. 7. from Saline County, Kansas (Loc. S8-9).  
Exact locality of 6., unknown.
- Fig. 8-11. *Crassinella? semicostata* Scott. 8., 9. RV interior and exterior holotype KU500268.  
10., 11. LV interior and exterior, paratype KU500267 (X4). Kiowa Formation,  
McPherson County, Kansas (Loc. M3-3).
- Fig. 12. *Corbula? fenti* Scott, RV (X6). Kiowa Formation, Saline County, Kansas (Loc. S4,  
KU500283b).
- Fig. 13. *Aporrhaid* indet. (X2). Kiowa Formation, McPherson County, Kansas (Loc. M4-15).
- Fig. 14. *Nuculana mutata* Stephenson, casts of opposed valves (KU50040a,b) (X5). Kiowa Formation  
Clark County, Kansas (Loc. C1-9).
- Fig. 15, 16. *Turritella seriatim-granulata* Roemer, pleisotypes USNM 103149a,b, (X1). Purgatoire  
Formation, Mesa Tucumcari, New Mexico (from Stanton, 1947).
- Fig. 17. *Turritella kansasensis* Meek (KU500349) (X2). Kiowa Formation, Saline County, Kansas  
(Loc. S8-9).
- Fig. 18. *Turritella belviderei* Cragin (KU500323) (X2). Kiowa Formation, Ellsworth County,  
Kansas (Loc. E3-2).
- Fig. 19. *Venezoliceris kiowanum* (Twenhofel) (X0.5). Goodland Formation, Fort Worth, Texas  
(from Young, 1966).
- Fig. 20. *Adkinsites bravoensis* (Böse) (X1). Kiamichi Formation, Tarrant County, Texas.
- Fig. 21, 22. *Engonoceras belviderenae* (Cragin) (X0.5). Lateral and ventral views, basal unit of  
Kiowa Formation, Avilla Hill, Comanche County, Kansas (Loc. Cm 1).

## PLATE 2 UPPER ALBIAN-CENOMANIAN BIVALVES, SOUTHERN WESTERN INTERIOR BASIN (see page 229)

- Fig. 1, 3. *Texigryphaea corrugata corrugata* (Say) (X1). 1. Juvenile left valve, hypotype, USNM  
28770a, Lower Cretaceous, middle Late Albian, Duck Creek Formation, near  
Denison, Texas. 3. Adult left valve, USNM 28770b, same locality.
- Fig. 2, 4. "*Lopha*" (s.l.) *quadruplicata* (Shumard) (X2). Hypotypes, Late Albian, Washita Group,  
1-2 miles south of Fort Worth, Texas. 2. Right valve, exterior, USNM 103180a.  
4. Left valve, exterior, USNM 103180b.
- Fig. 5. "*Trachycardium*" *kansasense* (Meek) (X2). Plastoparatype, USNM 79054, left valve (X2).  
Late Albian, Dakota Group, Belvidere Formation (=Kiowa Shale), Mentor Member,  
12 miles southwest of Salina, Kansas.
- Fig. 6. *Protocardia texana* (Conrad) (X1). USNM 239546, USGS loc. 1978, Late Albian,  
Belvidere Formation (=Kiowa Shale), Mentor Member, 0.25 miles west of Osborne  
House, near Marquette, Kansas.
- Fig. 7. *Texigryphaea corrugata belviderenensis* (Hill and Vaughan) (X1). Lectoparatype (herein  
designated), USNM 28774b (lectoholotype is 28774a, original of Hill and Vaughan,  
1898, pl. 10., Figs. 1, 2), middle Late Albian, "Belvidere Beds" (=Kiowa Shale)  
near Belvidere, Kansas.
- Fig. 8. *Texigryphaea mucronata* (Gabb) (X1). Left valve, hypotype, USNM 28779a, Late Albian  
or lowest Cenomanian, "*arietinus* clay" (=Del Rio Shale), Shoal Creek, near  
Lindus Spring, Traverse County, Texas.
- Fig. 9, 11. *Scabrotirgonia emoryi* (Conrad) (X1). Left and right valve respectively, of holotype,  
USNM 9849, Washita Group, Late Albian, between El Paso and Frontera, Texas.
- Fig. 10, 12. *Texigryphaea tucumcari* (Marcou) (X1). Left valve, hypotype, USNM 22233a, Washita  
Group equivalent, Late Albian, Mesa Tucumcari, New Mexico.
- Fig. 13, 14. "*Exogyra*" (now *Ceratostreon*) *texana* Roemer (X1). 13. Left valve, hypotype, USNM  
239802, Late Albian, Fredericksburg Group, Walnut Clay, Tennessee Valley, north-  
west of Belton, Texas. 14. Hypotype, USNM 103211, late Middle to (?) early  
Late Albian, Comanche Series, Walnut Clay, 9 miles from Austin, Texas on road  
Bee Caves.

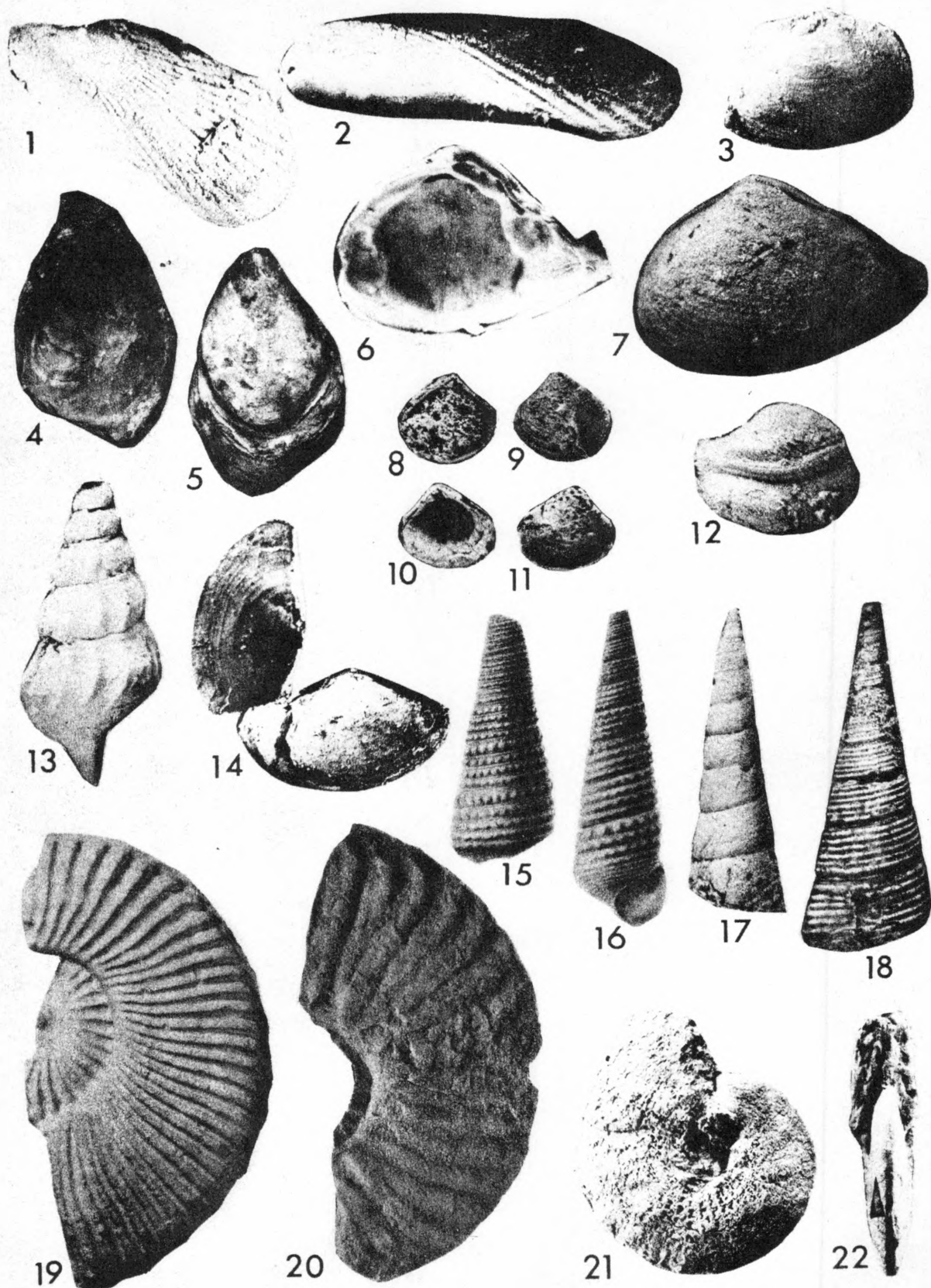


PLATE 1.

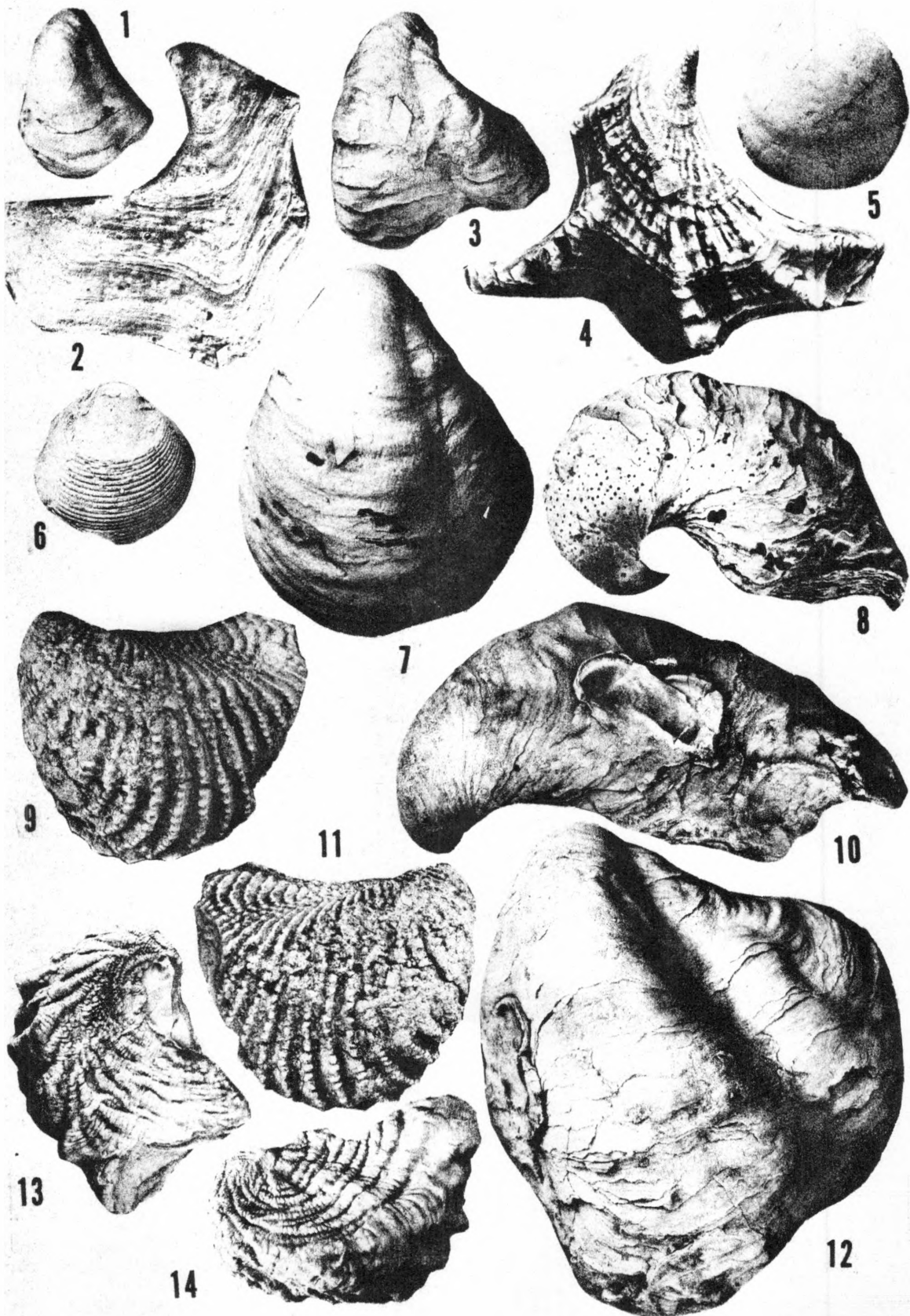


PLATE 2.

## PLATE 3 UPPER ALBIAN AND LOWER CENOMANIAN INOCERAMIDAE, NORTHERN AND CENTRAL REGIONS, WESTERN INTERIOR BASIN

(see page 231)

- Fig. 1. "*Inoceramus*" *athabaskensis* McLearn (X1/2). 1. Hypotype (*I. dunveganensis* McLearn of Jones and Gryc, 1960), USNM 129216, basal 10' of Ninuluk Formation, Colville River, northern Alaska; Late Albian-Early Cenomanian.
- Fig. 2. "*Inoceramus*" *moberliensis* McLearn (X1). Plastoholotype of GSC 8945 (USNM 236082), Goodrich Formation, Cool Creek, British Columbia; Late Albian.
- Fig. 3. "*Inoceramus*" *goodrichensis* McLearn (X1). Plastoplectotype of GSC 9713 (USNM 236083), first sandstone, Sikanni Formation, Cypress and Halfway, British Columbia; Late Albian.
- Fig. 4. "*Inoceramus*" *comancheanus* Cragin (X1). Lectoholotype (herein designated), USNM 32686, Duck Creek Formation, 2-3 miles northeast of Denison, Texas; Late Albian.
- Fig. 5. "*Inoceramus*" *dunveganensis* McLearn (X1). Plastoplectotype (GSC, unfigured) (USNM 236084), Dunvegan Formation, Peace River, Alberta; Late Albian (?) - Early to Middle Cenomanian.
- Fig. 6. "*Inoceramus*" *anglicus* Woods (X1). Hypotype, USNM 128695, Grandstand Formation, Kurupa River, northern Alaska; Late Albian.
- Fig. 7. "*Inoceramus*" *moberliensis* McLearn, n. subsp. (late evolutionary variant), USNM 239547, USGS 10892, Lower Cretaceous, Late Albian, upper part of Thermopolis Shale, NW 1/4 sec. 9, T 6 S, R 32 E, Crow Indian Reservation, Montana.
- Fig. 8. *Inoceramus mconnelli* Warren (X1). Plastocotype (USNM 236085), Dunvegan Formation, Peace River, Alberta; Early Cenomanian?.
- Fig. 9. "*Inoceramus*" *bellvueensis* Reeside (X1). Paratype, (USNM 32513, specimen 9), Skull Creek Shale Member, South Platte Formation, Dakota Group, hogback just north of Bellvue, Larimer County, Colorado; Late Albian.
- Fig. 10. "*Inoceramus*" *eulessanus* Stephenson (X1). Holotype, USNM 105160. Euless (?) Member, Woodbine Formation, Lower Cenomanian, slope near State Highway 183, 1.4 miles west-southwest of Euless, Tarrant County, Texas.

## PLATE 4 UPPER ALBIAN AND CENOMANIAN BIVALVES, WESTERN INTERIOR BASIN (see page 232)

- Fig. 1, 4. *Phelopteria salinensis* (White), middle Late Albian, Skull Creek Shale Member, South Platte Formation, Dakota Group, Poudre Valley and Reservoir Company ditch, 2 miles north of Bellvue, Colorado. 1. Right valve (X2). Yale University (K. M. Waage) loc. A-812, Middle Skull Creek Shale Member, bed 29 of Waage, 1961, p. 106. 4. Left valve (X1). Ibid. loc. A-812, middle of Skull Creek Shale, bed 29 of Waage, 1961, p. 106.
- Fig. 2. *Tetrigryphaea mucronata* (Gabb), left valve (X1). Hypotype, USNM 28779b, Late Albian or earliest Cenomanian, "arietina clay" (Del Rio Shale), Shoal Creek, near Lindus Spring, Travis County, Texas.
- Fig. 3. "*Inoceramus*" *bellvueensis*? Reeside, n. subsp. (X1). Illustrated specimen, USNM 239788, USGS loc. 23303, Lower to early Middle (?) Cenomanian, Belle Fourche Shale, 10 feet below top, SW 1/3 sec. 20, T 9 N, R 2 E, Butte County, South Dakota.
- Fig. 5. "*Inoceramus*" *crippsi* Mantell, s.l., hypotype (X1). USNM 105162, USGS loc. 17163, early Late Cenomanian, Templeton Member, Woodbine Formation, gully south of Old Sherman Highway, 2.8 miles ESE of Whitesboro, Grayson County, Texas.
- Fig. 6. *Inoceramus arvanus arvanus* Stephenson, holotype (X1). USNM 105157, Middle Cenomanian, Lewisville Member, Woodbine Formation, 0.5 mile north of U.S. Highway 83, 0.5 mile west of Grayson County Line, Cooke County, Texas.
- Fig. 7. *Inoceramus arvanus* Stephenson, n. subsp. trans. to *I. rutherfordi* Warren (X1). Hypotype, USNM 108849, late Middle Cenomanian, basal Eagle Ford Shale, Walnut Creek, 4.75 miles ENW of Mansfield, Tarrant County, Texas.
- Fig. 8. *Inoceramus rutherfordi* Warren (X1). Hypotype, USNM 239787, USGS loc. 10838, early Late Cenomanian, Eagle Ford Shale, Arroyo 0.25 mile south of Eagle Pass Road, 7 miles SE of Del Rio, Val Verde County, Texas.
- Fig. 9. *Inoceramus tenuistriatus*? Nagao and Matsumoto, questionable hypotype (X1). USNM 169402, USGS locality 30225, Late Cenomanian, Lower Bridge Creek Limestone Member, Greenhorn Formation, *Sciponoceras gracile* zone, locality data as in Fig. 10.
- Fig. 10. *Inoceramus prefragilis* Stephenson s.l., n. subsp. (late evolutionary form), hypotype, USNM 169325, Kauffman locality K-68-2-22, early Late Cenomanian, lower Lincoln Member, Greenhorn Formation, in gullies bordering gravel road leading north from Oklahoma Highway 124 to Black Mesa State Park, 0.4 mile east of Mineral Townsite, Cimarron County, Oklahoma.
- Fig. 11. *Inoceramus prefragilis prefragilis* Stephenson, paratype (rugate variant showing

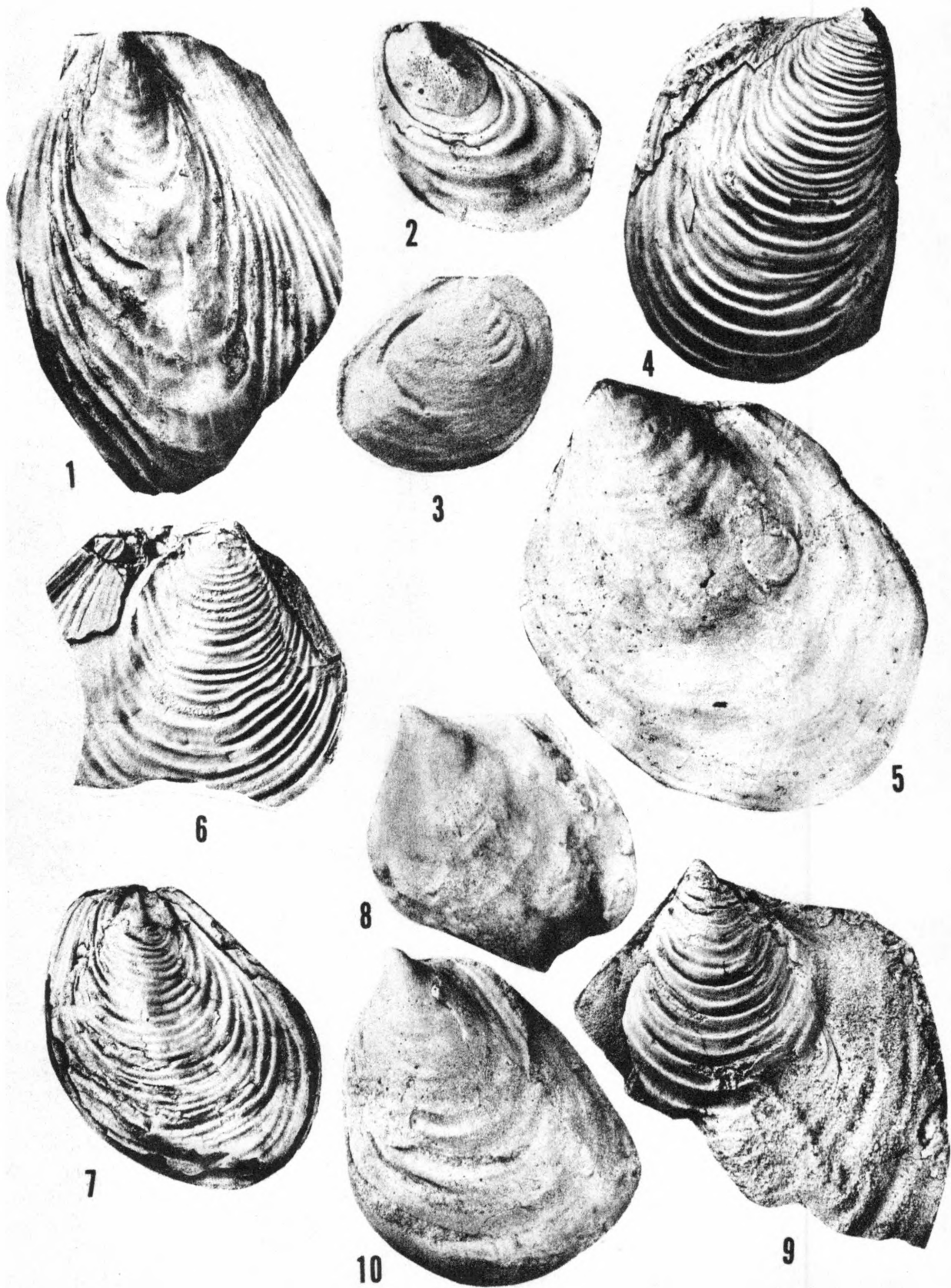


PLATE 3.

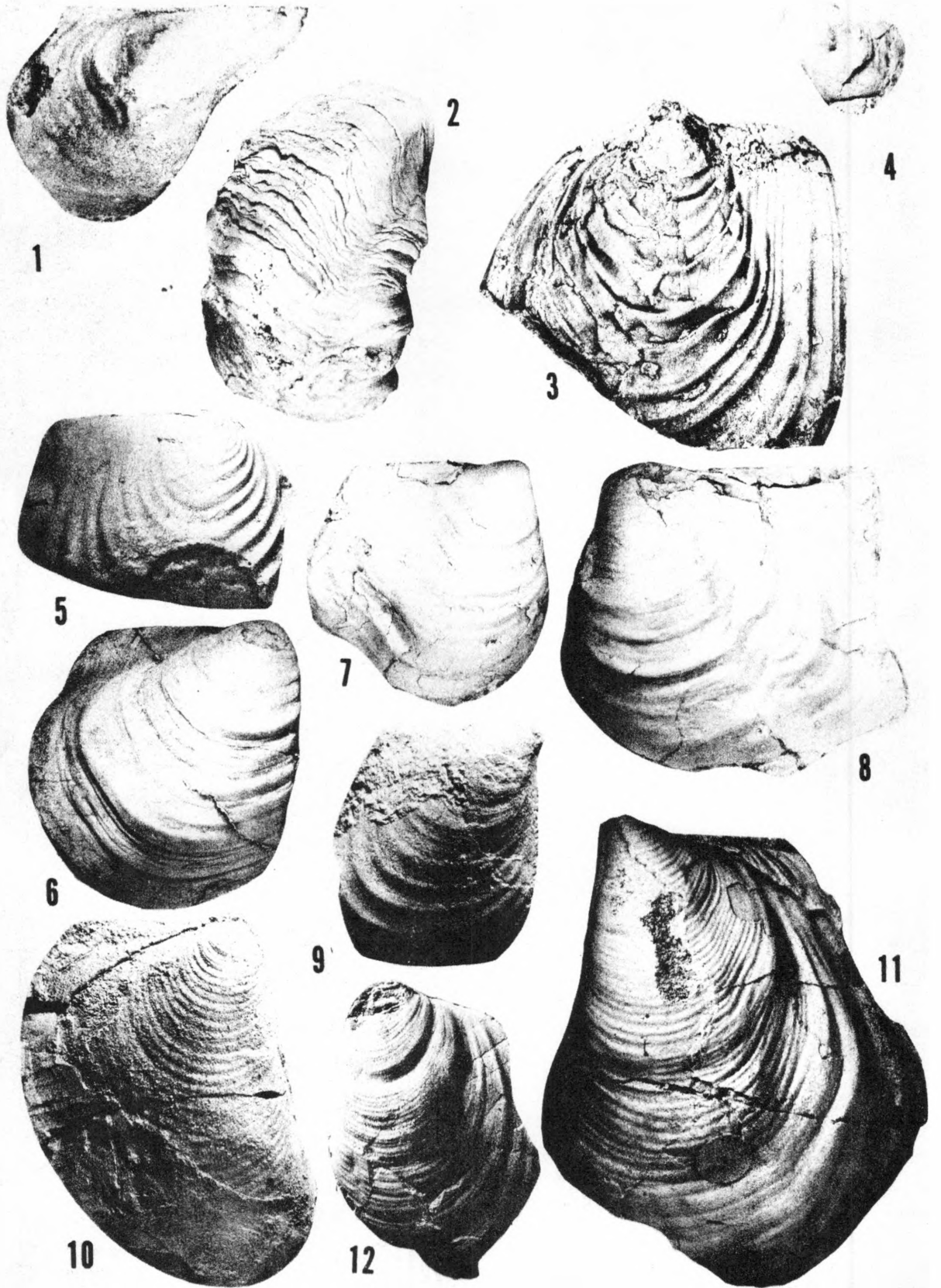


PLATE 4.



typical shallow sulcus), (X1). USNM 105153a, USGS locality 19015, Middle Cenomanian, Woodbine Sandstone, Lewisville Member, near branch 1.3 miles east-southeast of Terrace, 0.35 mile southeast of Dugan's Chapel, Grayson County, Texas.

- Fig. 12. *Inoceramus pictus* Sowerby, s.l., n. subsp. (fine ornament) (X1). Hypotype, USNM 164394, USGS locality 30235, early Late Cenomanian, lower Hartland Member, Greenhorn Formation, *Durweganoceras albertense* zone, gullies on east slope of Carizozo Creek, just southeast of Mineral Townsite, NW 1/4 sec. 18, T 4 N, R 2 E, Cimarron County, Oklahoma.

PLATE 5 CENOMANIAN-TURONIAN BIVALVES, WESTERN INTERIOR BASIN (see page 234)

- Fig. 1, 7. *Inoceramus ginterensis* Pergament, hypotypes (X1). 1. Left valve, USNM 169358, USGS locality 30234; 7. Typical adult left valve, USNM 169355, USGS locality 30235. Both from the middle Late Cenomanian, lower Fairport Member, Greenhorn Formation, *Durweganoceras albertense* zone, west-trending gullies, east slope of Carizozo Creek Valley, SE edge of Mineral Townsite, NW 1/4 sec. 18, T 4 N, R 2 E, Cimarron County, Oklahoma.
- Fig. 2. *Inoceramus flavus pictoides* Sornay, hypotype (X1). USNM 169395, USGS locality 30235, stratigraphic and geographic data as above.
- Fig. 3. *Inoceramus pictus pictus* Sowerby, hypotype (X1). USNM 239785, latest Cenomanian, *Sciponoceras gracile* zone, Upper Britton Member, Eagle Ford Shale, Texcrete Quarry near Dallas, Texas.
- Fig. 4. *Inoceramus corpulentus* McLearn, hypotype (X1). USNM 239786, latest Cenomanian, *Sciponoceras gracile* zone, upper part of the Britton Formation, Eagle Ford Shale, J. D. Powell locality DP-20, walls of emergency spillway, Garza-Little Elm Reservoir, southern Denton County, Texas.
- Fig. 5, 9, 10. *Exogyra* n. sp. aff. *E. boveyensis* Bergquist, figured specimens (X2). Left valves from the early Upper Cenomanian, zone of *Durweganoceras pondi*, Lincoln Member, Greenhorn Formation, Huerfano Park, Colorado. 5. University of Michigan, Museum of Paleontology (UMMP) 43216. 9., 10. Posterior and lateral views, respectively, UMMP 43214.
- Fig. 6. "*Ostrea*" *bentonensis* Logan, hypotype (X2). UMMP 43230, lower Fairport Member, Carlile Shale, early Middle Turonian, zone of *Collignonoceras woollgari*, Huerfano Park, Colorado.
- Fig. 8. *Pycnodonte newberryi* (Stanton), lectoparatype (herein designated) (X1). USNM 8775a, Latest Cenomanian or Lower Turonian, "Colorado Group" (presumably Tropic Shale), Kanab Valley, Utah.
- Fig. 11. *Inoceramus tenuimbonatus* Warren, hypotype (X1). USNM 239787, latest Cenomanian, upper *Sciponoceras gracile* zone, upper Britton Member, Eagle Ford Shale, Texcrete Quarry, near Dallas, Texas.

PLATE 6 CENOMANIAN-TURONIAN BIVALVES, WESTERN INTERIOR BASIN (see page 236)

- Fig. 1. *Ostrea prudentia* White. Lectoholotype (herein designated), left valve of a complete bivalved specimen (X1). From cotype lot USNM 8639a, probably Late Cenomanian, lower Colorado Group or upper Dakota Group, east of Impracticable Ridge, Utah.
- Fig. 2. *Inoceramus flavus flavus* Sornay. Hypotype (X1). USNM 239790, USGS Mesozoic locality D 9449, upper one-fifth of the Britton Member, Eagle Ford Shale, exposures along the southeast bank, west fork of the Trinity River, northwest part of the community of Eagle Ford, 800 meters or m east of Loop 12, Dallas County, Texas.
- Fig. 3. *Exogyra olisiponensis* Sharpe. Hypotype (X1). USNM 73613, USGS locality 12248, basal part of Mancos Shale, road from Notom to Cainesville, 2 miles northeast of Notom, Wayne County, Utah.
- Fig. 4, 5. *Crassostrea coalvillensis* (Meek). Cotypes (X1). 4. Exterior of right valve, USNM 7800a. 5. Interior of right valve, USNM 7800b. Late Cenomanian and Early Turonian, probably Coalville Member, Frontier Formation, railroad cut and dump, east edge of Coalville, Utah.
- Fig. 6. *Mytiloides?* "*latus*" s.l. (Mantell). Hypotype (X1). UMMP 43285, shaly limestone in beds transitional between the Bridge Creek Limestone Member, Greenhorn Formation and the Fairport Member, Carlile Shale, early Middle Turonian, north Santana Creek Valley, Huerfano Park, Colorado.
- Fig. 7. *Mytiloides* sp. aff. *M. submytiloides* Seitz. Figured specimen (X1). USNM 169335,

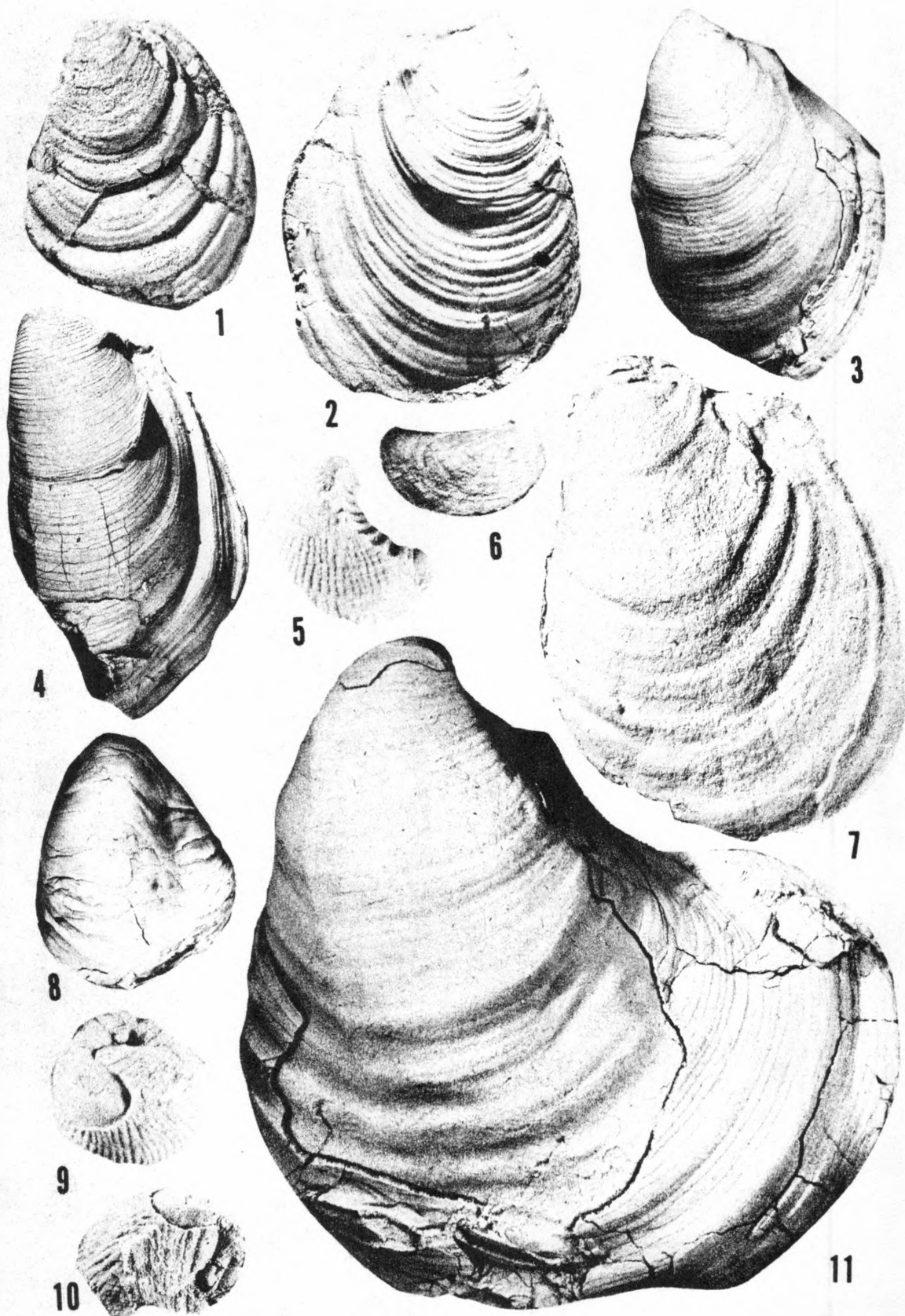


PLATE 5.

- USGS locality 30243, uppermost Hartland Member, Greenhorn Formation, zone of *Sciponoceras gracile*, Latest Cenomanian, locality as for Fig. 10.
- Fig. 8, 12. *Mytiloides mytiloides* (Mantell). Hypotypes (X1). From the middle and upper portions of the Bridge Creek Limestone Member, Greenhorn Formation, middle Early Turonian. 8. Large right valve, UMMP 43295, exposures 0.25 mile north of Farisita Post Office, Huerfano Park, Colorado. 12. USNM 22868, exposures along Muddy Creek, Huerfano Park, Huerfano County, Colorado.
- Fig. 9. *Mytiloides mytiloides arcuata* (Seitz)? Hypotype (X1). UMMP 43297, late Early Turonian, upper Bridge Creek Limestone Member, Greenhorn Formation, exposures in field 0.5 mile east of Turkey Creek and 1 mile north-northeast of Birmingham School, Huerfano Park, Colorado.
- Fig. 10. *Mytiloides opalensis* (Böse). Hypotype (X1). USNM 169310a, USGS locality 30229, early Early Turonian, lower Bridge Creek Limestone Member, Greenhorn Formation, in ditches bordering gravel road leading north from Oklahoma Highway 124 to Black Mesa State Park, 0.4 mile east of Mineral Townsite, Cimarron County, Oklahoma.
- Fig. 11. *Mytiloides*, sp. aff. *M. duplicostatus* (Anderson). Figured specimen (X1). USNM 169334, USGS locality 30229, lower Bridge Creek Limestone Member, Greenhorn Formation, Early Turonian, locality as in Fig. 10.
- Fig. 13. *Mytiloides labiatus* (Schlotheim), s.l., transitional to *M. subhercynicus* (Seitz). Hypotype (X1). USNM 239791, early Middle Turonian, zone of *Collignonoceras woollgari*, lower Fairport Member, Carlile Shale, on State Farm 1-2 miles from the west edge of Pueblo, Colorado, on the Rock Canyon Anticline, Pueblo County, Colorado.

## PLATE 7 LOWER AND MIDDLE TURONIAN BIVALVES, WESTERN INTERIOR BASIN (see page 237)

- Fig. 1, 2. *Inoceramus (Inoceramus) cuvieri* Sowerby. Hypotypes (X1). Early Middle Turonian, zone of *Collignonoceras woollgari*, sec. 18, T 13 S, R 12 W, on county road 2.8 miles north of railroad crossing in Bunker Hill, Russell County, Kansas. 1. Internal mold, left valve, slightly rugate variety, USNM 239792; 2.5 feet above base, Fairport Member, Carlile Shale. 2. Internal mold, right valve with inflated early umbonal area, quadrate variety, USNM 239793; uppermost bed, Pfeifer Member, Greenhorn Formation.
- Fig. 3-6. *Mytiloides labiatus labiatus* (Schlotheim) sensu Seitz (1934). Hypotypes (X1). Highest Early Turonian, 4 feet above base, Pfeifer Member, Greenhorn Formation, locality as in Figs. 1, 2. 3. Right valve, USNM 239794. 4. Left valve, USNM 239795. 5. Left valve, USNM 239803. 6. Right valve, USNM 239804.
- Fig. 7, 8. *Mytiloides subhercynicus subhercynicus* (Seitz). Hypotypes (X1). Young adult shells, upper part of zone of *M. labiatus labiatus* (Schlotheim), highest Early Turonian, 4-5 feet above base, Pfeifer Member, Greenhorn Formation, locality as in Figs. 1, 2. 7. Right valve, USNM 239796. 8. Left valve, USNM 239797.
- Fig. 9, 13. *Mytiloides subhercynicus transiens* (Seitz). Hypotypes (X1). Early Middle Turonian, *Collignonoceras woollgari*-*Inoceramus cuvieri* zone. 9. Upper Tropic Shale, 70-75 feet below top, valley 1/2-1 mile southwest of Orderville, Utah, USNM 239798. 13. Top bed of Pfeifer Member, Greenhorn Formation, zone of *Collignonoceras woollgari*, early Middle Turonian, locality as in Figs. 1, 2, USNM 239799.
- Fig. 10, 12. *Mytiloides subhercynicus* (Seitz), n. subsp. transitional to *M. mytiloides* (Mantell). Hypotypes (X1). Left and right valves (composite molds) respectively. 10. USNM 239808. 12. USNM 239809. Both from 5 feet above the base of the Fairport Member, Carlile Shale, early Middle Turonian, SE 1/4 sec. 29, T 11 S, R 16 W, bluffs of intermittent southern tributary to Saline River, 4.5 miles west and 1 mile north of Fairport, Ellis County, Kansas.
- Fig. 11. *Mytiloides (?) hercynicus* (Petrascheck). Hypotype (X1). USNM 239805. Left valve (latex cast), early Middle Turonian, *Collignonoceras woollgari* zone, concretions and lenticular limestone units 70-75 feet below the top of the Tropic Shale, valley 0.5-1 mile southwest of Orderville, Utah.
- Fig. 14. *Mytiloides labiatus* (Schlotheim; sensu Seitz, 1934), n. subsp. (late form). Hypotype (X1). USNM 239801, latest Early Turonian, 4-5 feet above base, Pfeifer Member, Greenhorn Formation, locality as in Figs. 1, 2.

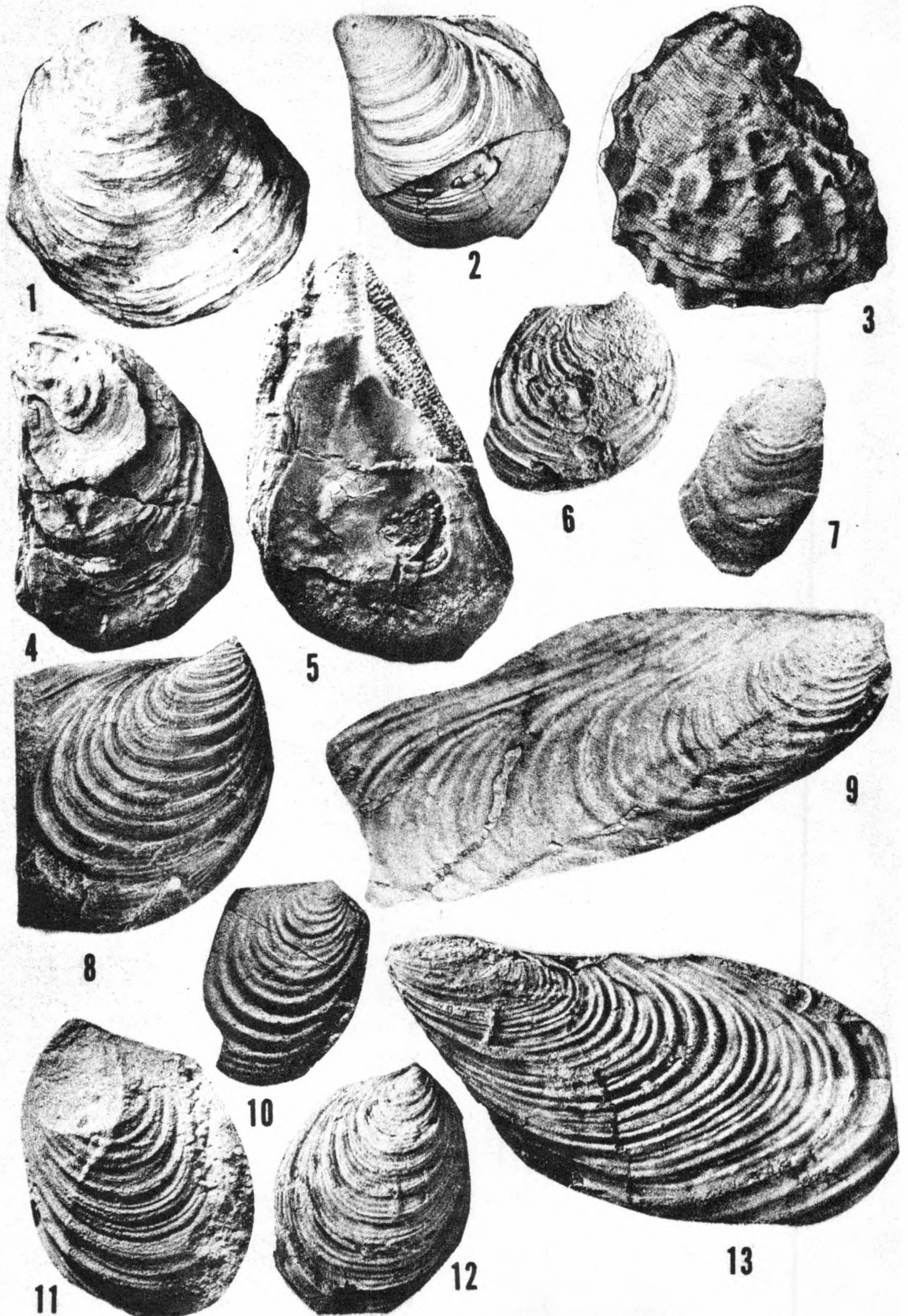


PLATE 6.

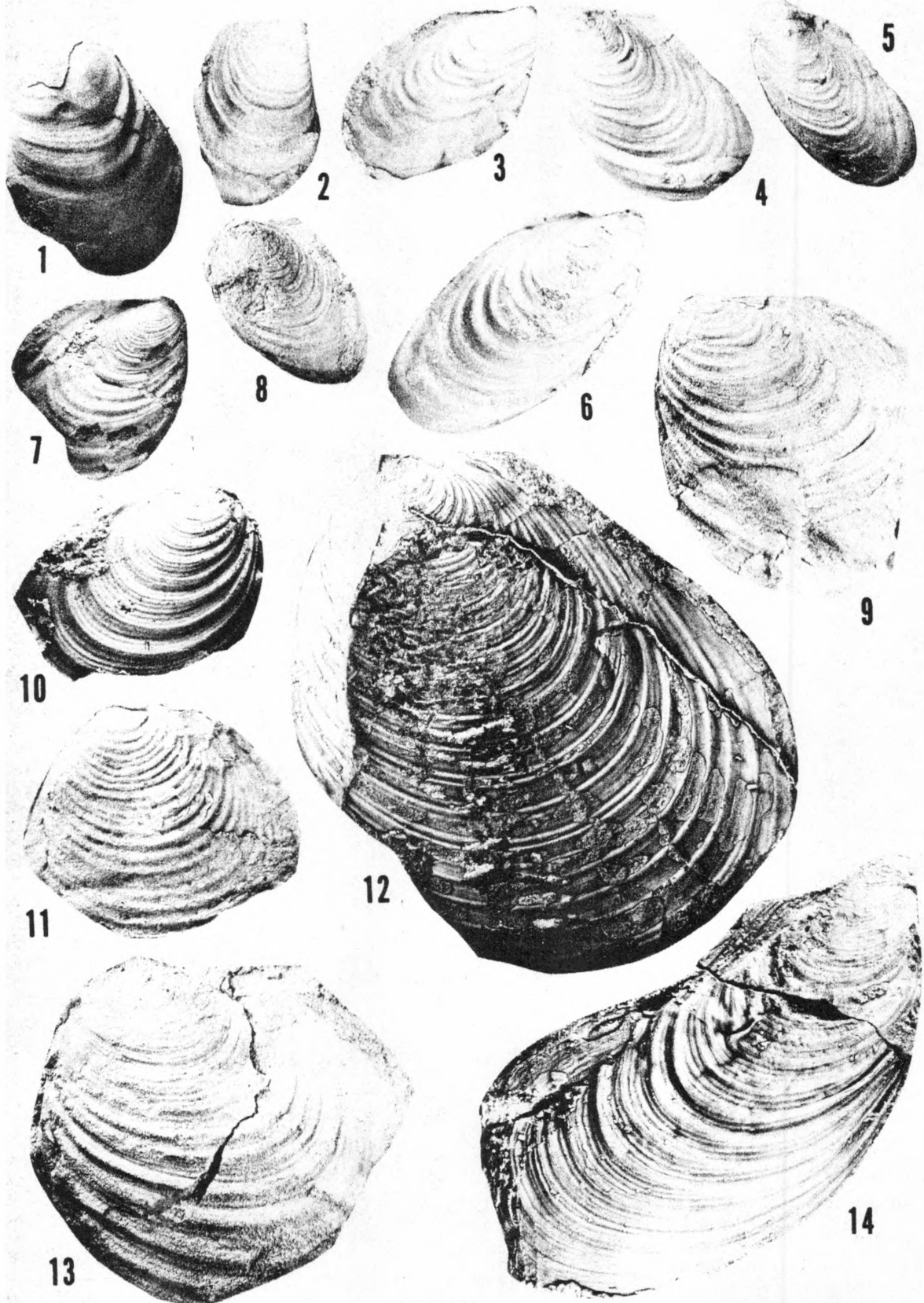


PLATE 7.

## LATE 8 TURONIAN INOCERAMIDAE FROM THE WESTERN INTERIOR BASIN (see page 239)

- Fig. 1, 4, 8. *Inoceramus (Inoceramus) contellatus* Woods, hypotypes (X1). Left valves, late Middle Turonian, *Prionocyclus hyatti* zone, Codell Sandstone Member, Carlile Shale, from Huerfano Park, Huerfano County, Colorado. 1., 4. Anterior and lateral views, respectively, UMMP 43263, locality as in Figs. 2, 3. 8. UMMP 43260, stream banks 1.3-1.5 miles north-northwest of Red Wing, SW 1/4 SE 1/4 sec. 26, T 26 S, R 71 W, Huerfano County, Colorado.
- Fig. 2, 3. *Inoceramus (Inoceramus) apicalis* Woods, hypotype (X1). UMMP 43301, lateral and anterior views, respectively, stratigraphic levels as in Figs. 1, 8, from 50 yards south-southwest of Lower Pass Creek School, SW 1/4 sec. 8, T 27 S, R 70 W, Huerfano Park, Huerfano County, Colorado.
- Fig. 5. *Inoceramus (Inoceramus) flaccidus* White (X1/2). Lectoholotype (herein designated), USNM 8618, Middle Turonian, *Prionocyclus hyatti* zone, probably upper Blue Hill Shale or lower Codell Sandstone Member, Carlile Shale, from five miles "above" (north of?) Pueblo, Pueblo County, Colorado.
- Fig. 6, 15. *Inoceramus (Inoceramus) perplexus* Whitfield (X1). Cotypes, USNM 12263a (6.) and USNM 12263b (15.). Middle Late Turonian, zone of *Scaphites whitefieldi*, Sage Breaks Shale Member, Carlile Shale, on Belle Fourche River, 10 miles west of Crow Peak, Black Hills, South Dakota.
- Fig. 7, 12, 13. *Inoceramus (?) dimidius dimidius* White, early Late Turonian, zone of *Coilopoceras colleti* and *Prionocyclus macombi*. 7., 13. Lectoholotype, (herein designated) (7 is X3, 13 is X2), USNM 8623a, typical of species. 12. Lectoparatype (herein designated) USNM 8623b; both from Juana Lopez Member equivalent, Mancos Shale, east bank of Rio Puerco, 6 miles below Casa Salazar, New Mexico.
- Fig. 9, 10. *Inoceramus (Inoceramus) howelli* White, cotypes (X1). USNM 8052a, b, respectively, right and left lateral views of medium-sized adult shells, from the zone of *Prionocyclus hyatti*, late Middle Turonian, Frontier Formation, Colorado Group, along the Lower Potato Valley, Utah.
- Fig. 14. *Inoceramus (Inoceramus) perplexus*, n. subsp. (late form), hypotype (X1). USNM 239806, left valve, composite mold. Late Turonian, zone of *Scaphites nigricollensis*-*S. corvensis*, upper unnamed shale member, Carlile Shale, road cuts on northeast side of Colorado Highway 9 in 12 mile Park, 8 miles north-northwest of Parkdale, Fremont County, Colorado.
- Fig. 11, 16. *Inoceramus (Inoceramus)* n. sp. aff. *I. (I.) flaccidus* White and *I. (I.) lamarcki* Parkinson, figured specimens (X1). Internal molds of right valves, USNM 239800 (Fig. 11). USNM 239807 (Fig. 16). Upper Fairport Member, Carlile Shale, middle Middle Turonian, along the Smoky Hill River Valley, N 1/2 sec. 22 and NE 1/4 sec. 21, T 15 S, R 20 W, southwestern Ellis County, Kansas.

## LATE 9 MIDDLE AND UPPER TURONIAN BIVALVES, WESTERN INTERIOR BASIN (see page 241)

- Fig. 1, 2. *Lopha curabula* (Seeley)?, left valves (X1). Hypotypes, zone of *Prionocyclus hyatti* (upper part), late Middle Turonian, from the Codell Sandstone Member, Carlile Shale, 1.3-1.5 miles north-northwest of Red Wing, Huerfano County, Colorado; uncatalogued.
- Fig. 3-5, 7. *Lopha lugubris* (Conrad), n. subsp. (early, weakly plicate form), hypotypes (X2). Early Late Turonian. 3. Left valve, lowest Juana Lopez Member, zone of *Prionocyclus macombi* (lower part), Carlile Shale, 0.5 mile east of Mae's School, SE 1/4 sec. 11, T 26 S, R 69 W, Huerfano County, Colorado, University of Michigan Museum of Paleontology (UMMP) 43465. 4. Right valve, interior, Juana Lopez Member equivalent, middle Mancos Shale, 525 feet above the base, southeast Gypsum Valley-Disappointment Valley area, San Miguel County, Colorado; USNM 132258. 5. Exterior, weakly plicated right valve, lower Juana Lopez Member, stratigraphy and locality as in Fig. 3. 7. Right valve exterior, upper Juana Lopez Member, Carlile Shale, zone of *Prionocyclus wyomingensis*, cliff along northwest side of Oak Creek, NE 1/4 SW 1/4 sec. 5, T 27 S, R 68 W, Huerfano County, Colorado; UMMP 43487.
- Fig. 6, 8-10. *Lopha lugubris lugubris* (Conrad), hypotypes (X2). Early Late Turonian, zone of *Prionocyclus wyomingensis wyomingensis*, Juana Lopez Member (middle-upper) of the Mancos Shale (Figs. 6, 8) or of the Carlile Shale (Figs. 9, 10). 6. Interior of finely plicate right valve, in 50 feet of yellow calcareous sandstone and sandy calcarenite (Juana Lopez Member equivalent), 3.5 miles south of Casa Salazar, Mt. Taylor Quad., New Mexico; USNM 132160. 8. Elongate left valve, stratigraphy and locality as in Fig. 6; USNM 132157. 9. Typical left valve, upper Eagle Ford Shale, layer 1, Texas Portland Cement Co. Quarry, 2.5 miles

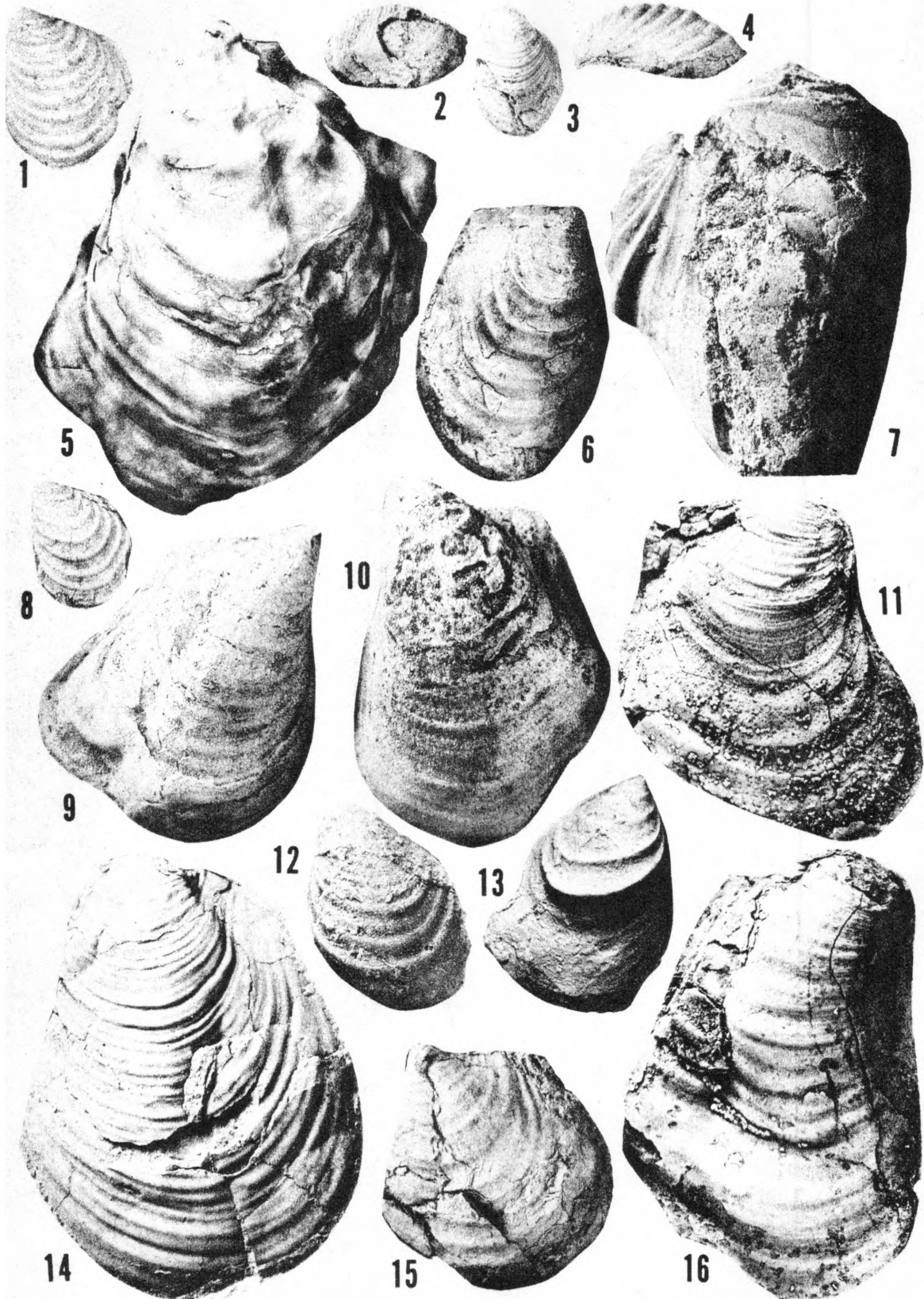


PLATE 8.

east of Eagle Ford, Dallas County, Texas; USNM 132156. 10. Strongly plicate right valve, exposures near Malachite, Huerfano Park, Huerfano County, Colorado; USNM 22860a.

- Fig. 12-14. *Lopha bellaplicata novamexicana* Kauffman, paratypes (X1). Late Middle Turonian, middle part of zone of *Prionocyclus hyatti*. 12. Characteristic left valve, middle Mancos Shale, at Carthage, New Mexico; USNM 132274. 13., 14. Lateral and anterior views, respectively, left valve, stratigraphy and locality as in Fig. 12; USNM 132271.
- Fig. 11, 15, 16, 18-20. *Lopha bellaplicata bellaplicata* (Shumard), hypotypes (X1). Late Middle Turonian, upper part of zone of *Prionocyclus hyatti*. 11. Anterior view, left valve, upper part of Eagle Ford Shale, along Jefferson Boulevard, Dallas County, Texas; USNM 132231. 15. Small left valve, upper Eagle Ford Shale, near Sherman, Texas; USNM 11882a. 16. Broadly ribbed left valve, Codell Sandstone Member, Carlile Shale, at Carlile Springs, 18 miles west of Pueblo, Colorado; USNM 22861. 18. Large right valve, smooth variant, from the upper Eagle Ford Shale, layer 1, quarry of Texas Portland Cement Co., 2.5 miles east of Eagle Ford, Dallas County, Texas; USNM 7539. 19. Large typical left valve, sandstones near the top of the Eagle Ford Shale, along Whitesboro Road, 1.75 miles west of Sherman, Grayson County, Texas; USNM 132229. 20. Small, finely plicated left valve, stratigraphy and locality as in Fig. 18; USNM 132220.
- Fig. 17, 23. *Mytiloides lusatae* (Andert), hypotypes (X1). Latest Turonian, probably zone of *Scaphites corvensis-Prionocyclus quadratus*, brown concretions 73 feet above second sandstone above base of Frontier Formation, 1 mile southeast of Sinclair, Carbon County, Wyoming. USNM 240318 (Fig. 17). USNM 240319 (Fig. 23).
- Fig. 21. *Mytiloides? frechi* (Flegel), left valve (X1). Hypotype, USNM 240320, stratigraphy and locality as in Figs. 17, 23.
- Fig. 22, 26. *Inoceramus waltersdorfensis waltersdorfensis* Andert, internal molds of right valves, hypotypes (X1). Latest Turonian, zone of *Scaphites corvensis-Prionocyclus quadratus* (?). 22. Upper Colorado Shale, 5.5 miles south of Shelby, sec. 20, T 31 N, R 2 W, Toole County, Montana; USNM 240321. 26. Upper 10 feet of unnamed shale member, upper Carlile Shale, stream gully 1.3-1.5 miles north-northeast of Red Wing, SW 1/4 SE 1/4 sec. 26, T 26 S, R 71 W, Huerfano County, Colorado; UMMP 43311.
- Fig. 24. *Mytiloides* n. sp. aff. *M. kleini* (Müller) and *M. lusatae* (Andert), (= "*Inoceramus problematicus*" Schlotheim of various U.S. authors), left valve (X1). Figured specimen, USNM 240322; uppermost Turonian, Frontier Formation, bed 12 along Bear River near mouth of Sulphur Creek, near Bear River City, Wyoming.
- Fig. 25. *Pyonodonte aucella* (Roemer), hypotype (X1). Typical left valve, Coniacian (mainly lower part), Eutaw Formation, 0.25 mile south of Old Hamburg, Perry County, Alabama; USNM 73625.

PLATE 10 TURONIAN BIVALVES, WESTERN INTERIOR BASIN (see page 243)

- Fig. 1. *Mytiloides? "latus"* (Mantell) sensu Hattin (1962) and other American authors; hypotype, (X1). Composite mold of right valve, UMMP 43285, uppermost bed of the Bridge Creek Limestone Member, Greenhorn Formation, zone of *Mytiloides labiatus labiatus*, early Middle Turonian, stream bed of North Santana Creek, NE 1/4 NE 1/4 sec. 25, T 25 S, R 69 W, Huerfano County, Colorado. Colorado.
- Fig. 2. *Mytiloides dresdensis labiatoidiformis* (Tröger), hypotype (X1). Internal mold of left valve, USNM 240328, from the lowest Austin Chalk along Cow Creek, at elevation 1598 feet, by road crossing Davenport Ranch, Cinco de Mayo, Malvado Quadrangle, Texas. Identical forms occur in basal Fort Hays Member, Niobrara Formation, throughout southern and southeastern Colorado. Latest Turonian.
- Fig. 3. *Mytiloides? lusatae* (Andert) transitional to *M.? frechi* (Flegel), hypotype, (X1). USNM 240337, left valve, highest Turonian, probably *Scaphites corvensis* zone or younger, Frontier Formation, brown concretions 73 feet above second sandstone above base of formation, 1 mile southeast of Sinclair, Carbon County, Wyoming.
- Fig. 4. *Mytiloides flegelii mytiloidiformis* (Tröger), hypotype (X1). Composite mold of right valve, UMMP 43300, upper unnamed shale member of the Carlile Shale, probably zone of *Scaphites nigricollensis*, Latest Turonian, in stream valley 1.3-1.5 miles north-northwest of Red Wing, on Jones Cattle Company Ranch, SW 1/4 SE 1/4 sec. 26, T 26 S, R 71 W, Huerfano County, Colorado.
- Fig. 5. *Mytiloides lusatae* (Andert), erect variety, hypotype (X1). USNM 240338, latest Turonian, possibly zone of *Scaphites corvensis*, locality and stratigraphy as in Fig. 3.
- Fig. 6. *Mytiloides africanus* Heinz, hypotype (X1). USNM 240339, left valve, latest Turonian,



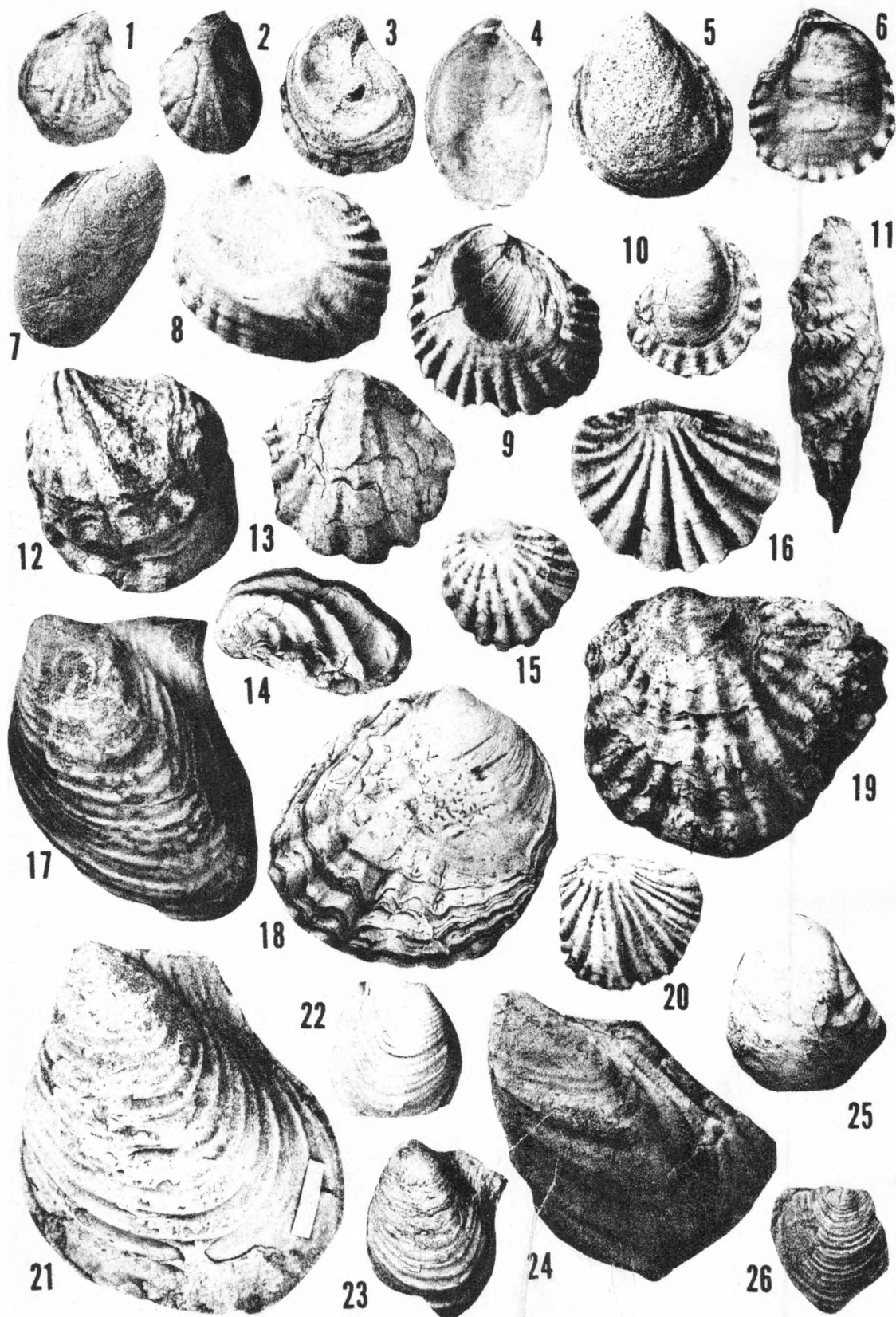


PLATE 9.

- zone of *Scaphites corvensis?*, stratigraphy, locality as in Fig. 3.
- Fig. 7. *Inoceramus* n. sp. aff. *I. glatziae* Flegel, figured specimen (X1). USNM 240340, left valve, locality and stratigraphy as in Fig. 3; highest Turonian.
- Fig. 8. *Inoceramus waltersdorfensis* Andert, n. subsp., hypotype (X1). Left valve, original of "*Inoceramus fragilis* Hall and Meek" of Whitfield, 1880, from the "Fort Benton" Group, probably Sage Breaks Shale Member of the Carlile Shale, Latest Turonian, along Beaver Creek, Black Hills, South Dakota; USNM 12273.
- Fig. 9, 15. *Mytiloides* n. sp. aff. *M. lusatae* (Andert) and *M. kleini* (Müller), figured specimens, left valves (X1). UMMP 43249 (Fig. 9). UMMP 43250 (Fig. 15). From the late Middle Turonian, upper part of zone of *Prionocyclus hyatti*, Codell Sandstone Member, Carlile Shale, from 1.0 mile east of Williams Creek, either side of unimproved road, W 1/2 NE 1/4 sec. 12, T 25 S, R 70 W, Huerfano County, Colorado.
- Fig. 10, 11. *Esogyra suborbiculata* Lamarck, hypotype (X1). USNM 22862a, left valve, posterior and lateral views, respectively, late Middle Turonian, upper part of *Prionocyclus hyatti* zone, Codell Sandstone Member, Carlile Shale, Bluffs along Poison Canon, Huerfano Park, Huerfano County, Colorado.
- Fig. 12. *Mytiloides* (?) sp. aff. *M. kleini* (Müller), figured specimen (X1). USNM 240341, internal mold of right valve, latest Turonian, locality and stratigraphy as in Fig. 3.
- Fig. 13. *Ostrea anomioides* Meek, block with cotypes (X1). USNM 7823, shells of left and (predominantly) right valves, Middle-Late Cenomanian and/or Turonian, Colorado Group, banks of Missouri River below Gallatin, Montana.
- Fig. 14. *Mytiloides* n. sp. aff. *M. fiegei* (Tröger), figured specimen, (X1). USNM 240342, composite internal mold, left valve, highest Turonian, stratigraphy and locality as in Fig. 3.

PLATE 11 UPPER TURONIAN AND CONIACIAN INOCERAMIDAE, WESTERN INTERIOR BASIN (see page 244)

- Fig. 1. *Mytiloides fiegei fiegei* (Tröger), hypotype (X1). Right valve, USNM 204323, Latest Turonian, zone of *Prionocyclus quadratus* and *Scaphites corvensis*, Frontier Formation, concretions 73 feet above the second sandstone unit above the base of the formation, 1 mile southeast of Sinclair, Carbon County, Wyoming.
- Fig. 2. *Volvicceramus grandis* (Conrad) (?=*V. involutus* (Sowerby)), hypotype (X1). USNM 240343, posterior view, left valve, Upper Coniacian, lower part of Smoky Hill Member, Niobrara Formation, 0.5 mile north of junction of Hackberry Creek and Smoky Hill River, sec. 25, T 14 S, R 25 W, Kansas.
- Fig. 3, 4. *Inoceramus erectus erectus* Meek, hypotypes (X1). Left and right valves, respectively. Early Coniacian, *I. erectus* zone. 3. Lower one-third of the Fort Hays Limestone Member, Niobrara Formation, hogback on southwest edge of Canon City, Colorado; hypotype of *I. deformis* Meek of Stanton, 1893; USNM 21119. 4. Upper Colorado Shale, 5.5 miles south of Shelby, secs. 20, 21, T 31 N, R 2 W, Toole County, Montana; USNM 240325.
- Fig. 5. *Inoceramus (Inoceramus) ernsti* Heinz, hypotype (X1). Internal mold of left valve, highest Turonian, probably *Scaphites corvensis*-*Prionocyclus quadratus* zone, USNM 240327, Frontier Formation, Bear River at mouth of Sulphur Creek, Wyoming.
- Fig. 6. *Inoceramus erectus* Meek, n. subsp. ("late form"), hypotype (X1). USNM 240326; *I. erectus* zone (upper part), middle Early Coniacian. Second limestone unit above base of Fort Hays Limestone Member, Niobrara Formation, in stream valley cutting Niobrara Hogback 1.1 miles north of Red Wing, 1.0 miles north of Colorado State Highway 150, SW 1/4 SE 1/4 sec. 26, T 26 S, R 71 W, Huerfano County, Colorado.
- Fig. 7. *Inoceramus* (?) (*Cremnoceramus*?) *schloenbachi* Boehm, hypotype (X1/2). (Hypotype of *I. deformis* Meek in Stanton, 1893), USNM 21119, early Middle Coniacian, highest Fort Hays Limestone Member, or from limestones in the Lower Smoky Hill Member, Niobrara Formation, near Canon City, Colorado.

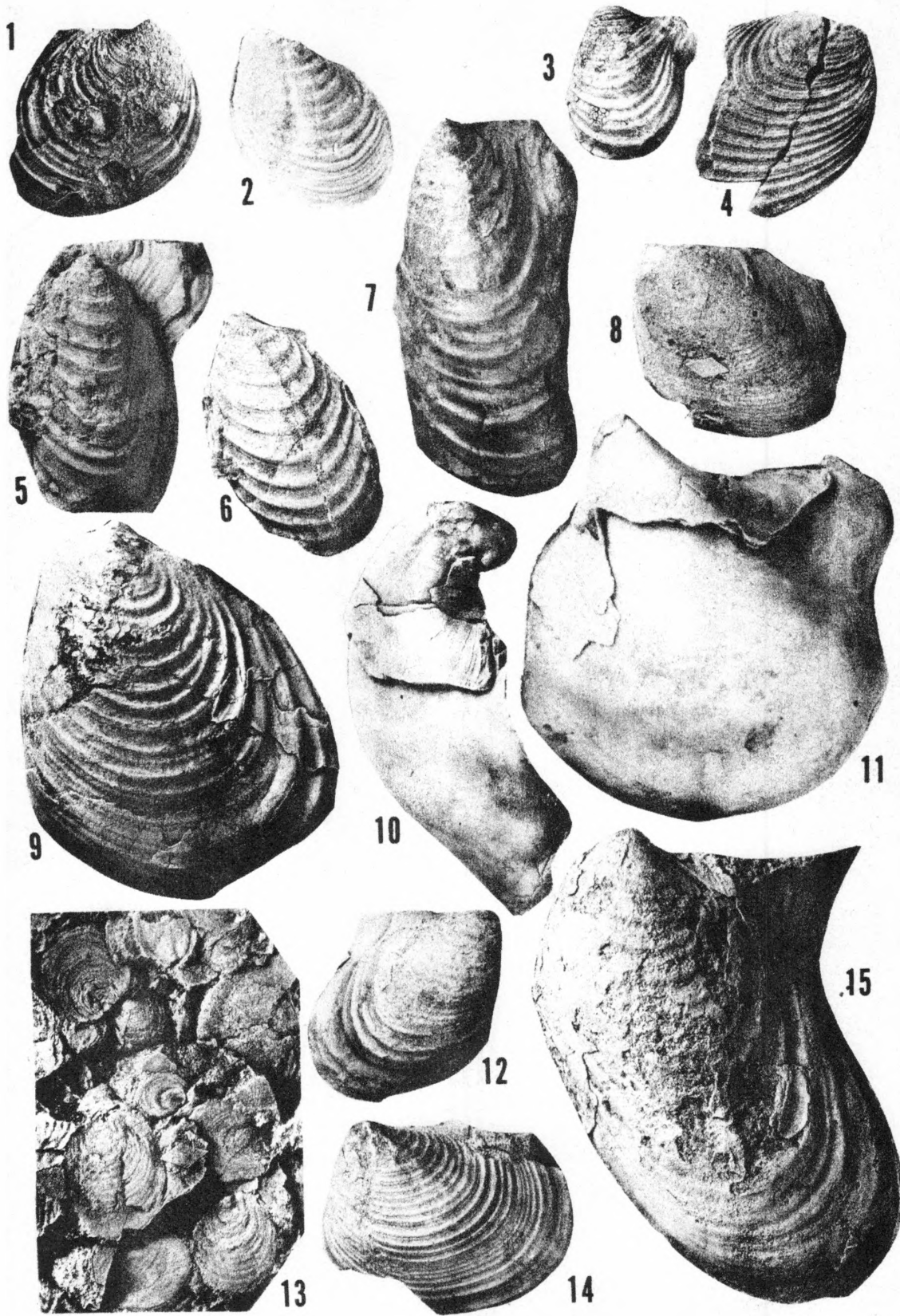
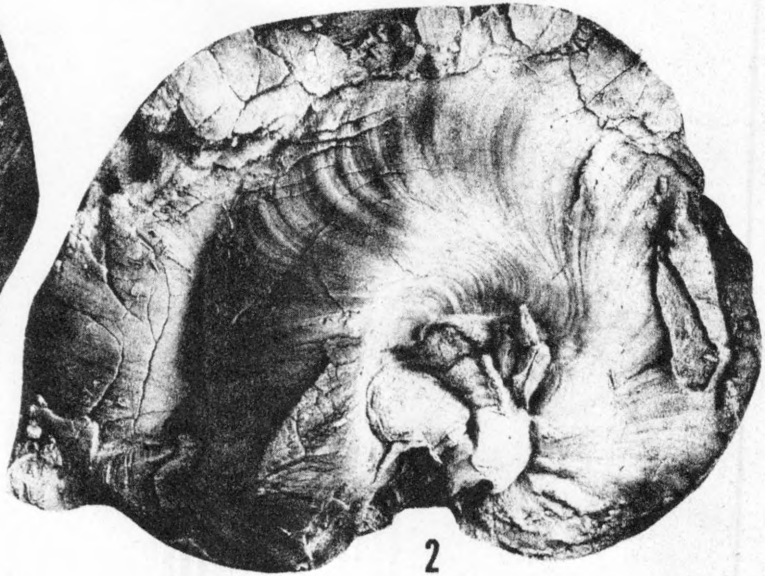


PLATE 10.



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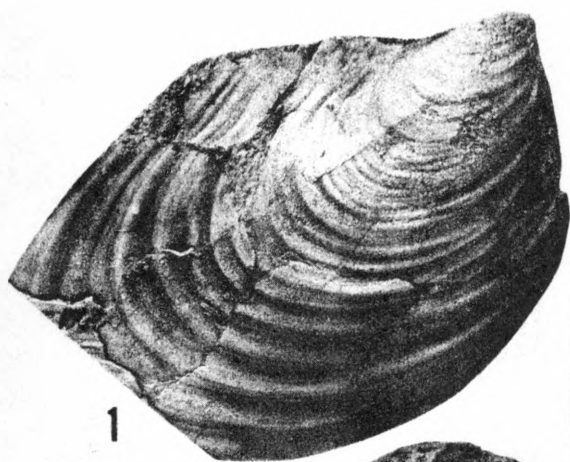
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## PLATE 12 UPPER TURONIAN AND CONIACIAN INOCERAMIDAE, WESTERN INTERIOR BASIN (see page 246)

- Fig. 1. *Mytiloides aviculoides* (Meek and Hayden), paratype (X1). Right valve, USNM 242b, highest Turonian, possibly zone of *Scaphites corvensis*, basal Fort Hays Limestone Member, Niobrara Formation, bluffs along Little Blue River, Nebraska, near Kansas line.
- Fig. 2. *Inoceramus(?) deformis* Meek, n. subsp. ("late form"), hypotype (X1/2). Internal mold of left valve, USNM 240345, late Early Coniacian, *I. deformis* (late form) zone, upper Fort Hays Limestone Member, Niobrara Formation, from hogback just west and southwest of Lower Pass Creek School, just off of Colorado State Road 305, SE 1/4 sec. 7, SW 1/4 sec. 8, T 27 S, R 70 W, Huerfano County, Colorado.
- Fig. 3. *Inoceramus(?) deformis deformis* Meek, hypotype, internal mold of right valve (X1). USNM 4460a, middle Early Coniacian, zone of *I. deformis deformis*, middle and upper Fort Hays Limestone Member, Niobrara Formation, from Colorado City, Colorado.
- Fig. 4. *Mytiloides fiegei fiegei* (Tröger), hypotype (X1). Composite mold of left valve, USNM 240344, latest Turonian, zone of *Scaphites corvensis* or somewhat younger, 73 feet above the second sandstone above the base of the Frontier Formation, 1 mile southeast of Sinclair, Carbon County, Wyoming.
- Fig. 5. *Cremonceramus browni* (Cragin), hypotype (X1/2). Internal mold of left valve, USNM 4460b, from limestones at the top of the Fort Hays Member or in the lower part of the Smoky Hill Member, Niobrara Formation, early Middle Turonian, *C. browni* zone, at Colorado City, Colorado. (Original hypotype of *Inoceramus deformis* Meek, 1877, Rept. U.S. Geol. Surv. 40th Parallel, vol. IV, pt. 1, p. 146, pl. 14, Figs. 4, 4a).

## PLATE 13 UPPER TURONIAN THROUGH SANTONIAN BIVALVES, WESTERN INTERIOR BASIN (see page 247)

- Fig. 1. *Inoceramus gilberti* White, cotype (X1). Internal mold of right valve, USNM 8050a, from the Colorado Group (probably latest Coniacian or Early Santonian), near Last Chance Creek, southern Utah.
- Fig. 2. *Mytiloides aviculoides* (Meek and Hayden), holotype (X1). USNM 242a, internal mold of right valve, highest Turonian, *Scaphites corvensis* zone, lower Fort Hays Limestone Member, Niobrara Formation, along Little Blue River bluffs, near Kansas-Nebraska line.
- Fig. 3. *Volvicceramus grandis* (Conrad) (?=V. involutus Sowerby), hypotype (X1). Interior of small right valve, USNM 240329, from the Late Coniacian, lower Smoky Hill Member, Niobrara Formation, sec. 25, T 14 S, R 25 W, 0.5 mile north of the junction of Hackberry Creek and Smoky Hill River, Kansas.
- Fig. 4, 5, 7. "*Ostrea*" (*Pseudoperma*) *congesta* (Conrad), hypotypes, from the Smoky Hill Member, Niobrara Formation; Coniacian, Santonian. 4. Interior of small right valve (X1). UMMP 43417, lower Smoky Hill Member, 1.0 mile east of Williams Creek, along unimproved road, W 1/2 NE 1/4 sec. 12, T 25 S, R 70 W, Huerfano County, Colorado. 7. Typical isolated left valve, UMMP 43420, lower Smoky Hill Member, road cuts along south side of the Colorado Highway 69, 0.7 mile east of Badito, S 1/2 sec. 4, T 27 S, R 68 W, Huerfano County, Colorado. 5. Slab with typical clustered occurrence of species (X1). USNM 238a, near mouth of l'Eau Qui Court, on Missouri River, near Niobrara, Nebraska.
- Fig. 6, 9, 10. *Cremonceramus inconstans* (Woods), hypotypes (X1). Late Early to early Middle Coniacian upper Colorado Shale, along banks of Marias River, SW 1/2 sec. 8, T 30 N, R 1 W, Toole County, Montana. 6. Typical adult specimen showing strong break in slope, USNM 240333. 9., 10. Small left valves showing early umbonal ornament prior to development of slope change, USNM 240334 and 240335, respectively.
- Fig. 8. *Lopha sannionis* (White), a cotype (X1). Right valve with typical ornament, USNM 8056a, late Early to early Middle Coniacian, Frontier Formation, valley of the Weber River near Coalville, Utah.
- Fig. 11. *Cremonceramus wandereri* (Andert), hypotype (X1). Anterior view of paired valves, Middle Coniacian, upper Colorado Shale (Niobrara equivalent), 5.5 miles south of Shelby, sec. 20, 21, T 31 N, R 2 W, Toole County, Montana.



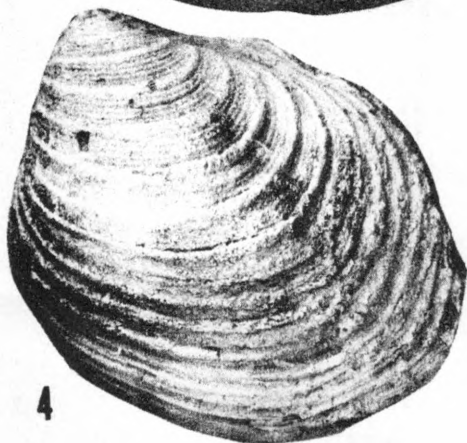
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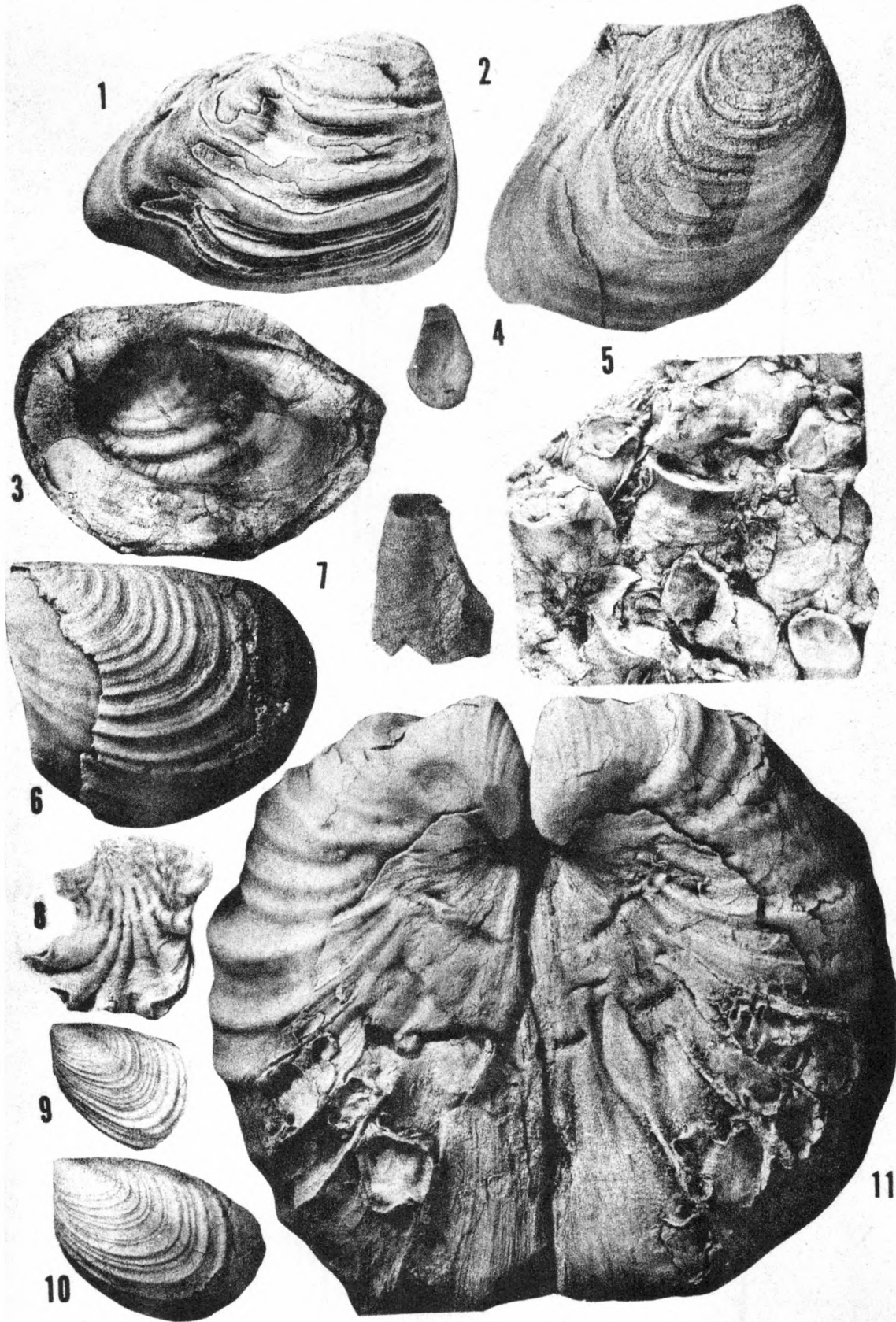


PLATE 13.

## PLATE 14 UPPER ALBIAN AMMONITES, NORTHERN PART OF THE WESTERN INTERIOR BASIN (see page 249)

- Fig. 1-3. *Neogastropilites cornutus* (Whiteaves). (X1). 1. Var. A, USNM 129320. 2. Var. D-E, USNM 129320g. 3. Var. E-F, USNM 129320k. From a single concretion in the basal part of the Mowry shale at USGS loc. 23021, Park County, Wyoming.
- Fig. 4-6. *Neogastropilites muelleri* Reeside and Cobban. (X1). 4. Var. A, USNM 129416b. 5. Var. E, USNM 129416k. 6. Var. F, USNM 129416n. From a single concretion at a horizon just below the middle of the Mowry Shale Member of the Colorado Shale at USGS loc. 24065, Petroleum County, Montana.
- Fig. 7-9. *Neogastropilites americanus* (Reeside and Weymouth). (X1). 7. Var. A, USNM 129528h. 8. Var. C, USNM 129528g. 9. Var. E, USNM 129528m. From a single concretion 115 feet below the base of the Big Elk Sandstone Member of the Colorado Shale at USGS loc. 23042, Wheatland County, Montana.
- Fig. 10-12. *Neogastropilites haasi* Reeside and Cobban. 10. (X3). Var. A, USNM 129308. 11. (X2). Var. C, USNM 129312. 12. (X3). Var. E, USNM 129318. From dark shale just beneath Mowry Shale Member of Colorado Shale at USGS loc. 24566, Stillwater County, Montana.
- Fig. 13-15. *Neogastropilites cornutus* (Whiteaves). 13. (X1). Var. B, USNM 129332. 14. (X1). Var. C, USNM 129349. 15. (X2). Var. F, USNM 129404. From the basal part of the Mowry Shale at USGS loc. 23021, Park County, Wyoming.
- Fig. 16-18. *Neogastropilites muelleri* Reeside and Cobban. (X1). 16. Var. A, USNM 129418. 17. Var. C, USNM 129457. 18. Var. F, USNM 129501. From a horizon just below middle of Mowry Shale Member of Colorado Shale at USGS loc. 24065, Petroleum County, Montana.
- Fig. 19-21. *Neogastropilites americanus* (Reeside and Weymouth). 19. (X1). Var. A, USNM 129532. 20. (X2). Var. C, USNM 129578. 19., 20. From Colorado Shale, 115 feet below Big Elk Sandstone Member at USGS loc. 23042, Wheatland County, Montana. 21. (X2). Var. E, USNM 129624. From the Mowry Shale at USGS loc. 24502, Carbon County, Montana.
- Fig. 22-24. *Neogastropilites maclearni* Reeside and Cobban. 22. (X1). Var. A, USNM 129626. From Colorado Shale, 50 feet below Big Elk Sandstone Member, at USGS loc. 24610, Wheatland County, Montana. 23. (X1). Var. B, USNM 129629. 24. (X2). Var. D, GSC 13659. 23., 24. From Colorado Shale, 60 feet below Big Elk Sandstone Member at USGS loc. 24609, Wheatland County, Montana.

## PLATE 15 UPPER ALBIAN-CENOMANIAN AMMONITES, WESTERN INTERIOR BASIN (ALL FIGURES NATURAL SIZE) (see page 250)

- Fig. 1, 2. *Acanthoceras amphibolum* Morrow. USNM 220380. Frontier Formation, Big Horn County, Montana. Late Middle Cenomanian.
- Fig. 3, 4. *Neogastropilites americanus* (Reeside and Weymouth). AMNH 28098:20. Mowry Shale Member of Colorado Shale, Stillwater County, Montana. Middle Late Albian.
- Fig. 5-7. *Sciponoceras gracile* (Shumard). 5., 6. USNM 220383, from the Frontier Formation, Natrona County, Wyoming. 7. USNM 163854, from the Greenhorn Limestone, Pueblo County, Colorado. Latest Cenomanian.
- Fig. 8, 9. *Calyoceras (Conlinoceras) tarrantense gilberti* Cobban and Scott. USNM 163907. Thatcher Limestone Member of Graneros Shale, Pueblo County, Colorado. Earliest Middle Cenomanian.

## PLATE 16 CENOMANIAN AMMONITES, WESTERN INTERIOR BASIN (see page 251)

- Fig. 1, 2. *Desmoceras (Moremanoceras) scotti* (Moreman). (X1). Hypotype 166340. 1. Ventral view. 2. Lateral view. From the Eagle Ford Formation at USGS loc. 19716, 2 miles northeast of Bells, Texas.
- Fig. 3, 4. *Tragodesmoceras carlilense*. (X1). Paratype USNM 166355. 3. Apertural view. 4. Lateral view. From limestone concretions in the lower part of the Carlile Shale, along the flanks of the Black Hills.
- Fig. 5. *Durweganoceras pondi* Haas. (X1/2). Holotype AMNH 26416. Near Greybull, Wyoming. Early Late Cenomanian.
- Fig. 6. *Calyoceras naviculare* (Mantell). (X1). Hypotype USNM 166373. From the basal bed of the Bridge Creek Limestone Member of the Greenhorn Limestone on the Model anticline in southeast Colorado.



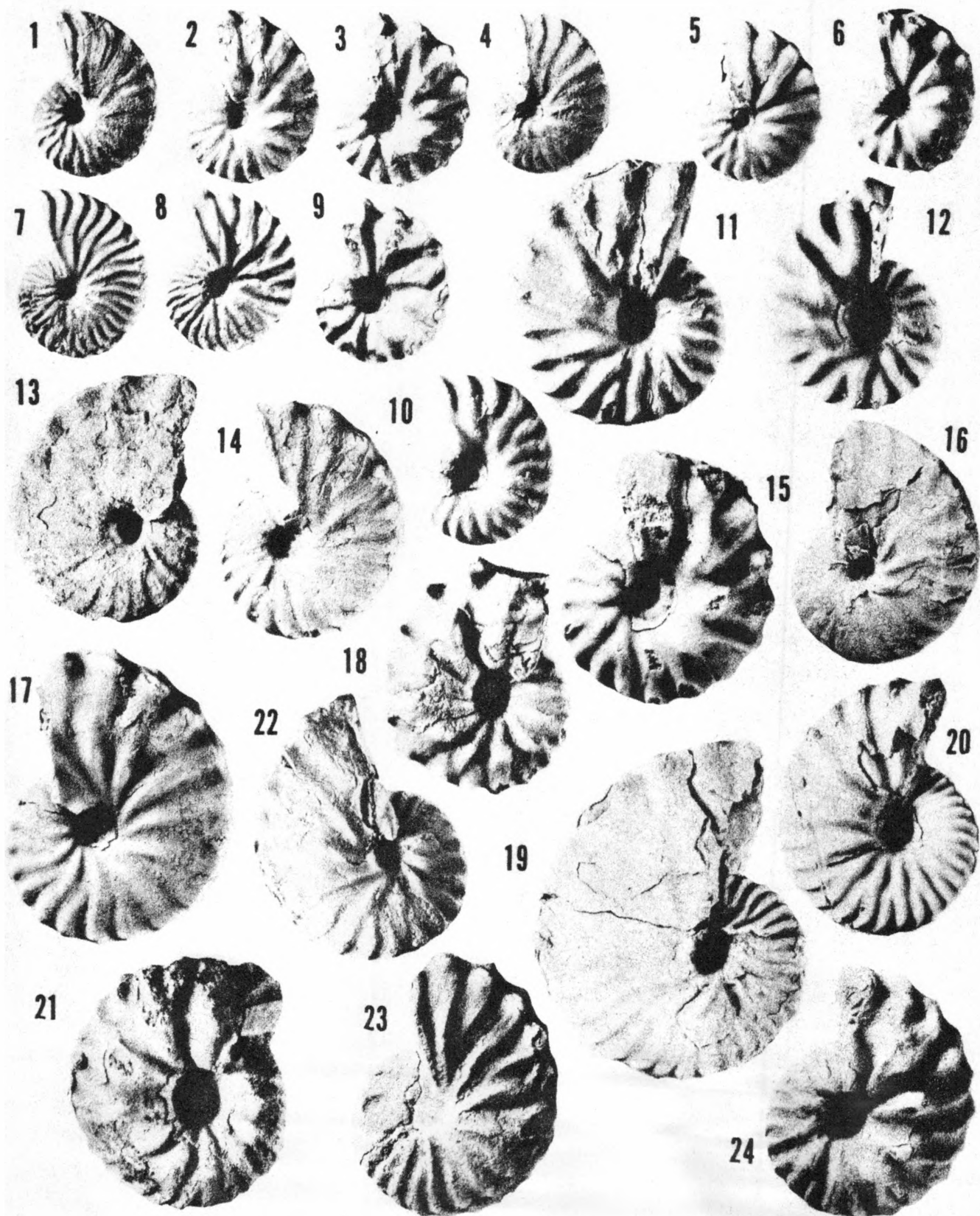


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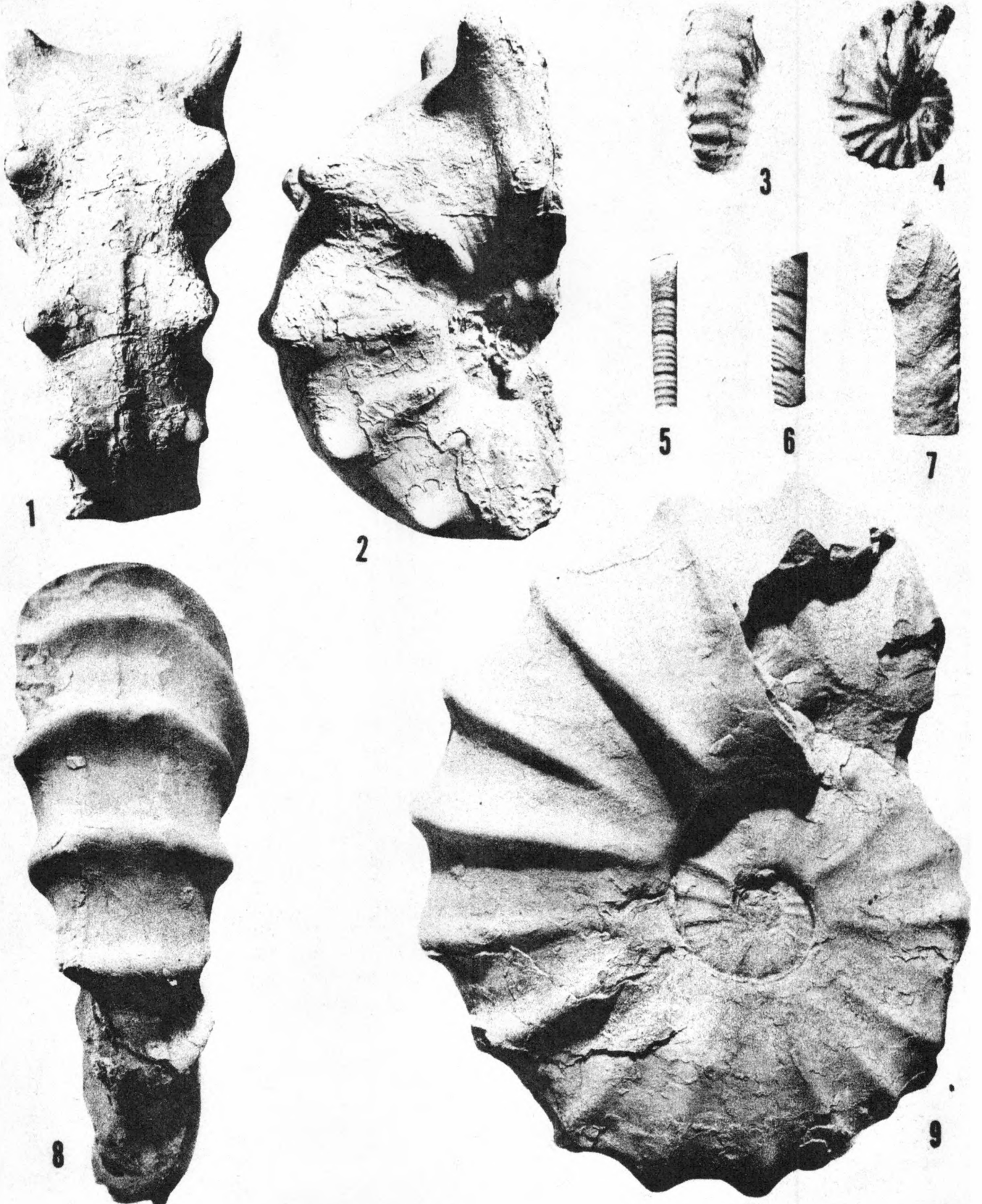


PLATE 15.



PLATE 16.

## PLATE 17 CENOMANIAN AMMONITES, WESTERN INTERIOR BASIN (see page 253)

- Fig. 1, 2. *Nigerioceras scotti* Cobban. (X1). Paratype USNM 166410. Ventral and lateral views, respectively. From a bed of limestone near the base of the Bridge Creek Limestone Member of the Greenhorn Limestone at USGS loc. D6756.
- Fig. 3. *Calycoceras naviculare* (Mantell). (X1). Hypotype USNM 166373. Ventral view. From the basal bed of the Bridge Creek Limestone Member of the Greenhorn Limestone on the Model anticline in southeast Colorado.
- Fig. 4. *Dunveganoceras parvum* Cobban. (X1). Holotype USNM 108330. Lateral view. From the Lower Cenomanian Mosby Sandstone Member, Colorado Shale, near south side of spillway of Yellow Water Reservoir in the SW 1/4 sec. 7, T 13 N, R 26 E, Petroleum County, Montana.
- Fig. 5, 6. *Turrilites (Euturrilites) scheuchzerianus* (Böse). (X1). Hypotypes. 5. USNM 163884. From 11 feet above the Thatcher Limestone Member at USGS loc. D5124, bed of Greenhorn Creek in center of sec. 35, T 23 S, R 66 W, Pueblo County, Colorado. 6. USNM 163886. From about 10-11 feet above the Thatcher Limestone Member at USGS loc. D5128, in highway cut on line between secs. 25 and 26, T 23 S, R 66 W, Pueblo County, Colorado, 8.3 miles south of Burnt Mill Road and 0.2 mile south of Muddy Creek on Interstate 25.
- Fig. 7. *Worthoceras gibbosum* Moreman. (X1). Hypotype USNM 163822. From 8 feet above the base of the Bridge Creek Limestone Member at USGS loc. D6572, SE 1/4 SW 1/4 and SE 1/4 NE 1/4 sec. 21, T 18 S, R 68 W, Fremont County, Colorado.
- Fig. 8, 9. *Stomohamites* cf. *S. simplex* (d'Orbigny). (X1). Hypotypes. 8. USNM 163821. From 20 feet above the Thatcher Limestone Member at USGS loc. D6726, badland in Graneros Shale in NE 1/4 sec. 13, T 24 S, R 65 W, Pueblo County, Colorado. 9. USNM 163814. From Bridge Creek Limestone Member, USGS loc. D4888, south bank of Bridge Creek in the SE 1/4 NE 1/4 SW 1/4 sec. 14, T 23 S, R 42 W, Hamilton County, Kansas.

## PLATE 18 CENOMANIAN AMMONITES, WESTERN INTERIOR BASIN (see page 254)

- Fig. 1, 2. *Acanthoceras granerosense* Cobban and Scott. (X1). 1. Paratype USNM 163957. From 11 feet above the Thatcher Limestone Member at USGS loc. D5124, bed of Greenhorn Creek in center of sec. 35, T 23 S, R 66 W, Pueblo County, Colorado. 2. Holotype USNM 163953. From 9 feet above the Thatcher Limestone Member at USGS loc. D5291. Same locality as Fig. 1.
- Fig. 3, 4. *Kanaboceras septemseriatum* (Cragin). (X1). Hypotype USNM 163977. Lateral and ventral views, respectively. From 5 feet above the base of the Bridge Creek Limestone Member at USGS loc. D6571; high bench in SW 1/4 NW 1/4 NE 1/4 sec. 21, T 18 S, R 68 W, Fremont County, Colorado.
- Fig. 5, 6. *Pseudocalyoceras dentonense* (Moreman). (X1). Hypotype USNM 163923. Lateral and ventral views, respectively. From 5 feet above the base of the Bridge Creek Limestone Member, USGS loc. D6571. From the same locality as Figs. 3, 4.
- Fig. 7, 8. *Puebloites corrugatus* (Stanton). (X1). Hypotypes. 7. USNM 163825. Lateral view. From 2.5 feet above the base of the Bridge Creek Limestone Member at USGS loc. D6472, NW 1/4 NW 1/4 NW 1/4 sec. 1, T 21 S, R 66 W, Pueblo County, Colorado. 8. USNM 163826. Lateral view. From near the base of the Bridge Creek Limestone Member at USGS loc. 22915, SE 1/4 SE 1/4 sec. 13, T 17 S, R 67 W, El Paso County, Colorado.

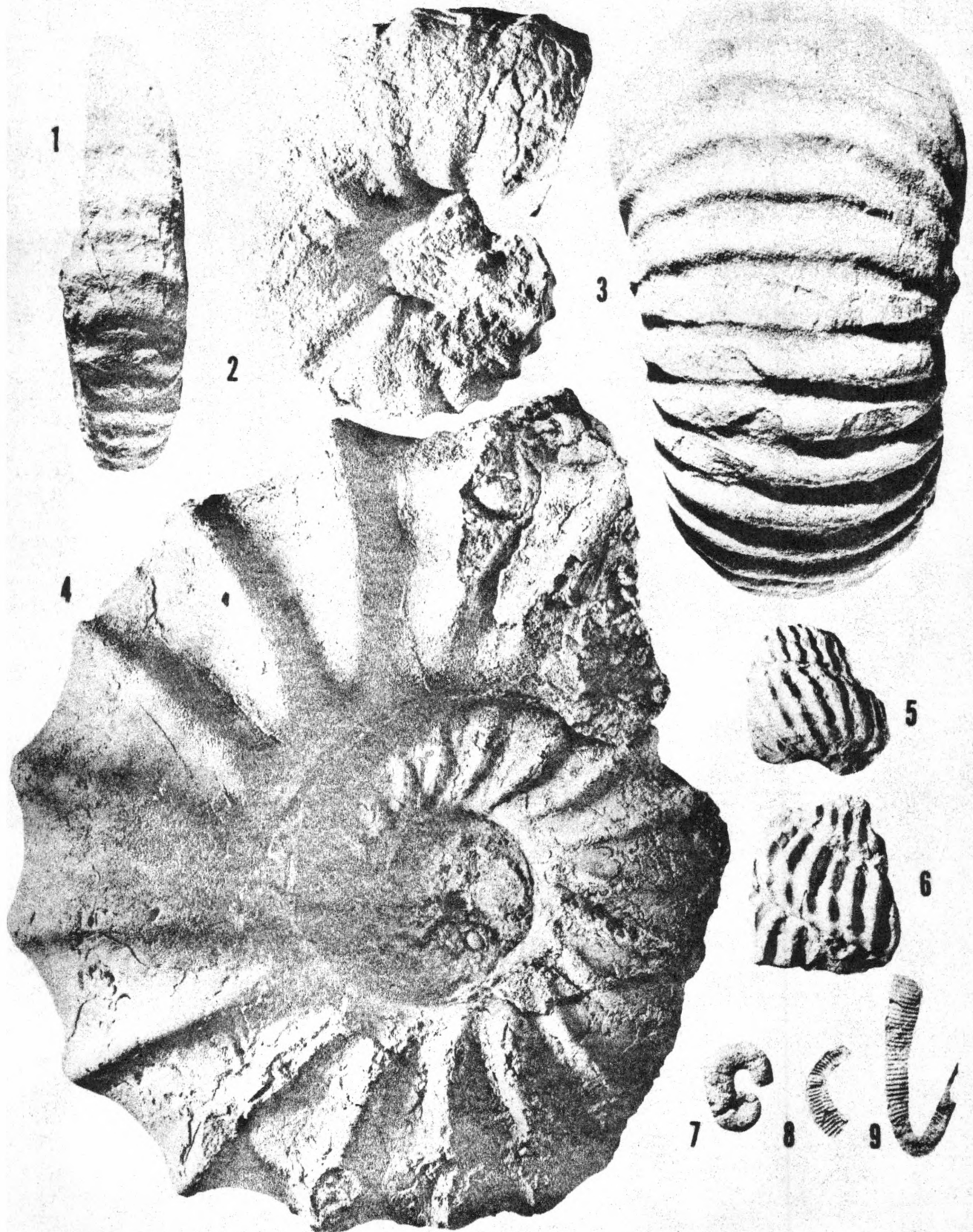


PLATE 17.

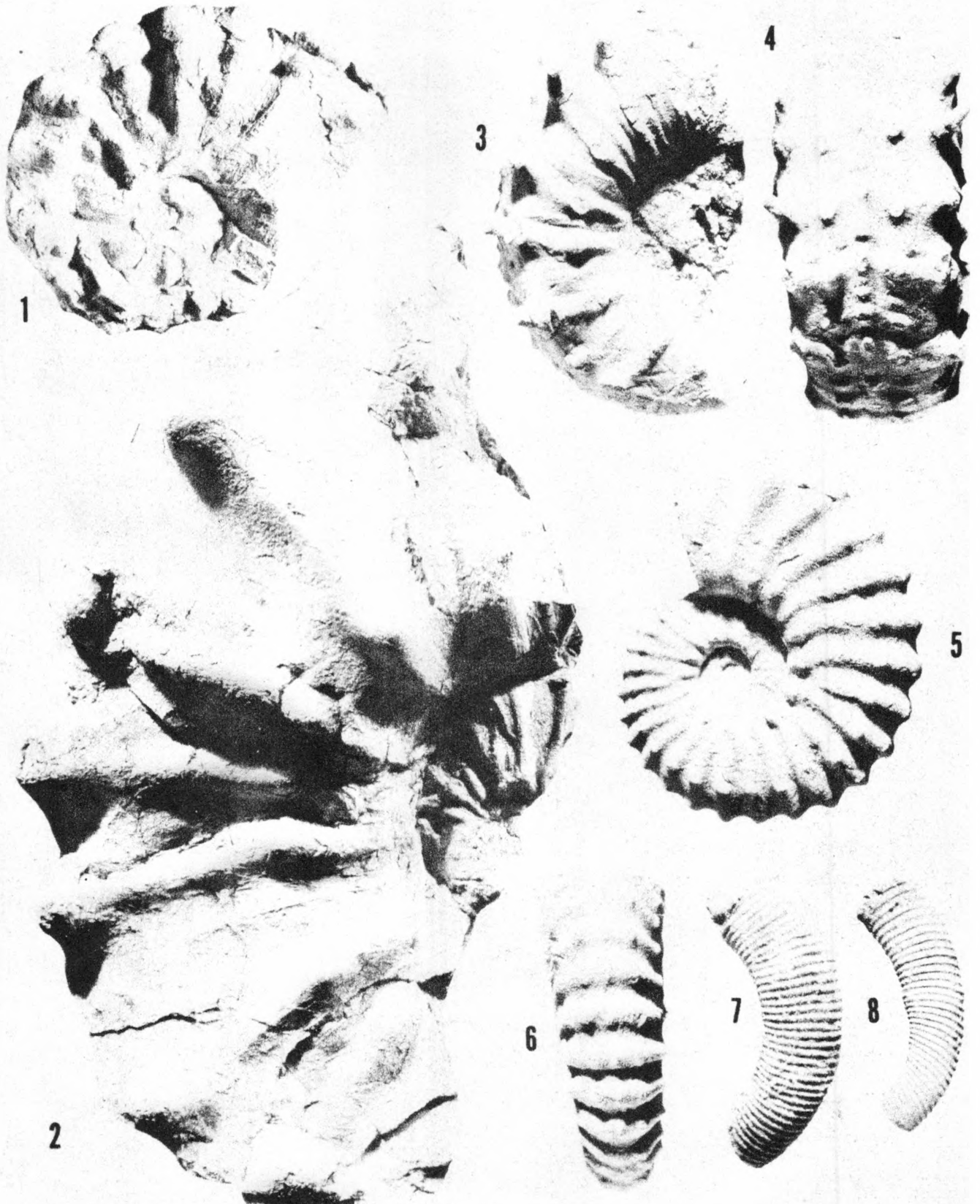


PLATE 18.

## PLATE 19 CENOMANIAN AND TURONIAN AMMONITES, WESTERN INTERIOR BASIN (see page 256)

- Fig. 1, 2. *Allocrioceras annulatum* (Shumard). (X1). Hypotype USNM 8638. Ventral and lateral views, respectively. *S. gracile* zone, lower Tropic Shale, southeast of Paria, Upper Kanab, Utah.
- Fig. 3, 4. *Neoptychites xetiformis* Pervinquière. (X1). Hypotype USNM 164046. Lateral view. From the Bridge Creek Limestone at USGS loc. 15393, Wild Horse Park in sec. 2, T 19 S, R 66 W, Pueblo County, Colorado.
- Fig. 5, 6. *Mammites nodosoides* (Schlotheim) subsp. *wingi* Morrow. (X1). Ventral and lateral views, respectively. 5. Hypotype USNM 164009. From the Bridge Creek Limestone Member at USGS loc. D4879, south bank of Bridge Creek in the NW 1/4 NE 1/4 NW 1/4 sec. 23, T 23 S, R 42 W, Hamilton County, Kansas. 6. Hypotype USNM 164009. From 25.5 feet above the base of the Bridge Creek Limestone Member at USGS loc. D4305, SW 1/4 NE 1/4 sec. 25, T 20 S, R 66 W, Pueblo County, Colorado.
- Fig. 7. *Metoicoceras whitei* Hyatt. (X1). Hypotype USNM 163988. From 2.5 feet above the base of the Bridge Creek Limestone Member at USGS loc. D6472, NW 1/4 NW 1/4 NW 1/4 sec. 1, T 21 S, R 66 W, Pueblo County, Colorado.
- Fig. 8, 9. *Watinoceras coloradoense* (Henderson). (X1). Hypotype USNM 164001. Ventral and lateral views, respectively. From 20 feet above the base of the Bridge Creek Limestone Member of the Greenhorn Limestone, USGS loc. D6478, SW 1/4 NW 1/4 sec. 25, T 20 S, R 66 W, Pueblo County, Colorado.
- Fig. 10. *Watinoceras reesidei* Warren? (X1). Juvenile hypotype USNM 163993. From 20 feet above the base of the Bridge Creek Limestone Member at USGS loc. D6147, SW 1/4 NW 1/4 NW 1/4 sec. 1, and NE 1/4 NE 1/4 sec. 2, T 27 S, R 66 W, Pueblo County, Colorado.
- Fig. 11, 12. *Prionocyclus quadratus* Cobban. (X1). Paratype USNM 108334. Lateral and ventral views, respectively. Sage Breaks Member, 9 miles southeast of Rapid City, South Dakota. Late Late Turonian.

PLATE 20 UPPER CENOMANIAN *DUNVEGANOCERAS ALBERTENSE* FROM MONTANA (see page 257)

- Fig. 1. *Dunveganoceras albertense* (Warren) subsp. *montanense* Cobban. Side view of the holotype USNM 108326, from USGS locality 21488. One mile south-southeast of Yellow Water Reservoir, in the SE 1/4 SE 1/4 sec. 14, T 13 N, R 25 E, Petroleum County, Montana.

PLATE 21 UPPER CENOMANIAN *METOICOCERAS MUELLERI* FROM MONTANA (see page 258)

- Fig. 1. *Metoicoceras muelleri* Cobban. Side view, natural size, of the holotype USNM 108321, from USGS locality 21487. About 1.5 miles south-southwest of Yellow Water Reservoir, in the NW 1/4 sec. 23, T 13 N, R 25 E, Petroleum County, Montana.

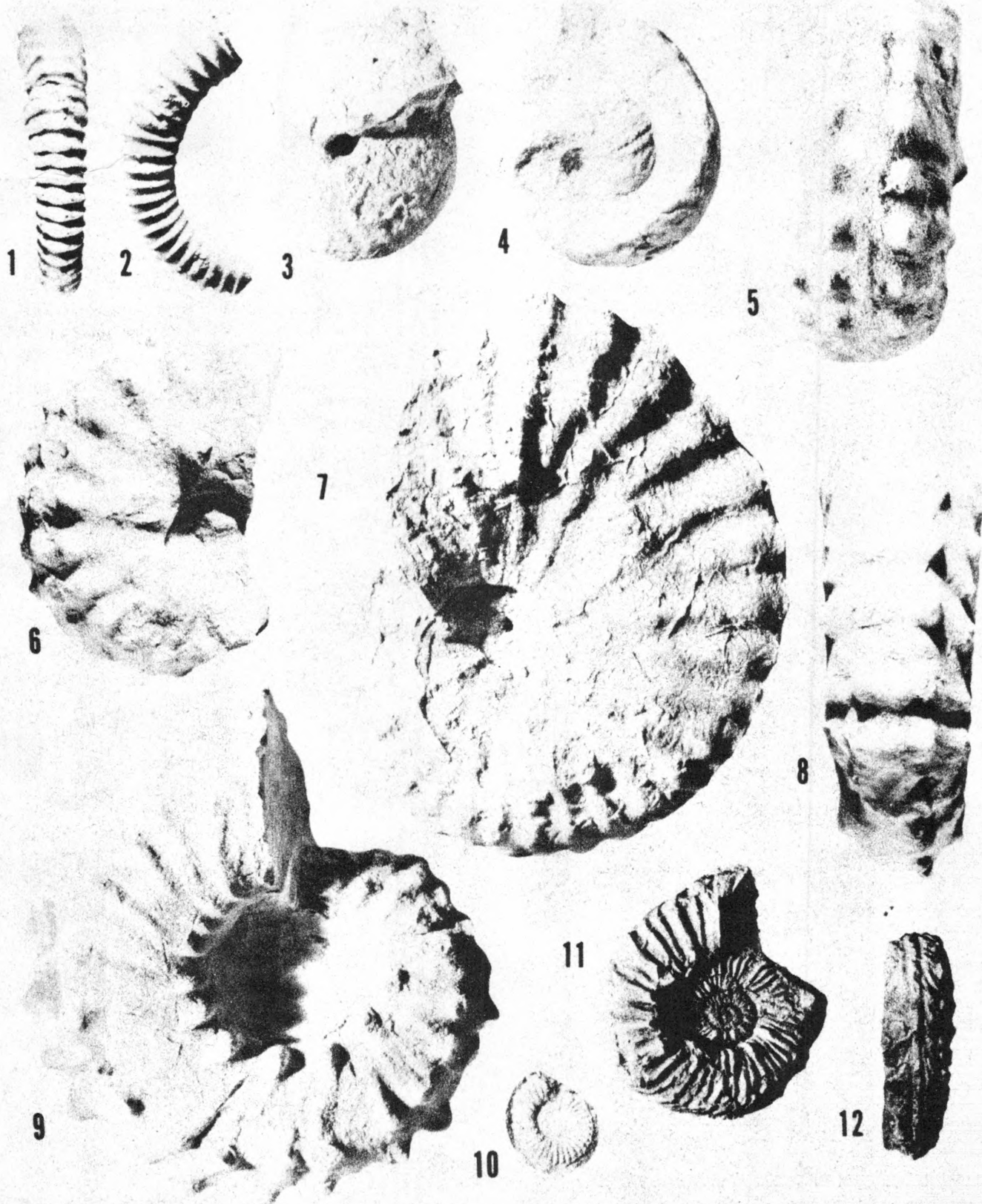


PLATE 19.



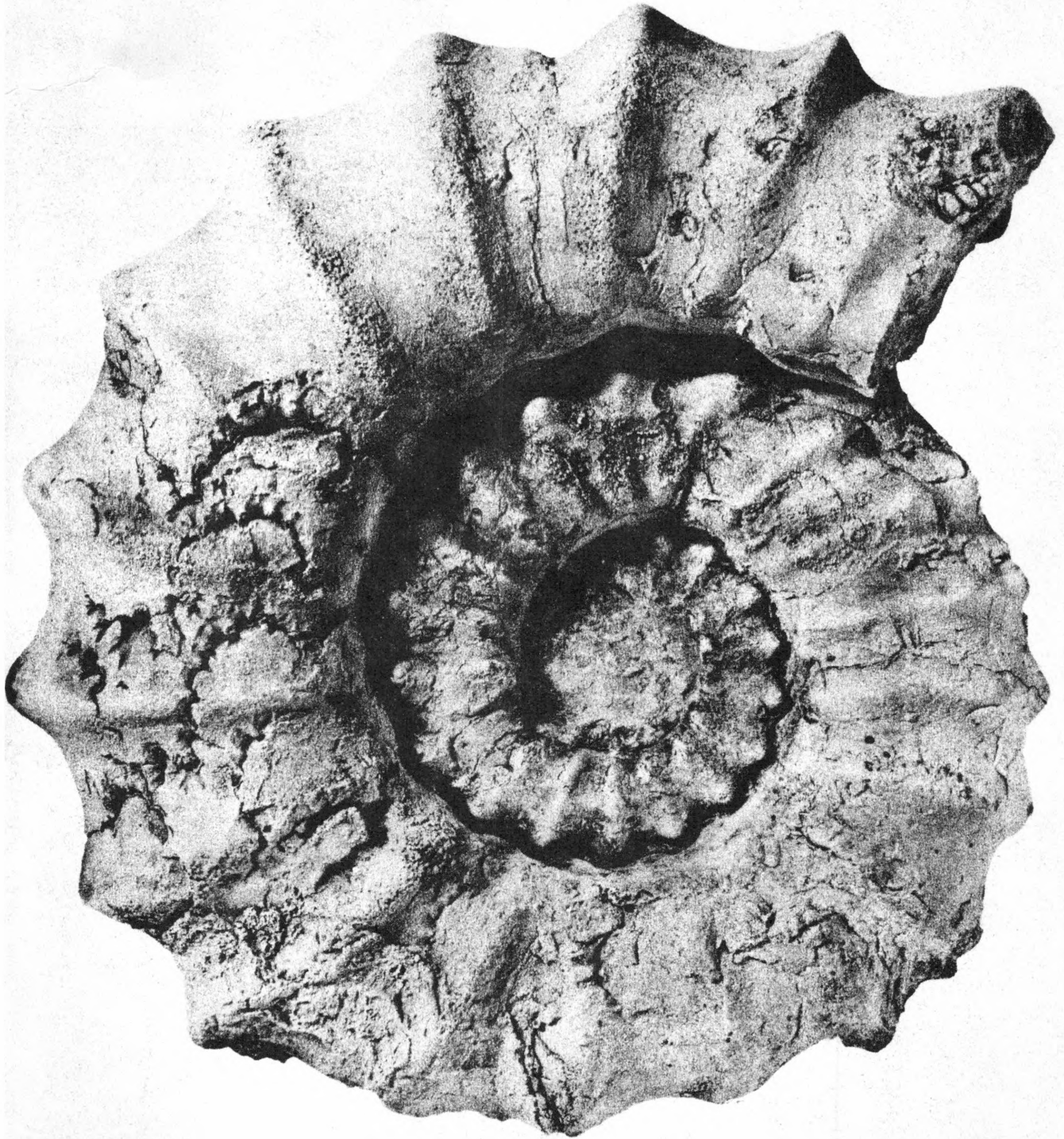


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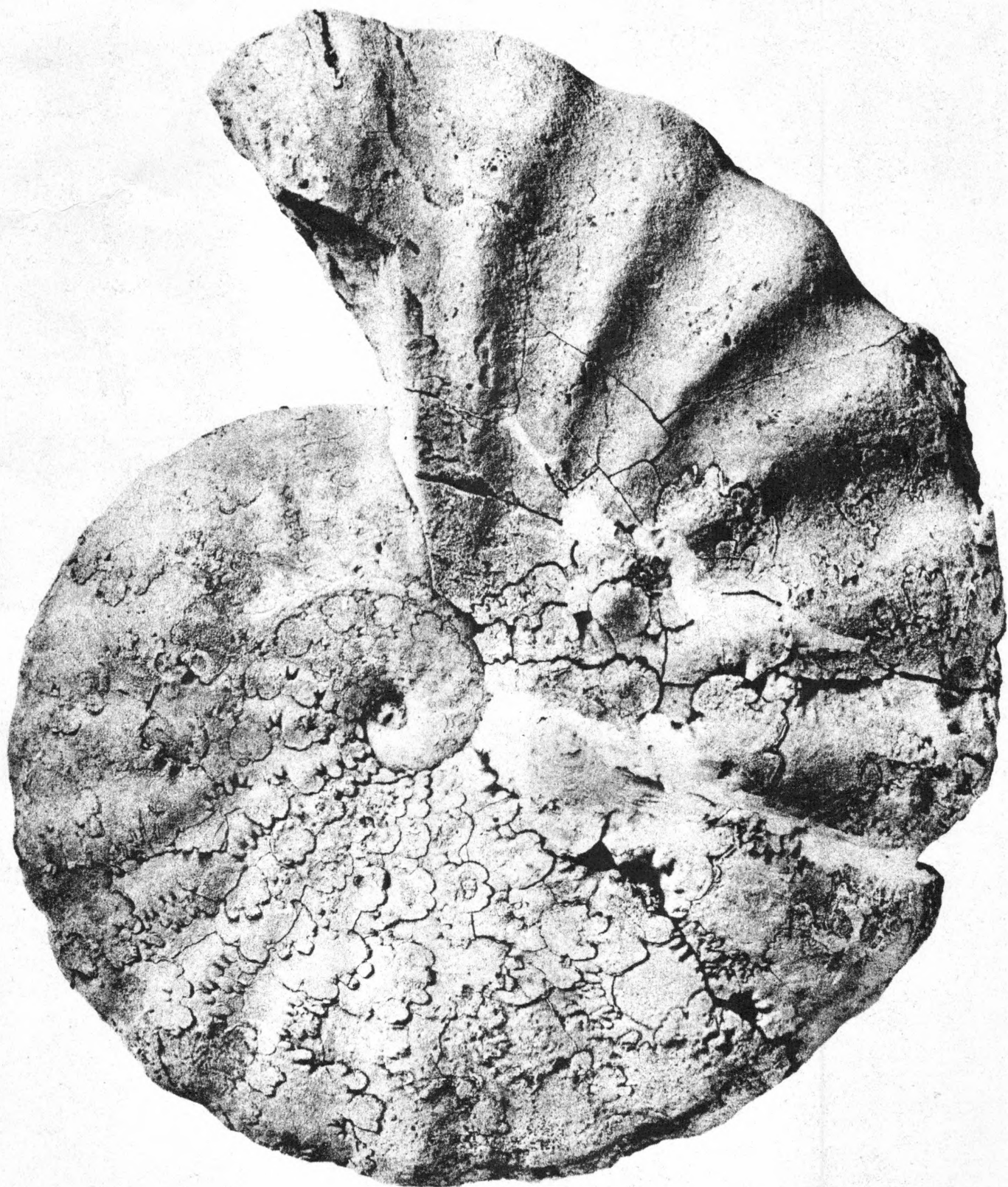


PLATE 21.

- PLATE 22 CENOMANIAN-TURONIAN AMMONITES, WESTERN INTERIOR BASIN (ALL FIGURES NATURAL SIZE) (see page 260)
- Fig. 1. *Prionocyclus hyatti* (Stanton). USNM 220385. Blue Hill Shale Member of Carlile Shale, Smith County, Kansas. Middle Middle Turonian.
- Fig. 2, 3. *Prionocyclus reesidei* Sidwell. USNM 220389. Wall Creek Sandstone Member of Frontier Formation, Natrona County, Wyoming. Late Turonian.
- Fig. 4-6. *Collignonicerus woollgari* (Mantell). USNM 220384. Carlile Shale, Weston County, Wyoming. Lower Middle Turonian.
- Fig. 7, 8. *Watinoceras coloradoense* (Henderson). USNM 163995. Bridge Creek Limestone Member of Greenhorn Formation, Pueblo County, Colorado. Basal Turonian.
- Fig. 9, 10. *Soaphites whitfieldi* Cobban. USNM 220387. Turner Sandy Member of Carlile Shale, Weston County, Wyoming. Late Late Turonian.
- Fig. 11, 12. *Soaphites warreni* Meek and Hayden. USNM 220386. Wall Creek Sandstone Member of Frontier Formation, Carbon County, Wyoming. Late Turonian.
- Fig. 13. *Turrilites (Turrilites) acutus* Passy. USNM 163871. Thatcher Limestone Member of Graneros Shale, Pueblo County, Colorado. Early Middle Cenomanian.
- Fig. 14. *Prionocyclus wyomingensis elegans* Haas. USNM 220388. Turner Sandy Member of Carlile Shale, Niobrara County, Wyoming. Late Turonian.
- Fig. 15, 16. *Plesiacanthoceras wyomingense* (Reagan). USNM 220381. Belle Fourche Shale, Carter County, Montana. Late Middle Turonian.
- Fig. 17, 18. *Metoicoceras muelleri* Cobban. USNM 220382. Mosby Sandstone Member of Colorado Shale, Petroleum County, Montana. Early Late Cenomanian.

- PLATE 23 CENOMANIAN-TURONIAN AMMONITES, WESTERN INTERIOR BASIN (see page 261)
- Fig. 1, 2. *Soaphites larvaeformis* Meek and Hayden. (X1). USNM 106743. Lateral and ventral views respectively. Carlile Shale, near base, 2.5 miles south of Newcastle, Weston County, Wyoming.
- Fig. 3, 4. *Soaphites carlilensis* Morrow. (X1). USNM 106742b. Lateral and ventral views, respectively. Carlile Shale, 57-81 feet above base, 5 miles north of Belle Fourche in the SW 1/4 SE 1/4 SW 1/4 sec. 11, T 9 N, R 2 E, Butte County, South Dakota.
- Fig. 5, 6. *Soaphites warreni* Meek and Hayden. (X1). USNM 106746. Lateral and apertural views, respectively. 14.5 feet above base of Turner Sandy Member of Carlile Shale, 5 miles north of Belle Fourche in the SW 1/4 SE 1/4 SW 1/4 sec. 11, T 9 N, R 2 E, Butte County, South Dakota.
- Fig. 7, 8. *Soaphites ferronensis* Cobban. (X1). Paratype USNM 106760b. Lateral and apertural views, respectively. From the Ferron Sandstone Member near Emery, Utah.
- Fig. 9, 10. *Soaphites whitfieldi* Cobban. (X1). Holotype USNM 106735. Lateral and ventral views, respectively. 251-264 feet above base of Carlile Shale, 6 miles north of Belle Fourche in the N 1/2 sec. 10, T 9 N, R 2 E, Butte County, South Dakota.
- Fig. 11, 12. *Soaphites nigricollensis* Cobban. (X1). Holotype USNM 106730. Ventral and lateral views, respectively. 59 feet below top of Turner Sandy Member of Carlile Shale, 6 miles north of Belle Fourche in the NE 1/4 NE 1/4 NW 1/4 sec. 10, T 9 N, R 2 E, Butte County, South Dakota.
- Fig. 13, 14. *Soaphites corvensis* var. *bighornensis* Cobban. (X1). Holotype USNM 106756. Lateral and ventral views, respectively. 180 feet above base of Carlile Member of Cody Shale, 33 miles south of Hardin in the E 1/2 NW 1/4 SW 1/4 sec. 36, T 6 S, R 32 E, Big Horn County, Montana.
- Fig. 15, 16. *Soaphites impendicostatus* Cobban. (X1). Holotype USNM 106686. Lateral and ventral views, respectively. From the Colorado Shale 183-197 feet above top of Calcareous Member of Greenhorn age, 2 miles north of Fort Shaw in the S 1/2 secs. 35 and 36, T 21 N, R 2 W, Cascade County, Montana.
- Fig. 17, 18. *Soaphites binneyi* Reeside. (X1). USNM 106705. Lateral and ventral views, respectively. From the Cody Shale 575-774 feet above base, Ray Lake, 8 miles north of Lander, in the SW 1/4 NE 1/4 sec. 25, T 1 S, R 1 E, Fremont County, Wyoming.
- Fig. 19, 20. *Desmosoaphites erdmanni* Cobban. (X1). USNM 106724. Ventral and lateral views, respectively. From the Colorado Shale 10 feet below top, 8 miles west of Shelby, at head of ravine 3 miles north of Marias River in the NE 1/4 sec. 31, T 32 N, R 3 W, Toole County, Montana.
- Fig. 21, 22. *Vascoceras (Greenhornoceras) birchbyi* Cobban and Scott. (X1). USNM 164028. Lateral and ventral views, respectively. From 20 feet above base of Bridge Creek Limestone Member, bed 97 at USGS loc. D6147; Birchby, 1967, SW 1/4 NW 1/4 NW 1/4 sec. 1, and NE 1/4 NE 1/4 sec. 2, T 21 S, R 66 W, Pueblo County, Colorado.

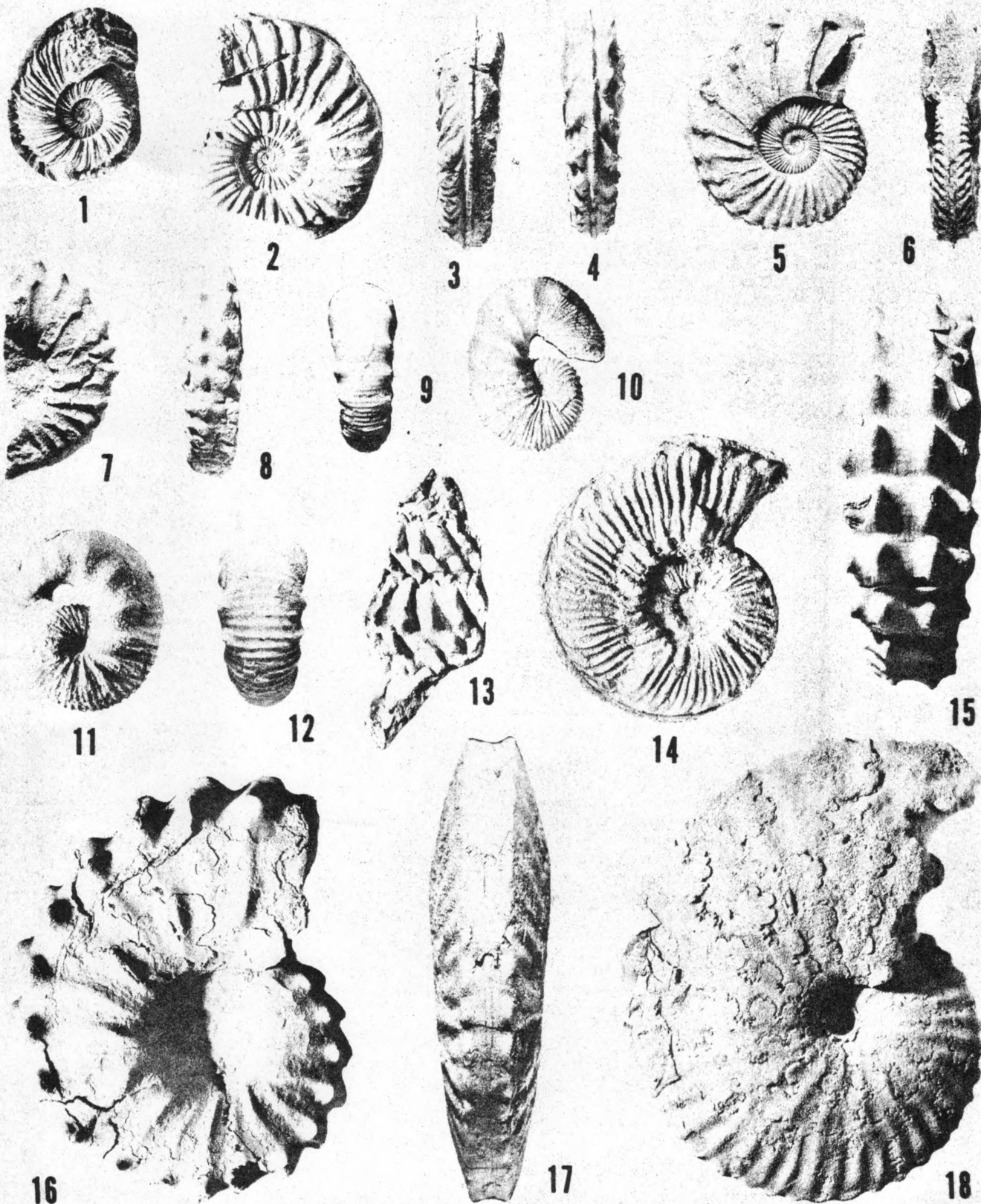


PLATE 22.

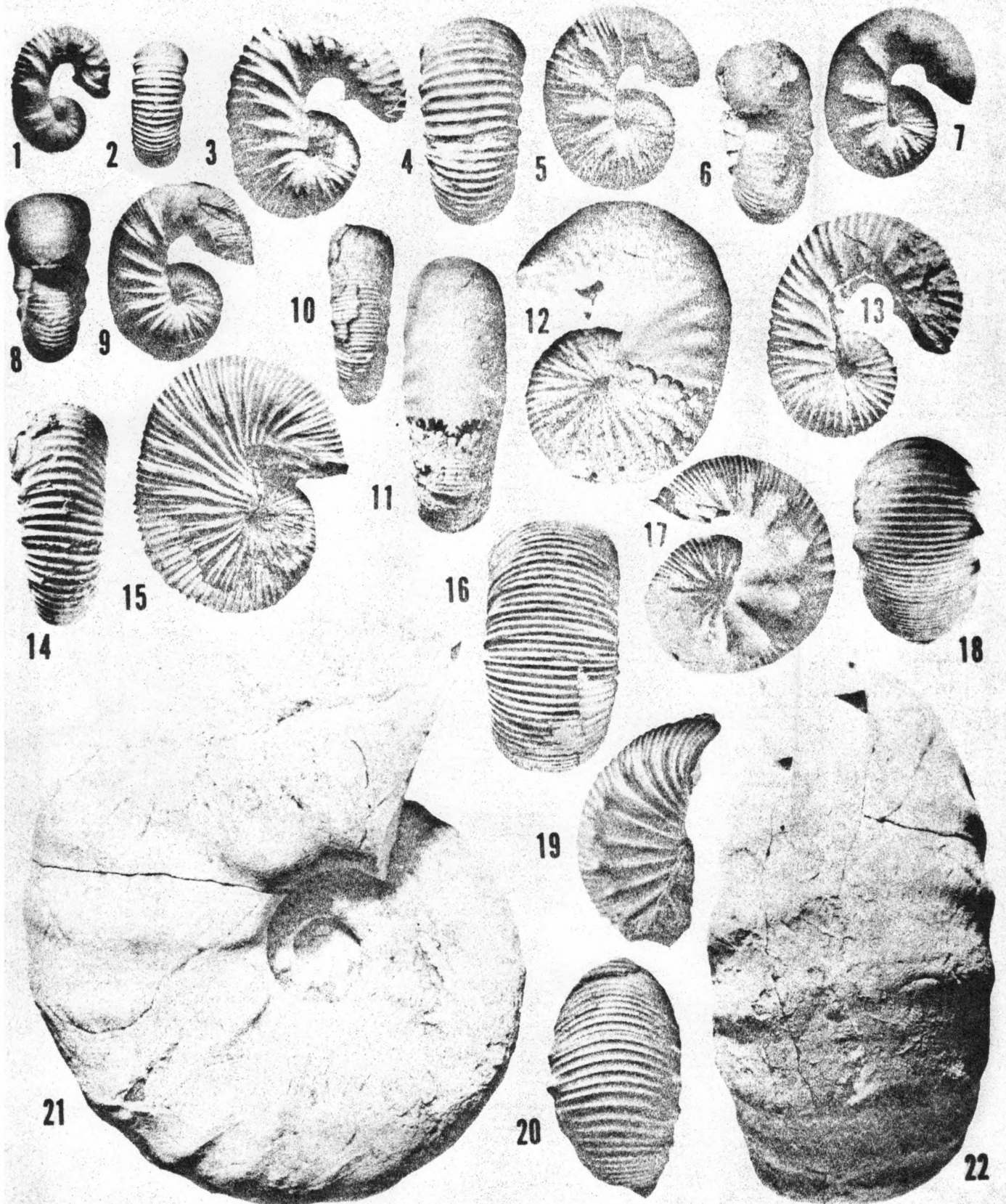


PLATE 23.

## PLATE 24 CONIACIAN-SANTONIAN AMMONITES, WESTERN INTERIOR BASIN (see page 263)

- Fig. 1, 2. *Scaphites preventricosus* Cobban. (X1). Holotype USNM 106675. Lateral and apertural views, respectively. From 514-525 feet below top of Colorado Shale, north bank of Marias River, 5.5 miles south of Shelby in the NE 1/4 sec. 20, T 31 N, R 2 N, Toole County, Montana.
- Fig. 3, 4. *Scaphites ventricosus* Meek and Hayden. (X1). USNM 106700. Lateral and ventral views, respectively. From Cody Shale, 538 feet above base in the NE 1/4 NW 1/4 sec. 20, T 42 N, R 112 W, Teton County, Wyoming.
- Fig. 5, 6. *Clisosaphites saxitonus* (McLearn). (X1). USNM 106739a. Lateral and apertural views, respectively. From the Colorado Shale, 165 feet below the top, 11 miles south of Devon, in SE 1/4 SW 1/4 sec. 34, T 30 N, R 2 E, Toole County, Montana.
- Fig. 7, 8. *Clisosaphites vermiformis* (Meek and Hayden). (S1). USNM 106713a. Lateral and ventral views, respectively. From 234-252 feet below the top of Colorado Shale, east bank of Marias River, 11 miles southwest of Shelby, in the W 1/2 NE 1/4 SE 1/4 sec. 14, T 31 N, R 4 W, Toole County, Montana.
- Fig. 9, 10. *Scaphites depressus* Reeside. (X1). USNM 106693. Lateral and ventral views, respectively. From 700 feet above base of Cody Shale at Line Creek, in the NW 1/4 NW 1/4 sec. 35, T 58 N, R 103 W, Park County, Wyoming.

## PLATE 25 SANTONIAN-EARLY CAMPANIAN AMMONITES, WESTERN INTERIOR BASIN (see page 264)

- Fig. 1, 2. *Scaphites leei* Reeside I. (X1). USNM 160231. Ventral and lateral views of a female. 10 feet below top of Marias River Shale at USGS loc. 21419; 8 miles west of Shelby at head of ravine, 3 miles north of Marias River in the NE 1/4 sec. 31, T 32 N, R 3 W, Toole County, Montana.
- Fig. 3, 4. *Scaphites leei* Reeside II. (X1). USNM 160235. Lateral and ventral views of a female. 43 feet above base of Telegraph Creek Formation at USGS loc. D4280, 17 miles southeast of Billings, in the W 1/2 SW 1/4 sec. 5, T 2 S, R 29 E, Yellowstone County, Montana.
- Fig. 5, 6. *Scaphites leei* Reeside II. (X1). USNM 160234. Lateral and ventral views of a male. From the same locality as Figs. 3, 4.
- Fig. 7. *Scaphites leei* Reeside III. (X1). USNM 160237. Lateral view of a male. 590 feet below top of Mancos Shale at USGS loc. D4075, 3 miles west of Gallina in the SE 1/4 SE 1/4 NE 1/4 sec. 11, T 23 N, R 1 W, Rio Arriba County, New Mexico.
- Fig. 8. *Scaphites leei* Reeside III. (X1). USNM 160244. Lateral view of a female. From the same locality as Fig. 7.
- Fig. 9. *Scaphites hippocrepsis* (DeKay) I. (X1). USNM 160250. Lateral view of a male. Cody Shale, 160 feet above top of Niobrara Shale Member at USGS loc. D4181, 9 miles southeast of Manderson in the NE 1/4 NW 1/4 NW 1/4 sec. 20, T 49 N, R 91 W, Big Horn County, Wyoming.
- Fig. 10. *Scaphites hippocrepsis* (DeKay) I. (X1). USNM 160259. Lateral view of a female. From the same locality as Fig. 9.
- Fig. 11, 12. *Scaphites hippocrepsis* (DeKay) II. (X1). USNM 160292. Lateral and apertural view of a male. Cody Shale at USGS loc. D3244, 9 miles northwest of Midwest in the NE 1/4 sec. 35, T 41 N, R 80 W, Natrona County, Wyoming.
- Fig. 13, 14. *Scaphites hippocrepsis* (DeKay) II. (X1). USNM 160297. Lateral and apertural views of a female. Cody Shale at USGS loc. D4185, 665 feet above top of Niobrara Shale Member, west flank of Manderson anticline, 8 miles southeast of Manderson in the NW 1/4 NE 1/4 NE 1/4 sec. 19, T 49 N, R 91 W, Big Horn County, Wyoming.
- Fig. 15. *Scaphites hippocrepsis* (DeKay) III. (X1). USNM 160306. Lateral view of a male. Cody Shale at USGS loc. 21206, 7 miles east of Hardin near the center of the north line of sec. 13, T 1 S, R 34 E, Big Horn County, Wyoming.
- Fig. 16. *Scaphites hippocrepsis* (DeKay). (X1). USNM 131465. Lateral view of a female. From the same locality as Fig. 15.
- Fig. 17. *Scaphites leei* Reeside III. (X1). USNM 160238. Ventral view of a male. From the same locality as Fig. 7.
- Fig. 18. *Scaphites leei* Reeside III. (X1). USNM 160248. Apertural view of a female. From the same locality as Fig. 7.
- Fig. 19, 20. *Trachyscaphites spiniger* (Schlüter) subsp. *porchi* Adkins. (X1). 19. USNM 132320. Lateral view. From the Pecan Gap Chalk Member of the Taylor marl near the Gulf, Colorado and Santa Fe Railway about 0.8 mile east of Pecan Gap, Delta County, Texas. USGS loc. 9713. 20. USNM 132324. Lateral view. From the Anacacho limestone on west-flowing branch of Salado Creek about 7 miles northeast of San Antonio, Bexar County, Texas. USGS loc. 7651.

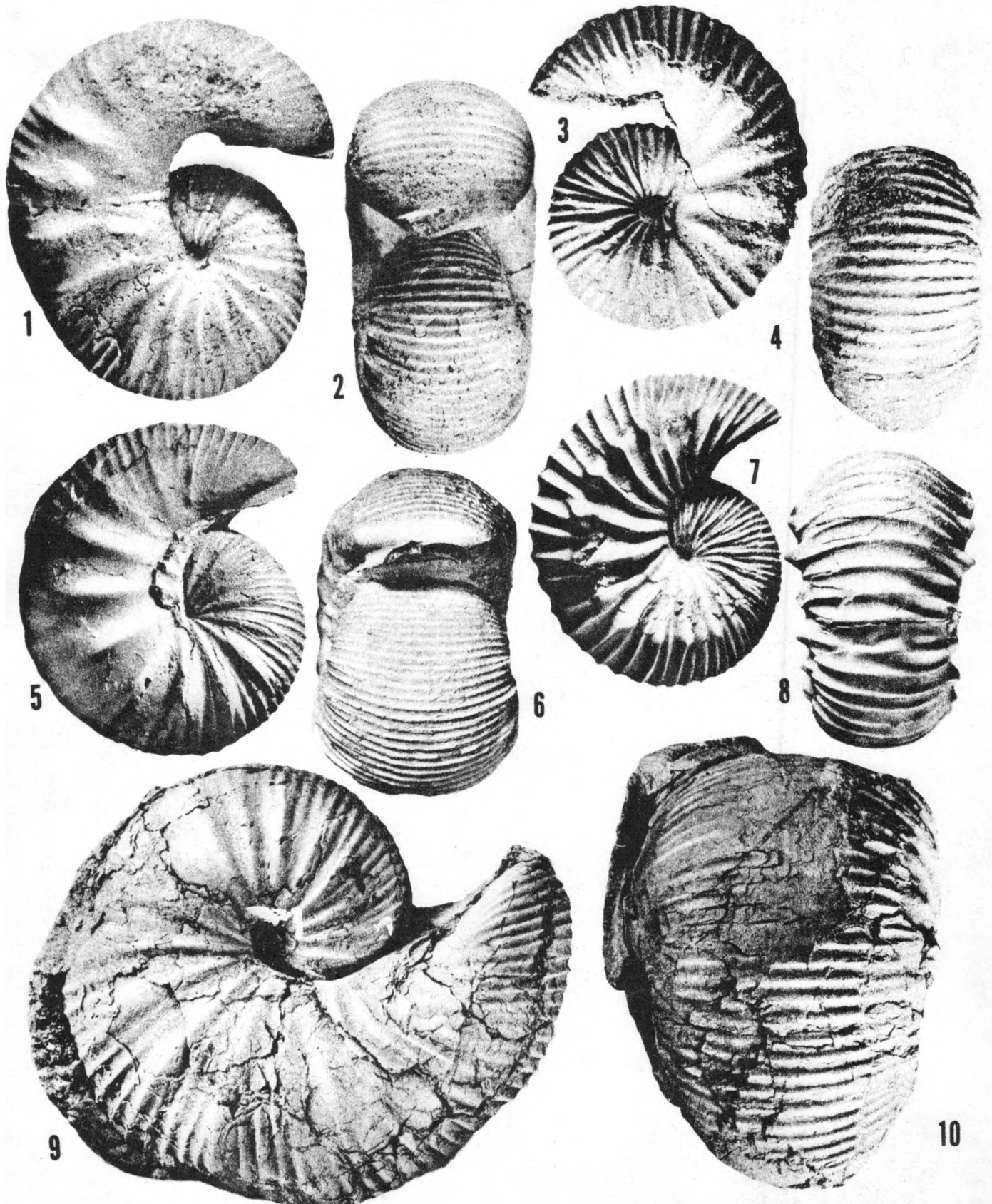
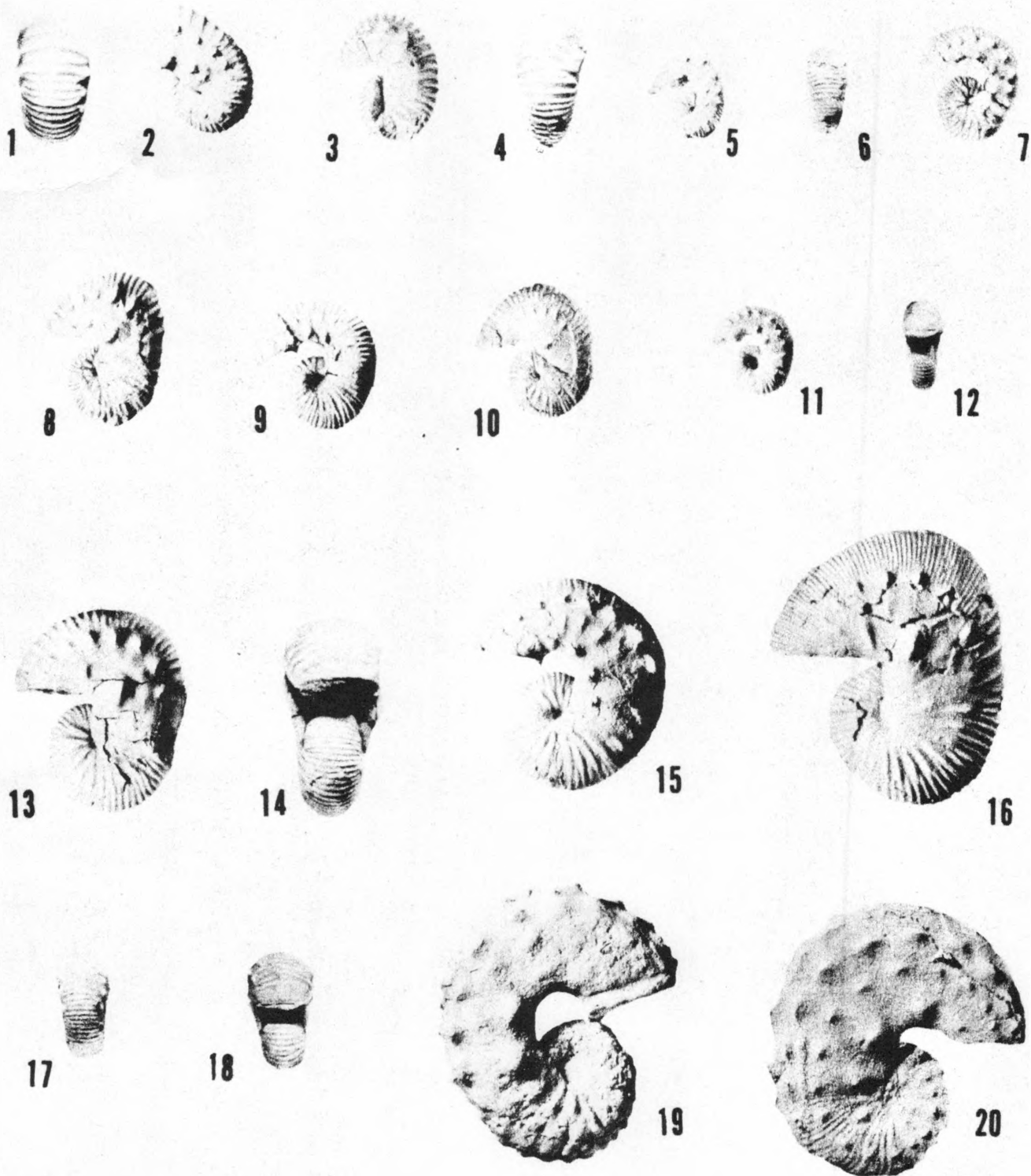


PLATE 24.





## PLATE 26 TURONIAN AND UPPER CAMPANIAN AMMONITES, WESTERN INTERIOR BASIN (see page 266)

- Fig. 1. *Prionocyclus quadratis* Cobban. (X1). USNM 108332. From Sage Breaks Member of Carlille Shale, Carter County, Montana. Upper Turonian.
- Fig. 2, 3. *Prionocyclus wyomingensis* Meek. Cotypes; USNM 7729; Lateral and ventral views, respectively. From the Colorado Group, valley of the Medicine Bow River, Wyoming. Upper Turonian.
- Fig. 4, 5. *Prionocyclus macombi* Meek. Ventral and lateral views, Holotype, USNM 22940; lower part of "Middle" Cretaceous, banks of Canadian River, New Mexico. Upper Turonian.
- Fig. 6. *Collignoniceras woollgari* (Mantell). Lateral view, Hypotype; Fort Benton Group, southeast Black Hills, South Dakota; early Middle Turonian.
- Fig. 7. *Prionocyclus hyatti* (Stanton). USNM 22941, Cotype. Apertural view, from Codell Sandstone Member, Huerfano Park, Colorado; late Middle Turonian.
- Fig. 8, 9. *Baculites eliasi* Cobban. (X1/2). From Scott and Cobban, 1975, Generalized.
- Fig. 10, 11. *Baculites jenseni* Cobban. (X1/2). From Scott and Cobban, 1975, Generalized.
- Fig. 12, 13. *Baculites reesidei* Elias. (X1/2). From Scott and Cobban, 1975, Generalized.
- Fig. 14, 15. *Baculites cuneatus* Cobban. (X1/2). From Scott and Cobban, 1975, Generalized.

## PLATE 27 GENERALIZED RECONSTRUCTIONS OF CAMPANIAN AMMONITES, WESTERN INTERIOR BASIN (see page 267)

- Fig. 1, 2. *Baculites compressus* Say. (X1/2). From Scott and Cobban, 1975.
- Fig. 3. *Exilloceras jenneyi* (Whitfield). (X1/2). From Scott and Cobban, 1975.
- Fig. 4. *Didymoceras cheyennense* (Meek and Hayden). (X1/2). From Scott and Cobban, 1975.
- Fig. 5. *Didymoceras nebrascense* (Meek and Hayden). (X1/2). From Scott and Cobban, 1975.
- Fig. 6-8. *Baculites scotti* Cobban. (X1/2). From Scott and Cobban, 1975.
- Fig. 9-11. *Baculites gregoryensis* Cobban. (X1/2). From Scott and Cobban, 1975.
- Fig. 12. *Didymoceras stevensoni* (Whitfield). (X1/2). From Scott and Cobban, 1975.
- Fig. 13-15. *Baculites perplexus* Cobban. (X1/2). From Scott and Cobban, 1975.
- Fig. 16-18. *Baculites asperiformis* Meek. (X1/2). From Scott and Cobban, 1975.
- Fig. 19-21. *Baculites maclearni* Landes. (X1/2). From Scott and Cobban, 1975.
- Fig. 22-24. *Baculites obtusus* Meek. (X1/2). From Scott and Cobban, 1975.

## PLATE 28 CONIACIAN-SANTONIAN FOSSILS, WESTERN INTERIOR BASIN (see page 268)

- Fig. 1. "*Inoceramus*" (*Platyceramus*) *platinus* Logan. (X1). USNM 131533. From the upper part of the upper chalky shale unit of the Smoky Hill Shale Member in the SE 1/4 NW 1/4 sec. 15, T 20 S, R 65 W, Pueblo County, Colorado: Santonian.
- Fig. 2. "*Inoceramus*" (*Endocostea*) *balticus* Boehm. (X1). USNM 131523. From the lower part of the upper chalky shale unit of the Smoky Hill Shale Member in the NW 1/4 SE 1/4 sec. 10, T 20 S, R 65 W, Pueblo County, Colorado: Middle and Upper Santonian.
- Fig. 3. "*Inoceramus*" (*Cladoceramus*) *undulatoplicatus* Roemer. (X1). USNM 131506. From the lower part of the middle shale unit of the Smoky Hill Shale Member in the NW 1/4 SE 1/4 sec. 9, T 20 S, R 65 W, Pueblo County, Colorado: Lower-Middle Santonian.
- Fig. 4, 5. *Tesantites americanus* (Lasswitz). (X1). USNM 131520. From the upper part of the middle shale unit, middle Smoky Hill Member in sec. 1, T 32 S, R 62 W, Las Animas, County, Colorado: Middle Santonian.
- Fig. 6. *Baculites asper* Morton. (X1). USNM 131516. From the same locality as Fig. 4 and 5.
- Fig. 7. *Baculites codyensis* Reeside. (X1). USNM 131515. From the same locality as Figs. 4 and 5.

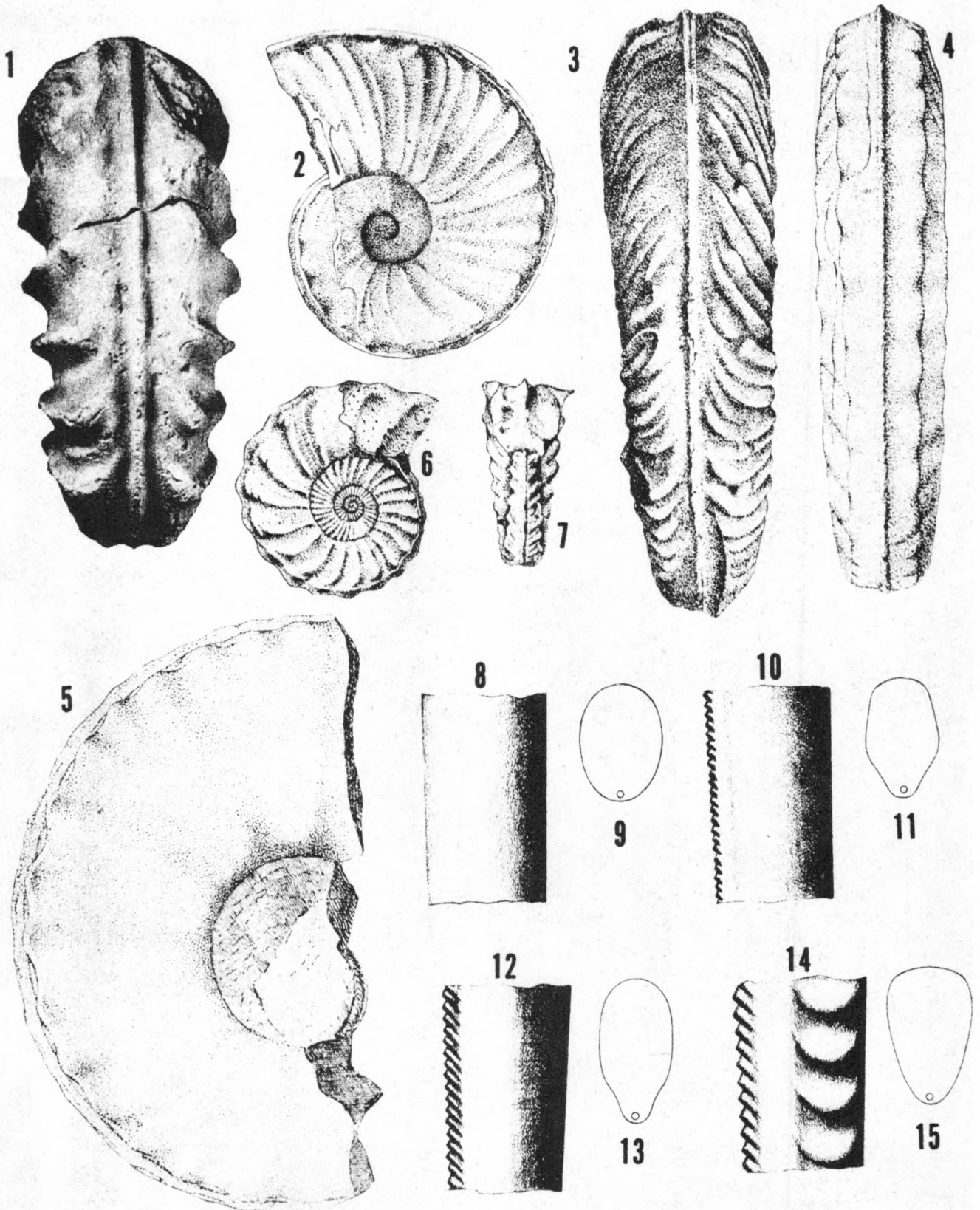


PLATE 26.

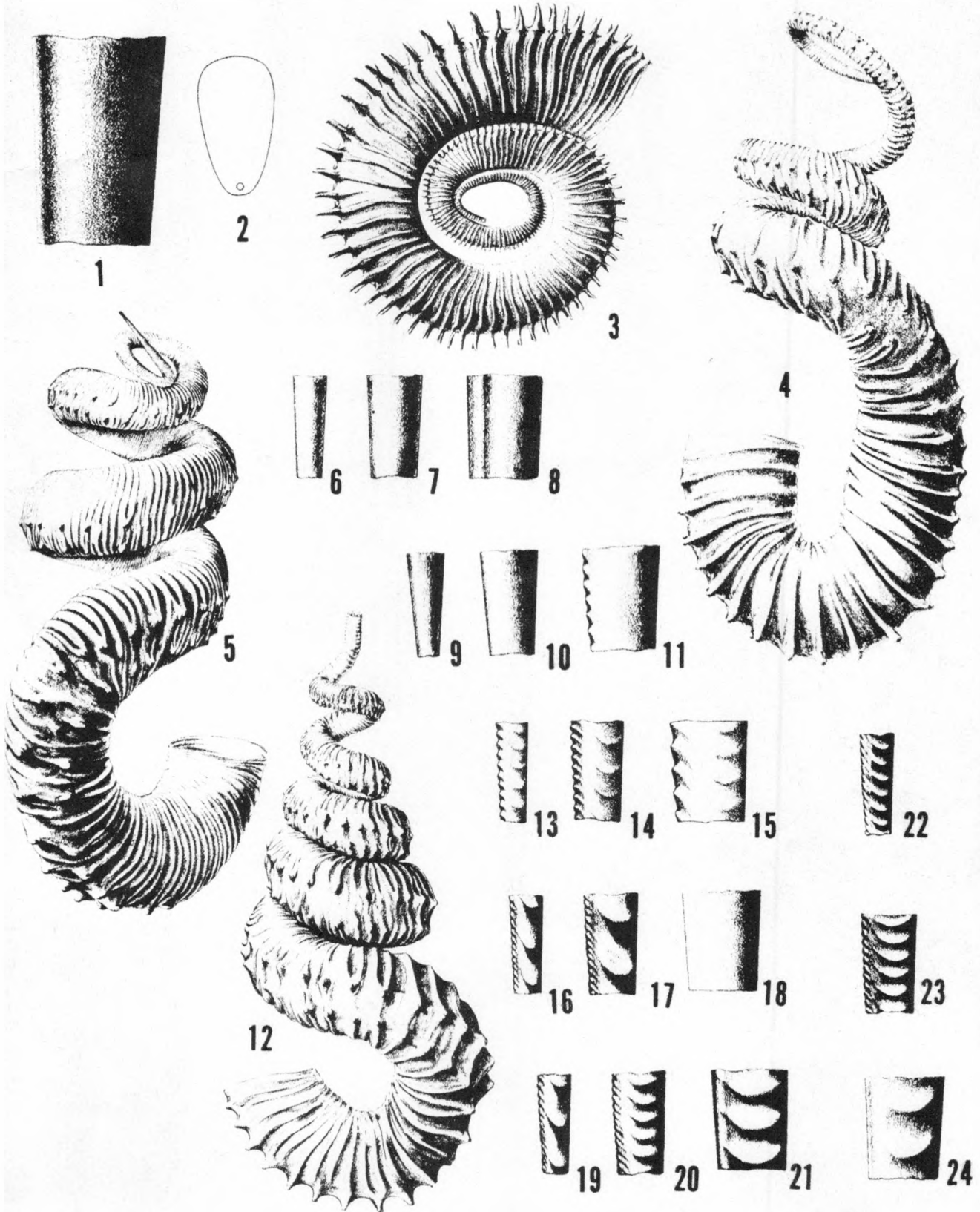


PLATE 27.

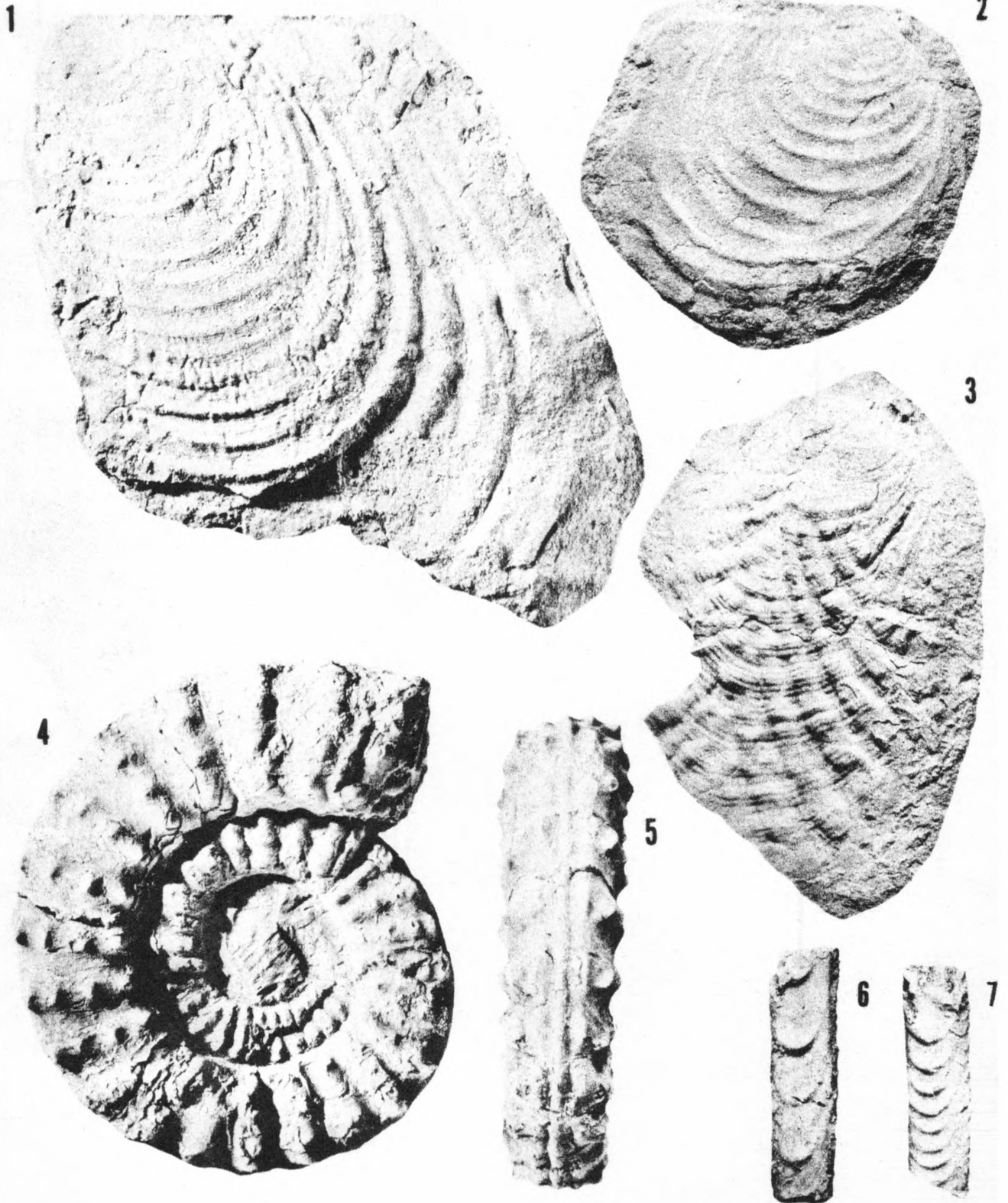


PLATE 20.

## PLATE 29 CONIACIAN-CAMPANIAN BACULITES, WESTERN INTERIOR BASIN (see page 270)

- Fig. 1, 8. *Baculites eliasi* Cobban. (X1). Holotype USNM 108969. End and lateral views. From the Bearpaw Shale near Fort Peck, Montana. Latest Campanian.
- Fig. 2, 11. *Baculites scotti* Cobban. (X1). 2. USNM 108931c. Lateral view. 11. USNM 108929. Lateral view. From the Pierre Shale 5 miles northeast of Pueblo, Colorado. Middle Late Campanian.
- Fig. 3, 4. *Baculites gilberti* Cobban. (X1). Holotype USNM 108911. Ventral and lateral views. From the Pierre Shale just below the Hygiene Member, 4 miles north of Boulder in the SW 1/4 NE 1/4 sec. 31, T 2 N, R 70 W, Boulder County, Colorado. Early Late Campanian.
- Fig. 5, 6. *Baculites jenseni* Cobban. (X1). USNM 131119b. Lateral and ventral views. From limestone concretions in the upper part of the Bearpaw Shale about 12 miles northeast of Melstone, Montana. Late Late Campanian.
- Fig. 7. *Baculites gregoryensis* Cobban. (X1). Holotype USNM 106987. Lateral view. From the Gregory Member of Pierre Shale 2 miles west of Oacoma, in SE 1/4 sec. 22, T 104 N, R 72 W, Lyman County, South Dakota. Middle Late Campanian.
- Fig. 9. *Baculites sweetgrassensis* Cobban. (X1). Holotype USNM 106983. Lateral view. From the Colorado Shale, 514-525 feet below the top, on the Sweetgrass Arch in the NE 1/4 sec. 20, T 31 N, R 2 W, Toole County, Montana. Middle Coniacian.
- Fig. 10. *Baculites mariasensis* Cobban. (X1). Paratype USNM 106986. Lateral view. From the Colorado Shale, 514-525 feet below the top in the north bank of the Marias River, 5.5 miles south of Shelby in NE 1/4 sec. 20, T 31 N, R 2 W, Toole County, Montana. Middle Coniacian.

## PLATE 30 CAMPANIAN-MAASTRICHTIAN BACULITES, WESTERN INTERIOR BASIN (see page 271)

- Fig. 1, 2. *Baculites asperiformis* Meek. (X1). USNM 131015e. Lateral and ventral views. From the upper part of the Sharon Springs Member of the Pierre Shale about a mile northeast of McAllaster in the NE 1/4 sec. 13, T 12 S, R 37 W, Logan County, Kansas. Earliest Late Campanian.
- Fig. 3, 6. *Baculites cuneatus* Cobban. (X1). Paratype USNM 108967d. 3. End view. 6. Lateral view. From the Bearpaw Shale near Hardin, Montana. Late Late Campanian.
- Fig. 4, 5. *Baculites obtusus* Meek. (X1). USNM 131011c. Lateral and ventral views, respectively. From the lower part of the Pierre Shale a few miles northeast of Canon City in the SW 1/4 sec. 10, T 18 S, R 70 W, Fremont County, Colorado. Late Early Campanian.
- Fig. 7, 12. *Baculites* smooth species of Cobban, 1962. (X1). USNM 131014b. Lateral and dorsal views, respectively. From the lower part of the Pierre Shale near Red Bird in the SE 1/4 SW 1/4 sec. 13, T 38 N, R 62 W, Niobrara County, Wyoming. Middle Early Campanian.
- Fig. 8. *Baculites grandis* Hall and Meek. (X1/3). Lateral view. From Beecher Island Shale Member, Pierre Formation, 1 mile northwest of Beecher Island, Yuma County, Colorado. Early Early Maastrichtian.
- Fig. 9. *Baculites maclearni* Landes. (X1). USNM 131013d. From the Cliff House Sandstone 5 miles southwest of Fort Lewis in the SW 1/4 SE 1/4 sec. 10, T 34 N, R 12 W, La Plata County, Colorado. Late Early Campanian.
- Fig. 10, 11. *Baculites perplexus* Cobban. (X1). Lateral and ventral views, respectively. From the upper part of the Steele Shale in the Big Muddy oil field 4.3 miles west-southwest of Glenrock, in the SE 1/4 NE 1/4 sec. 9, T 33 N, R 76 W, Converse County, Wyoming. Early Late Campanian.

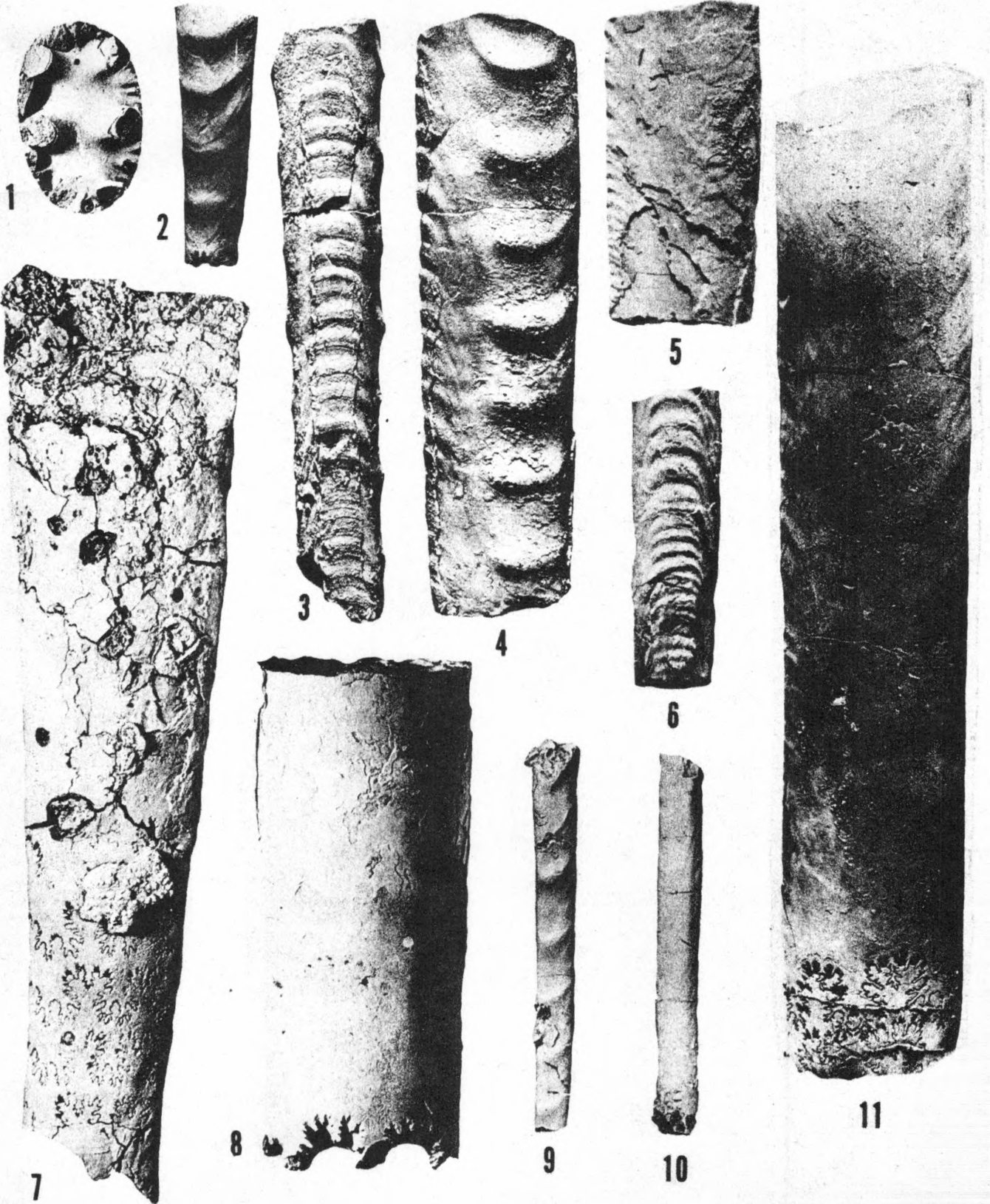


PLATE 29.

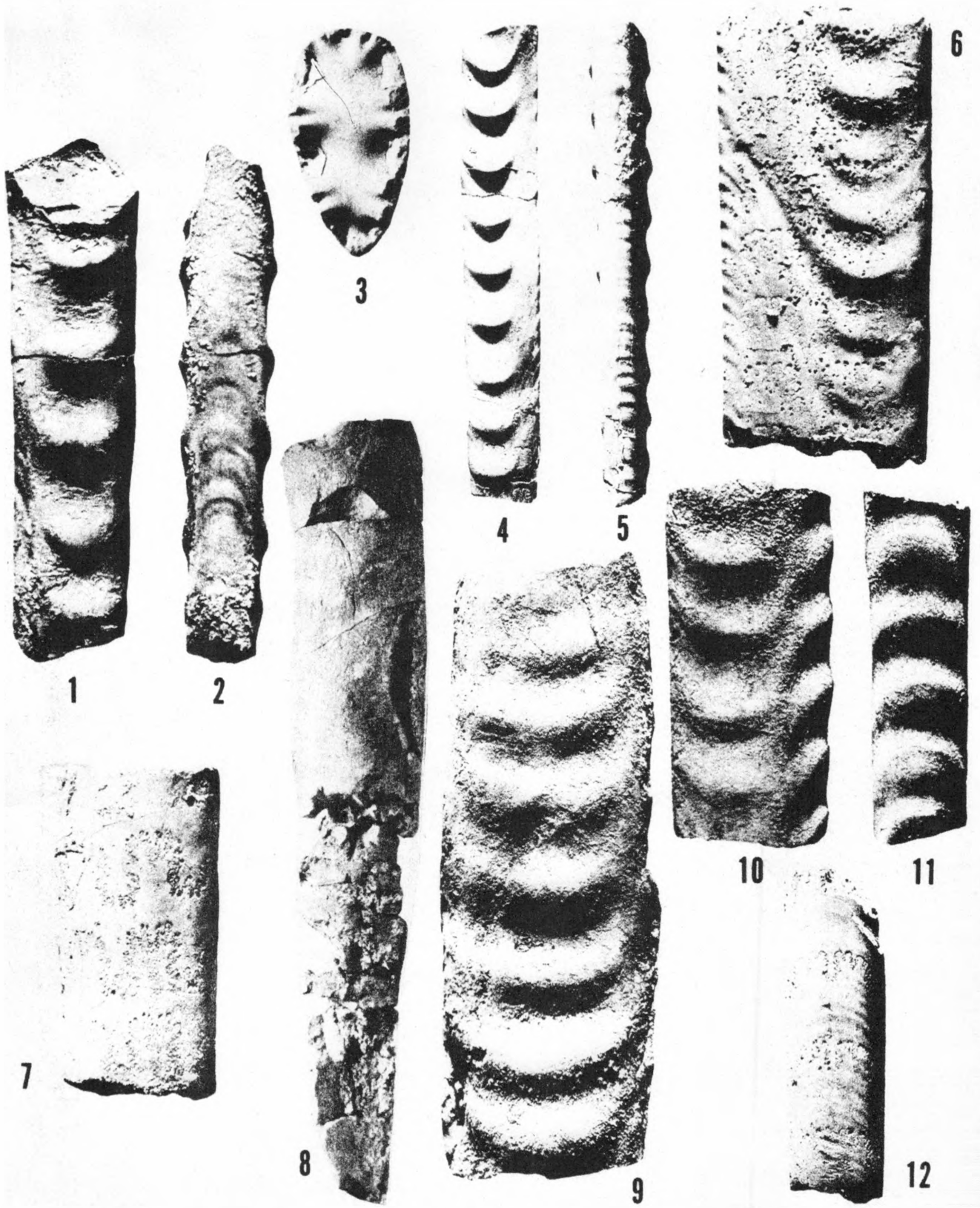


PLATE 30.

## PLATE 31 CAMPANIAN-MAASTRICHTIAN BACULITES, WESTERN INTERIOR BASIN (see page 273)

- Fig. 1. *Baculites reesidei* Elias. Type (X1). Lateral view. From Lake Creek Shale Member, Pierre Formation, center sec. 35, T 11 S, R 39 W, Wallace County, Kansas. Late Late Campanian.
- Fig. 2. *Baculites pseudovatus* var. A. Elias. Type (X1). Lateral view. From *Baculites* zone of Salt Grass Shale Member, Pierre Formation, E sec. 2, T 12 S, R 42 W, Wallace County, Kansas. Middle Late Campanian.
- Fig. 3, 6. *Baculites rugosus* Cobban. Type (X1). 3. USNM 131121b. End view. 6. USNM 131121c. Lateral view. From the lower part of the Monument Hill Bentonitic Member of the Pierre Shale on the north flank of the Black Hills uplift, at the head of Timber Creek in the SE 1/4 sec. 14, T 3 S, R 56 E, Carter County, Montana. Middle Late Campanian.
- Fig. 4. *Baculites clinolobatus* Elias. 1933. (X2/5). Lateral view. From Beecher Island Shale Member, Pierre Formation, one half mile northeast of Beecher Island, Yuma County, Colorado. Middle Early Maastrichtian.
- Fig. 5. *Baculites pseudovatus* Elias. Type (X4/5). Lateral view. From upper Weskan Shale Member, Pierre Formation, NW 1/4 sec. 18, T 13 S, R 41 W, Wallace County, Kansas. Middle Late Campanian.

## PLATE 32 CAMPANIAN-MAASTRICHTIAN SCAPHITES, WESTERN INTERIOR BASIN (see page 274)

- Fig. 1. *Hoploscaphites nodosus plenus* (Meek and Hayden). Holotype (X1). Upper Pierre Shale, "Yellowstone River, 150 miles from its mouth" (Meek, 1876). Late Campanian.
- Fig. 2, 7. *Hoploscaphites gilli* Cobban and Jeletzky. 2. (X1). Holotype, lateral view, USNM 132611. From Cody Shale, near Glenrock, Wyoming. 7. (X1). Rear view USNM 132623. From the Mitten Black Shale Member of the Pierre Shale near Red Bird, Wyoming. Early Late Campanian.
- Fig. 3. *Discoscaphites conradi intermedius* (Meek and Hayden). Holotype (X1), Fox Hills Sandstone, Moreau River, South Dakota. Early Maastrichtian.
- Fig. 4. *Discoscaphites abyssinus* (Morton). Hypotype (X1), Fox Hills Sandstone, Moreau River, South Dakota. Early Maastrichtian.
- Fig. 5. *Discoscaphites mandanensis* (Morton). Hypotype (X1), Fox Hills Sandstone, Moreau River, South Dakota. Early Maastrichtian.
- Fig. 6. *Discoscaphites conradi* (Morton) s.s. Hypotype (X1), Fox Hills Sandstone, South Dakota. Early Maastrichtian.
- Fig. 8. *Hoploscaphites nodosus quadrangularis* (Meek and Hayden). Hypotype (X1). Upper Pierre Shale, near Cheyenne River, South Dakota. Late Campanian.
- Fig. 9. *Hoploscaphites nodosus brevis* (Meek and Hayden). Holotype (X1). Upper Pierre Shale, near Cheyenne River, South Dakota. Late Campanian.
- Fig. 10. *Hoploscaphites nicolleti* (Morton). Hypotype (X1). Fox Hills Sandstone, South Dakota. Early Maastrichtian.
- Fig. 11. *Discoscaphites cheyemensis* (Owen). Hypotype (X1). Fox Hills Sandstone, "Moreau and Cheyenne Rivers" (Meek, 1876), South Dakota. Early Maastrichtian.





PLATE 31.

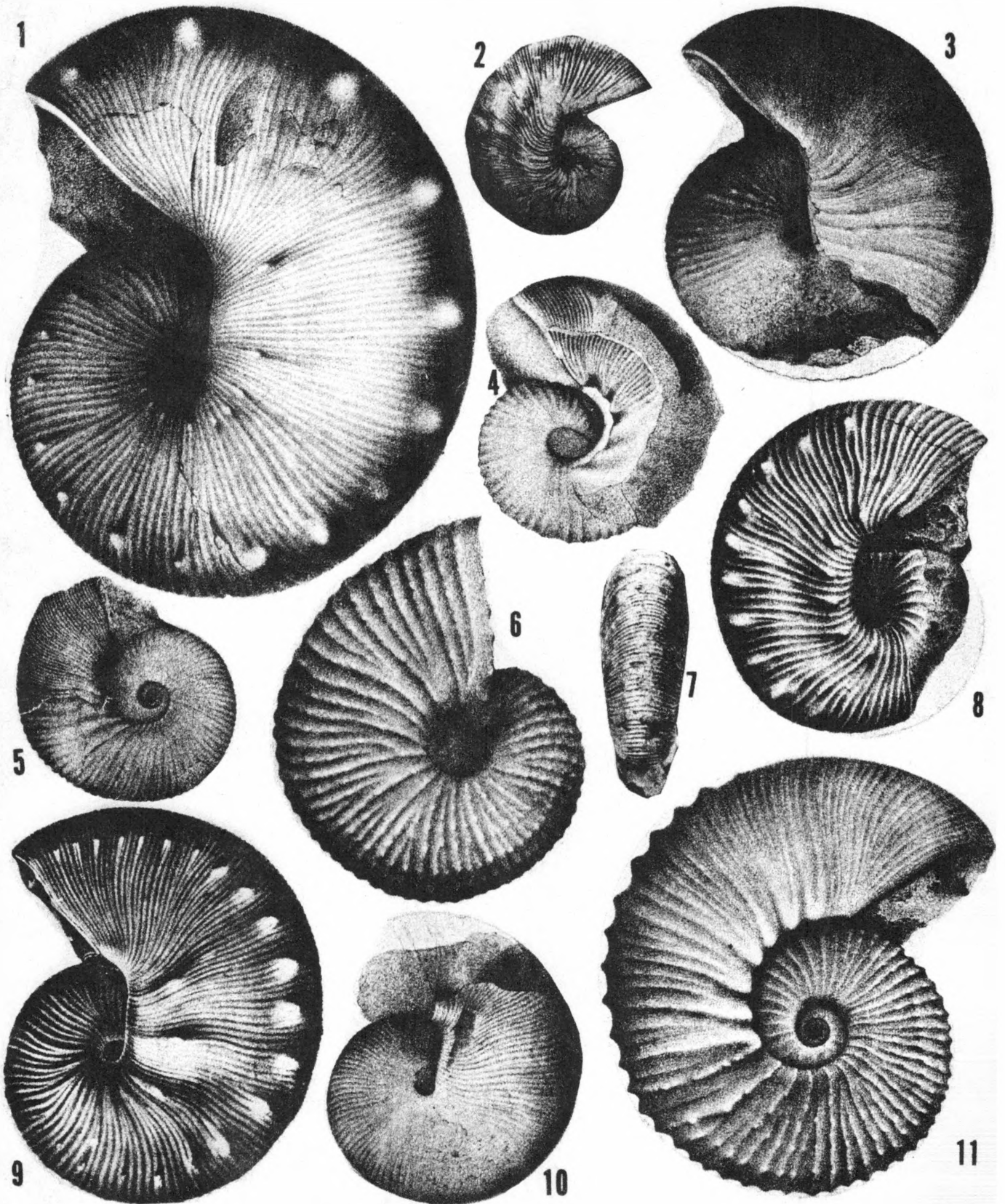


PLATE 32.