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THE CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS IN THE WESTERN INTERIOR OF THE UNITED STATES

BY

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CONTENTS

ILLUSTRATIONS

INSERT

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By JOHN B. REESIDE, Jr.

INTRODUCTION

It is the purpose of this paper to describe the cephalopods contained in a collection of 200 lots of fossils from the Eagle sandstone and other formations in the lower part of the Montana group of the Upper Cretaceous of the western interior of the United States. All the lots studied were obtained by members of the United States Geological Survey and are deposited in the United States National Museum. The lots include material from Montana, Wyoming, South Dakota, Utah, Colorado, and New Mexico. The writer intends, as opportunity offers, to describe the other groups of organisms represented in the collection and to discuss then the stratigraphic relations and significance of the entire assemblage of species.

The writer takes this opportunity to express his appreciation of the work of Mr. W. O. Hazard, who photographed the specimens, and of Miss Frances Wieser, who retouched the photographs and assembled the plates.

THE CEPHALOPODS AND THEIR DISTRIBUTION

The forms present in the collection have been assigned to 41 species and varieties in 12 genera, with several others not definitely determined. They are as follows:

Eutrephoceras alcesense Reeside, n. sp.
- thomi Reeside, n. sp.

Hamites novimexicanus Reeside, n. sp.
- sp. undet.

Baculites ovatus Say.
- ovatus var. haresi Reeside, n. var.
- compressus Say.
- aquilaensis Reeside, n. sp.
- aquilaensis var. separatus Reeside, n. var.
- aquilaensis var. obesus Reeside, n. var.
- asper Morton.
- thomi Reeside, n. sp.
- sp. undet.

Helicoceras rubeyi Reeside, n. sp.

Puzosia (Latidorsella) mancosensis Reeside, n. sp.

Desmoscaphites bassleri Reeside, n. gen. and sp.
- novimexicanus Reeside, n. sp.

Haresiceras placentiforme Reeside, n. gen. and sp.
- placentiforme var. parvum Reeside, n. var.
- natronense Reeside, n. sp.
- fisheri Reeside, n. sp.

Acanthoceras? montanaense Reeside, n. sp.

Scaphites hippocrepis (DeKay) Morton.
- hippocrepis var. pusillus Reeside, n. var.
- hippocrepis var. tenuis Reeside, n. var.
- hippocrepis var. crassus Reeside, n. var.
- stantoni Reeside, n. sp.
- similis Whitfield.
- aquilaensis Reeside, n. sp.
- aquilaensis var. costatus Reeside, n. var.
- aquilaensis var. nanus Reeside, n. var.
- leei Reeside, n. sp.
- leei var. parvus Reeside, n. var.
- levis Reeside, n. sp.
- sp. undet.

Aptychus of Scaphites sp.

Placenticeras meeki Boehm.
- planum Hyatt.
- syrtale (Morton) Meek.
- newberryi Hyatt.
- sancarlosense Hyatt.
- sancarlosense var. pseudosyrtale Hyatt.
- guadalupae (F. A. Roemer) Meek.
- sp. undet.

Mortoniceras omeraense Reeside, n. sp.

Peroniceras leei Reeside, n. sp.

These fossils were collected from the following formations:

Virgelle sandstone, Blackfeet Indian Reservation, northwestern Montana.

Eagle sandstone, Judith region, the Crazy Mountain region, and the Musselshell Valley, central Montana.

Eagle sandstone and Telegraph Creek formation, Billings region, lower valley of Little Horn River, and northern part of Big Horn Basin, southern Montana.

Sandstone in Steele shale about 1,000 feet below Parkman sandstone member of Mesaverde formation, upper valley of Little Horn River, Wyoming.

Upper part of Cody shale, middle and southern parts of Big Horn Basin, Wyoming.

Lower half of Pierre shale, western and northern rim of the Black Hills, Montana, Wyoming, and South Dakota.

Steele shale, at several horizons below the Parkman sandstone member of Mesaverde formation, Buffalo region, Wyoming.

Steele shale, Shannon sandstone member and beds just below it, Salt Creek oil field, Wyoming.

Steele shale, central Wyoming.

Upper part of Mancos shale, including Emery sandstone member, central and east-central Utah.

Upper part of Mancos shale, including Bluegate sandstone member, southeastern Utah.

Upper middle part of Mancos shale, Moffat County, northwestern Colorado.

Basal part of Pierre shale, northeastern Colorado.

Upper middle part of Mancos shale, northern San Juan Basin, southwestern Colorado.

Upper part of Mancos shale, southern San Juan Basin, northwestern New Mexico.

Uppermost part of Mancos shale and basal part of Mesaverde formation, upper Rio Grande valley, New Mexico.

Approximately two-thirds of the lots included in the collection contain cephalopods. The forms present at each of the localities are indicated in the accompanying table of distribution, and the generalized geographic position is shown on the map constituting Figure 1. Detailed descriptions of the individual localities are given in the following list:

Localities at which cephalopods were collected from the Eagle sandstone

No. on Figure 1	U. S. G. S. Mesozoic locality No.	Collector, year of collection, description of locality, and collector's stratigraphic assignment
1	7157	T. W. Stanton and M. R. Campbell, 1911. North Fork of Kennedy Creek, about ½ mile above junction with South Fork, Blackfeet Indian Reservation, Glacier County, Mont. Eagle [Virgelle] sandstone, near base.
5	7156	T. W. Stanton, 1911. Grade of old wagon road on Swiftcurrent Creek opposite mouth of Boulder Creek, about 5 miles west of Babb, Glacier National Park, Glacier County, Mont. Eagle [Virgelle] sandstone(?).
8	7143	T. W. Stanton and M. R. Campbell, 1911. Top of ridge south of Lake Creek, about 2 miles east of Basin Mountain and 12 miles west of Browning, Blackfeet Indian Reservation, Glacier County, Mont. Eagle [Virgelle] sandstone(?).
9	7150	T. W. Stanton and M. R. Campbell, 1911. Lot 4, sec. 6, T. 32 N., R. 12 W., Blackfeet Indian Reservation, Glacier County, Mont. Eagle [Virgelle] sandstone or later beds.
11	7152	T. W. Stanton and M. R. Campbell, 1911. Head of gorge in SE. ¼ sec. 4, T. 32 N., R. 12 W., Blackfeet Indian Reservation, Glacier County, Mont. Eagle [Virgelle] sandstone(?).
12	7153	Same as 7152, but undoubted Eagle [Virgelle] sandstone.
14	7138	T. W. Stanton and M. R. Campbell, 1911. NW. ¼ sec. 26, T. 31 N., R. 11 W., Blackfeet Indian Reservation, Pondera County, Mont. Eagle [Virgelle] sandstone(?).
19	2859	T. W. Stanton and J. B. Hatcher, 1903. Missouri River, 1 mile below mouth of Birch Creek, Fergus County, Mont. Eagle sandstone, upper bed.
26	2868	T. W. Stanton and J. B. Hatcher, 1903. Dog Creek 1½ miles above mouth, near Judith, Fergus County, Mont. Eagle sandstone.
28	2863	T. W. Stanton, 1903. Dog Creek 3 miles above mouth, Fergus County, Mont. Eagle sandstone, shale above the bed containing *Cardium speciosum*.
31	7917	C. F. Bowen, 1912. Five miles northwest of Kendall, in sec. 12, T. 18 N., R. 17 E., Fergus County, Mont. Eagle sandstone.
38	6034	T. W. Stanton and R. W. Stone, 1909. Top of hill one-fourth mile southwest of Summit station on Chicago, Milwaukee & St. Paul Ry., Meagher County, Mont. Second brown sandstone ridge beneath prominent Eagle sandstone ridge.
40	6027	T. W. Stanton, 1909. Northwest of Myersburg, in sec. 24, T. 4 N., R. 7 E., Park County, Mont. Eagle sandstone.
42	9996	C. F. Bowen, 1916. Near center of sec. 22, T. 7 N., R. 18 E., Wheatland County, Mont. Eagle sandstone(?).

Localities at which cephalopods were collected from the Eagle sandstone—Continued

No. on Figure 1	U. S. G. S. Mesozoic locality No.	Collector, year of collection, description of locality, and collector's stratigraphic assignment
43	9989	C. F. Bowen, 1916. SE. ¼ sec. 10, T. 8 N., R. 21 E., Golden Valley County, Mont. Eagle sandstone(?).
47	2936	T. W. Stanton, 1903. Willow Creek, 6 miles above old Fort Maginnis-Junction City Road, Fergus County, Mont. Eagle sandstone, near base.
49	10398	K. C. Heald, 1920. Half a mile south of Winnett, Fergus County, Mont. In shale 250 feet below Eagle sandstone.
50	7900	Harvey Bassler, 1912. Eight miles northeast of Winnett, in sec. 31, T. 16 N., R. 28 E., Fergus County, Mont. Eagle sandstone(?).
51	7901	Harvey Bassler, 1912. Nine miles northeast of Winnett, in sec. 33, T. 16 N., R. 28 E., Fergus County, Mont. Eagle sandstone.
52	7902	Harvey Bassler, 1912. Ten miles northeast of Winnett, in sec. 34, T. 16 N., R. 28 E., Fergus County, Mont. Eagle sandstone.
53	7907	C. F. Bowen and Harvey Bassler, 1912. Ten miles northeast of Winnett, in sec. 34, T. 16 N., R. 28 E., Fergus County, Mont. Eagle sandstone, near top.
54	7905	C. F. Bowen and Harvey Bassler, 1912. Cat Creek, 12 miles northeast of Winnett, in sec. 1, T. 15 N., R. 28 E., Fergus County, Mont. Eagle sandstone, near top.
56	12167	K. C. Heald and G. F. Moulton, 1922. Four miles northwest of Laurel, Yellowstone County, Mont. Telegraph Creek formation, 63 feet beneath top.
57	12168	K. C. Heald and G. F. Moulton, 1922. Four miles northwest of Laurel, Yellowstone County, Mont. Telegraph Creek formation, 55 feet beneath top.
58	12169	K. C. Heald and G. F. Moulton, 1922. Four miles northwest of Laurel, Yellowstone County, Mont. Telegraph Creek formation, 22 feet below top.
60	11208	W. T. Thom, jr., 1922. SW. ¼ sec. 26, T. 1 S., R. 27 E., Yellowstone County, Mont. Telegraph Creek formation (Elk Basin sandstone member of Hares).
62	10744	T. W. Stanton and W. T. Thom, jr., 1921. Pryor Creek, 1 mile east of site of Coburn, Yellowstone County, Mont., in sec. 31, T. 1 N., R. 29 E. Lower ledge of Eagle sandstone.
64	10746	T. W. Stanton and W. T. Thom, jr., 1921. Near cabin south of old railroad grade in sec. 28, T. 1 S., R. 30 E., 6 miles west of Toluca, Big Horn County, Mont. Soft sandstone of lower part of Eagle formation.
65	10902	W. T. Thom, jr., 1921. Sec. 27, T. 1 S., R. 30 E., Big Horn County, Mont. Elk Basin sandstone member of Telegraph Creek formation.
67	10748	T. W. Stanton and W. T. Thom, jr., 1921. Spring Creek, half a mile west of Custer Battlefield Highway, near west line of sec. 1, T. 1 S., R. 30 E., 5 miles northwest of Toluca, Big Horn County, Mont. Eagle sandstone.
68	10907	W. T. Thom, jr., 1921. Sec. 2, T. 3 S., R. 28 E., Yellowstone County, Mont. Virgelle sandstone member of Eagle sandstone.
70	9644	C. J. Hares, 1916. Sec. 30, T. 5 S., R. 23 E., 3 miles southwest of Fromberg, Carbon County, Mont. Elk Basin sandstone [member of Telegraph Creek formation].
71	4998	T. W. Stanton and C. A. Fisher, 1907. Base of bluff just west of race track at Bridger, Carbon County, Mont. Eagle sandstone.
72	5000	T. W. Stanton and C. A. Fisher, 1907. Lowest massive sandstone in ridge just west of race track, Bridger, Carbon County, Mont. Eagle sandstone.

Distribution of cephalopods of the Eagle sandstone and related formations, by localities

[T, Type locality; X, occurrence; ?, doubtful identification]

U. S. G. S. Mesozoic locality No.	7157	7156	7143	7150	7152	7153	7138	2859	2868	2863	7917	6034	6027	9996	9989	2936	10398	7900	7901	7902	7907	7905
State	Montana																					
Region	Blackfeet Indian Reservation							Judith region				Crazy Mountain region		Musselshell Valley								
Map No.	1	5	8	9	11	12	14	19	26	28	31	38	40	42	43	47	49	50	51	52	53	54
Eutrephoceras alcesense Reeside, n. sp																X						
thomi Reeside, n. sp																						
Hamites novimexicanus Reeside, n. sp																						
sp. undet																						
Baculites ovatus Say	X			X	X					X					X			X		X	X	X
ovatus var. haresi Reeside, n. var																						
compressus Say																					X	
aquilaensis Reeside, n. sp																						
aquilaensis var. separatus Reeside, n. var											X					X						
aquilaensis var. obesus Reeside, n. var																						
asper Morton										X	X											
thomi Reeside, n. sp																						
sp. undet			X			X		X	X			X	X									
Helicoceras rubeyi Reeside, n. sp																						
Puzosia (Latidorsella) mancosensis Reeside, n. sp																						
Desmoscaphites bassleri Reeside, n. gen. and sp			X				X															
novimexicanus Reeside, n. sp																						
Haresiceras placentiforme Reeside, n. gen. and sp																						
placentiforme var. parvum Reeside, n. var																						
natronense Reeside, n. sp																						
fisheri Reeside, n. sp																						
Acanthoceras? montanaense Reeside, n. sp																						
Scaphites hippocrepis (DeKay) Morton											X					X	X		X			X
hippocrepis var. pusillus Reeside, n. var																						
hippocrepis var. tenuis Reeside, n. var																						
hippocrepis var. crassus Reeside, n. var																						
stantoni Reeside, n. sp																T						X
similis Whitfield																						?
aquilaensis Reeside, n. sp																T				X		X
aquilaensis var. costatus Reeside, n. var																						
aquilaensis var. nanus Reeside, n. var																						
leei Reeside, n. sp																						
leei var. parvus Reeside, n. var																						
levis Reeside, n. sp																						
sp. undet																		X				
Aptychus of Scaphites sp																						
Placenticeras meeki Boehm																						
planum Hyatt																						
syrtale (Morton) Meek																						
newberryi Hyatt																						
sancarlosense Hyatt																						
sancarlosense var. pseudosyrtale Hyatt																						
guadalupae (Roemer) Meek																						
sp. undet		X					X							X			X				X	
Mortoniceras omeraense Reeside, n. sp																						
Peroniceras leei Reeside, n. sp																						

U. S. G. S. Mesozoic locality No.	12167	12168	12169	11208	10744	10746	10902	10748	10907	9644	4998	5000	9646	9647	9649	9663	5745	10750	10752	9916	10756	10757	12631	12633	12639
State	Montana																								
Region	Billings region									Northern Big Horn Basin							Valley of Little Horn River						Northern rim of Black Hills		
Map No.	56	57	58	60	62	64	65	67	68	70	71	72	74	75	76	79	80	81	82	83	84	85	86	87	88
Eutrephoceras alcesense Reeside, n. sp										X											X				
thomi Reeside, n. sp																					T				
Hamites novimexicanus Reeside, n. sp																									
sp. undet																					X				
Baculites ovatus Say					X					X	X				X		X				X		X	X	
ovatus var. haresi Reeside, n. var	X			X								X		T											
compressus Say											X														
aquilaensis Reeside, n. sp					X																X				
aquilaensis var. separatus Reeside, n. var									X												X				
aquilaensis var. obesus Reeside, n. var								X																	
asper Morton					X			X													X				
thomi Reeside, n. sp							T																		
sp. undet		X	X			X												X	X	X		X			
Helicoceras rubeyi Reeside, n. sp																									
Puzosia (Latidorsella) mancosensis Reeside, n. sp				X															X						
Desmoscaphites bassleri Reeside, n. gen. and sp				X			X											X	X						
novimexicanus Reeside, n. sp																									
Haresiceras placentiforme Reeside, n. gen. and sp																							X		X
placentiforme var. parvum Reeside, n. var																									
natronense Reeside, n. sp																									
fisheri Reeside, n. sp																									
Acanthoceras? montanaense Reeside, n. sp															T										
Scaphites hippocrepis (DeKay) Morton				X					X				X		X		X				X	X			X
hippocrepis var. pusillus Reeside, n. var																									
hippocrepis var. tenuis Reeside, n. var																	X								
hippocrepis var. crassus Reeside, n. var																									
stantoni Reeside, n. sp								X	X																
similis Whitfield																	X								
aquilaensis Reeside, n. sp					X												X				X		X		
aquilaensis var. costatus Reeside, n. var															X										
aquilaensis var. nanus Reeside, n. var																									
leei Reeside, n. sp																									
leei var. parvus Reeside, n. var																									
levis Reeside, n. sp																									
sp. undet																									
Aptychus of Scaphites sp																									
Placenticeras meeki Boehm														X		X					X			X	
planum Hyatt					X								X												
syrtale (Morton) Meek																	X								
newberryi Hyatt																									
sancarlosense Hyatt																									
sancarlosense var. pseudosyrtale Hyatt																									
guadalupae (Roemer) Meek																									
sp. undet										X															
Mortoniceras omeraense Reeside, n. sp																									
Peroniceras leei Reeside, n. sp																									

U. S. G. S. Mesozoic locality No.	9625	9772	9620	9756	9672	9673	9676	9755	9740	9771	9763	8922	9445	10256	10257	10258	10260	6053	5807	9605	4905	5808	5809	5810	9452	9454
State	Wyoming																									
Region	Northern Big Horn Basin													Western Big Horn Basin				Valley of Little Horn River							Southern Big Horn Basin	
Map No.	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	107	108	109	110	111	112	113	115	116	117
Eutrephoceras alcesense Reeside, n. sp	T								X			X								X					X	
thomi Reeside, n. sp																										
Hamites novimexicanus Reeside, n. sp																										
sp. undet																										
Baculites ovatus Say		X		X	X	X	X		X			X	X					X		X	X	X		X		X
ovatus var. haresi Reeside, n. var			X						X			X														
compressus Say																										
aquilaensis Reeside, n. sp								X										T	X	X						
aquilaensis var. separatus Reeside, n. var	X									X										T						
aquilaensis var. obesus Reeside, n. var			X																T							
asper Morton			X																							
thomi Reeside, n. sp																										
sp. undet																	X						X		X	
Helicoceras rubeyi Reeside, n. sp																										
Puzosia (Latidorsella) mancosensis Reeside, n. sp																										
Desmoscaphites bassleri Reeside, n. gen. and sp																										
novimexicanus Reeside, n. sp																										
Haresiceras placentiforme Reeside, n. gen. and sp	T				X				X																	
placentiforme var. parvum Reeside, n. var																										T
natronense Reeside, n. sp																										
fisheri Reeside, n. sp																										
Acanthoceras? montanaense Reeside, n. sp																										
Scaphites hippocrepis (DeKay) Morton	X				X				X	X	X	X	X	X			X	X	X	X	X					
hippocrepis var. pusillus Reeside, n. var	T																									
hippocrepis var. tenuis Reeside, n. var																		X								
hippocrepis var. crassus Reeside, n. var																					T				X	
stantoni Reeside, n. sp												X						X								
similis Whitfield	X								X																	
aquilaensis Reeside, n. sp	X								X	X					X		X	X	X							X
aquilaensis var. costatus Reeside, n. var	T																									
aquilaensis var. nanus Reeside, n. var	T									X																
leei Reeside, n. sp	T																									
leei var. parvus Reeside, n. var																										
levis Reeside, n. sp																										
sp. undet			X			X										X										
Aptychus of Scaphites sp																										
Placenticeras meeki Boehm	X				X				X	X								X								
planum Hyatt	X				X																					
syrtale (Morton) Meek																										
newberryi Hyatt																										
sancarlosense Hyatt																										
sancarlosense var. pseudosyrtale Hyatt																										
guadalupae (Roemer) Meek																										
sp. undet																							X			
Mortoniceras omeraense Reeside, n. sp																										
Peroniceras leei Reeside, n. sp																										

U. S. G. S. Mesozoic locality No.	5750	5751	5752	11999	4940	7268	10700	10701	10702	10703	10704	8995	9020	10455	10456	10465	12054	12656	12723	12726	12714	12730	11926	12695	12660	12654
State	Wyoming																									South Dakota
Region	Buffalo region						Salt Creek oil field					Central region					Western and northern rim of Black Hills									
Map No.	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	135	136	137	138	139	140	141	143	144	146
Eutrephoceras alcesense Reeside, n. sp												X			X											
thomi Reeside, n. sp																										
Hamites novimexicanus Reeside, n. sp																										
sp. undet								X	X	X				X												
Baculites ovatus Say			X				X	X					X	X			X	X		X	X			X	X	
ovatus var. haresi Reeside, n. var		X		X										X			X	X								X
compressus Say																										
aquilaensis Reeside, n. sp					X																X	X				
aquilaensis var. separatus Reeside, n. var																										
aquilaensis var. obesus Reeside, n. var																										
asper Morton							X					X							X							
thomi Reeside, n. sp																										
sp. undet	X										X												X			
Helicoceras rubeyi Reeside, n. sp															X		T									
Puzosia (Latidorsella) mancosensis Reeside, n. sp																										
Desmoscaphites bassleri Reeside, n. gen. and sp																										
novimexicanus Reeside, n. sp																										
Haresiceras placentiforme Reeside, n. gen. and sp																	X				X	X				X
placentiforme var. parvum Reeside, n. var																										
natronense Reeside, n. sp								T																		
fisheri Reeside, n. sp																										
Acanthoceras? montanaense Reeside, n. sp																										
Scaphites hippocrepis (DeKay) Morton					X		X					X	X	X	X		X	X				X				
hippocrepis var. pusillus Reeside, n. var																										
hippocrepis var. tenuis Reeside, n. var															T		X				X					
hippocrepis var. crassus Reeside, n. var																										
stantoni Reeside, n. sp																										
similis Whitfield																										
aquilaensis Reeside, n. sp												X	X			X		X	?							X
aquilaensis var. costatus Reeside, n. var																										
aquilaensis var. nanus Reeside, n. var																	X									
leei Reeside, n. sp															X											
leei var. parvus Reeside, n. var																										
levis Reeside, n. sp																										
sp. undet						X		X																		
Aptychus of Scaphites sp																					X					
Placenticeras meeki Boehm						X						X														
planum Hyatt				X														X								
syrtale (Morton) Meek																										
newberryi Hyatt																										
sancarlosense Hyatt																										
sancarlosense var. pseudosyrtale Hyatt																										
guadalupae (Roemer) Meek																										
sp. undet																										
Mortoniceras omeraense Reeside, n. sp																										
Peroniceras leei Reeside, n. sp																										

U. S. G. S. Mesozoic locality No.	11953	11954	11955	12249	13280	13324	13247	13248	13249	13250	13340	11709	11948	11712	11706	12598	10484	10434	10429	10426
State	Utah											Colorado								
Region	Central				Southeast	Eastern						Northwest				Northeast	San Juan Basin			
Map No.	147	148	149	150	151	152	154	155	156	157	160	161	162	164	166	167	168	169	170	171
Eutrephoceras alcesense Reeside, n. sp											X									
thomi Reeside, n. sp																				
Hamites novimexicanus Reeside, n. sp												X								
sp. undet																				
Baculites ovatus Say	X										X	X							X	X
ovatus var. haresi Reeside, n. var											X									
compressus Say																				
aquilaensis Reeside, n. sp				X			X			X						X				
aquilaensis var. separatus Reeside, n. var																				
aquilaensis var. obesus Reeside, n. var																				
asper Morton				X								X								
thomi Reeside, n. sp																				
sp. undet		X	X		X	X		X	X					X			X			
Helicoceras rubeyi Reeside, n. sp												X								
Puzosia (Latidorsella) mancosensis Reeside, n. sp							X													
Desmoscaphites bassleri Reeside, n. gen. and sp					X		X	X	X	X					X		X	X		
novimexicanus Reeside, n. sp																				
Haresiceras placentiforme Reeside, n. gen. and sp																				
placentiforme var. parvum Reeside, n. var																				
natronense Reeside, n. sp													X							
fisheri Reeside, n. sp											T									
Acanthoceras? montanaense Reeside, n. sp																				
Scaphites hippocrepis (DeKay) Morton						X					X	X							X	
hippocrepis var. pusillus Reeside, n. var																				
hippocrepis var. tenuis Reeside, n. var											X									
hippocrepis var. crassus Reeside, n. var																			X	
stantoni Reeside, n. sp												X								
similis Whitfield																				
aquilaensis Reeside, n. sp						X				X	X	X								
aquilaensis var. costatus Reeside, n. var																				
aquilaensis var. nanus Reeside, n. var											X									
leei Reeside, n. sp							X													
leei var. parvus Reeside, n. var																				
levis Reeside, n. sp																				
sp. undet	X																			X
Aptychus of Scaphites sp																				
Placenticeras meeki Boehm																				
planum Hyatt				X																
syrtale (Morton) Meek																				
newberryi Hyatt																				
sancarlosense Hyatt																				
sancarlosense var. pseudosyrtale Hyatt																				
guadalupae (Roemer) Meek											X									
sp. undet																				
Mortoniceras omeraense Reeside, n. sp																				
Peroniceras leei Reeside, n. sp																				

U. S. G. S. Mesozoic locality No.	10141	10142	10143	12004	12005	12005a	12006	12013	4453	7194	8000	7195	13433	7999	7188	6778	6779	7172	7175	7165	7166	7164	7180	3532	8352
State	New Mexico																								
Region	San Juan Basin								Upper Rio Grande Valley																
Map No.	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201
Eutrephoceras alcesense Reeside, n. sp																			X	X			X		
thomi Reeside, n. sp																									
Hamites novimexicanus Reeside, n. sp																					T				
sp. undet									X												X				
Baculites ovatus Say	X	X		X	X		X													X	X		X		
ovatus var. haresi Reeside, n. var		X		X	X		X		X						X	X							X		
compressus Say																									
aquilaensis Reeside, n. sp				?							X								X		X				
aquilaensis var. separatus Reeside, n. var		X																			X				
aquilaensis var. obesus Reeside, n. var									X																
asper Morton				X		X			X											X					
thomi Reeside, n. sp																									
sp. undet			X															X				X			X
Helicoceras rubeyi Reeside, n. sp																									
Puzosia (Latidorsella) mancosensis Reeside, n. sp		T																							
Desmoscaphites bassleri Reeside, n. gen. and sp	T				X			X																	
novimexicanus Reeside, n. sp																								T	
Haresiceras placentiforme Reeside, n. gen. and sp																									
placentiforme var. parvum Reeside, n. var																									
natronense Reeside, n. sp																									
fisheri Reeside, n. sp																									
Acanthoceras? montanaense Reeside, n. sp																									
Scaphites hippocrepis (DeKay) Morton				X																		X			
hippocrepis var. pusillus Reeside, n. var																									
hippocrepis var. tenuis Reeside, n. var																									X
hippocrepis var. crassus Reeside, n. var				X																			X		
stantoni Reeside, n. sp		X							X																
similis Whitfield																									
aquilaensis Reeside, n. sp		X		X																					
aquilaensis var. costatus Reeside, n. var																									
aquilaensis var. nanus Reeside, n. var				X																					
leei Reeside, n. sp							X													T			X		
leei var. parvus Reeside, n. var									T									X							
levis Reeside, n. sp																									
sp. undet																									
Aptychus of Scaphites sp																									
Placenticeras meeki Boehm														?				X		X			X	X	
planum Hyatt									X						X	X		X		X	X		X	X	
syrtale (Morton) Meek																									
newberryi Hyatt																							X		
sancarlosense Hyatt										X		X				X		X	X	X	X		X		
sancarlosense var. pseudosyrtale Hyatt																								X	
guadalupae (Roemer) Meek						X														X			X	X	
sp. undet		X									X		X				X					X			
Mortoniceras omeraense Reeside, n. sp																							T		
Peroniceras leei Reeside, n. sp																							T		

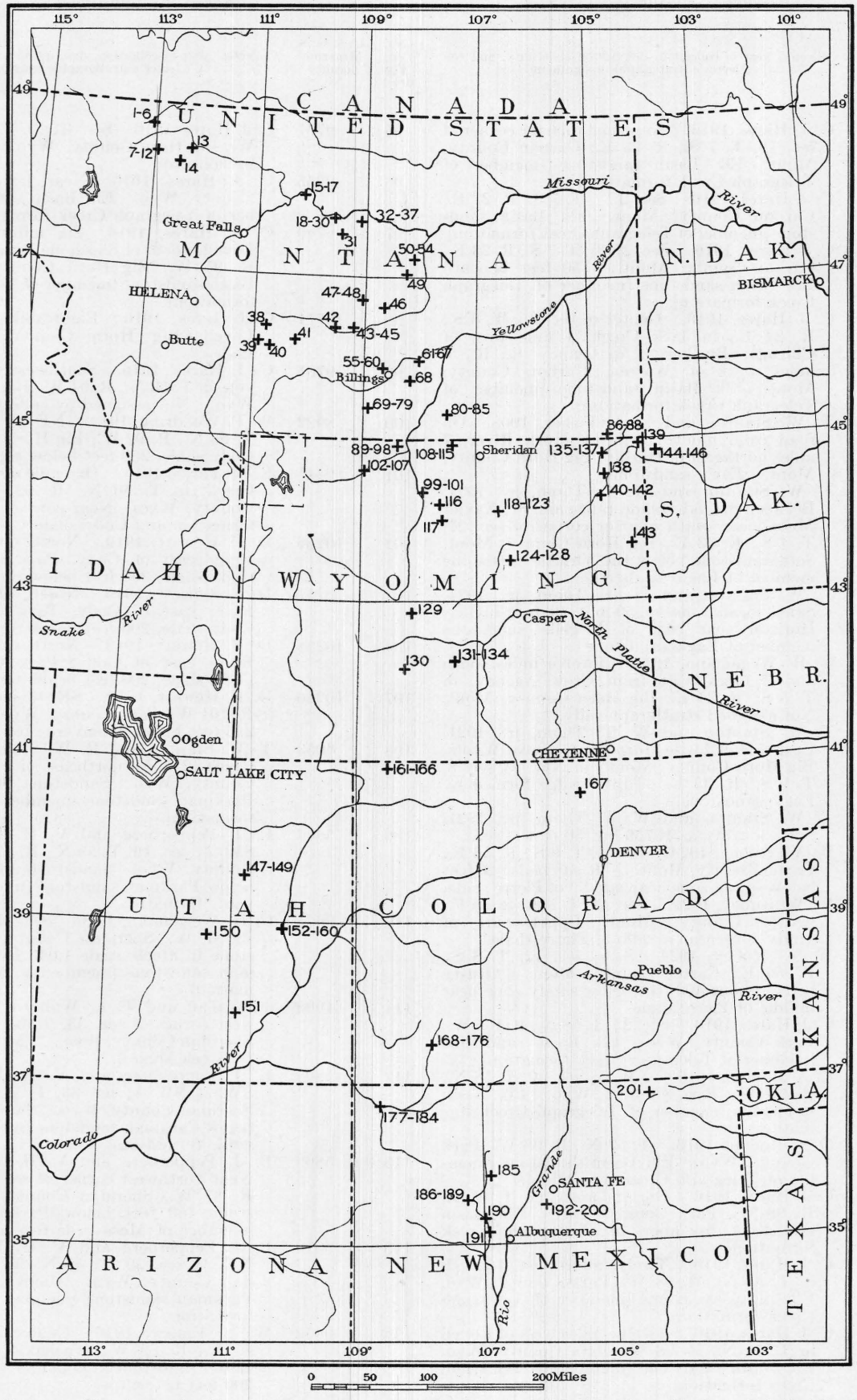


FIGURE 1.—Map showing localities of collections from the Eagle sandstone and related formations. Numbers refer to the table of distribution and to the detailed description of localities on pages 2—6

Localities at which cephalopods were collected from the Eagle sandstone—Continued

No. on Figure 1	U. S. G. S. Mesozoic locality No.	Collector, year of collection, description of locality, and collector's stratigraphic assignment
74	9646	C. J. Hares, 1916. Near east quarter corner of sec. 16, T. 7 S., R. 23 E., Carbon County, Mont. Elk Basin sandstone [member of Telegraph Creek formation].
75	9647	C. J. Hares, 1916. Sec. 2(?), T. 7 S., R. 23 E., Carbon County, Mont. Elk Basin sandstone [member of Telegraph Creek formation].
76	9649	C. J. Hares, 1916. Sec. 27(?), T. 7 S., R. 23 E., Carbon County, Mont.; 150 feet beneath Elk Basin sandstone [member of Telegraph Creek formation].
79	9663	C. J. Hares, 1916. Center of sec. 35, T. 8 S., R. 24 E., in Jack Creek, 1 mile west of Chicago, Burlington & Quincy R. R., 6 miles west of Warren, Carbon County, Mont. Elk Basin sandstone [member of Telegraph Creek formation].
80	5745	T. W. Stanton and C. A. Fisher, 1908. On road from mouth of Little Horn River, 7 miles northeast of Hardin, Big Horn County, Mont. Eagle sandstone.
81	10750	T. W. Stanton and W. T. Thom, jr., 1921. Between Shoulderblade Butte and St. Xavier Mesa, near south quarter corner of sec. 27, T. 4 S., R. 33 E., Big Horn County, Mont. Soft sandstone below the Virgelle sandstone member of Eagle sandstone.
82	10752	T. W. Stanton and W. T. Thom, jr., 1921. Same locality as 10750 but 40 feet higher. Horizon near base of Virgelle sandstone member of Eagle sandstone.
83	9916	C. H. Wegemann, 1916. Twelve miles south and 3 miles west from Crow Agency, in T. 5 S., R. 34 E., Big Horn County, Mont. Not assigned stratigraphically.
84	10756	T. W. Stanton and W. T. Thom, jr., 1921. East side of Little Horn River above Wyola, Big Horn County, Mont., in NW. ¼ sec. 8, T. 9 S., R. 35 E. Top of ridge formed by Eagle sandstone.
85	10757	T. W. Stanton and W. T. Thom, jr., 1921. Same locality as 10756 but 50 feet lower.
86	12631	W. W. Rubey, 1924. Sec. 1, T. 9 S., R. 56 E., Carter County, Mont. "Rusty beds" 20 feet below sandy zone near middle of Pierre shale.
87	12633	W. W. Rubey, 1924. Sec. 11, T. 8 S., R. 56 E., Carter County, Mont. Upper part of sandy zone near middle of Pierre shale.
88	12639	W. W. Rubey, 1924. S. ½ sec. 12, T. 8 S., R. 56 E., Carter County, Mont. "Rusty beds" about 400 feet below sandy zone near middle of Pierre shale.
89	9625	C. J. Hares, 1916. Sec. 25, T. 58 N., R. 100 W., Park County, Wyo. Elk Basin sandstone [member of Telegraph Creek formation].
90	9772	C. A. Bonine, 1916. NW. ¼ sec. 30, T. 58 N., R. 99 W., Park County, Wyo. Elk Basin sandstone [member of Telegraph Creek formation].
91	9620	C. A. Bonine, 1916. T. 57 N., R. 98 W., Park County, Wyo. Elk Basin sandstone [member of Telegraph Creek formation].
92	9756	C. J. Hares, 1916. Garland anticline, T. 56 N., R. 98 W., Park County, Wyo. Elk Basin sandstone [member of Telegraph Creek formation].
93	9672	C. J. Hares, 1916. Twelve miles west of Lovell in T. 56 N., R. 98 W., Park County, Wyo. Elk Basin sandstone [member of Telegraph Creek formation].
94	9673	C. J. Hares, 1916. Twelve miles west of Lovell in T. 56 N., R. 98 W., Park County, Wyo. Elk Basin sandstone [member of Telegraph Creek formation].

Localities at which cephalopods were collected from the Eagle sandstone—Continued

No. on Figure 1	U. S. G. S. Mesozoic locality No.	Collector, year of collection, description of locality, and collector's stratigraphic assignment
95	9767	C. J. Hares, 1916. Sec. 31(?), T. 56 N., R. 97 W., Big Horn County, Wyo. Not assigned by collector.
96	9755	C. J. Hares, 1916. Near Lovell, Big Horn County, Wyo. Elk Basin sandstone [member of Telegraph Creek formation].
97	9740	C. J. Hares, 1916. Six miles northeast of Lovell, north of Shoshone River, in T. 57 N., R. 95 W., Big Horn County, Wyo. Elk Basin sandstone [member of Telegraph Creek formation].
98	9771	C. J. Hares, 1916. Eight miles southeast of Lovell, Big Horn County, Wyo. Cody shale.
99	9763	C. J. Hares, 1916. Southwest of Sheep Canyon, in T. 53 N., R. 94 W., Big Horn County, Wyo. Not assigned by collector.
100	8922	W. P. Woodring, 1914. NE. ¼ SW. ¼ sec. 5, T. 50 N., R. 92 W., Big Horn County, Wyo. Cody shale, 250 feet below top.
101	9445	E. M. Parks, 1915. One mile north of Nowood Creek, in T. 50 N., R. 92 W., Big Horn County, Wyo. Near contact of Mesaverde formation and Cody shale.
102	10256	D. F. Hewett, 1919. North side of Shoshone River east of Cody, Park County, Wyo. Cody shale, 200 feet below top.
103	10257	D. F. Hewett, 1919. North side of Shoshone River east of Cody, Park County, Wyo. Cody shale, 200 feet below top.
104	10258	D. F. Hewett, 1919. North side of Shoshone River east of Cody, Park County, Wyo. Cody shale, 200 feet below top.
107	10260	D. F. Hewett, 1919. SE. ¼ sec. 1, T. 51 N., R. 101 W., Park County, Wyo. Cody shale, 295 feet below Mesaverde formation.
108	6053	T. W. Stanton and R. W. Stone, 1909. Pass Creek, 2 miles northeast of Slack, Sheridan County, Wyo. Sandstone 900 feet below Parkman sandstone [member of Mesaverde formation].
109	5807	L. J. Pepperberg and V. H. Barnett, 1908. SW. ¼ sec. 19, T. 58 N., R. 87 W., Sheridan County, Wyo. Sandstone about 1,000 feet below Parkman sandstone [member of Mesaverde formation].
110	9605	C. H. Wegemann, 1916. Sec. 32, T. 58 N., R. 87 W., Sheridan County, Wyo. Sandstone in Steele shale 1,040 feet below Parkman sandstone [member of Mesaverde formation].
111	4905	J. A. Taff and T. E. Williard, 1907. Southwest corner of sec. 33, T. 58 N., R. 87 W., Sheridan County, Wyo. "Middle of Pierre" (=Steele shale).
112	5808	L. J. Pepperberg and V. H. Barnett, 1908. SW. ¼ SW. ¼ sec. 33, T. 58 N., R. 87 W., Sheridan County, Wyo. Sandstone 450 feet below Parkman sandstone [member of Mesaverde formation].
113	5809	L. J. Pepperberg and V. H. Barnett, 1908. Near northwest corner of sec. 30, T. 58 N., R. 87 W., Sheridan County, Wyo. Sandstone 450 feet below Parkman sandstone [member of Mesaverde formation].
115	5810	L. J. Pepperberg and V. H. Barnett, 1908. NE. ¼ sec. 29, T. 58 N., R. 87 W., Sheridan County, Wyo. About 100 feet below Parkman sandstone [member of Mesaverde formation].
116	9452	W. B. Emery, 1915. Center of sec. 25, T. 47 N., R. 89 W., Washakie County, Wyo. Lower sandstone in upper part of Cody shale, 200 feet below top.

Localities at which cephalopods were collected from the Eagle sandstone—Continued

No. on Figure 1	U. S. G. S. Mesozoic locality No.	Collector, year of collection, description of locality, and collector's stratigraphic assignment
117	9454	C. T. Lupton, 1915. Five miles southwest of junction of Buffalo and Nowood Creeks, in T. 44 N., R. 88 W., Washakie County, Wyo. Two hundred and fifty feet below top of Cody shale.
118	5750	T. W. Stanton and C. A. Fisher, 1908. N. ½ sec. 13, T. 49 N., R. 83 W., Johnson County, Wyo. Steele shale, 300 feet below Parkman sandstone [member of Mesaverde formation].
119	5751	T. W. Stanton and C. A. Fisher, 1908. NW. ¼ sec. 13, T. 49 N., R. 83 W., Johnson County, Wyo. Steele shale, 1,400 feet below Parkman sandstone [member of Mesaverde formation].
120	5752	T. W. Stanton and C. A. Fisher, 1908. NW. ¼ sec. 13, T. 49 N., R. 83 W., Johnson County, Wyo. Steele shale.
121	11999	A. J. Collier, 1922. Sec. 20, T. 48 N., R. 82 W., Johnson County, Wyo. Parkman(?) sandstone [member of Mesaverde formation].
122	4940	T. E. Williard, 1907. Between forks of Crazy Woman Creek, ½ mile northwest of Klondike, Johnson County, Wyo. Pierre shale [Steele shale].
123	7268	C. H. Wegemann, 1911. Northwest of Ono schoolhouse, on east side of great butte about 20 miles south of Buffalo, Johnson County, Wyo. Pierre shale [Steele shale].
124	10700	J. B. Reeside, jr., 1921. Half a mile west of Castle Rock in Salt Creek oil field, Natrona County, Wyo. Steele shale, 200 feet below Shannon sandstone member.
125	10701	J. B. Reeside, jr., 1921. Same as 10700 but 150 feet below Shannon sandstone member.
126	10702	J. B. Reeside, jr., 1921. One-fourth mile west of Castle Rock, in Salt Creek oil field, Natrona County, Wyo. Steele shale, 100 feet below Shannon sandstone member.
127	10703	J. B. Reeside, jr., 1921. Same as 10702 but in lower part of Shannon sandstone member.
128	10704	J. B. Reeside, jr., 1921. Same as 10702 but near top of Shannon sandstone member.
129	8995	J. B. Reeside, jr., 1914. SE. ¼ SE. ¼ sec. 36, T. 34 N., R. 95 W., 30 miles east of Lander, Fremont County, Wyo. Steele shale.
130	9020	C. J. Hares, 1914. Alkali Creek, 48 miles southeast of Lander, in T. 28 N., R. 92 W., Fremont County, Wyo. Steele shale.
131	10455	A. E. Fath and G. F. Moulton, 1920. Southwest corner NW. ¼ sec. 12, T. 26 N., R. 90 W., Sweetwater County, Wyo. Steele shale, 1,728 feet above the base.
132	10456	A. E. Fath and C. Y. Hsieh, 1920. Sec. 7, T. 26 N., R. 88 W., near the Mahoney ranch, Carbon County, Wyo. Steele shale, 1,728 feet above base.
133	10465	N. W. Bass and C. Y. Hsieh, 1920. Near quarter corner between secs. 7 and 8, T. 26 N., R. 88 W., Carbon County, Wyo. Steele shale, 1,120 feet above base.
135	12054	W. W. Rubey, 1923. North of Mud Creek and 4 miles west of Huberts ranch on New Haven-Rocky Point Road, in NW. ¼ sec. 30, T. 56 N., R. 67 W., Crook County, Wyo. Calcareous concretions just above basal "rusty beds" of Pierre shale.
136	12656	W. W. Rubey, 1924. E. ½ sec. 26, T. 56 N., R. 68 W., Crook County, Wyo. Middle of Pierre shale, about 1,000 feet above base.
137	12723	W. W. Rubey, 1924. SE. ¼ sec. 26, T. 56 N., R. 68 W., Crook County, Wyo. Upper bed of sandy zone near middle of Pierre shale.
138	12726	W. W. Rubey, 1924. NE. ¼ sec. 32, T. 54 N., R. 67 W., Crook County, Wyo. "Rusty beds," 50 feet above base of Pierre shale.

Localities at which cephalopods were collected from the Eagle sandstone—Continued

No. on Figure 1	U. S. G. S. Mesozoic locality No.	Collector, year of collection, description of locality, and collector's stratigraphic assignment
139	12714	W. W. Rubey, 1924. Sec. 2, T. 58 N., R. 61 W., Crook County, Wyo. "Rusty beds," in lower part of Pierre shale.
140	12730	W. W. Rubey, 1924. SE. ¼ sec. 32, T. 49 N., R. 66 W., Crook County, Wyo. "Rusty beds," 175 feet above base of Pierre shale.
141	11926	W. W. Rubey, 1923. Two and one-half miles west-northwest of Thornton, Weston County, Wyo. Upper part of basal "rusty beds" of Pierre shale.
143	12695	W. W. Rubey, 1924. One and one-half miles south of Newcastle, Weston County, Wyo. Basal "rusty beds" of Pierre shale.
144	12660	W. W. Rubey, 1924. Sec. 8, T. 11 N., R. 3 E., Butte County, S. Dak. Upper part of "rusty beds" in lower part of Pierre shale.
146	12654	W. W. Rubey, 1924. W. ½ sec. 11, T. 8 S., R. 5 E., Butte County, S. Dak. "Rusty beds," 50 feet above base of Pierre shale.
147	11953	E. M. Spieker and J. B. Reeside, jr., 1923. West end of Helper, sec. 13, T. 13 S., R. 9 E., Carbon County, Utah. Mancos shale, 190 feet below top.
148	11954	E. M. Spieker and J. B. Reeside, jr., 1923. West end of Helper, sec. 13, T. 13 S., R. 9 E., Carbon County, Utah. Mancos shale, 150 feet below top.
149	11955	E. M. Spieker and J. B. Reeside, jr., 1923. Two miles west of Helper on road between Helper and Price, Carbon County, Utah. Mancos shale, 20 feet below top.
150	12249	E. M. Spieker, W. T. Thom, jr., and J. B. Reeside, jr., 1923. Two miles southwest of Emery, in sec. 18, T. 22 S., R. 6 E., Emery County, Utah. Emery sandstone member of Mancos shale, probably in lower part.
151	13280	James Gilluly and J. B. Reeside, jr., 1925. Four miles east of old Box Bar ranch, in sec. 27, T. 31 S., R. 8 E., northwest of Henry Mountains, Garfield County, Utah. Mancos shale, 545 feet below Bluegate sandstone member.
152	13324	D. J. Fisher, 1925. SW. ¼ sec. 25, T. 18 S., R. 14 E., Emery County, Utah. Upper part of Mancos shale.
154	13247	E. M. Spieker and J. B. Reeside, jr., 1925. One mile east of Desert station, Denver & Rio Grande Western R. R., Emery County, Utah. Mancos shale, 1,710 feet above base.
155	13248	Same locality as 13247 but 1,750 feet above base of Mancos shale.
156	13249	Same locality as 13247 but 1,900 feet above base of Mancos shale.
157	13250	Same locality as 13247 but 1,920 feet above base of Mancos shale.
160	13340	D. J. Fisher, 1925. NW. ¼ sec. 18, T. 21 S., R. 18 E., Emery County, Utah. Mancos shale, 800 feet below top.
161	11709	J. D. Sears, W. H. Bradley, and J. B. Reeside, jr., 1923. SW. ¼ NE. ¼ sec. 12, T. 10 N., R. 101 W., Moffat County, Colo. Mancos shale, 4,040 feet above base.
162	11948	J. D. Sears, W. H. Bradley, and J. B. Reeside, jr., 1923. SW. ¼ NE. ¼ sec. 12, T. 10 N., R. 101 W., Moffat County, Colo. Mancos shale, 3,925 feet above base.
164	11712	J. D. Sears, W. H. Bradley, and J. B. Reeside, jr., 1923. SE. ¼ sec. 2, T. 10 N., R. 101 W., Moffat County, Colo. Mancos shale, 3,700 feet above base.
166	11706	J. D. Sears, W. H. Bradley, and J. B. Reeside, jr., 1923. SW. ¼ NW. ¼ sec. 12, T. 10 N., R. 101 W., Moffat County, Colo. Mancos shale, 2,275 feet above base.

Localities at which cephalopods were collected from the Eagle sandstone—Continued

No. on Figure 1	U. S. G. S. Mesozoic locality No.	Collector, year of collection, description of locality, and collector's stratigraphic assignment
167	12598	Kirtley Mather, James Gilluly, and J. B. Reeside, jr., 1924. Head of Fossil Creek, about sec. 4, T. 6 N., R. 69 W., Larimer County, Colo. Pierre shale, 100 feet above Niobrara formation.
168	10484	J. B. Reeside, jr., 1920. NW. ¼ SE. ¼ sec. 13, T. 35 N., R. 10 W., La Plata County, Colo. Mancos shale, 1,000 feet below top.
169	10434	T. C. Hopkins, 1920. Center of sec. 13, T. 35 N., R. 10 W., La Plata County, Colo. Mancos shale, 1,000 feet below top.
170	10429	T. C. Hopkins and J. B. Reeside, jr., 1920. NE. ¼ SE. ¼ SE. ¼ sec. 24, T. 35 N., R. 10 W., La Plata County, Colo. Mancos shale, 800 feet below top.
171	10426	T. C. Hopkins and J. B. Reeside, jr., 1920. SW. ¼ NW. ¼ sec. 30, T. 35 N., R. 9 W., La Plata County, Colo. Mancos shale, 950 feet below top.
177	10141	Harvey Bassler, 1917. West foot of Hogback Mountain, 1 mile north of Shiprock Road, in sec. 32, T. 30 N., R. 16 W., San Juan County, N. Mex. Mancos shale, 280 feet below top.
178	10142	Harvey Bassler, 1917. Same locality as 10141. Mancos shale, 160 feet below top.
179	10143	Harvey Bassler, 1917. Same locality as 10141. Mancos shale, 120 feet below top.
180	12004	J. B. Reeside, jr., 1923. SW. ¼ NE. ¼ sec. 20, T. 30 N., R. 16 W., San Juan County, N. Mex. Mancos shale, 75 feet below top.
181	12005	J. B. Reeside, jr., 1923. SW. ¼ NE. ¼ sec. 20, T. 30 N., R. 16 W., San Juan County, N. Mex. Mancos shale, 190 feet below top.
182	12005A	J. B. Reeside, jr., 1923. SW. ¼ NE. ¼ sec. 20, T. 30 N., R. 16 W., San Juan County, N. Mex. Mancos shale, 90 feet below top.
183	12006	J. B. Reeside, jr., 1923. SW. ¼ NE. ¼ sec. 20, T. 30 N., R. 16 W., San Juan County, N. Mex. Mancos shale, 115 feet below top.
184	12013	J. B. Reeside, jr., 1923. NE. ¼ NE. ¼ sec. 30, T. 30 N., R. 16 W., San Juan County, N. Mex. Mancos shale, 435 feet below top.
185	4453	J. H. Gardner, 1907. Three-quarters of a mile north of Copper City, in T. 20 N., R. 1 W., Sandoval County, N. Mex. Mesaverde formation near base.
186	7194	W. T. Lee, 1911. Road from Cabezon to Raton Spring, Sandoval County, N. Mex. Transition beds between Mancos shale and Mesaverde formation.
187	8000	T. W. Stanton and W. T. Lee, 1912. Bluff north of Cabezon, Sandoval County, N. Mex. Mancos shale.
188	7195	W. T. Lee, 1911. Bluffs at Cabezon, Sandoval County, N. Mex. Upper part of Mancos shale.
189	13433	B. C. Renick, 1925. Four miles west-southwest of Cabezon, Sandoval County, N. Mex. Upper part of Mancos shale.
190	7999	T. W. Stanton and W. T. Lee, 1912. Two miles northeast of Casa Salazar, Sandoval County, N. Mex. Basal part of Mesaverde formation.
191	7188	W. T. Lee, 1911. North of San Ignacio, Bernalillo County, N. Mex. Mancos shale, 200 feet above Punta de la Mesa sandstone member.
192	6778	W. T. Lee, 1910. Hagan coal field, in T. 13 N., R. 6 E., Sandoval County, N. Mex. Base of coal-bearing sandstones (Mesaverde formation).
193	6779	W. T. Lee, 1910. Hagan coal field, in T. 13 N., R. 6 E., Sandoval County, N. Mex. Base of coal-bearing sandstone (Mesaverde formation).

Localities at which cephalopods were collected from the Eagle sandstone—Continued

No. on Figure 1	U. S. G. S. Mesozoic locality No.	Collector, year of collection, description of locality, and collector's stratigraphic assignment
194	7172	W. T. Lee, 1911. Hagan coal mine, in T. 13 N., R. 6 E., Sandoval County, N. Mex. Highest marine fossils (Mesaverde formation).
195	7175	W. T. Lee, 1911. Hagan coal field, in T. 13 N., R. 6 E., Sandoval County, N. Mex. Base of concretion zone in lower part of Mesaverde formation.
196	7165	W. T. Lee, 1911. One mile southwest of Waldo, Santa Fe County, N. Mex. Mancos shale, upper 200 feet, and Mesaverde formation, basal part.
197	7166	W. T. Lee, 1911. Three miles northwest of Waldo, Santa Fe County, N. Mex. Upper part of Mancos shale.
198	7164	W. T. Lee, 1911. Two miles southwest of Madrid, Santa Fe County, N. Mex. Mancos shale, 50 to 100 feet below top.
199	7180	W. T. Lee, 1911. Omera mine, east flank of Ortiz Mountains, Santa Fe County, N. Mex. Uppermost part of Mancos shale.
200	3532	W. T. Lee, 1905. One mile north of Galisteo Creek and 1 mile east of head of Canyon del Yeso, Santa Fe County, N. Mex. Uppermost part of Mancos shale.
201	8352	W. T. Lee, 1913. Two and one-half miles southeast of Clifton House and about 10 miles southeast of Raton, Colfax County, N. Mex. Pierre shale.

SYSTEMATIC DESCRIPTIONS

Class CEPHALOPODA

Subclass TETRABRANCHIATA

Order NAUTILOIDEA

Suborder ORTHOCHOANITES

Family NAUTILIDAE Owen

Genus EUTREPHOCERAS Hyatt

This genus includes these forms like the type *E. dekayi* which have globose ananepionic substages, increasing subsequently with great rapidity in all their diameters. The ana- and metanepionic substages are highly tachygenic and these shells have very small, and often hardly perceptible and much flattened, umbilical perforations. The siphuncles are subdorsan from the apex through the nepionic stage in some species, in others this position is not maintained, but the siphuncle is generally in the later stages near the dorsum and in the ephebic stages it is dorsad of the center.

The nepionic stage has longitudinal ridges and transverse bands, the former disappearing in adults which are smooth.

The form of the whorl in section is nephritic from an early age and changes but little throughout life.

The sutures are almost straight, having but slight ventral lobes, broad ventro-lateral saddles, lobes on the umbilical zones and deep lobes in the zone of impression. There are no annular obes at any stage of development.—Hyatt.[1]

Hyatt's remarks about the genotype are based on specimens from the later part of the Montana group of the Western Interior of the United States ("Dakotah"), whereas the true *E. dekayi* (Morton)

[1] Hyatt, Alpheus, Phylogeny of an acquired characteristic: Am. Philos. Soc. Proc., vol. 32, p. 555, 1894.

is from New Jersey. It would seem, therefore, that the real genotype is the species referred by Meek and other writers to *E. dekayi* but deserving an independent name.

From the four other genera originally assigned to the family by Hyatt *Eutrephoceras* may be distinguished most easily as follows: From *Digonioceras* Hyatt in having a nephritic rather than subtrigonal cross section of the whorl in the adult; from *Cenoceras* Hyatt in having a nephritic rather than subquadragonal cross section of the whorl in the adult; from *Cymatoceras* Hyatt in the lack of broad ribs on the shell and in the straighter suture; from *Nautilus* Linnaeus in the broad outline of all the later stages, the general position of the siphuncle dorsad of the middle of the septum, and the straighter sutures.

The writer has examined a number of specimens of *Eutrephoceras* of Cretaceous age. The sutures are very much alike in all of them; the surface of all the larger specimens, where preserved, is nearly smooth; and the position of the siphuncle is very much the same in all. The conspicuous differences between them are in the form of the cross section of the whorl and the size of the shell. These differences seem to offer a valid basis for separation into species, and, so far as the writer's material goes, form and size are constant within each of considerable groups of specimens of the same age and restricted geographic distribution and differ between the respective groups. It is likely that if complete and well-preserved shells were available numerous other differences would be found, but it seems desirable to distinguish the groups that can be recognized now, even though some of them are difficult to separate on the basis of such details as are commonly preserved.

Eutrephoceras alcesense Reeside, n. sp.

Plates 1–2; Plate 3, Figures 1–5; Plate 5, Figures 1–2

Shell attaining large size, the type having a maximum diameter of 240 millimeters; stout, well rounded throughout life. Young stages globose, but whorl becomes relatively higher in the later stages. Cross section of whorl nephritic in outline at all stages of growth, changing but little; greatest width at about the middle of the height of the cross section; proportion of height to breadth about as 6 to 7. Siphuncle nearly central or dorso-central. Aperture has broad rounded lateral ears and broad rounded ventral sinus. Umbilicus closed.

Surface of shell not retained in most specimens. In one specimen, however, at a diameter of about 80 millimeters fine but distinct crenulated longitudinal lines are present on the venter and coarser lines of growth over the rest of the whorl. Another broken specimen, which would have a diameter of 170 millimeters if complete, shows the same ornamentation.

Sutures are those of the genus—nearly straight with shallow ventral lobe, ventrolateral saddles, and umbilical lobes.

Eutrephoceras alcesense differs from the later species called by Meek [2] *Nautilus dekayi* Morton (the genotype of *Eutrephoceras*) in size, for it attains nearly twice the diameter of Meek's form; and in proportions, for the ratio of height to width of the cross section of the whorl is as 6 to 7 in *E. alcesense* and 3 to 4 in Meek's form. It differs from *E. dekayi* (Morton), as refigured by Whitfield,[3] from the Navesink and Redbank formations of New Jersey, in its larger size and in proportions, the ratio of height to width of the cross section of the whorl in the eastern species being as 3 to 4. From *E. bryani* (Gabb),[4] of the Vincentown sand in New Jersey, it differs in its larger size and in proportions, the ratio of height to width of whorl in *E. bryani* being as 8 to 7. An unnamed species in the Ripley formation of Alabama is consistently much smaller. Another from the Navarro formation of Texas has a persistently flattened venter. A third from the *Mortoniceras texanum* zone in the Gulf region[5] is stouter and even larger than *E. alcesense.*

The specific name is derived from the occurrence of the type in Elk Basin, in southern Montana (*alces*, elk).

Occurrence: At 14 localities—Eagle sandstone, Musselshell Valley, and Little Horn Valley, Montana; Elk Basin sandstone member of Telegraph Creek formation and upper part of Cody shale, Big Horn Basin, Montana and Wyoming; Steele shale, central Wyoming; uppermost part of Mancos shale, eastern-central Utah; uppermost part of Mancos shale and basal Mesaverde formation, upper Rio Grande region, New Mexico. (See table, p. 2.)

Eutrephoceras thomi Reeside, n. sp.

Plate 44, Figures 1, 2

Shell attaining large size, the type having a maximum diameter of 220 millimeters, very stout, and well rounded. Earlier stages not seen. Cross section broadly nephritic, greatest width of cross section near the umbilicus; proportion of height to breadth about as 5 to 6½. Siphuncle not seen. Aperture has broadly rounded lateral ears and broad, rounded ventral sinus. Umbilicus closed.

Shell substance mostly preserved on the type specimen. Surface shows only the growth lines parallel to the aperture and on the venter faint crowded longitudinal lines.

Sutures are those of the genus.

[2] 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.

[3] Whitfield, R. P., Gasteropoda and Cephalopoda of the Raritan clays and Greensand marls of New Jersey: U. S. Geol. Survey Mon. 18, p. 243, pl. 37, figs. 1–6; pl. 38, figs. 1–4, 1892.

[4] Idem, p. 244, pl. 38, figs. 5, 6.

[5] Stephenson, L. W., Cretaceous deposits of the eastern Gulf region: U. S. Geol. Survey Prof. Paper 81, p. 29, 1914.

Eutrephoceras thomi differs from its associate *E. alcesense* in the form of the cross section. From the other species with which *E. alcesense* was compared it differs in much the same details.

The species is named for Mr. W. T. Thom, jr.

Occurrence: Eagle sandstone in NW. ¼ sec. 8, T. 9 S., R. 35 E., Big Horn County, Montana.

Order AMMONOIDEA

Suborder EXTRASIPHONATA

Family LYTOCERATIDAE

Subfamily MACROSCAPHITINAE

Genus HAMITES Parkinson

The name *Hamites* in its wider sense has been applied to a group of aberrant ammonites that have as a common feature an elongated tubular shell with both straight and curved parts. Many authors consider it to include such forms as *Ptychoceras* and *Diptychoceras*, with the whorls in contact. Others prefer to include only forms in which the whorls are not in contact at any stage. Even with this less general conception a considerable number of subgenera have been proposed, based on the form of the younger stages, the number of curves present in the shell, etc. In the extreme view *Hamites* is limited to certain Albian species, and other generic names are applied to the other groups. Unfortunately, few specimens are complete enough to refer definitely to these groups, and in fact it is difficult at times to distinguish fragments belonging to groups quite distinct from *Hamites*, as, for example, some of the forms of *Helicoceras*.

In the broad sense, accepted here, *Hamites* is applied to such ammonites as have three or four straight parts connected by two or three curved parts that form arcs of 180°, the whole shell lying on one plane with whorls widely separated. The ribs are commonly simple and pass without interruption entirely around the shell; they are usually not tuberculate. The suture has two strongly incised lateral lobes.

The specimens in hand would all fall within this definition of *Hamites* on the basis of sculpture, though none are complete enough to give more than a suggestion of the form of the entire shell.

Hamites novimexicanus Reeside, n. sp.

Plate 4, Figures 1–6

This species is represented by a number of fragments, of which the two best are figured and the larger taken as the type. It has an elliptical cross section and is somewhat flattened on the inner or antisiphonal side of the whorl. The ribs pass entirely around the whorl and are all simple and without tubercles. They are sharp, moderately high, and separated by concave interspaces perhaps twice as wide as the ribs. The ribs are gently inclined to the axis of the whorl and are very weak on the inner side but increase to a maximum on the outer or siphonal side. The cross section of the smaller end of the type measures 21 by 16 millimeters, and there are nine ribs in 30 millimeters of the outer margin. Sutures not seen.

Species of *Hamites* very similar to this in form and sculpture have been found at a number of horizons in the Cretaceous. The material usually available affords so little on which to base valid comparisons that the writer has hesitated to add another name to the list. However, the convenience and usefulness of a name in future discussions is undoubted, and for that reason one is here assigned.

Occurrence: Upper part of Mancos shale, Moffat County, Colorado, and Santa Fe County, New Mexico. (See table, p. 2.)

Hamites sp. undet.

Plate 3, Figures 6, 7; Plate 4, Figures 7–11

Fragments from six localities indicate the presence of several species of *Hamites* distinct from *H. novimexicanus* Reeside, n. sp. Inasmuch as the specimens offer only small parts of the shell, and species with very similar characters have a long range, it has seemed inadvisable to attempt to name the fragments in hand.

One fragment with septa obscurely preserved has a broadly oval cross section and broad flattened ribs with narrow interspaces. (See pl. 4, fig. 11.) The septa show two bifid lateral lobes and are moderately incised. This specimen is from the same locality as *Hamites novimexicanus* Reeside, n. sp., and might be the septate part of that species, though the sculpture and cross section are quite distinct.

Several fragments, with and without septa, have a round-oval cross section and sculpture of close-set, rather rounded ribs. (See pl. 4, figs. 9, 10.) The septate and unseptate specimens do not differ in sculpture. These specimens differ from *H. novimexicanus* in the form of the cross section and in the ribs, which are more rounded. The difference in sculpture is apparently not due to the state of preservation of the specimens.

A third type is represented by fragments with high, sharp, relatively distant ribs and a nearly circular cross section. (See pl. 3, figs. 6, 7; pl. 4, figs. 7, 8.) No septa were observed. These specimens in some respects suggest large individuals of *Helicoceras rubeyi* Reeside but differ in their larger size and proportionately closer set ribs.

Occurrence: At 6 localities—Eagle sandstone, Little Horn Valley, Montana; Steele shale, Salt Creek oil field, central Wyoming; uppermost part of Mancos shale and basal part of Mesaverde formation, upper Rio Grande valley, New Mexico. (See table, p. 2.)

Genus BACULITES Lamarck

Shell with minute, closely coiled initial stage but quickly becoming straight and assuming the form of a staff, which with increasing age increases slowly in diameter. Cross section subtriangular, oval, or subcircular, though usually more or less compressed laterally. Living chamber large, aperture with long, straight, rounded extension on the siphonal side and lateral sinuses. Surface smooth or with low rounded ribs that are parallel to the aperture and as a rule are distinct only on the flanks, or with low rounded nodes on the flanks. Suture has generally six saddles and six lobes; saddles bifid; lobes, except the antisiphonal lobe, bifid.

Baculites has been commonly extended to include several groups with rather different characters. In its strictest sense it includes only forms with the features of the genotype *B. vertebralis* Lamarck, as given above, and excludes the forms like *B. baculoides* Mantell with laterally directed aperture and regularly disposed ridges on the interior of the shell (= *Cyrtochilus* Meek, *Scipionoceras* Hyatt, *Lechites* Nowak) and forms like *B. neocomiensis* D'Orbigny with four lobes and saddles in the suture (= *Bochianites* Lory). Whether *B. paradoxus* Pervinquière,[6] with five lobes and saddles in the suture, should be included may be questioned. Spath [7] has proposed to apply *Euhomaloceras* to forms like *B. incurvatus* Dujardin and *Eubaculites* to forms like *B. vagina* Forbes, both usually admitted into the genus *Baculites*. In its strictest sense *Baculites* is an Upper Cretaceous genus.

The details of the earliest stages of *Baculites* were unknown until late years but have been described for at least two species, *B. compressus* Say [8] and *B. chicoensis* Trask.[9] Specimens of the early stages of *B. ovatus* Say are figured with this paper. (See pl. 7, figs. 6–8.)

Baculites ovatus Say

Plate 5, Figures 12, 13; Plate 6, Figures 1–4; Plate 7, Figures 1–8

1820. *Baculites ovata* Say, Am. Jour. Sci., 1st ser., vol. 2, p. 41.
1828. *Baculites ovata* Say. Morton, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 6, p. 89, pl. 5, figs. 5, 6.
1830. *Baculites ovatus* Say. Morton, Am. Jour. Sci., 1st ser., vol. 17, p. 280; vol. 18, p. 249, pl. 1, figs. 6–8.
1830. *Baculites ovatus* Say. Morton, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 6, p. 196, pl. 8, figs. 6–8.
1834. *Baculites ovatus* Say. Morton, Synopsis of the organic remains of the Cretaceous group in the United States, p. 42, pl. 1, figs. 6–8.
1853. *Baculites ovatus* Say. Marcou, Explanatory text to geologic map of United States and British Provinces of North America, p. 46, pl. 7, fig. 5.
1856. *Baculites ovatus* Say. Hall and Meek, Am. Acad. Arts and Sci. Mem., new ser., vol. 5, p. 399, pl. 5, figs. 1a–c; pl. 6, figs. 1–7.
1875. *Baculites ovatus* Say. White, U. S. Geog. Surveys W. 100th Mer. Rept., vol. 4, p. 199, pl. 19, figs. 4a, 5a–c (not figs. 4b, c).
1876. *Baculites ovatus* Say. Meek, U. S. Geol. Survey Terr. Rept., vol. 9, p. 394, pl. 20, figs. 1a–b, 2a–d.
1889. *Baculites ovatus* Say. Whiteaves, Contr. Can. Paleontology, vol. 1, p. 181.
1892. *Baculites ovatus* Say. Whitfield, U. S. Geol. Survey Mon. 18, p. 275, pl. 46, figs. 3–9.
1898. *Baculites ovatus* Say. Logan, Kansas Univ. Geol. Survey, vol. 4, p. 509, pl. 109, fig. 3.
1907. *Baculites ovatus* Say. Weller, New Jersey Geol. Survey, Paleontology, vol. 4, p. 821, pl. 109, fig. 5.
1910. *Baculites ovatus* Say. Grabau and Shimer, North American index fossils, p. 181, figs. 1437, 1438.
1916. *Baculites ovatus* Say. Gardner, Maryland Geol. Survey, Upper Cretaceous, pp. 375–377, pl. 12, figs. 2, 3.

Morton says of this species:

Transversely suboval, with semielliptical lateral undulations; septa six-lobed, and a smaller one behind; lobes of the superior faces of the septa three on each side, with a minute one between each, dentated at their edges. * * * The above description is derived from Mr. Say, excepting the undulatory sides, which is obvious in all the more perfect specimens I have seen. * * * In other instances these undulations are scarcely perceptible, probably owing to attrition.

Meek's description is in part as follows:

Shell attaining a large size, elongated and rather gradually tapering; section ovate, the antisiphonal side being more broadly rounded than the opposite (or very rarely a little flattened?); aperture of the same form as the transverse section; extension of the lip on the siphonal side long, tapering, and narrowly rounded at the end; lateral sinuses of same deep, and about half to one-third the greater diameter of the shell; antisiphonal margin of the lip prominently rounded in outline; surface of young and medium-sized specimens generally nearly smooth, while the nonseptate part of the adult shell is provided with broad, undefined, obliquely transverse ridges, or undulations, that arch parallel to the obscure lines of growth and become nearly or quite obsolete as they approach the siphonal side, on which they are rarely represented by very small, irregular ridges, scarcely distinct from the marks of growth.

Septa moderately closely arranged, or sometimes a little crowded; siphonal lobe nearly twice as wide as long and provided with two large terminal widely separated, more or less spreading branches * * * first lateral sinus about as wide as long but narrower than the siphonal lobe and divided at the free end into two short, nearly equal branches * * * first lateral lobe oblong-ovate, being longer and narrower than the siphonal lobe and deeply divided at its end into two very nearly equal branches, with each from four to five spreading and digitate subdivisions, in part generally so arranged as to give the main branches a tripartite appearance at their extremities; second lateral sinus of nearly same size as first, and * * * similarly subdivided; second lateral lobe broader and shorter than the first * * * third lateral sinus much smaller than either of the others * * * antisiphonal lobe (ventral lobe of D'Orbigny and others) scarcely as large as one of the terminal branches of the siphonal lobe, longer than wide, with three or four small lateral branches, and normally a trifid free extremity.

Most of the specimens referred to this species, the most abundant baculite of the fauna, are typical in

[6] Pervinquière, Léon, Études de paléontologie tunisienne, I, Céphalopodes des terrains secondaires, p. 94, pl. 4, figs. 10, 11, 1907.

[7] Spath, L. F., On new ammonites from the English chalk: Geol. Mag., vol. 61, p. 80, 1926.

[8] Brown, A. P., On the young of *Baculites compressus* Say: Acad. Nat. Sci. Philadelphia Proc. for 1891, pp. 159–160, 1891; The development of the shell in the coiled stage of *Baculites compressus* Say: Idem for 1892, p. 136, pl. 9, 1892.

[9] Smith, J. P., The larval coil of *Baculites:* Am. Naturalist, vol. 35, pp. 39–49, 1901.

form, sculpture, and suture, though none seem to reach the size of many specimens occurring in later beds of the Montana group. None of the specimens in hand reach a greater size than 50 millimeters in diameter and most of them are smaller, whereas many specimens from later horizons reach a diameter of 80 millimeters. The collections include a number of specimens of the initial coiled stage and the early part of the straight shell. These young forms agree entirely with those described for other species of the genus.

The species may be recognized by its well-rounded cross section; smooth or, in the latest stages, obscurely undulated flanks; large size; and relatively simple, little-incised suture. It differs from *B. compressus* Say, its frequent associate at higher horizons in the Montana group, in its stouter shell, with ovate cross section and much less digitate suture; from *B. aquilaensis* Reeside in possessing smooth early stages, only obscure undulations on the later stages, and a stouter form and in attaining a larger size. *B. aquilaensis* var. *obesus* Reeside has the stout shell of *B. ovatus* but all the other characters of *B. aquilaensis*. The writer has observed no specimens in this fauna with the characters of *B. ovatus* var. *baculus* Meek.[10]

Occurrence: At 56 localities—Virgelle sandstone of northwestern Montana; Eagle sandstone of central and southern Montana; Telegraph Creek formation of northern Big Horn Basin, Montana and Wyoming; lower half of Pierre shale of western Black Hills region; upper part of Cody shale of Big Horn Basin, Wyoming; Steele shale of region just east of Big Horn Mountains, Wyoming; Steele shale of central Wyoming; upper part of Mancos shale, central Utah; upper part of Mancos shale, northwestern Colorado; upper part of Mancos shale, San Juan Basin, Colorado and New Mexico; uppermost part of Mancos shale, upper Rio Grande valley, New Mexico. (See table, p. 2.) Also occurs abundantly in the later parts of the Montana group up to the base of the Fox Hills sandstone and in the later Cretaceous formations of the Atlantic and Gulf Coastal Plain.

Baculites ovatus Say var. haresi Reeside, n. var.

Plate 6, Figures 5–10; Plate 7, Figures 9, 10

1833. *Baculites compressa* Say. Morton, Am. Jour. Sci., 1st ser., vol. 23, p. 291; vol. 24, pl. 9, fig. 1.
1834. *Baculites compressus* Say. Morton, Synopsis of the organic remains of the Cretaceous group in the United States, p. 43, pl. 9, fig. 1.
1892. *Baculites compressus* Say. Whitfield, U. S. Geol. Survey Mon. 18, p. 277, pl. 46, figs. 1, 2.
1896. *Baculites compressus* Say. Gilbert, U. S. Geol. Survey Seventeenth Ann. Rept., pt. 2, pl. 62.

This variety differs from the typical form only in possessing a compressed shell. It has the venter and dorsum rounded, as in *B. ovatus* proper, and also the relatively simple suture and smooth shell. It differs from *B. compressus* in lacking the tendency to taper toward the siphonal side and in the details of the suture, though very rare individuals may be considered as a connecting link between *B. ovatus* and *B. compressus*. It differs from *B. aquilaensis* in possessing a smooth shell and attaining a large size, but it may be considered as connecting, through individuals with somewhat stronger sculpture, *B. ovatus* and *B. aquilaensis*.

Many specimens recorded as *B. compressus* Say in the literature really belong here, for they have the well-rounded cross section and the suture of this variety rather than the tapered cross section and the suture of *B. compressus*.

This variety is named for Mr. C. J. Hares, who collected the type specimen.

Occurrence: At 21 localities—Telegraph Creek formation, Billings region, Montana; Eagle sandstone and Telegraph formation, northern Big Horn Basin, Montana and Wyoming; Steele shale, Buffalo region, Wyoming; lower part of Pierre shale, western and northern rim of Black Hills; Steele shale, central Wyoming; upper part of Mancos shale, east-central Utah; upper part of Mancos shale, San Juan Basin and upper Rio Grande valley, New Mexico. (See table, p. 2.)

Baculites compressus Say

Plate 9, Figures 1–5

1820. *Baculites compressa* Say, Am. Jour. Sci., 1st ser., vol. 2, pp. 41–42.
1854. *Baculites compressus* Say. Hall and Meek, Am. Acad. Arts and Sci. Mem., new ser., vol. 5, pp. 400–402, pl. 5, figs. 2a, b; pl. 6, figs. 8, 9.
1876. *Baculites compressus* Say. Meek, U. S. Geol. Survey Terr. Rept., vol. 9, pp. 400–404, pl. 20, figs. 3 a–c; text figs. 55, 56.
1891. *Baculites compressus* Say. Brown, Acad. Nat. Sci. Philadelphia Proc. [vol. 43], pp. 159, 160, text figs. 1–6.
1891. *Baculites compressus* Say. Brown, Nautilus, vol. 5, p. 19, text figs. 1–6.
1892. *Baculites compressus* Say. Brown, Acad. Nat. Sci. Philadelphia Proc. [vol. 44], pp. 136–141, pl. 9.
1910. *Baculites compressus* Say. Grabau and Shimer, North American index fossils, p. 181, figs. 1435, 1436.
1914. *Baculites compressus* Say. Smith, Acceleration of development in fossil Cephalopoda, Leland Stanford Junior Univ. Pub., Univ. ser., pl. 14, fig. 13.
Not 1833. *Baculites compressa* Say. Morton, Am. Jour. Sci., 1st ser., vol. 23, p. 291; vol. 24, pl. 9, fig. 1.
Not 1834. *Baculites compressus* Say. Morton, Synopsis of the organic remains of the Cretaceous group in the United States, p. 43, pl. 9, fig. 1.
Not 1892. *Baculites compressus* Say. Whitfield, U. S. Geol. Survey Mon. 18, p. 277, pl. 46, figs. 1, 2.

Say's original description is as follows:

Elongated, much compressed; transverse section oblong-oval, narrowed to each end; lobes dilated, dentated on their edges, with from three to five sutures on each side and a profound one at tip. * * * The description is taken from two fragments

[10] Meek, F. B., Invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. Survey Terr. Rept., vol. 9, p. 397, text figs. 51, 52, 1876.

in the collection of the Academy of Natural Sciences (of Philadelphia), which were brought from the Missouri, one by Messrs. Lewis and Clark and the other by Mr. Thomas Nuttall.

This description, unaccompanied by a figure, is scarcely adequate to define the species. Morton in 1833 quoted Say's original description and figured a specimen, of which he says:

> This beautiful fossil was described by Mr. Say * * * but is now figured for the first time from a fine specimen in possession of my friend, John P. Wetherill, Esq., and brought from the Great Bend of the Missouri River.

Again in 1834 Morton quoted Say's description and published the same figure with the statement that "the name *compressus* * * * is sufficiently descriptive, as will be seen by reference to the accompanying figure, which was drawn from a specimen lent me by J. P. Wetherill, Esq."

From the statements by Say and Morton it is logical to conclude that Morton did not have Say's specimens, and that inasmuch as Morton used Say's original specimen of *B. ovatus* Say to illustrate that species he would have used the original specimens of *B. compressus* if they had been available. It is therefore unlikely that Whitfield was correct in the following statement:

> Among the specimens sent me from the Academy of Natural Sciences at Philadelphia as New Jersey fossils, I find the type specimen of this species (*B. compressus* Say), used by Mr. Say in his original description and afterward figured by Dr. S. G. Morton. * * * Mr. Say says that the specimen came to him from the collection made by Mr. Nuttall; that it was washed out from the banks of the Missouri River between White River and the Mandan settlements, as stated by Dr. Morton. The specimen was owned by and loaned to Dr. Morton by J. P. Wetherill, Esq., and I find his initials still on it in ink.

The catalog of types[11] held by the Academy of Natural Sciences of Philadelphia lists only the specimen figured by Morton and does not attribute this specimen to Say, as it does the type of *B. ovatus* Say also held by the academy. It seems to the writer legitimate to infer that the type of *B. compressus* is lost.

Hall and Meek in 1854 described and figured in detail what they believed to be *B. compressus* Say. Meek again in 1876 gave a very full description of the same or similar material. Meek's description is in part as follows:

> Shell attaining a large size, rather rapidly tapering, particularly in the young, or near the smaller extremity of adult specimens, strongly compressed laterally in medium-sized examples, but more convex in the young and toward the larger extremity of large adults; non-septate portion of fully developed specimens, provided with large broad lateral undulations; lines of growth generally obscure; siphonal margin sometimes crossed by small undefined wrinkles; transverse section, like the outline of the aperture, varying with size and age, being ovate in very small specimens, strongly compressed in medium-sized examples and proportionately more broadly ovate in the large adult.
>
> Septa usually crowded, and with lobes and sinuses deeply divided into slender branches; siphonal lobe nearly twice as wide as long and provided with two widely separated tripartite and digitate terminal branches and one smaller digitate lateral branch on each side; first lateral sinus as long as the siphonal lobe but not much more than half as wide and very deeply divided * * * first lateral lobe longer than the siphonal lobe and about half as wide, with two small, parallel, sharply digitate terminal branches, standing, as it were, on a stem formed by the very narrow body * * * second lateral sinus usually a little longer but otherwise very similar to the first; second lateral lobe shorter and broader than the first * * * third lateral sinus usually not larger than one of the main terminal branches of the others * * * antisiphonal lobe generally only about half as long as the second lateral and much narrower.

It is very clear that *B. compressus* Say of Morton and Whitfield is not *B. compressus* Say of Hall and Meek. Inasmuch as Say's original description is inadequate and his type specimens are unavailable, and as Hall and Meek had abundant material from the region where Say's specimen was obtained, the writer prefers to follow Hall and Meek's clear conception of the species and consider Morton's specimen as the compressed variety *haresi* Reeside, n. var., of *B. ovatus* Say.

Baculites compressus, in the sense in which the name is used in this paper, may be easily recognized by the form of the cross section, compressed, tapered toward the siphonal side; by the suture, deeply digitate, with the two terminal branches of the first lateral lobe supported on a slender stem; and by the unsculptured shell, smooth except in the largest specimens. These characteristics are persistent in all the specimens the writer has examined, chiefly from beds higher than the *Scaphites hippocrepis* zone. Even in specimens as small as 10 millimeters in diameter, such as those contained in the collection from which Meek's figured specimens came, the form and suture of the species are distinct and differ sharply from those of the equivalent stages of *B. ovatus* and *B. aquilaensis*. Many of the specimens assigned in the literature to *B. compressus* lack the tapered cross section and the peculiar suture of the species and are really the compressed variety *haresi* Reeside of *B. ovatus*, with which species they agree in the rounded-oval cross section and in suture. An examination of a large number of specimens, from various horizons, preserved in the collections in the United States National Museum showed but one specimen combining the evenly rounded form of *B. ovatus* and the suture of *B. compressus*.

The collections from the *Scaphites hippocrepis* zone in the writer's hands contain only one specimen with the form and suture of this species. Another specimen is unseptate but has the characteristic form and is assigned to it. The species is therefore one of the

[11] Johnson, C. W., Annotated list of the types of invertebrate Cretaceous fossils in the collection of the Academy of Natural Sciences, Philadelphia: Acad. Nat. Sci. Philadelphia Proc., vol. 57, pp. 4–28, 1905.

rarest members of the fauna—so rare that question might well be raised as to the authenticity of the specimens in hand. There is no means of knowing at this time, however, whether these specimens really came from the zone containing the Eagle fauna, and it must be left for future experience to determine whether *B. compressus* actually does belong to the Eagle fauna or is restricted to later faunas.

Occurrence: At 2 localities—Eagle sandstone, northeast of Winnett, Fergus County, and northern Big Horn Basin, Montana. Abundant in the later formations of the Montana group up to the base of the Fox Hills sandstone. (See table, p. 2.)

Baculites aquilaensis Reeside, n. sp.

Plate 6, Figures 11–13; Plate 8, Figures 1–14

1849. *Baculites anceps* Lamarck. Roemer, Texas, p. 416.
1852. *Baculites anceps* Lamarck. Roemer, Kreidebildungen von Texas, pp. 36, 37, pl. 2, figs. 3a–g.
1861. *Baculites anceps* [part] Gabb, Acad. Nat. Sci. Philadelphia Proc. for 1861, p. 395. (Not pl. 3, figs. 2, 3, 4.)
1903. *Baculites anceps* Lamarck. Johnson, Columbia Univ. School of Mines Quart., vol. 24, p. 132, pl. 11, figs. 30a–c.
1904. ?*Baculites anceps* Lamarck. Lasswitz, Geol. und Pal. Abh., n. ser., vol. 6, p. 235.

Shell of medium size, rather rapidly tapering for the genus, with compressed-ovate cross section. Surface shows numerous well-marked but rounded arcuate ribs or undulations on the antisiphonal half of the sides. These ribs appear at a comparatively early stage (at as small a diameter as 10 millimeters) and persist with increasing distinctness through all the later stages. Suture moderately incised but in its proportions quite like that of many specimens of *B. ovatus* Say.

Baculites aquilaensis is marked by the early appearance and distinctness of the arcuate ribs, its compressed form in cross section, and its medium size in even the largest individuals. It differs, among the associated species, from *B. ovatus* Say in its smaller size, compressed form, stronger sculpture, and the early appearance of the sculpture; from *B. compressus* Say in its smaller size, less tapered cross section, relatively strong sculpture, and the details of the suture; from *B. asper* Morton in its close-set arcuate ribs and its compressed form. It is connected with *B. ovatus* through *B. ovatus* var. *haresi* Reeside and *B. aquilaensis* var. *obesus* Reeside and with *B. asper* through *B. aquilaensis* var. *separatus* Reeside.

Baculites aquilaensis belongs to a group of species with strong arcuate lateral elevations commonly identified since Roemer's time as *B. anceps* Lamarck, a species characteristic of a very late zone of the European Cretaceous. It is doubtful, however, whether any of the American forms are really referable to this species. The writer has not been able to gain a clear idea of the real characters of the European form, inasmuch as the literature shows a considerable variation in the concept of the species held by European students. In America at least three related though distinct species have been designated *B. anceps*—shells with a carinate siphonal margin, as in *B. carinatus* Morton; shells with broadly rounded cross section and close-set ribs, as in *B. anceps* var. *obtusus* Meek; and such shells as *B. aquilaensis* with compressed ovate cross section and close-set ribs. Some authors have extended the name to include also under *B. anceps* such shells with distant circumscribed nodes and stout cross section as are obviously *B. asper* Morton. The writer believes these distinct groups deserve separate specific names.

The specific name is derived from the occurrence of the species in the Eagle sandstone of Montana (*aquila*, eagle).

Occurrence: At 15 localities—Eagle sandstone, Billings region, Montana; Steele shale, Little Horn Valley, Wyoming; Telegraph Creek formation, northern Big Horn Basin; Steele shale, Buffalo region, Wyoming; lower part of Pierre shale, western rim of Black Hills, Wyoming; Emery sandstone member of Mancos shale, central Utah; upper part of Mancos shale, east-central Utah; basal part of Pierre shale, foothill region, eastern Colorado; upper part of Mancos shale, San Juan Basin and upper Rio Grande valley, New Mexico. (See table, p. 2.)

Baculites aquilaensis var. separatus Reeside, n. var.

Plate 8, Figures 15–21; Plate 9, Figures 6–15; Plate 45, Figures 5, 6

A number of specimens differ from the typical form in showing a tendency toward rounded nodes instead of arcuate undulations on the sides and in having these nodes more distantly placed on the shell. These specimens therefore approach in some measure *B. asper* Morton, though differing from it in having the nodes somewhat arcuate and not as widely spaced and in having a much more compressed shell. The suture is like those of the type of the species and *B. ovatus*.

Occurrence: At 8 localities—Eagle sandstone, Judith region, Musselshell Valley, Billings region, Little Horn Valley, Montana; upper part of Cody shale, Big Horn Basin, Wyoming; Steele shale, Little Horn Valley, Wyoming; upper part of Mancos shale, San Juan Basin, upper Rio Grande valley, New Mexico. (See table, p. 2.)

Baculites aquilaensis var. obesus Reeside, n. var.

Plate 10, Figures 1–8

This variety differs from the type only in the ovate form of its cross section, which is like that of normal *B. ovatus*. A specimen from New Mexico referred to this variety has the sculpture and cross section in agreement, but the nodes are somewhat more ele-

vated and more distant than in the type specimen of the variety. It suggests *B. asper* except for the large size of the shell and arcuate form of the nodes and should perhaps receive a separate specific name. The writer prefers to place it here for the present.

Occurrence: At 4 localities—Eagle sandstone, Billings region, Montana; Telegraph Creek formation, northern Big Horn Basin, and Steele shale, Little Horn Valley, Wyoming; upper part of Mancos shale, upper Rio Grande valley, New Mexico. (See table, p. 2.)

Baculites asper Morton

Plate 10, Figures 9–12; Plate 11, Figures 5–16

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.
1861. *Baculites anceps* (part) Lamarck. Gabb, Acad. Nat. Sci. Philadelphia Proc. for 1861, p. 395, pl. 3, fig. 4. (Not figs. 2, 3.)
1876. *Baculites asper* (part) Morton? Meek, U. S. Geol. Survey Terr. Rept., vol. 9, pp. 404, 405, pl. 39, figs. 10a, d. (Not figs. 10b, c.)
1885. *Baculites asper* Morton. Whiteaves, Contr. Canadian Paleontology, vol. 1, pt. 1, p. 82.
1899. *Baculites asper* Morton? Stanton, U. S. Geol. Survey Mon. 32, p. 636.
Not 1849. *Baculites asper* Morton. Roemer, Texas, p. 416.
Not 1852. *Baculites asper* Morton. Roemer, Kreidebildungen von Texas, p. 36, pl. 2, figs. 2 a–d.
Not 1892. *Baculites asper* Morton. Whitfield, U. S. Geol. Survey Mon. 18, p. 278, pl. 46, figs. 10, 11.
Not 1894. *Baculites asper* Morton? Stanton, U. S. Geol. Survey Bull: 106, pp. 167, 168, pl. 36, figs. 4, 5.
Not 1900. *Baculites asper* Morton? Herrick and Johnson, Denison Univ. Sci. Lab. Bull., vol. 11, p. 213.
Not ? 1904. *Baculites asper* Morton. Lasswitz, Geol. und Pal. Abh., n. ser., vol. 6, p. 235.
Not 1907. *Baculites asper* Morton? Weller, New Jersey Geol. Survey, Paleontology, vol. 4, p. 823, pl. 109, figs. 6–7.
Not 1916. *Baculites asper* Morton. Gardner, Maryland Geol. Survey, Upper Cretaceous, p. 377, pl. 12, figs. 8, 9.

Morton characterized the species thus: "Transversely suboval, with prominent circumscribed, lateral nodes, and numerous septa." Meek described it as follows:

> Small, very gradually tapering shell, with an ovate section and ornamented along each side, near the antisiphonal margin, both on the septate and nonseptate portions, by a row of rather distantly separated nodelike prominences that show the faintest perceptible tendency to extend obliquely forward and toward the siphonal side, as undulations parallel to the lines of growth. * * * The septa * * * present no very essential difference from those of *B. ovatus*.

The writer, without seeing Morton's specimens, conceives this species to include small baculites with a broadly ovate cross section, distant, rounded nodes on the antisiphonal half of the flanks, and rather numerous weak undulations on the siphonal side that have only a faint connection with the rounded nodes. This concept of the species would eliminate the forms with arcuate nodes even though distantly placed on the shell, the forms with a tapered cross section and subacute siphonal margin, and the forms with compressed shells. These characters in various combinations are valid specific differences. Many authors have extended the scope of the name *B. asper* Morton much too far and have included all forms with distant nodes, whatever the other characters.

Roemer's *B. asper* Morton (1852) seems to have short arcuate ridges instead of rounded nodes. Whitfield's *B. asper* Morton (1892) and Weller's (1907) also are evidently some other species. Stanton's *B. asper* Morton? (1894) is compressed relatively and has a tapered cross section and distinctly arcuate nodes. Herrick and Johnson (1900) speak of their specimens as representing a large form, a character which would exclude them from *B. asper*. Gardner's specimen (1916) lacks the distinct nodes and is more compressed.

The writer has specimens from 14 localities which in form and sculpture agree with *B. asper* as here conceived. Several specimens show the suture. It is more deeply incised than Gabb's figure of the suture of the type and has the proportions of lobes and saddles rather different, especially the second saddle.

The distribution and range of *B. asper* is not certainly known, because of the confusion in the use of the name. Stephenson [12] reports it only from the *Exogyra ponderosa* zone of the Gulf series. It probably does not extend into the latest Montana faunas of the Western Interior province, nor downward into the Turonian faunas.

Occurrence: At 14 localities—Eagle sandstone, Judith region, Montana; Eagle sandstone and Telegraph Creek formation, Billings region, Montana; Eagle sandstone, Little Horn Valley, Montana; lower half of Pierre shale, western rim of Black Hills, Wyoming; Steele shale, Salt Creek oil field and other parts of central Wyoming; upper part of Mancos shale, Moffat County, Colorado; Emery sandstone member of Mancos shale, central Utah; upper part of Mancos shale, San Juan Basin and upper Rio Grande valley, New Mexico. (See table, p. 2.)

Baculites thomi Reeside, n. sp.

Plate 12, Figures 9–14

Shell small, very gradually tapered; aperture not known; cross section broadly ovate; slightly flattened on the antisiphonal side in the late stages. Surface has somewhat distantly placed rounded lateral nodes, each of which is distinctly connected with the corresponding opposite node by a single strongly marked siphonal rib or undulation; rarely there is an intercalated siphonal rib.

[12] Stephenson, L. W., Cretaceous deposits of the eastern Gulf region: U. S. Geol. Survey Prof. Paper 81, Table 9, 1914.

The suture is little incised and has about the proportions of that of *Baculites ovatus* Say.

This species is marked by its small size, ovate cross section, rounded lateral nodes, and relatively distant siphonal ribs. It resembles *B. asper* Morton but differs in the possession of a single strong siphonal rib to each lateral node, instead of several very weak ribs to each node as in *B. asper*. It may be separated from *B. aquilaensis* Reeside and varieties by its ovate cross section, rounded lateral nodes, and siphonal ribs. The suture of *B. thomi* differs from those of *B. asper* figured in its lesser incision of the lobes and saddles.

Specimens inseparable from *B. thomi* occur at a locality in sec. 17, T. 35 N., R. 3 W., Toole County, Mont. (U. S. G. S. Mesozoic locality 11995), in association with such species as *Scaphites ventricosus* Meek and Hayden and *Uintacrinus socialis* Grinnell, indicating that *B. thomi* ranges down into the upper part of the Colorado group.

Baculites thomi is named for Mr. W. T. Thom, jr., who collected the type specimen.

Occurrence: Elk Basin sandstone member of Telegraph Creek formation, sec. 27, T. 1 S., R. 30 E., Big Horn County, Montana.

Baculites sp.

Baculites that are specifically indeterminable were collected at several localities which for the sake of completeness are listed in the table (p. 2).

Subfamily TURRILITINAE

Genus HELICOCERAS D'Orbigny

Helicoceras has been applied generally to a group of aberrant ammonites with shell coiled in a regular conical spire, the whorls completely separated at all stages of growth; the suture containing six lobes, the first lateral lobes bifid and the saddles bifid. The species originally cited by D'Orbigny,[13] *H. annulatus* and *H. gracilis*, have slender volutions, wide-open low spires, and simple ribs without nodes, though D'Orbigny himself later included rather high-spired shells with nodose ribs. The type species is Albian.

There has been much variation in the scope given to the genus by later writers. Some conceive it broadly and consider it a subgenus of *Turrilites* Lamarck. Others conceive it in a narrower sense as an independent unit or even split the larger group into a number of smaller generic units.

Meek [14] proposed two subgenera and added a third with some doubt—*Helicoceras* in the strict sense, with continuous ribs without nodes or with two rows of nodes on the siphonal side; *Patoceras*, with a smooth band on the siphonal side; *Spiroceras*, with continuous ribs and three rows of nodes on the siphonal side. Hyatt [15] proposed for species assigned by many authors to *Helicoceras* several names of generic rank based chiefly on the form of the shell in its various stages and on ornamentation. The specimens usually available are fragmentary and lack critical parts, so that it is difficult to assign most individual specimens with any degree of certainty or to treat the whole group with clearness. It is not possible usually to do more than apply the broad concept of the genus with the reservation that it is probably a heterogeneous assemblage.

The specimens treated in this paper seem to be of the type of D'Orbigny's original species and are therefore assigned to *Helicoceras* without question, though perhaps the difference in age from D'Orbigny's species is sufficient ground for doubt.

Helicoceras rubeyi Reeside, n. sp.

Plate 3, Figures 8–10; Plate 5, Figures 3–11

This species is represented by a number of fragments and by several individuals showing the initial whorl and the early stages. The complete shell is small and had the form of a low wide-open spire, rather variable in the amount of curvature of the whorl, some shells being more closely coiled than others. All the fragments are distinctly curved and the larger ones distinctly helical. The whorls are slender and in cross section very broadly elliptical to circular. The nucleus is very much like that of *Baculites*, a compact coil of a little more than one turn and about 0.6 millimeter in greatest diameter, with a constriction at the end of the first volution. For about 2 millimeters along the whorl from the nucleus the tube is straight and increases in diameter from 0.3 to 0.4 millimeter. Then it begins to curve gently and increases in diameter gradually, at about the same rate throughout: In the type at 6 millimeters along the tube from the nucleus the diameter is 0.7 millimeter; at 12 millimeters, 1.1 millimeters; at 18 millimeters, 1.6 millimeters; and at the latest part preserved, at 39 millimeters, 3.0 millimeters. Some of the other specimens indicate a maximum diameter of about 5 millimeters. Apparently the entire shell, measured along the whorl, did not exceed 100 millimeters in length. All the larger specimens are unseptate. One (pl. 5, figs. 8, 9) shows much of the septate part of the shell and a considerable part of the living chamber. The aperture is not definitely known, but several specimens suggest by their sculpture (pl. 5, fig. 3) that they are very near the aperture and that it was simple.

The shell is smooth for the first 9 millimeters of its length; then faint rounded ribs appear which are inclined apicad as they pass to the inner (antisiphonal) side of the whorl. These ribs increase in height,

[13] D'Orbigny, Alcide, Paléontologie française, Terrain crétacé, vol. 1, pp. 611–613, 1841.

[14] Meek, F. B., Invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. Survey Terr. Rept., vol. 9, pp. 485–487, 1876.

[15] Hyatt, Alpheus, Phylogeny of an acquired characteristic: Am. Philos. Soc. Proc., vol. 32, pp. 568–577, 1894.

sharpness, and distance apart as the diameter increases, and on the later parts of the shell they are sharp, high, and separated by relatively broad concave interspaces. On the last 5 millimeters of the type there are nine ribs. The ribs completely encircle the whorl and are a little lower on the inner (antisiphonal) than the outer (siphonal) side of the whorl. On several fragments which are interpreted as being close to the aperture the sharp, broadly separated ribs pass with brief transition into crowded weak lines which decrease in strength and are almost invisible on the last part of the shell. (Pl. 5, fig. 3.)

The suture is simple. It shows a broad siphonal lobe, two undissected lateral lobes, and a simple antisiphonal lobe, all separated by bifid saddles.

This interesting species might be compared on the basis of form and sculpture with a number of others from several horizons in the Cretaceous, though, as with *Hamites*, there is little profit to be had from such a comparison.

The species is named for Mr. W. W. Rubey, who collected the type lot.

Occurrence: Lower half of Pierre shale, western rim of Black Hills; Steele shale, central Wyoming; upper part of Mancos shale, Moffat County, Colorado. (See table, p. 2.)

Family DESMOCERATIDAE

Subfamily DESMOCERATINAE

Genus PUZOSIA Bayle

Whorl not deeply embracing, rounded on the venter, in some species rather swollen, in others rather flat; marked by welts on the shell and furrows on the internal cast, as well as by ribs parallel to the welts on the outer part of the flanks and venter; suture with symmetrical trifid first lateral lobe, rapid decrease in size of elements beyond the second lateral saddle, auxiliaries forming a hanging lobe; saddles high, broad above, narrow below, divided by a long lobule; second saddle generally longer than first.

Subgenus LATIDORSELLA Jacob

Umbilicus small, whorls swollen, ventral region broad; undulating furrows on internal cast, in some species not well defined; suture like *Puzosia* s. s. in the symmetry of the first lateral lobe, which hardly exceeds in length the siphonal lobe; the elements decrease rather regularly and are not very much inclined—that is, the hanging lobe is not well individualized.

Grossouvre [16] proposed the name *Schlueteria* for species with the external form of *Phylloceras* and the internal characters of *Puzosia*. Kossmatt [17] believed that the species cited by Grossouvre are all referable to other genera, and that *Schlueteria* is insufficiently defined. Pervinquière called attention to several species that fit better the diagnosis of Grossouvre than those cited by that author. Pervinquière, however, followed Kossmatt in discarding the name and preferred to assign the intermediate species to *Puzosia* (*Latidorsella*), and in this the writer has followed him. The diagnoses given above are largely from Pervinquière.[18] Spath [18a] revives Grossouvre's genus in an emended form, with *S. larteti* Seunes as genotype, and uses *Latidorsella* only for Albian species. If *Schlueteria* is accepted the species described below will fall within it.

[16] De Grossouvre, Albert, Les ammonites de la Craie supérieure, p. 216, 1894.

[17] Kossmatt, Franz, Untersuchung über die südindische Kreideformation: Beitr. Paläontologie Oesterr.-Ungarns u. des Orients, vol. 9, pp. 105–107, 1895.

[18] Pervinquière, Léon, Études de paléontologie tunisienne; I, Céphalopodes des terrains secondaires, pp. 138–143, 1907.

[18a] Spath, L. F., On Upper Cretaceous Ammonoidea from Pondoland: Durban Mus. Ann., vol. 3, p. 45, 1921.

Puzosia (Latidorsella) mancosensis Reeside, n. sp.

Plate 12, Figures 1–8

This species is represented by two small specimens from one locality, the larger and better preserved of which is taken as the type; two imperfect specimens from another locality; and a good specimen from a third locality.

The earliest part visible on the smaller specimen is at a diameter of about 8 millimeters. This has a narrow flat flank, well-rounded venter, and narrow umbilicus. The whorl is quite stout. At the greatest diameter of the smaller specimen, 18 millimeters, the form is much like that at 8 millimeters, except that the whorl is proportionately higher. The umbilicus has increased but little in size, and the flat flanks are broader. The entire shell forms a stout disk. The earliest part visible of the larger specimen is at a diameter of 20 millimeters, the latest part is at a diameter of 27 millimeters. The whorl throughout has flat flanks and well-rounded venter. The relative height of the whorl increases with age. Umbilicus very small, with rounded umbilical shoulder. The whole shell forms a stout disk. Living chamber and aperture unknown.

The sculpture at a diameter of 8 millimeters and throughout the later stages consists of rather coarse low-rounded ribs on the outer part of the flanks and a few obscure furrows extending from the umbilicus over the venter. The inner part of the flanks is smooth. The ribs have a falciform outline with a distinct forward bend on the venter. There are 30 of these ventral ribs to each whorl. On the latest part of the larger specimen the ventral ribs decrease in distinctness so much as to suggest that at a little larger size the entire shell would be smooth. The furrows on the cast are fairly distinct on the early part of the type but not visible on the later part.

The suture shows a large siphonal lobe; first lateral saddle of about the same size as the siphonal lobe and divided into two unequal parts, the larger (external) part being again divided so that the first lateral saddle

appears nearly trifid; first lateral lobe somewhat smaller than the siphonal lobe; second lateral saddle and lobe much smaller than the first; remaining elements of suture decreasing regularly in size and lying in a nearly straight inclined line. Dorsal suture not observed.

This species is distinguished by the stout discoid form, small umbilicus, smooth flanks, and coarsely costate venter, and it also differs from other species of *Puzosia* in the details of the suture. It agrees very well with the diagnosis of the subgenus *Latidorsella*, the coarseness of the ventral ribs and some of the details of the suture possibly being exceptional. Among European species none is very close. *Puzosia* (*Latidorsella*) *diphylloides* Forbes, of the late Santonian and Campanian, as figured by Kossmatt [19] and Pervinquière [20] has some resemblances but differs sharply in having a relatively smooth venter and stout whorls.

A single specimen from sec. 17, T. 35 N., R. 3 W., Toole County, Mont. (U. S. G. S. Mesozoic locality 11995), associated with *Uintacrinus socialis* Grinnell and *Scaphites ventricosus* Meek and Hayden, is generically identical with *Puzosia mancosensis* but lacks the coarse ribs on the younger stages and seems to be a different species.

The specific name is derived from the occurrence of the type specimen in the Mancos shale.

Occurrence: At 4 localities—Eagle sandstone, Little Horn Valley, Montana; Telegraph Creek formation, Billings region, Montana; upper part of Mancos shale, east-central Utah; upper part of Mancos shale, San Juan Basin, New Mexico. (See table, p. 2.)

Genus DESMOSCAPHITES Reeside, n. gen.

Shell of moderate size, with stout well-rounded whorls; last living chamber abnormal. Umbilicus small. Sculpture in early whorls of stout rounded ribs that begin in the umbilicus, pass outward with gentle inclination forward, and cross the venter with more or less arching forward; many of these ribs fork on the flanks, and there are frequent intercalated ribs; each whorl shows six or eight emphasized, larger ribs bordered by distinct constrictions. Sculpture in later whorls to beginning of living chamber much like earlier whorls except that constrictions are not discernible and ribs are somewhat finer. On the living chamber (of the only species in which it is now completely known) a few high, prominent primary ribs split into three or four secondary ribs; between the primary ribs fine intercalated ribs rise and cross the venter, the grouping around the primaries giving the effect of a bundle opening outward.

Suture has large siphonal lobe, first lateral saddle about same size as siphonal lobe and unsymmetrically trifid; first lateral lobe a little shorter than siphonal lobe and symmetrically trifid. Other elements of suture small.

This genus differs from all the other scaphites in the possession of constrictions in the early stages and a trifid first lateral lobe in the adult suture. It seems undoubtedly to be derived from a desmoceratid stock.

The only species now known to the writer that may be assigned here are the two described below and unnamed forms from the upper part of the Colorado group (lower Santonian or Coniacian) of Montana.

Desmoscaphites bassleri Reeside, n. sp.

Plate 21, Figures 17–21; Plate 22, Figures 8–12

The specimen selected as the type of this species preserves one side of a complete living chamber and the umbilical part of the last coiled whorl. Other specimens show more of the early stages and are drawn on in the description.

Shell of medium size, round-oval in lateral view. Earliest whorls seen, at diameter of 5 millimeters, smooth and well rounded; at a diameter of 8 millimeters cross section of whorl is nearly circular; in later stages the flanks are somewhat flattened and the venter very broadly rounded; the flanks merge evenly into the venter. The living chamber is stout, not much unrolled, increasing in size gradually to the bend and then decreasing to the aperture, which is strongly constricted; flanks of living chamber somewhat flattened and merging evenly into the venter and the sloping umbilical shoulder. Umbilical margin concave inward.

Whorl at a diameter of 5 millimeters smooth. At a diameter of 8 millimeters the inner part of the flank is nearly smooth, but on the middle part rather broad, low, rounded primary ribs rise; these primary ribs fork on the outer part of the flank into two broad, low, rounded secondary ribs, and an occasional intercalated secondary rib rises; these secondary ribs cross the venter with a shallow forward bend. At intervals of about one-sixth of a whorl a single rib is elevated somewhat above its neighbors and is bordered by distinct constrictions. This rather coarse type of sculpture prevails to the beginning of the living chamber, the ribs, however, becoming more numerous and relatively finer as size increases. On the last half whorl of the septate part of the shell there are 12 to 15 primary ribs and about 40 secondary ribs. On the living chamber 8 to 10 prominent, subacute primary ribs pass nearly straight from the umbilical border to the border of the venter, where each rises into a sharp conical tubercle. These tubercles are highest at the bend of the living chamber and decrease in height forward and backward from the bend. On

[19] Kossmatt, Franz, Untersuchungen über die südindische Kreideformation: Beitr. Paläontologie Oesterr.-Ungarns u. des Orients, vol. 11, p. 108, pl. 19, figs. 8, 9, 1896.

[20] Pervinquière, Leon, Études de paléontologie tunisienne; I, Céphalopodes des terrains secondaires, p. 140, pl. 6, figs. 1–7, 1907

the venter three or four threadlike ribs pass from each tubercle straight across the venter. Springing from the umbilical ribs on the flanks and also rising between them fine threadlike ribs similar to those rising from the tubercles pass outward and across the venter. This grouping of the fine ribs on the living chamber about the primary ribs gives them the appearance of a bundle that opens outward. The ventral ribs are of about equal strength and evenly spaced.

The suture of this species is the normal suture of the genus. Siphonal lobe and first lateral saddle about equal in size, the saddle unequally trifid; first lateral lobe shorter than the siphonal lobe and unsymmetrically trifid; other elements small—second lateral lobe and four or five auxiliary lobes.

The characteristic features of this species are the stout, relatively coarse-ribbed earlier whorls; the living chamber with prominent, straight, fasciculate umbilical ribs with lesser ribs between; the single row of ventro-lateral tubercles; the fine, evenly spaced ribs on the venter of the living chamber; and the relatively slight uncoiling of the living chamber.

This species resembles in sculpture and form some varieties of *Scaphites ventricosus* Meek and Hayden [21] but differs in the possession of tubercles and in the generic features. It resembles *Scaphites vermiformis* Meek and Hayden [22] in gross form and in possessing a single row of tubercles but differs in having only fine, closely spaced ribs on the venter of the living chamber and less prominent nodes. It differs sharply from *Scaphites nodosus* Owen and its varieties [23] in its straight ribs, single row of nodes, and proportionately wider venter, and in the generic characters. Among European species *Desmoscaphites bassleri* is externally closest perhaps to *Scaphites geinitzi* (D'Orbigny) Schlüter [24] but differs in its stouter shell, straight ribs, finer ribs between the prominent ribs, and lesser uncoiling of the living chamber. The figures of *Scaphites geinitzi* D'Orbigny given by several other European writers are not very close in their external details to the American species.

This species is named for Mr. Harvey Bassler, who collected the type specimen.

Occurrence: At 16 localities—Eagle [Virgelle] sandstone (?), Blackfoot Indian Reservation, Montana; Telegraph Creek formation, Billings region, Montana; Eagle sandstone and Telegraph Creek formation, Little Horn Valley, Montana; upper part of Mancos shale, east-central Utah; Moffat County, Colorado, and San Juan Basin, Colorado and New Mexico. (See table, p. 2.)

[21] Stanton, T. W., The Colorado formation and its invertebrate fauna: U. S. Geol. Survey Bull. 106, p. 186, pl. 44, figs. 8–10; pl. 45, fig. 1, 1893.

[22] Idem, p. 183, pl. 44, fig. 3.

[23] Meek, F. B., Invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. Survey Terr. Rept., vol. 9, pp. 426–430, pl. 25, figs. 1–4; pl. 26, figs. 1a–c, 1876.

[24] Schlüter, Clemens, Cephalopoden der oberen deutschen Kreide, p. 75, pl. 23, figs. 12–22; pl. 27, fig. 9, 1871.

Desmoscaphites novimexicanus Reeside, n. sp.

Plate 11, Figures 1–4

This species is based on a single specimen that preserves the coiled part of the shell and the beginning of the uncoiled living chamber. The earliest whorls visible, at a diameter of about 13 millimeters, are nearly circular in cross section. At the last septum, at a diameter of 25 millimeters, the venter is flattened a little, though the cross section is still stout and well rounded. The part of the living chamber preserved is slightly crushed, and its normal form is thereby obscured.

The sculpture of the septate part of the shell consists of coarse short rounded primary ribs that pass halfway outward on the flanks of the whorl and then fork into two coarse rounded secondary ribs that pass straight across the venter; there are no intercalated ribs. The constrictions are not conspicuous, perhaps because the earlier stages are not uncovered, but they are discernible. On the last half whorl of the septate part of the shell there are 8 primary ribs and 16 secondary ribs. On the fragment of the living chamber preserved the ribs are of the same type as on the septate part but finer and less distinct. It is not possible to decide from the part preserved whether there are nodes on the living chamber.

The suture has a long, narrow ventral lobe; first lateral saddle of same size as ventral lobe; first lateral lobe two-thirds the length of the ventral lobe, somewhat wider and symmetrically trifid; second lateral lobe and saddle and other elements of the suture small. Dorsal suture not seen.

This species is distinguished by the well-rounded cross section of the septate whorls, the coarse rounded bifurcating ribs, and the characteristic proportions of the suture. It differs from *Desmoscaphites bassleri* in its stouter whorls, in the lack of intercalated ribs, and in the details of the suture. From all other scaphites it differs in its trifid first lateral lobe.

Occurrence: Uppermost part of Mancos shale, 1 mile east of head of Canyon del Yeso, Santa Fe County, New Mexico.

Family COSMOCERATIDAE

Subfamily HOPLITINAE

Genus HARESICERAS Reeside, n. gen.

The writer has a number of specimens which do not fit any established genus of ammonites. For these the name *Haresiceras* is proposed, with the species *placentiforme* as genotype. The generic name is given in honor of Mr. C. J. Hares, who collected the specimens on which the genus is founded. The fundamental generic characters combined in this genus are compressed whorls with flat venter bordered by two rows of nodes, very narrow umbilicus, and subparallel flanks; obscure sigmoid ribs curving sharply forward

from the umbilicus to the middle of the flank, then passing radially to the venter, and crossing it uninterrupted but with a forward bend; suture with long triangular first lateral lobe and numerous auxiliary lobes.

The genus stands between *Placenticeras* Meek and *Hoplites* Neumayr in its characters, though it is very likely in an entirely distinct genetic line from that of *Placenticeras*. It has compressed form, narrow umbilicus, obscure ribs, and many auxiliary lobes of the suture, as in numerous species of *Placenticeras*. However, the sigmoid curvature of the ribs is the reverse of that of *Placenticeras;* the form and suture are distinct, even in the young stages, as may be seen by comparing the figures given on Plates 13 and 22; the flanks are subparallel and do not have the widest part near the umbilicus, as in all species of *Placenticeras* the writer has seen. The genus is like *Hoplites* in the shape of the lateral ribs and the form of the whorl and of the siphonal lobe, first lateral lobe, and second lateral lobe of the suture. It differs in having continuous ribs on the venter, weak lateral ribs, many auxiliary lobes of the suture, and a very narrow umbilicus. The suture and gross form are similar to those of *Metaplacenticeras* Spath,[25] but the young stages and the sculpture are distinct. In form the genus recalls *Forbesiceras* Kossmatt, but the suture is different. In gross form and suture it is much like *Sonneratia* Bayle and other desmoceratid genera, but the subparallel flanks, bicarinate venter, and lack of constrictions are sufficient to separate it. *Hoplitoides* Von Koenen has some similar characters but differs in suture.

The writer places *Haresiceras* in the subfamily Hoplitinae because of its suture, form of the whorl, and sculpture. The variation shown in the literature in the assignment of some genera, such as *Sonneratia*, might authorize an assignment to the Desmoceratidae, but the nodose carinae and lack of constrictions at any stage of growth would seem sufficient to deny it.

The writer knows no other species than those described below which belong to this genus.

Haresiceras placentiforme Reeside, n. sp.

Plate 13, Figures 1–14; Plate 45, Figure 4

Shell compressed, with flat, subparallel flanks and flat venter bordered by a pair of nodose keels. Whorls up to a diameter of 3.5 millimeters (2½ whorls) stout, at first wider than high, then circular in cross section. From this stage to that at a diameter of 15 millimeters (4⅙ whorls) the whorl increases in relative height, the flanks flatten, and finally the venter begins to flatten. At the stage with diameter of 15 millimeters a pair of nodose keels appears bordering the flattened venter, and the cross section of the whorl takes on the quadrate aspect maintained in all the later stages. At a diameter of 35 millimeters the cross section is quadrate, much higher than wide, with subparallel flanks which near the venter slope rather abruptly inward and form an obscure ventrolateral shoulder. The venter in this specimen is 6 millimeters wide. Near the umbilicus the slope is more gradual to the umbilical shoulder. In the largest specimens at hand, all incomplete but certainly attaining a diameter of 65 millimeters, the form of the whorl is like that at 35 millimeters. The umbilicus is wide only in the very early stages. At the end of the third whorl the umbilicus is already narrow and remains so. In the type at a diameter of 31 millimeters the umbilicus is one-twentieth the diameter of the shell, and in the largest specimens is not more than one-thirtieth the diameter. The umbilical shoulder is rounded in all the specimens seen. The living chamber occupies fifteen-sixteenths of the last whorl. The aperture is sinuous, with a shallow lateral extension, its form being exactly that of the ribs.

The early whorls are smooth. The first ribs are seen on the flanks at a diameter of 11 or 12 millimeters. These are obscure, faint sickle-shaped folds which rise at the umbilical shoulder, bend sharply forward until the outer third of the flank is reached, then pass straight outward to the venter. The ventral ribs seem to rise a little later than the lateral ribs. At a diameter of 25 millimeters the lateral ribs are like those on the younger whorls but are still fainter and end in a tubercle of the marginal keel. Between these tubercles of the keels continuous low ribs pass, arched strongly forward, across the flat venter. On the very latest part of the type the ribs on the inner part of the flank seem to have disappeared and are faint on the outer part and venter, though this may be due in part to the condition of preservation of the specimen. On the largest individuals the flanks of the whorl from 40 to 50 millimeters in diameter are nearly smooth, only fine striae showing. The remainder of the shell to the aperture bears fine, irregularly spaced sigmoid ribs separated by fine striae.

The suture of the type at a diameter of 31 millimeters shows a relatively short external lobe, a long triangular first lateral lobe, a short second lateral lobe, and six or seven auxiliary lobes arranged in a straight line and gradually decreasing in size inward. An internal suture at the same diameter as that just described but on another specimen shows a narrow single-pointed internal lobe with a high, narrow saddle adjacent to it and a long, narrow single-pointed auxiliary lobe next, and then two short lobes with relatively broad saddles between. Few data concerning the early sutures are furnished by the material in hand. Part of the suture at two, three, and four whorls is shown in Plate 13. At two whorls (2 milli-

[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, pls. 1–2, 1926.

meters in diameter) the external lobe is incised, the first lateral saddle has a single marginal lobe, and the first lateral lobe is unsymmetrical; at three whorls (6 millimeters in diameter), the external lobe and the first lateral lobe have assumed the form characteristic of the later stages. The writer was unable to determine the number of auxiliary lobes at any stage between that at two whorls and that at five whorls.

This species is not a common member of the fauna, but ample well-preserved material is available for its foundation, and it will probably be confused with no other American ammonite and with few extra-American forms. The differences from the other species recognized in the genus are given below.

Occurrence: Telegraph Creek formation, northern Big Horn Basin, Wyoming; lower half of Pierre shale, western and northern rim of the Black Hills.

Haresiceras placentiforme var. parvum Reeside, n. var.

Plate 14, Figures 1–3

A single specimen preserving the early whorls and a part of the living chamber a fourth of a whorl in length differs from the type of the species in having a relatively strong sculpture and in acquiring distinct ribs at a diameter of 5 millimeters and the ventrolateral keels at a diameter of 10 millimeters. It is apparently fully adult. The suture differs in no respect from that of the type of the species.

Occurrence: Upper part of Cody shale, 5 miles southwest of junction of Buffalo and Nowood Creeks, Washakie County, Wyoming.

Haresiceras natronense Reeside, n. sp.

Plate 14, Figures 4–16

Shell compressed, with flat subparallel flanks and concave venter bordered by nodose keels. Earliest whorls well rounded and relatively stout, increasing in relative height until at a diameter of 8 or 9 millimeters the whorls have distinctly flattened flanks, the venter becomes flattened and the nodose keels appear. The cross section in the subsequent stages has a quadrate aspect. The venter is 4 millimeters wide at a diameter of 28 millimeters, 5.5 millimeters wide at a diameter of 45 millimeters. In the largest specimen at hand, with a diameter of about 55 millimeters, the cross section in all the later stages is high, compressed, subquadrate. The aperture is partly preserved on this specimen and shows a sinuous outline with broadly rounded shallow lateral extension. (See pl. 14, fig. 13.) The living chamber occupies fifteen-sixteenths of the last whorl. The umbilicus throughout is very small, even in the large specimen attaining a size of only 1.5 millimeters. The umbilical shoulder is rounded.

The earliest part of the shell seen, at a diameter of 2 millimeters, shows faint, broad sickle-shaped lateral ribs. These become more distinct and on the succeeding whorl, to a diameter of 6 millimeters, are very well marked. This whorl shows 18 ribs. The venter is at first smooth, but the lateral ribs eventually extend to and across the venter. At a diameter of 7 or 8 millimeters the ventral ribs are very distinct. At a diameter of about 10 millimeters, the ribs fade from the inner part of the flanks of the whorl, which have then only fine striae and only the outer part shows ribs. In the half whorl from 10 to 18 millimeters in diameter there are about 30 of these low rounded ribs, each of which rises into a node at the ventral margin and then passes across the venter with a strong forward arching. Above a diameter of 18 to 20 millimeters, the lateral ribs fade from the outer part of the flank also and from the venter, and the whole surface of the shell except for the nodose keels is marked only by fine striae. These have the sigmoid form of the early ribs. Near the aperture the shell has fine crowded ribs of sigmoid form.

The suture does not differ in any essential from that of *Haresiceras placentiforme*.

Haresiceras natronense differs from *H. placentiforme* in its more compressed form, narrower and rather concave venter, and more distinct sculpture and in acquiring the lateral keels at an early stage. It differs from *H. placentiforme* var. *parvum* in acquiring distinct ribs at an earlier stage and in its narrower venter and more compressed shell.

The specific name is derived from Natrona County, Wyo., in which the type locality is situated.

Occurrence: Steele shale, beneath Shannon sandstone member, Salt Creek oil field, Wyoming; upper part of Mancos shale, Moffat County, Colorado.

Haresiceras fisheri Reeside, n. sp.

Plate 45, Figures 1–3

Shell much compressed with flat subparallel flanks and flat, narrow venter bordered by nodose keels. Earliest whorls visible, at a diameter of 15 millimeters, have rounded venter and flat flanks; at a diameter of 20 millimeters, the venter begins to show a narrow truncation which gradually becomes well marked and persists to the end of the shell. The venter is 2 millimeters wide at the maximum diameter of the type, 34 millimeters, and the cross section is high and much compressed. Living chamber only partly preserved—three-fifths of whorl remains. Aperture unknown. Umbilical shoulder rounded.

All the stages exposed are sculptured; inner flanks nearly smooth: outer flanks marked by low ribs distant about twice their width, curving evenly forward to the ventrolateral nodes. Each third or fourth rib raised into greater prominence than the others. Well-marked ribs pass across the venter, connecting the ventrolateral nodes.

Suture not well preserved but apparently not departing from that of the other species of the genus.

This species is characterized by the great compression of the whorls, narrow venter, and strong sculpture, which separate it readily from the other species. It is based on only one specimen, but this is well characterized and decidedly different from its allies.

The specific name is given in honor of Mr. D. J. Fisher, who collected the type.

Occurrence: Mancos shale, 800 feet below top, in the NW. ¼ sec. 18, T. 21 S., R. 18 E., Emery County, Utah.

Subfamily ACANTHOCERATINAE

Genus ACANTHOCERAS Neumayr

Acanthoceras? montanaense Reeside, n. sp.

Plate 22, Figures 1–4

A single complete but poorly preserved specimen of a small ammonite is the basis of this species. The living chamber is fairly well preserved, but the septate whorls are crushed and afford few details.

Shell small but stout, involute, with wide, very gently arched venter, bordered by sharp nodose keels and with flattened flanks meeting the venter at right angles. The earliest part of the shell visible (stage at a diameter of 7 millimeters) shows a broad, gently arched venter and apparently flattened flanks meeting the venter in sharp marginal keels. Though the whorl is crushed, the flanks appear to have sloped in the original condition evenly from the umbilicus to the marginal keels of the venter, and the whorl may have had a cross section of triangular outline with apex inward. At the position of the last septum (stage at diameter of 12 millimeters) the whorl is relatively swollen near the umbilicus and is nearly quadrate in cross section. In the final stage preserved (diameter 20 millimeters), the whorl is fully quadrate in cross section. The living chamber occupies three-fourths of a whorl. Aperture simple, quadrate. Umbilicus very small; umbilical shoulders rounded with gentle inner slope.

As preserved, the flanks of the earliest part visible are smooth, but the broad venter has rather coarse rounded ribs arched strongly forward and connecting the nodes of the marginal keels. The living chamber has about 15 moderately high, faintly arcuate simple ribs, each of which rises in the umbilicus and passes to a node of the ventral keel, and 18 strongly arched ventral ribs. Some of the primary ribs seem to end in double nodes, accounting for the greater number of ventral ribs, but there are not intercalated ribs.

The suture is not decipherable.

The quadrate cross section of the whorl and the coarse simple sculpture separate this species from any other ammonite the writer knows. It resembles in gross form and sculpture some species of the European and African Turonian referred to *Acanthoceras*, but its generic assignment must remain in doubt until more material is available.

Occurrence: Telegraph Creek formation, sec. 27, T. 7 S., R. 23 E., Carbon County, Montana.

Subfamily SCAPHITINAE

Genus SCAPHITES Parkinson

Parkinson's original description [26] of *Scaphites* applied to "a fossil concamerated shell, commencing with spiral turns; the last of which, after being elongated, is reflected back toward the spiral part." His figure was afterward referred to *S. aequalis* Sowerby which thereby became the type of the genus.

The comprehensive original genus was accepted for years as described but in 1876 was limited somewhat by Meek [27] through the separation of *Macroscaphites*. Meek then divided the remainder into two subgenera—*Scaphites* proper and *Discoscaphites*. The first he divided into three sections—(*a*) group of *S. aequalis* Sowerby, with coiled part relatively small, narrow umbilicus, round venter, single row of nodes, if any, on the margin of the venter of living chamber; (*b*) group of *S. nodosus* Owen, with coiled part relatively large, deflected part short, venter more or less flattened, with a row of nodes on the margin and a second row near the umbilicus; (*c*) group of *S. trinodosus* Kner and *S. tridens* Kner, with three rows of nodes on the rounded periphery. *Discoscaphites* Meek divided into two sections—(*a*) group of *S. conradi* Morton, with narrow umbilicus, coiled part forming most of the shell, flattened periphery, and four to nine rows of nodes on each flank, the outer row being the largest; (*b*) group of *S. cheyennensis* Owen, with relatively wide umbilicus and little-deflected body chamber.

Meek's concept of the genus prevailed until 1900, when Hyatt [28] accepted *Discoscaphites* as an independent genus and modified Meek's subgenus *Scaphites* by proposing to separate *Anascaphites*, with *S. ventricosus* Meek and Hayden as type, and *Jahnites*, with *S. geinitzi* D'Orbigny var. *binodosus* Roemer of Jahn as the type, and elevating all three to the rank of genera. No diagnoses were given.

In 1910 Yabe [29] proposed the genus *Yezoites* to include part of *Scaphites* in the broad sense. It included forms with a suture presenting a single pointed internal lobe and a very high internal saddle next to it. Yabe rejected Hyatt's genera as insufficiently defined.

Nowak [30] in 1912 rejected *Yezoites* Yabe and apparently ignored the proposals of Meek and Hyatt. He proposed to establish *Holcoscaphites*, with *S. aequalis* Sowerby as genotype; *Acanthoscaphites*, with *S. tridens* Kner as genotype; and *Hoploscaphites*, with *S. constrictus* as genotype. *Holcoscaphites* has a narrow umbilicus; stout whorls; sculpture like *Holcoste-*

[26] Parkinson, James, Organic remains of a former world, vol. 3, p. 145, pl. 10, fig. 10, 1811.

[27] Meek, F. B., Invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. Survey Terr. Rept., vol. 9, pp. 413–417, 1876.

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

[29] Yabe, Hisakatsu, Die Scaphiten der Oberkreide von Hokkaido: Beitr. Paläontologie Oesterr.-Ungarns u. des Orients, vol. 23, pp. 159–174, pl. 15, 1910.

[30] Nowak, Jan, Untersuchungen über die Cephalopoden der oberen Kreide in Polen, pt. 2, Die Skaphiten: Acad. sci. Cracovie Bull. internat., année 1911, ser. B, pp. 547–588, 1912.

phanus; suture with lobes and saddles gradually smaller inward to the line of involution, then gradually larger on the dorsum to the median plane; the bifid lobes develop from trifid; dorsal lobe trifid. *Acanthoscaphites* has whorls always higher than wide; sculpture of straight or nearly straight simple ribs beginning in an umbilical node and in the young supplemented by intercalated ribs which in later stages become similar to the primary ribs; adults have ventral nodes; suture with two lateral lobes and one or two auxiliaries, second and other laterals much shorter than first; three internal saddles, the first highest and broadest, the others progressively smaller; suture strongly incised. *Hoploscaphites* has flattened shells with involute whorls; umbilicus broader in youth, then narrower; ribs arched, bending forward on the flank and forking at different heights without forming nodes; suture with two lateral lobes and two or three auxiliaries, second lateral much shorter than first; first internal saddle small and narrow, second broad and higher than first; suture not strongly incised.

The writer has elsewhere [31] expressed the opinion that *Scaphites* Parkinson should be retained for the group for which *Holcoscaphites* Nowak was proposed, that *Acanthoscaphites* Nowak is valid, and that *Discoscaphites* Meek should be retained for the group to which *Hoploscaphites* Nowak was applied. The writer rejects *Anascaphites* Hyatt, *Jahnites* Hyatt, and *Yezoites* Yabe. A fourth genus of scaphites, *Desmoscaphites*, is proposed to include two species described in this paper.

The systematic position of the scaphites has been discussed by several writers. Neumayr [32] considered them to have been derived from *Olcostephanus*. Zittel [33] placed *Scaphites* under the Stephanoceratidae. Douvillé, according to Grossouvre,[34] assigned *Scaphites* to the family Pulchellidae. Grossouvre himself united the Pulchellidae with the Acanthoceratidae and included *Scaphites* in this enlarged family. Logan [35] placed the genus in the Stephanoceratidae. Hyatt [36] accepted Meek's family Scaphitidae, placing it between the families Macroscaphitidae and Lytoceratidae. J. P. Smith [37] thought *Scaphites* to be polyphyletic and related genetically to both *Hoplites* and *Lytoceras*. W. D. Smith [38] believed the group of *Scaphites nodosus* to be derived from a member of the Stephanoceratidae, and the group of *Scaphites condoni* to have had a common ancestor with *Baculites* and *Lytoceras*. Pervinquière [39] considered scaphites like *S. aequalis* to have been derived from *Olcostephanus* or *Holcodiscus*, but those like *Scaphites cunliffei* to have been derived from some of the Lytoceratidae. Nowak [40] indirectly assigned his *Holcoscaphites* (*Scaphites* proper) to the Stephanoceratidae, his *Acanthoscaphites* to the Acanthoceratidae, and his *Hoploscaphites* (*Discoscaphites*) to the Hoplitidae and thought that possibly other families might be represented among the scaphites.

J. P. Smith [41] in 1913 placed the scaphites as the subfamily Scaphitinae in the family Cosmoceratidae.

The scaphites described below all belong to the genus *Scaphites* Parkinson in its stricter sense—that is, the group for which Nowak proposed the name *Holcoscaphites*. They are placed in six species, under which are separated also six varieties.

Three of the varieties and one species include forms that are dwarfed but otherwise mature. These very small scaphites, as a rule exactly like some larger individuals and at many places directly associated with them in occurrence, have always been a problem to the paleontologist. It is difficult to conceive how the young stages of a scaphite could have an unrolled living chamber like the larger adult. No evidence has been obtained of the formation and subsequent absorption of an abnormal living chamber, and indeed small individuals with an unrolled living chamber are almost invariably mature in septal development and sculpture. It is therefore assumed that scaphites in the younger stages are normal ammonites, though no one, so far as the writer knows, has recorded young individuals with a normal living chamber that could be assigned to species that are true scaphites in the adult. The beginning of such a sequence of form is known in a number of groups, but its completion is not known in any. Most students have accepted the theory that the young are normal in spite of the lack of material evidence for it and have considered the small specimens with abnormal living chamber to be mature but dwarfed individuals of the larger forms. D'Orbigny, Pompecki, Yabe, Nowak, and others have discussed the question and have come to this conclusion as the simplest and most satisfactory explanation. The writer has accepted it in considering the dwarf forms described below.

[31] Reeside, J. B., jr., The scaphites, an Upper Cretaceous ammonite group: U. S. Geol. Survey Prof. Paper 150–B (in press).

[32] Neumayr, Melchior, Die Ammoniten der Kreide und die Systematik der Ammonitiden: Deutsche geol. Gesell. Zeitschr., vol. 27, p. 924, 1875.

[33] Zittel, K. A., Handbuch der Paleontologie, vol. 2, p. 480, 1885.

[34] De Grossouvre, Albert, Les ammonites de la Craie supérieure: Carte géol. France Mém., Recherches sur la Craie supérieure, pt. 2, Paléontologie, p. 238, 1894.

[35] Logan, W. N., Contributions to the paleontology of the Upper Cretaceous series: Field Mus. Nat. Hist. Pub. 36, Geol. ser., vol. 1, pp. 207–211, pls. 22, 23, 1899.

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

[37] Smith, J. P., The larval coil of *Baculites*: Am. Naturalist, vol. 35, p. 45, 1901.

[38] Smith, W. D., The development of *Scaphites:* Jour. Geology, vol. 13, pp. 635–54, 1905.

[39] Pervinquière, Léon, Études de paléontologie tunisienne, pt. 1, Céphalopodes des terrains secondaires, p. 116, Paris, 1907.

[40] Nowak, Jan, op. cit., pp. 547–588.

[41] Smith, J. P., Ammonoidea, in Eastman, C. R., Textbook of paleontology by Karl von Zittel, 2d ed., vol. 1, p. 670, 1913.

Scaphites hippocrepis (DeKay)

Plate 14, Figures 17–20; Plate 15; Plate 16, Figures 1–10

1827. *Ammonites hippocrepis* DeKay, New York Lyc. Nat. Hist. Annals, vol. 2, pp. 273–277, pl. 5, fig. 5.
1828. *Scaphites cuvieri* Morton, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 6, p. 109, pl. 7, fig. 1.
1830. *Scaphites cuvieri* Morton, Am. Jour. Sci., 1st ser., vol. 17, pp. 280–281.
1834. *Scaphites hippocrepis* (DeKay). Morton, Synopsis of the organic remains of the Cretaceous group in the United States, p. 41, pl. 7, fig. 1.
1892. *Scaphites hippocrepis* (DeKay). Whitfield, U. S. Geol. Survey Mon. 18, p. 262, pl. 44, figs. 8–12.
1907. *Scaphites hippocrepis* [part] (DeKay). Weller, New Jersey Geol. Survey, Paleontology, vol. 4, p. 826, pl. 107, figs. 3–6.
1910. *Scaphites hippocrepis* (DeKay). Grabau and Shimer North American index fossils, p. 178, fig. 1431.
1916. *Scaphites hippocrepis* [part] (DeKay). Gardner, Maryland Geol. Survey, Upper Cretaceous, p. 382.

DeKay's description of this species is inadequate, but Morton's contains most of the essential characters by which it is now recognized, and his figure also is good. Morton's description is as follows:

> Larger whorl ventricose, with eight prominent lateral tubercles, and two others more elevated at the inner margin on each side; back delicately ribbed between the lateral tubercles; an obscure ridge from each of the latter to the umbilical margin; no visible septa. Smaller whorl compressed, half concealed, costated all round; septa numerous, serrated like those of an ammonite.

This species has a protoconch that does not differ materially in size and form from that of many other Mesozoic ammonites. It is about 0.5 millimeter wide, is calcareous, and possesses, so far as the writer has observed, neither constrictions nor ornamentation.

In the whorl succeeding the protoconch the cross section is wide and depressed. At about two and one-half whorls (diameter 1.7 millimeters) it is nearly circular. At about three whorls (diameter 2.5 millimeters) it is again wide and depressed and remains so. In the early whorls to a diameter of 1.5 millimeters increase in size is slow and the umbilicus wide; above 1.5 millimeters increase is rapid and the umbilicus very narrow. The adult shell is stout and elliptical, and the flattened flanks of the living chamber merge evenly into the broad venter. The living chamber at its bend is decidedly swollen, contracting in both directions away from this part. The umbilical shoulder of the straight part of the living chamber is convex inward. The aperture is contracted and its walls incurved.

The first three and a quarter whorls (to a diameter of 3.5 millimeters) are smooth. Then ventral ribs begin as faint wrinkles, becoming more distinct as the size of the whorl increases. The ribs on the flanks are evident at about three and a half whorls (diameter 5 millimeters), the umbilical walls remain smooth throughout, and the ribs are low and well rounded. On the coiled part of the adult, primary ribs, about 18 to each whorl, begin near the umbilical shoulder and pass straight outward halfway to the middle of the venter, rising in height progressively outward until at the end they form an indefinite elongated node. These primaries then fork into two or three secondaries which cross the venter without curving. Intercalated secondaries are common. At the beginning of the straight part of the abnormal living chamber the ribs are practically suppressed. On the remainder the primary ribs are represented normally by a large elongated tubercle and a smaller tubercle. Some individuals have one or two more obscure tubercles. From these tubercles very faint ribs pass out halfway to the middle of the venter, where there is normally a row of seven to nine low rounded tubercles from which the ventral ribs spring just as in the uncoiled whorls.

The suture is the normal scaphite suture, with the ventral lobe largest and the first and second lateral and auxiliary lobes progressively smaller. The first lateral is always bifid, the second lateral trifid in the early stages and commonly bifid in the adult. The auxiliaries are usually two in number, in some specimens three. The elements of the internal suture decrease progressively in size from the trifid internal lobe to the line of involution.

The characteristic features of the species are the broad, stout whorls and the swollen living chamber with its flanks smooth except for the two prominent primary nodes and with its row of seven to nine low rounded nodes bordering the venter. Some of the material studied is incomplete but can be recognized readily.

Variations from the typical form are common. The height of the tubercles and the distinctness of the obscure primary ribs on the living chamber, the relative coarseness of the ribs, the smaller details of the suture, and other characters vary with different individuals. Some of these forms with extreme development of the differences from the type are given varietal names below.

In a comparison with figures and descriptions of the European forms referred to *Scaphites hippocrepis* the writer can see no essential differences from the American specimens, and it seems quite justifiable to use the same name for them, though the writer is skeptical in general as to the validity of such widespread application of specific names. Schlüter's *S. cuvieri* Morton [42] is hardly separable from American specimens. Holzapfel's *S. hippocrepis* (DeKay [43]) appears likewise inseparable. Grossouvre's specimens [44] appear more

[42] Schlüter, Clemens, Cephalopoden der oberen deutschen Kreide, pp. 162–163, pl. 42, figs. 1–3, 1876.

[43] Holzapfel, Eduard, Die Mollusken der Aachener Kreide: Palaeontographica, vol. 34, p. 62, pl. 5, figs. 3a–b, 1888.

[44] De Grossouvre, Albert, Les ammonites de la Craie supérieure: Carte géol. France Mém., Recherches sur la Craie supérieure, pt. 2, Paléontologie, pp. 244–246, pl. 32, figs. 2, 3; pl. 35, fig. 6; pl. 37, fig. 3, 1894.

like the varieties *crassus* Reeside and *tenuis* Reeside. Pervinquière [45] found an identical or very closely related species in the upper Senonian of Tunis. The European forms are said to characterize the lower Campanian.

Occurrence: At 41 localities—Eagle sandstone, Judith region and Musselshell region, Montana; Eagle sandstone and Telegraph Creek formation, Billings region, Montana, and northern Big Horn Basin, Montana and Wyoming; upper part of Cody shale, Big Horn Basin, Wyoming; Eagle sandstone, Little Horn Valley, Montana; Steele shale, Little Horn Valley, Buffalo region, and Salt Creek oil field, central Wyoming; lower part of Pierre shale, western rim of Black Hills; upper part of Mancos shale, Moffat County, Colorado; east-central Utah, San Juan Basin, Colorado and New Mexico, upper Rio Grande region, New Mexico; Merchantville clay, New Jersey.

Scaphites hippocrepis (DeKay) Morton var. pusillus Reeside, n. var.

Plate 17, Figures 1–5

This variety differs from the typical form in no essential respect except that of size. The specimen of the typical form of the species represented by Figures 1–4, Plate 15, is 48 millimeters in total length, whereas the type of the present variety is 17 millimeters in length. The dwarf form is not quite so stout proportionately, the inner lip of the living chamber is not so convex, and the second primary tubercle is not so distinct, but it is a mature specimen in sculpture, form, and the development of the suture.

Occurrence: Telegraph Creek formation, sec. 25, T. 58 N., R. 100 W., Park County, Wyoming.

Scaphites hippocrepis (DeKay) Morton var. tenuis Reeside, n. var.

Plate 16, Figures 11–16

This variety differs from the typical form in the relative fineness of the ribs, especially on the living chamber. Some individuals of the variety also have peculiar arcuate secondary nodes unlike the low rounded nodes usual for the species. This feature is believed to be merely an individual variation and not of distinctive value. The variety is an extreme development of one tendency in the variations of the species. The type of the species as refigured by Whitfield [46] is finer ribbed than many specimens but is coarser than this variety. Weller [47] figured a specimen from the Merchantville clay of New Jersey which is as fine ribbed as Morton's type but is also coarser than the variety here described. Through the courtesy of Messrs. L. W. Stephenson and J. A. Udden, the writer has had in hand a specimen of this variety collected by Doctor Udden from the lower part of the Anacacho limestone on Muela Creek (Chaparrosa Creek on U. S. Geological Survey Brackett topographic map), Kinney County, Tex., the only specimen of *Scaphites hippocrepis* from the Gulf series that the writer has seen. Grossouvre [48] figures a specimen from France which is very close to if not identical with this variety.

Occurrence: At 7 localities—Eagle sandstone, Little Horn Valley, Montana; lower part of Pierre shale, western rim of Black Hills; Steele shale, central Wyoming; upper part of Mancos shale, east-central Utah; lower part of Pierre shale, Colfax County, New Mexico. (See table, p. 2.)

Scaphites hippocrepis (DeKay) Morton var. crassus Reeside, n. var.

Plate 17, Figures 6–15

This variety differs from the typical form in the relative coarseness of the ribs on the living chamber and the lack of clearly defined tubercles due to the unusual elevation of the primary ribs between the two sets of tubercles. The latter character is perhaps an individual feature and should not be emphasized as distinguishing the variety, for the tubercles, though obscured, may still be observed. Weller [49] figured an individual with coarse ribs from the Merchantville clay of New Jersey which may belong to this variety. It shows well-defined tubercles and in this differs from the type of the variety. Grossouvre [50] figures two specimens from France which appear to belong to this coarse-ribbed variety.

Occurrence: At 5 localities—Steele shale, Little Horn Valley, and upper part of Cody shale, southern Big Horn Basin, Wyoming; upper part of Mancos shale, San Juan Basin, Colorado and New Mexico, and upper Rio Grande valley, New Mexico. (See table, p. 2.)

Scaphites stantoni Reeside, n. sp.

Plate 17, Figures 16–21; Plate 18, Figures 1–7

Whorls below diameter of 4 millimeters not seen. From 4 to 12 millimeters whorls broad and depressed; above 12 millimeters whorls become relatively high and compressed. Adult shell elliptical, only moderately stout; flanks flattened and merging evenly into the rounded venter. The living chamber at its bend is swollen as in *Scaphites hippocrepis* (DeKay) Morton and decreases in size forward and backward from that

[45] Pervinquière, Léon, Études de paléontologie tunisienne; I, Céphalopodes de terrains secondaires, p. 123, 1907.

[46] Whitfield, R. P., Gasteropoda and Cephalopoda of the Raritan clays and greensand marls of New Jersey: U. S. Geol. Survey Mon. 18, p. 261, pl. 44, fig. 8, 1892.

[47] Weller, Stuart, Cretaceous paleontology of New Jersey; New Jersey Geol. Survey, Paleontology, vol. 4, p. 826, pl. 107, fig. 6, 1907.

[48] De Grossouvre, Albert, Les ammonites de la Craie supérieure: Carte géol. France Mém., Recherches sur la Craie supérieure, pt. 2, Paléontologie, p. 238, pl. 37, fig. 3, 1893.

[49] Weller, Stuart, Cretaceous paleontology of New Jersey: New Jersey Geol. Survey, Paleontology, vol. 4, p. 826, pl. 107, figs. 3–5, 1907.

[50] De Grossouvre, Albert, Les ammonites de la Craie supérieure: Carte géol. France Mém., Recherches sur la Craie supérieure, pt. 2, Paléontologie, p. 238, pl. 32, figs. 2, 3; pl. 35, fig. 6, 1894.

region. The umbilical shoulder of the straight part is convex inward. The aperture is constricted and has a small dorsal lappet.

The whorls from 4 to 7 millimeters in diameter show no sculpture except possibly indistinct ventral wrinkles above a diameter of 6 millimeters. At 8 millimeters in diameter the ventral ribs are distinct and relatively coarse (9 to a quarter whorl), low and well rounded. The primary ribs on the flanks are visible at a diameter of about 10 millimeters. At a diameter of 17 millimeters there are to each quarter whorl five straight, low, rounded primary ribs of even height and 16 straight, low, rounded secondary ribs. Each primary forks into two or three secondaries, and there are intercalated secondaries. On the living chamber the ribs are faint and very fine throughout, the prominent sculpture consisting of one large tubercle on the flank near the bend and six or seven low rounded tubercles on the margin of the venter.

The suture is the normal scaphite suture with elements progressively smaller from the plane of symmetry toward the line of involution. The second lateral saddle of the type is broader than in the other figured specimen, which has a suture more like that of *S. hippocrepis*. The variation is believed to have little significance.

The distinguishing characters of this species are the relatively compressed whorls with fine ribs, the single lateral node, and smooth venter of the living chamber. It is closely related to *S. hippocrepis* through such forms as the variety *tenuis* of that species, which has fine ribs, though this variety is much stouter and has more and higher nodes.

This species is named for Mr. T. W. Stanton, whose services to American Mesozoic paleontology are known to all.

Occurrence: At 8 localities—Eagle sandstone, Musselshell Valley, Billings region, Montana; upper part of Cody shale, Big Horn Basin, Wyoming; Steele shale, Little Horn Valley, Wyoming; upper part of Mancos shale, Moffat County, Colorado, and San Juan Basin, New Mexico; basal part of Mesaverde formation, upper Rio Grande valley, New Mexico. (See table, p. 2.)

Scaphites similis Whitfield

Plate 18, Figures 8–14

1892. *Scaphites similis* Whitfield, U. S. Geol. Survey Mon., vol. 18, p. 267, pl. 107, figs. 1, 2.

1907. *Scaphites hippocrepis* [part] (DeKay). Weller, New Jersey Geol. Survey, Paleontology, vol. 4, p. 826. (Not pl. 107, figs. 3–6.)

1916. *Scaphites hippocrepis* [part] (DeKay). Gardner, Maryland Geol. Survey, Upper Cretaceous, p. 382.

Shell small, the type specimen, the only one known at present being only five-sixths of an inch in its greatest length, and although not quite finished at the aperture, would not exceed 1 inch were it continued to its entire size. Volutions laterally compressed, rounded on the back, and marked by fine transverse ridges to beyond the commencement of the outer chamber, beyond which point the ridges are larger and indistinct, especially on the sides. A single line of nodes marks the outer angle of the body volutions and are largest opposite the middle of the horizontal portion of the coil. Septa not very crowded and rather simple, consisting of the dorsal lobe and three lateral lobes on each side outside of the umbilical cavity, which is quite small. Dorsal lobe moderately large, the lower branches not quite half as long as the height of the first sinus, the extremities rounded, and with a rounded protuberance on its outer side; above it there is one other projection on each side. First lateral lobe large, broadly flabelliform, with six short, blunt fingers arranged around its rounded end and one other at the junction of the first sinus; second and third lobes small and consisting of only a single bluntly rounded member each. The first sinus equals the first lateral lobe in size but is bilateral at the extremity, each division showing a slight indentation on the middle. The other sinuses are simple rounded sinuosities but slightly broader than the corresponding lobes.—(Whitfield.)

Whitfield compared this species to *Scaphites nodosus* Owen, but it is hardly like that form. The significant characters are the compression of the whorls, the lack of swelling of the living chamber, the lack of primary nodes, and the concave sloping umbilical wall of the living chamber.

The inner whorls of this species were not seen in the specimens in hand. In the adult the whole shell is relatively compressed, is elliptical, and lacks the conspicuous swelling of the living chamber present in *Scaphites hippocrepis* and *S. stantoni*. The whorls have flattened flanks, which merge evenly into the rounded venter. The umbilical shoulder of the living chamber slopes gently from the line of involution to the flank and is concave inward.

On the coiled part of the adult the sculpture consists of straight, low, rounded primary ribs, of even height throughout, each of which forks halfway from the umbilicus to the middle of the venter into two low and rounded secondaries. These run straight across the venter. Intercalated secondaries are common. There are 11 primaries and 25 secondaries on the last half whorl. Near the beginning of the straight part of the living chamber the primary ribs become coarser and higher and end in low tubercles. Then they disappear completely from the flanks, only the tubercle remaining. On a nearly complete specimen at hand these tubercles are not very distinct but are certainly present nearly to the aperture. On another specimen referred with some doubt to this species they are visible to the aperture. The secondary ribs continue over the living chamber without change except that they are perhaps a bit coarser.

The external suture only was seen. It is of the normal scaphite type but differs somewhat from Whitfield's illustration of the suture of the type of the species. The figures given by this author for both *Scaphites similis* and *S. hippocrepis* are unlike any scaphite sutures the writer is acquainted with and probably are inaccurate.

Weller and Gardner considered *Scaphites similis* Whitfield to be a young specimen of *S. hippocrepis* (DeKay) Morton. It differs, however, enough to deserve a distinctive name.

Occurrence: At 4 localities—Eagle sandstone, Little Horn Valley, Montana; Telegraph Creek formation, northern Big Horn Basin, Wyoming; Merchantville clay, New Jersey. (See table, p. 2.)

Scaphites aquilaensis Reeside, n. sp.

Plate 18, Figures 15–27; Plate 19, Figures 1–7

Shell at a diameter of a little over 1 millimeter shows whorls nearly circular in cross section with wide umbilicus. At 2 millimeters the whorls are broad, and they remain so to a diameter of about 4 millimeters, where they begin to increase in height. At a diameter of 10 millimeters the whorl is distinctly compressed and the flanks flat. In the type at this diameter the living chamber begins, the coiled part having about four complete whorls with a narrow umbilicus. The living chamber is of nearly uniform size throughout, there being only a small and gradual increase in size toward the constricted aperture and nothing comparable to the swelling present in some of the associated species. The umbilical shoulder of the living chamber is sharp with a steep umbilical wall and is nearly straight or concave inward on the straight part of the living chamber. The aperture is constricted, oval, and with a small dorsal lappet.

The inner whorls to a diameter of 4 millimeters are smooth. The ventral ribs appear then and above 6 millimeters are low, straight, and well rounded. The primary ribs are visible at a diameter of 5 millimeters and in the younger stages are straight, low, and rounded and culminate in an obscure node between the flank and the venter. Each primary forks into two secondaries with a few intercalated secondaries between. On the last half whorl of the coiled part of the type there are 8 primary and 21 secondary ribs. The primary ribs disappear at the beginning of the living chamber and are represented by a series of six rounded nodes on the sharp umbilical shoulder, extending almost to the aperture, and a series of seven to nine rounded nodes between the flank and the venter. From this second series of nodes the secondary ribs spring, fine and threadlike on the earlier part of the living chamber and mere striae on the final part.

The suture of the species is that of the genus and presents no unusual features.

The diagnostic characters of this species are the compressed form; the unswollen, nearly uniform living chamber; and the sharp umbilical shoulder with its row of tubercles. It is sharply distinguished from other American scaphites by the form and sculpture. It is nearest to *Scaphites aquisgranensis* Schlüter,[51] of the European Campanian, but differs from that species in the position of the second line of tubercles, the form of the venter, and the sculpture of the final part of the living chamber: in the American species the tubercles are placed nearer the umbilicus, the venter is much more rounded, and the last part of the living chamber has striae, not ribs. Schlüter's figures also show fewer umbilical tubercles. Grossouvre's figures of *S. aquisgranensis*[52] differ from Schlüter's in the presence of more umbilical tubercles and coarser ribs, much coarser proportionately than those of the variety *costatus* described below. They, however, show in form and sculpture the same differences from *S. aquilaensis*. Nowak[53] placed *S. aquisgranensis* with doubt in his genus *Hoploscaphites* and later[54] removed the question mark. It seems to the writer that the external suture shown by Schlüter would put the species with *Scaphites* s. s. (*Holcoscaphites* Nowak).

The specific name is derived from the occurrence of the type in the Eagle sandstone of Montana (*aquila*, eagle).

Occurrence: At 23 localities—Eagle sandstone, Musselshell Valley, Billings region, Little Horn Valley, Montana; Steele shale, Little Horn Valley, Wyoming; Telegraph Creek formation and upper part of Cody shale, Big Horn Basin, Wyoming; Steele shale, central Wyoming; lower part of Pierre shale, western rim of Black Hills; upper part of Mancos shale, east-central Utah, Moffat County, Colorado, and San Juan Basin, New Mexico. (See table, p. 2.)

Scaphites aquilaensis var. costatus Reeside, n. var.

Plate 19, Figures 8–13

This variety differs from the typical species in the relative coarseness of the ribs and in the persistence of ribs to the end of the living chamber. The ribs at the end of the living chamber are more widely separated than those on the straight part. The general form and sculpture agree with those of the typical species.

A feature of interest in this scaphite is the presence in the individual shown in Figures 10–13, Plate 19, of a pair of what seem to be muscle scars. The specimen is an internal cast and the scars are represented by shallow oval pits 5 millimeters long and 2.5 millimeters wide on the umbilical wall just anterior to the last septum. On the shell they must have stood as elevated plates.

The suture of the type of the variety is too poorly preserved for reproduction but seems to be like that of the species.

[51] Schlüter, Clemens, Cephalopoden der oberen Deutschen Kreide, p. 81, pl. 24, figs. 7–9, Cassel, 1872.

[52] Grossouvre, Albert, Ammonites de la Craie supérieure, p. 246, pl. 31, figs. 3, 4, 6, 1894.

[53] Nowak, Jan, Untersuchungen über die Cephalopoden der oberen Kreide in Polen: Acad. sci. Cracovie Bull. internat., année 1911, sér. B, p. 566, 1912.

[54] Nowak, Jan, Zur Bedeutung von *Scaphites* für die Gliederung der Oberkreide: K.-k. geol. Reichsanstalt Verh., Jahrgang 1916, No. 3, p. 66, 1916.

This variety, like the normal form of the species, is close to *Scaphites aquisgranensis* Schlüter but differs in the same characters as the species.

Occurrence: At 2 localities in Telegraph Creek formation of northern Big Horn Basin, Wyoming. (See table, p. 2.)

Scaphites aquilaensis var. nanus Reeside, n. var.

Plate 19, Figures 14–21; Plate 20, Figures 1–6

This variety differs from the typical form chiefly in size. Some of the distinctive characters of the species are obscured in some of the specimens, but there seems to be no doubt that they are dwarfs of the larger form. They are mature in form, sculpture, and suture. One individual (figs. 1–6, pl. 20) differs somewhat in the form of the living chamber but has the two rows of tubercles and other characters and is therefore referred to this variety. *Scaphites leei* var. *parvus* Reeside is similar but differs in the quadrate cross section of the living chamber and general stoutness of the whorls.

Occurrence: At 5 localities—Telegraph Creek formation, northern Big Horn Basin, and lower part of Pierre shale, western rim of Black Hills, Wyoming; upper part of Mancos shale, east-central Utah and San Juan Basin, New Mexico. (See table, p. 2.)

Scaphites levis Reeside, n. sp.

Plate 20, Figures 7–16

The writer has two very small specimens of a scaphite that shows no nodes whatever. The material in unsatisfactory as the basis of a new species, but as the writer has dwarf specimens of several other species of the genus that may be assigned with confidence because they possess the characters of full-sized specimens and that are no larger than those under consideration, he deems it expedient to name the latter.

The coiled part of these shells is moderately stout, well rounded, with narrow umbilicus. The living chamber increases in size toward the bend and decreases then toward the aperture but does not swell notably as in *S. hippocrepis* and *S. stantoni*. The umbilical shoulder of the straight part is convex inward, as in those species. The aperture appears to be only feebly constricted.

The coiled part of the shell has obscure rounded primary ribs, eight on the last half whorl, which are strongest near the last septum. Each of these forks into two secondaries, and between them intercalated ribs arise. On the last half whorl there are 25 secondaries, straight, low, and rounded. On the living chamber the flanks are smooth throughout, and the venter has at the beginning a few fine ribs, then a smooth space, then a few widely spaced threadlike ribs at the bend, followed by a smooth space to the aperture. There are no suggestions, even, of nodes.

The suture is the normal scaphite suture and is adult in having the second lateral lobe bifid and in other characters, though relatively simple.

Except for the absence of nodes and the unswollen living chamber these specimens might be dwarfs of some variety of *S. hippocrepis* or *stantoni*, or except for the absence of nodes and the convex umbilical shoulder, of *S. similis*.

Occurrence: Telegraph Creek formation, sec. 25, T. 58 N., R. 100 W., Park County, Wyoming.

Scaphites leei Reeside, n. sp.

Plate 20, Figures 17–22; Plate 21, Figures 1–7

Whorls below diameter of 12 millimeters not preserved in type. In another specimen (pl. 21, figs. 1–7) they are preserved at diameter of 6 millimeters and their form is indicated by an impression at diameter of about 3 millimeters. These early whorls are all broad and depressed, and the form remains the same throughout the septate part of the shell. The adult shell is elliptical, stout. On the coiled part of the shell the flattened flanks of the whorl merge evenly into the rounded venter. On the living chamber the venter flattens and the cross section takes a subquadrate form. The living chamber does not swell conspicuously at the bend but enlarges gradually from the last septum forward. The umbilical shoulder of the straight part is convex inward, as in *Scaphites hippocrepis*. Aperture constricted.

Sculpture on whorls below 12 millimeters not seen. Above 12 millimeters the sculpture of the coiled part consists of low rounded primary ribs which begin at the umbilicus, pass halfway to the venter, form a ventrolateral node, and then fork to form the straight rounded secondary ribs on the venter. Some intercalated secondary ribs are present. There would be perhaps 16 primary ribs and 40 secondaries on the last whorl of the coiled part. On the living chamber the primary ribs are represented by four rather prominent subequal nodes evenly spaced along the umbilical margin from the last septum to the aperture. These nodes lie a little way out from the umbilical shoulder. Obscure elevations connect these with the line of ventrolateral nodes, but otherwise the flanks are smooth. The ventrolateral nodes are prominent, subacute, highest at the bend of the living chamber. On the straight part of the living chamber the ventral ribs are weak and widely spaced; on the curved part, prominent and relatively coarse.

The external suture is the normal scaphite suture with parts decreasing progressively toward the line of involution. Internal suture not seen.

The characteristic features of this species are the stout whorls, the convex umbilical shoulder and subquadrate cross section of the living chamber, the high nodes, and the coarse ribs. The species resembles *S. hippocrepis* (DeKay) in general form but differs

sharply in the coarseness of the sculpture of the living chamber, the subquadrate cross section, and the four subequal, evenly spaced primary nodes. It resembles *S. aquilaensis* var. *costatus* Reeside in the sculpture of the living chamber but differs in the strength of the sculpture, the relative depression of the ventral side and consequent subquadrate cross section, the convex umbilical shoulder of the living chamber, and the stoutness of the shell as a whole. It is perhaps closest to *S. aquisgranensis* Schlüter among European forms but differs in the stoutness of the shell and the convex umbilical shoulder. It somewhat resembles *S. geinitzi* var. *binodosus* (Roemer) of Fritsch [55] in sculpture but differs widely in the form of the living chamber. This resemblance in sculpture and difference in form holds also for *S. meslei* Grossouvre.[56] Scupin [57] assigns the figures given by both Fritsch and Grossouvre to *S. kieslingswaldensis* Langenhan and Grundy. *S. leei* resembles some of the other published figures of *S. binodosus* Roemer but differs from all in the form of the shell and details of the sculpture.

This species is named for Mr. W. T. Lee, who collected the type specimen.

Occurrence: At 5 localities—Steele shale, central Wyoming; upper part of Mancos shale, east-central Utah and San Juan Basin and Santa Fe County, New Mexico. (See table, p. 2.)

Scaphites leei var. parvus Reeside, n. var.

Plate 21, Figures 8–16

This variety differs from the normal form of the species chiefly in size. It is from one-third to one-half the size of the larger individuals of the species but is adult in sculpture and suture. The living chamber is slightly more elongated, a feature that seems common in dwarfed forms. Perhaps the most notable difference is the lack of distinctly convex umbilical shoulder on the straight part of the living chamber. The variety resembles on this account *Scaphites aquilaensis* var. *nanus* Reeside but differs sharply in the quadrate cross section of the living chamber and the general stoutness of the shell.

Occurrence: At 2 localities—basal part of Mesaverde formation, upper Rio Grande valley, New Mexico. (See table, p. 2.)

Scaphites sp. undet.

Fragments of scaphites presenting no features suggesting their specific identity were found at several localities, which are listed in the table (p. 2).

[55] Fritsch, Anton, Cephalopoden der böhmischen Kreideformation, p. 42, pl. 14, fig. 13, 1872.

[56] De Grossouvre, Albert, Les ammonites de la Craie supérieure: Carte géol. France Mém., Recherches sur la Craie supérieure, pt. 2, Paléontologie, p. 239, pl. 32, figs. 4, 7, 1894.

[57] Scupin, Hans, Die löwenberger Kriede und ihre Fauna: Palaeontographica, Suppl. 6, pt. 2, p. 101, 1913.

Aptychus of Scaphites sp.

Plate 12, Figure 15

A single specimen of an aptychus was found in the lower part of the Pierre shale at a locality in sec. 2, T. 58 N., R. 61 W., Crook County, Wyo., in association with *Baculites ovatus*, *B. aquilaensis*, *Haresiceras placentiforme*, and *Scaphites hippocrepis* var. *tenuis*. It appears almost certainly to belong to the scaphite rather than to the other species present. Most of the shell substance is lacking, but a clear impression remains to show the form and surface markings of the concave side.

Subfamily PLACENTICERATINAE

Genus PLACENTICERAS Meek

Meek [58] in 1870 proposed the genus *Placenticeras* without description. Six years later [59] he described it as including shells

> usually of large size at maturity, lenticular or discoid in form with sides converging more or less gradually to the periphery, which is either very narrowly truncated or cuneate-carinate and, when truncated, flattened or slightly concave, with its margins angular and smooth, or more frequently each provided with a row of small, compressed, and generally alternating nodes, arranged with their longer diameters in the direction of the peripheral curve; volutions much broader on a line with the plane of the shell than convex, all deeply embracing; umbilicus small or very small; aperture sagittate or nearly so; lip unknown; surface in young examples nearly smooth, or only with sigmoid lines of growth, and in adult shells often one or two rows of small, low lateral nodes on each side, sometimes also provided with obscure, undefined lateral ridges or undulations; septa with from about 10 to 14 comparatively short, generally not very deeply divided lateral lobes and as many sinuses, arranged in somewhat undulated rows across each side of the volutions; siphonal lobe generally a little shorter than the first lateral lobe on either side; lateral lobes increasing regularly in length to the third one, inclusive, and beyond this diminishing in size to the umbilical margin.

Meek chose *Ammonites placenta* DeKay [60] as the genotype and separated his genus as defined above into two sections, *Placenticeras* proper and *Sphenodiscus*, suggesting that they might be considered distinct genera or even referred to distinct families. The section *Sphenodiscus* included all the species with cuneate periphery and simple saddles in the suture. The section *Placenticeras* included the species with the following characters:

> Shell with the very narrow periphery truncated and often provided with a row of compressed alternating nodes along each margin; volutions each about three-fourths embraced by the next succeeding outer one; septa with the lateral sinuses provided with more or less branched and digitate terminal divisions; umbilicus small or moderate. (Type as already stated.)

[58] Meek, F. B., A preliminary list of fossils collected by Dr. Hayden in Colorado, New Mexico, and California: Am. Philos. Soc. Proc., vol. 11, p. 429, 1870.

[59] Meek, F. B., Invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. Survey Terr. Rept., vol. 9, p. 462, 1876.

[60] Meek seems to have had in hand only specimens from the western interior which he referred to *P. placenta* DeKay but which are now designated *P. meeki* Boehm. His descriptions and all his figures are based on this material. Question might therefore be raised as to the genotype species, though no material change in the definition of the genus would result.

For some years the genus was accepted by most students in a very broad sense, and a number of species were assigned to *Placenticeras* which really belong to distinct genera. Douvillé,[61] Grossouvre,[62] and Kossmatt [63] restricted the genus to nearly the sense of Meek's original section *Placenticeras* and eliminated many of the species not properly assigned to it. Hyatt [64] in 1903 rejected still others and gave the genus the limits which have generally been accepted until very recently.

Johnson [65] in 1903 proposed the genus *Stantonoceras* to include the species of *Placenticeras* which acquire stout, subquadrate whorls in the adult stage. There is no other essential difference from such species of *Placenticeras* as *P. placenta* and *P. meeki*, and the group should hardly rank higher than a subgenus.

Spath [66] in 1926 proposed to separate from *Placenticeras* the ammonites like *P. milleri* Hauer as *Pseudoplacenticeras*, those like *P. fritschi* Grossouvre as *Proplacenticeras*, and those like *P. pacificum* J. P. Smith as *Metaplacenticeras*. The writer believes these genera to be valid.

The systematic position of *Placenticeras* has been a matter of debate. The earlier students assigned the genus to the family Amaltheidae. Later it was placed in the family Hoplitidae by H. Douvillé,[67] chiefly on the basis of the similarity of the early sutures to those of certain species of *Hoplites*. Douvillé believed the first, second, and third lateral lobes of the adult suture to arise from the primitive first lateral lobe of the youngest stages, homologous with the first lateral lobe of adult *Hoplites*. Grossouvre [68] accepted Douvillé's assignment of the genus, though Kossmatt [69] considered the evidence adduced insufficient proof. Smith [70] investigated the earlier stages of the forms designated *Placenticeras pacificum* Smith and *P. californicum* Anderson and followed Douvillé in the assignment of the genus to the Hoplitidae, though differing with Douvillé in his interpretation of the origin of the elements of the adult suture. Smith believed that *Placenticeras* as represented by his species was derived through *Hoplites* from *Cosmoceras*, and that the second, third, and fourth lobes of the adult suture arise from the subdivision of the first lateral lobe of the primitive suture and the first lateral lobe of the adult from a marginal lobe of the first lateral saddle of the primitive suture. Hyatt [71] studied the young stages of *P. meeki* Böhm (*P. whitfieldi* Hyatt) and concluded that at no stage in its development is the genus truly comparable with *Hoplites*. He believed that the first and second lateral lobes of the adult suture arise from marginal lobes of the first lateral saddle of the early suture and that only the third adult lateral lobe is the lineal descendant of the first lateral lobe of the early suture. Pervinquière,[72] in view of the very marked differences between *P. pacificum* and *P. californicum* on the one hand, and *P. meeki*, *P. intercalare*, and other typical species on the other hand, justly questioned whether the species examined by Smith and Hyatt really belong to the same genus. Pervinquière agreed with Smith and Douvillé in putting *Placenticeras* under *Hoplites* as a direct descendant. Sommermeier [73] interpreted the figures published by Smith and Hyatt as indicating that there is present a small lobe dividing the primitive first saddle, that the first and second adult lobes are adventitious lobes rising on the siphonal flank of the primitive first lateral lobe, and that the third adult lobe is the primitive first lateral lobe. He believed that the primitive second lateral lobe is variable in development and in *P. pacificum* Smith becomes the fourth adult lobe and exceeds in length the third adult lobe and that the sutures of *P. meeki* Boehm and *P. pacificum* are therefore essentially the same and prove a generic identity. He suggests, also, as another possibility, that the sixth adult lobe is really the primitive second lateral lobe and that the fourth and fifth adult lobes are adventitious. Smith [74] in one of the latest publications dealing with classification places the genus in the family Cosmoceratidae, subfamily Placenticeratinae, with the subfamily Hoplitinae as an earlier group.

The writer [75] has elsewhere expressed the opinion that typical *Placenticeras* like *P. meeki* have little or nothing in common with such forms as *P. pacificum* and has accepted for them the name *Metaplacenticeras* Spath.[76] With this restriction and the removal of *Pseudoplacenticeras* Spath and *Proplacenticeras* Spath, the following diagnosis will cover the characteristic features:

Shell large, discoidal, involute, compressed. Whorls stout, rounded in earliest stages; at a diameter of a few millimeters become higher than wide in cross section, with flattened venter; all later stages to a

[61] Douvillé, Henri, Classification des cératites de la Craie: Soc. géol. France Bull., vol. 18, p. 282, 1890.

[62] De Grossouvre, Albert, Les ammonites de la Craie supérieure: Carte géol. France Mém., Recherches sur la Craie supérieure, pt. 2, Paléontologie, p. 123, 1894.

[63] Kossmatt, Franz, Untersuchungen über die südindische Kreideformation: Beitr. Paläontologie Oesterr.-Ungarns u. des Orients, vol. 9, pp. 169–174, 1895.

[64] Hyatt, Alpheus, Pseudoceratites of the Cretaceous: U. S. Geol. Survey Mon. 44, pp. 188–242, 1903.

[65] Johnson, D. W., The geology of the Cerrillos Hills, New Mexico: Columbia Univ. School of Mines Quart., vol. 24, pp. 136–139, 1903.

[66] Spath, L. F., On new ammonites from the English chalk: Geol. Mag., vol. 63, p. 79, 1926.

[67] Douvillé, Henri, op. cit.

[68] De Grossouvre, Albert, op. cit., p. 123.

[69] Kossmatt, Franz, op. cit., pp. 169–174.

[70] Smith, J. P., The development and phylogeny of *Placenticeras:* California Acad. Sci. Proc., 3d ser., vol. 1, pp. 181–231, 1900.

[71] Hyatt, Alpheus, op. cit., p. 192.

[72] Pervinquière, Léon, Études de paléontologie tunisienne, Céphalopodes des terrains secondaires, p. 197, 1907.

[73] Sommermeier, L., Die Fauna des Aptien und Albien im nördlichen Perú, pt. 1: Neues Jahrb., Beilage-Band 30, pp. 319–321, 1910.

[74] Smith, J. P., Ammonoidea, in Eastman, C. R., Textbook of paleontology by Karl von Zittel, 2d ed., vol. 1, p. 671, 1913.

[75] Reeside, J. B., jr., A comparison of the genera *Metaplacenticeras* Spath and *Placenticeras* Meek: U. S. Geol. Survey Prof. Paper 147, pp. 1–5, pls. 1–2, 1926.

[76] Spath, L. F., On new ammonites from the English chalk: Geol. Mag., vol. 63, p. 79, 1926.

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 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 are not usually strong nor numerous. Suture in adult has three prominent lateral lobes and six or seven smaller lateral lobes.

The species of *Placenticeras* intergrade so extensively that it is difficult to place some specimens. There are intermediate forms connecting *P. guadalupae* with *P. sancarlosense* and *P. sancarlosense* with *P. syrtale* and with *P. planum*. *P. meeki* is connected with *P. intercalare* and *P. intercalare* with *P. syrtale*. Other species are similarly connected, and, as Hyatt [77] says, in substance, one must consider all the forms of *Placenticeras* as representing a single species or select certain convenient points of the series and name them as species. The writer in the following specific descriptions has attempted to define typical individuals with the understanding that many individuals vary from the typical forms.

Placenticeras appears to be entirely an Upper Cretaceous group. The forms from the Albian of Peru assigned by Sommermeier [78] to *Placenticeras* appear to the writer to belong to *Knemiceras*. There are four prominent lobes in the suture, and the details otherwise agree with *Knemiceras* rather than *Placenticeras*, though the degree of incision is greater than in most species of *Knemiceras*. *Placenticeras ebrayi* (Loriol),[79] of the Gault of Cosne, also appears to the writer very doubtfully assignable to *Placenticeras*, for both suture and sculpture present striking differences.

Placenticeras meeki J. Boehm

Plate 22, Figures 5–7; Plates 23–24; Plate 25, Figures 1–2

1876. *Placenticeras placenta* (DeKay) (part). Meek, U. S. Geol. Survey Terr., vol. 9, pp. 465–468, text fig. 65; pl. 24, fig. 2.

1898. *Placenticeras meeki* J. Boehm, Deutsche geol. Gesell. Zeitschr., vol. 50, p. 200 (footnote).

1903. *Placenticeras whitfieldi* Hyatt, U. S. Geol. Survey Mon. 44, pp. 221–232, pl. 45, figs. 3–16; pl. 46; pl. 47, figs. 1–4.

1910. *Placenticeras whitfieldi* Hyatt. Grabau and Shimer, North American index fossils, p. 218, figs. 1493, 1494.

Not 1907. *Placenticeras whitfieldi* Hyatt. Boule, Lemoine, and Thevenin, Annales de paléontologie, vol. 2, p. 48, pl. 12, fig. 5.

Meek in 1876 referred this species to *P. placenta* (DeKay), of the deposits of the Atlantic Coastal Plain. J. Boehm in 1898, following a suggestion by Whitfield,[80] proposed to separate the Western Interior forms from the Coastal Plain species as *P. meeki* and cited particularly the suture given as a text figure by Meek. In 1903 Hyatt described very fully the Western Interior species, including in it the specimens figured by Meek. He proposed the name *P. whitfieldi*, apparently not knowing of the earlier name.

The following quotation from Hyatt's extended discussion of this species gives most of the essential characters:

> This species can be distinguished from true *P. placenta* of New Jersey and the supposed western members of the same species by the following characters: The highly compressed volutions are more involute, and the venter is narrower throughout life and less completely rounded in old age, and this change comes in only at a much larger size than in the shells of *P. placenta*. Owing also to the absence of the median lateral line of tubercles the volution has flatter sides. All tubercles are wanting in typical forms at all stages, but very fine tubercles are present on either border of the venter and larger ones on the umbilical shoulders in some shells. Sometimes minute tubercles are present on the median part of the lateral aspect, but these occur only in the neanic stage, disappearing with the ventral tubercles in the ephebic stage. The sutures are more complicated in the young and are more overlapping than in *placenta*. The saddles are almost linear because of the excessive development of the lobes, which are very long and narrow. These differences hold with the materials so far examined. It must be remembered, however, that as yet no examination of a large number of specimens of both species from the same locality has been made, and it is likely that there are intermediate shells. Certainly no one can distinguish these species unless familiar with both forms or having both for comparison. The same may be said of *P. intercalare*, between which and this species there are intermediate shells in *P. whitfieldi* var. *tuberculatum*.
>
> I made special examination of the ventral lobes of *whitfieldi* in all available specimens. All had the peculiar very broad ventral with long, narrow branches on the lateral aspects except in rare cases in which *syrtale*-like or blunter arms were present. One specimen had the long, narrow arm on the right side and a blunt *syrtale*-like arm on the left side. As a rule the ventral lobe is symmetrical, but the siphonal saddle is often unequally developed or out of place. This saddle is often entire and flat, so that one is apt to regard this as the normal form, but variations are so frequent that only large numbers of specimens could determine the facts. This saddle may have a simple median marginal saddle or be trifid with three saddles, equal or unequal in size, or it may be bifid, with both marginals again subdivided, or of any shape between these and such irregular sinuous outlines that it is difficult to describe it. It is almost invariably sunken between two marginal saddles, one

[77] Hyatt, Alpheus, op. cit., p. 196.

[78] Sommermeier, L., op. cit., pp. 330–336, pl. 7, figs. 1, 2; pl. 8, figs. 1, 2; text figs. 12–14, 1910.

[79] De Loriol, Pierre, Études sur la faune des couches du Gault de Cosne: Soc. paléontologique suisse Mém., vol. 19, pp. 7, 8, pl. 1, 1882.

[80] Whitfield, R. P., Gasteropoda and Cephalopoda of the Raritan clays and greensand marls of New Jersey: U. S. Geol. Survey Mon. 18, p. 256, 1892.

on either side, but occasionally even these blend with the central part of the siphonal saddle.

* * * In 11 specimens * * * ranging in size from 110 millimeters in diameter to [300 millimeters] * * * the typical form was observed. No tubercles were present, and the first lateral saddles were very narrow and very deeply cut by almost straight and very long marginal lobes and saddles.

In all of these there are chevron marks more or less shown, and the sutures are similar. * * * The first three lateral lobes are not very steeply inclined apicad, and the fourth lateral is nearly or quite two-thirds as long as the third lateral. * * *

A specimen from South Dakota, * * * 113 millimeters in diameter, shows the costae and the chevrons, but the costae are quite foldlike. There were no tubercles on the edges of the ventral zone nor on the umbilical shoulders. The smallest part of the outer volution was about 30 millimeters and the widest part about 60 millimeters from the line of involution to venter.

Some of the fragments of volutions examined must have belonged to shells fully 15 inches in diameter, the size of the specimen from New Jersey figured by Morton as *P. placenta*, but none of these showed the gerontic degenerations in the rounding of the venter as in his figure. The wider separation and the simpler outlines of the sutures found in his figure also occur only at a comparatively early stage in this species. The ephebic stage has narrow concave venter on the thick shell and flattened zone on the same area in the cast. The sides are perfectly smooth, with faint sigmoidal, almost obsolescent costae.

Meek figures a specimen just entering upon the ephebic stage, and these costae are faintly indicated. It is, in fact, difficult to see them, and they can be felt better than seen in some specimens. The costae are often quite linear and distinct on the shell in the neanic stage but are not present before or after this stage. The divaricating ridges described and figured by Meek as lines have been described above as lateral chevrons with the apices pointing orad and occurring only on the outer thirds of the sides of the shell. They are very plain on the inner layers of shell and faintly indicated on the cast and entirely independent of the growth bands. At an older stage (probably the metephebic substage) than that figured by Meek they are quite broken or interrupted by the bands of growth on one side, where the nacreous layers are preserved, and on the other, in which part of the outer layer covers them, they are not visible. They are apparently characteristic of the neanic and part of the ephebic stage. The venter retains its flatness until the shell is very large. The sutures are really at considerable distances from each other, but the saddles are so deep and the lobes so long and narrow that the external outlines are approximated except on and near the venter. The first lateral saddles are straight and narrow, and there is consequently a band on either side of the venter in casts which is not cut up by intermingling sutures.

Shell attaining very large size, as much as 600 millimeters in diameter; much compressed, discoidal. Whorls at early stage (diameter of 6 millimeters) acquire a form with high triangular cross section, flat flanks, and very narrow, concave venter bordered by continuous ridges. This form is retained throughout life except that the venter in middle age becomes flat and loses the bordering ridges and later still becomes narrowly rounded. Living chamber about half a volution in length; aperture with broad, shallow lateral lappets and small ventral crest. Umbilicus very narrow, about one-seventh the diameter; umbilical shoulder well rounded in the younger stages but abruptly rounded and with steep inner wall in the later stages.

Sculpture in the very young stages, under 10 millimeters in diameter, consists of fairly numerous faint sigmoid ribs. In the later stages the whorls are smooth except for sigmoid growth lines, obscure coarse lateral folds, and latent tubercles on the umbilical shoulders.

The suture has wide external lobe; narrow first lateral saddle; first to third lateral lobes long and pointed, and included saddles narrow, almost linear; length increasing to third lobe; remaining elements of the suture gradually smaller to the line of involution. Suture much incised, and with a shallow sigmoid curvature.

Placenticeras meeki differs from its nearest allies very sharply in the much compressed form, smooth whorls with very narrow venter, and peculiar suture. From *P. placenta* it may be distinguished by its narrower venter, the lack of a median lateral line of tubercles, and the details of the more complex, sinuous suture; from *P. planum* by the narrow venter with smooth bordering keels, compressed whorl, lack of distinct umbilical nodes on the smaller stages, and the complex suture; from *P. stantoni* by the narrow smooth-keeled venter, lack of umbilical nodes, and details of the complex suture; from *P. pseudoplacenta* by the more compressed whorls, narrower venter, and inequality of the first three lateral saddles of the complex suture; from *P. intercalare* by the absence of distinct median lateral and umbilical tubercles and the smooth keels of the venter.

Placenticeras meeki has been found widely distributed in the Pierre shale and equivalent formations of the Western Interior province of the American Cretaceous. It is not known from the Atlantic or Gulf Coastal Plain. Boule, Lemoine, and Thevenin [81] report the species (as *P. whitfieldi*) from the lower Senonian of Diego Suarez, Madagascar, but the identification seems to be based on form and lack of ornament, and nothing is said about the suture—a very distinctive character of the species. The venter of the specimen figured by these authors is certainly wider than in any American specimen at the same diameter.

Occurrence: At 16 localities—Telegraph Creek formation, northern Big Horn Basin, Montana; Eagle sandstone, Little Horn Valley, Montana; upper part of Cody shale, Big Horn Basin, Wyoming; lower part of Pierre shale, western rim of Black Hills; Steele shale, Buffalo region and central Wyoming; uppermost part of Mancos shale and basal part of Mesaverde formation, upper Rio Grande region, New Mexico. (See table, p. 2.) Widely distributed also in the ater formations of the Montana group up to the base of the Fox Hills sandstone.

[81] Boule M., Lemoine, P., and Thevenin, A., Céphalopodes de Diego Suarez: Annales de paléontologie, vol. 2, p. 48, pl. 12, fig. 5, 1907.

Placenticeras planum Hyatt

Plate 25, Figures 3–7; Plates 26–29; Plate 30, Figures 1–2

1903. *Placenticeras planum* Hyatt, U. S. Geol. Survey Mon. 44, p. 202, pl. 33, figs. 2–4; pl. 34.
1903. *Placenticeras? intermedium* Johnson, Columbia Univ. School of Mines Quart., vol. 24, p. 134, pl. 8, figs. 27a, b.
1910. *Placenticeras planum* Hyatt. Grabau and Shimer, North American index fossils, p. 217, fig. 1492a, New York.

Hyatt gave the following description:

This species grades into *P. sancarlosense*, although very distinct from *guadalupae*. The sides are almost smooth, the tubercles being very small and obscure, except in the umbilicus. * * * The flat compressed aspect of the young is maintained until the shells reach a diameter of 221 millimeters, and the venter does not show any broadening out until after the shell reaches the gerontic stage.

One of the specimens from Presidio del Norte, No. 21651, is 240 millimeters in diameter. Four-fifths of the outer volution is in the gerontic stage, but the first part of the parephebic substage shows the venter still narrow, flat, and tuberculated. It then becomes rounded, but the volution still remains compressed. There are small tubercles in the umbilicus but these disappear in the older stages and almost the entire outer volution is smooth. The other specimen has similar characters, and the sutures are of the *guadalupae* and *syrtale* type.

This species is not separable in some varieties from *P. newberryi*, except by the absence of large lateral nodes at all stages.

The following description is based on the types of the species, which the writer had in hand, and associated specimens.

Shell of medium size, the largest individual in hand about 250 millimeters in diameter and incomplete, though apparently senile; moderately stout for the genus, with evenly curved flanks; venter at first concave, then flat, then rounded with age. At a diameter of 23 millimeters the whorl is 11 millimeters high and 6 millimeters wide and the venter is 1.5 millimeters wide, concave, with the flanks gently curved. At 38 millimeters, a half whorl later, the height is 20 millimeters, the width 8 millimeters, the width of the concave venter 2.5 millimeters, and the flanks well curved, with the widest part of the whorl at the middle of the height. At 60 millimeters, a half whorl later, the height is 31 millimeters, the width 15 millimeters, the width of the concave venter 3.5 millimeters and the flanks curved, with the widest part of the whorl about one-third the height outward from the line of involution. At 90 millimeters, a half whorl later, the height is 48 millimeters, the width 27 millimeters, the width of the venter, now flat, 5 millimeters, and the flanks broadly rounded, with the widest part of the whorl one-fourth the height from the line of involution. These measurements were made on the original of Hyatt's Figures 2 and 3, Plate 33. The original of Hyatt's Figures 2 and 3, Plate 34, is much the same as this specimen, though perhaps a little more compressed at the same diameters. The later stages of the second specimen show that the venter continues to broaden, the whorl widens externally faster than in the umbilical part, and at a diameter of 150 millimeters the whorl has an almost symmetrically elliptical cross section with the venter still distinct from the flanks. At this stage the whorl is 80 millimeters high and 45 millimeters wide, and the venter 9 millimeters wide. A smaller specimen, the original of Hyatt's Figure 4, Plate 33, has the same form as the first specimen to a diameter of 80 millimeters, where the venter suddenly begins to broaden and in a little more than a quarter of a volution becomes broadly rounded and continuous with the flanks. In large specimens from the type locality the form of the whorl varies somewhat. The venter is evenly rounded but wider in some specimens than in others. The proportion of height to width of the whorl varies from 2 : 1 to 3 : 2. In a specimen 250 millimeters in diameter the whorl is 130 millimeters high by 65 millimeters wide and narrowly rounded; in another a little smaller the whorl is 120 by 70 millimeters and more obtuse. The umbilicus in all the specimens is about a fifth of the diameter in width, with well-rounded shoulders that make it difficult to delimit the flank from the umbilicus.

The sculpture of the innermost whorls seen only in the umbilicus. At a diameter of about 25 millimeters faint tubercles appear on the umbilical shoulders and increase in strength until at 50 millimeters they are fairly sharp and distinct. In later stages these umbilical tubercles are broader and broader, and with the rounding of the venter they practically disappear. On the flanks only broad obscure folds appear at any stage, though on the specimen from Presidio del Norte, Mexico, mentioned by Hyatt the lateral folds are really low tubercles. The venter is bordered on the youngest stage visible in the type lot, that at a diameter of 55 millimeters, by distinct elongate nodes. These retain the same character but decrease in distinctness with increasing age of the specimen until with the rounding of the venter they disappear entirely.

The suture is syrtaloid; the siphonal lobe is relatively narrow; the first lateral saddle broad; the three larger lateral lobes rounded, about equal in size to the two included saddles, and increasing somewhat from the first to the third; the remaining elements are gradually smaller to the line of involution. The suture is not much incised, and the bodies of the lobes and saddles are heavy and solid.

The writer conceives the species to be characterized by the combination of the moderately stout shell with relatively wide venter, small umbilical tubercles, smooth, rounded nontuberculate flanks, relatively simple syrtaloid suture with wide first lateral saddle, and other elements slightly increasing to the third lateral lobe and decreasing gradually beyond it. It is connected with *P. sancarlosense* by such forms as that shown by Plate 29, Figures 4–8. This specimen at

a diameter of about 150 millimeters has rather weak sculpture and rounded whorl but is too stout for *P. planum*.

Placenticeras planum need be compared only with the nearly smooth members of the genus. It differs from *P. meeki* in its wider venter, stouter whorls at any given stage, and simpler syrtaloid suture; from *P. placenta* in lacking the median lateral row of tubercles and in possessing a stouter whorl and simpler suture; from *P. stantoni* in its more rounded flanks, wider venter, and wider first saddle of the suture, though the degree of complication of the suture is about the same; from *P. pseudoplacenta* in the more rounded flanks and wider venter and in lacking the subequality of the first three lateral saddles of the suture, though the degree of complication is about the same. Hyatt [82] cites *P. planum* in a list of species which develop heavy, blunt nodes, but this would seem to be an error. Perhaps *P. newberryi* was meant.

The writer has four individuals from the Eagle sandstone of Montana which agree very closely with *P. planum*, much more than with any other species. They possess the wide venter, the smooth, rounded flanks, and the syrtaloid suture of this species, and though two of the specimens are crushed and somewhat weathered there seems to be little doubt of their identity with Hyatt's species. Three of these specimens are relatively small, the largest being about 100 millimeters in diameter and representing the larger half of a nearly complete shell—that is, the part of the outer whorl preserved is unseptate and is nearly all of the living chamber. The next largest specimen is a complete though crushed cast 90 millimeters in diameter. The smallest specimen preserves parts of two whorls, the outer at a diameter of perhaps 70 millimeters. The fourth specimen is as large as many specimens of *P. planum* from the type locality of the species—that is, 260 millimeters in diameter—and agrees perfectly with them.

The species has been found also at a number of localities in northern New Mexico, at one on the western rim of the Black Hills, and at one in central Utah. The types of the species come from the San Carlos beds at San Carlos, Presidio County, Tex., where they are associated with *Placenticeras guadalupae*, *P. sancarlosense*, *Mortoniceras omeraense*, and *Scaphites* aff. *S. inflatus* Roemer. It has been reported by Stephenson [83] from a number of localities in the *Mortoniceras texanum* subzone of the eastern Gulf region, a horizon older than that of the present specimens.

Occurrence: At 15 localities—Eagle sandstone, Billings region, Montana; Telegraph Creek formation, northern Big Horn Basin, Montana and Wyoming; Steele shale of Buffalo region, Wyoming; lower part of Pierre shale, western rim of Black Hills; Emery sandstone member of Mancos shale, central Utah; uppermost part of Mancos shale and basal part of Mesaverde formation, upper Rio Grande valley, New Mexico. (See table, p. 2.)

Placenticeras syrtale (Morton) Meek

Plate 30, Figures 3–6; Plate 31, Figures 1–2

1834. *Ammonites syrtalis* Morton, Synopsis of the organic remains of the Cretaceous group in the United States, p. 40, pl. 16, fig. 4.
1876. *Placenticeras syrtale* (Morton). Meek, U. S. Geol. Survey Terr. Rept., vol. 9, p. 469.
1903. *Placenticeras syrtale* (Morton). Hyatt, U. S. Geol. Survey Mon. 44, pp. 205–206, pl. 27, figs. 15–17; pl. 28, figs. 1–6.
1910. *Placenticeras syrtale* (Morton). Grabau and Shimer, North American index fossils, pl. 217, figs. 1492 b–d.
Not *Placenticeras syrtale* (Morton) of other than North American strata, cited by many authors.

The writer has a single specimen from the Eagle sandstone which is referred to *Placenticeras syrtale* (Morton). The original description is as follows:

> Shell much compressed but widening rapidly toward the aperture; two series of nodes, one on the umbilical margin, the other near the periphery; nodes but little elevated, except on the umbilical margin, near the aperture, where they are profoundly elevated; periphery; with two series of pyramidal nodules, giving it a dentated appearance; septa distant, sigmoidal. Greatest diameter about 3 inches.

Hyatt refigured Morton's type specimen and discussed the relationship to the similar species of the genus. A continuous series of forms connects smooth, compressed species like *P. meeki* Boehm and stout tuberculated forms like *P. guadalupae* Roemer. In this series *P. syrtale* lies between *P. intercalare* Meek and *P. sancarlosense* Hyatt in its external characters. *P. sancarlosense* and its variety *pseudosyrtale* are, however, relatively stout whorled and broad ventered at all stages—in fact, the adult stage of *P. sancarlosense* in some individuals approaches the quadrate form of whorl characteristic of *P. guadalupae*. The specimen in hand is clearly not of this type but lies toward the other end of the series. Between *P. syrtale* and *P. intercalare* the distinction must be drawn on the strength of sculpture and the details of the suture. The following comparison shows the differences between the two species:

[82] Hyatt, Alpheus, op. cit., p. 211.

[83] Stephenson, L. W., Cretaceous deposits of the eastern Gulf region and species of *Exogyra* from the eastern Gulf region and the Carolinas: U. S. Geol. Survey Prof. Paper 81, p. 24, tables 2–9, 1914.

P. intercalare	*P. syrtale*
Whorl moderately stout, slightly swollen at middle line of tubercles; flanks flat between tubercles; widest part at umbilical shoulder; venter wider than in *P. whitfieldi*, with bordering row of linear nodes.	Whorl moderately stout,[84] swollen at both lines of tubercles, widest at inner row, which lies toward middle of flank; flanks between tubercles concave; venter like that of *P. intercalare*, with high, rather stout bordering tubercles.
Umbilicus small. Three rows of nodes, middle row toward middle of the flank, inner row almost on umbilical shoulder; very obscure ribs connecting the nodes.	Umbilicus relatively wide. Three rows of nodes, middle row near venter, inner toward middle of flank; in adult stage the nodes exaggerated. Obscure ribs connecting nodes, both ribs and nodes higher than in *P. intercalare*.
External lobe wide; first lateral saddle narrow; first three lobes gradually larger, fourth and others gradually smaller; lobes broader than saddles, long and pointed, though less so than in *P. meeki*. Elements of suture moderately incised.	External lobe narrow, first lateral saddle wide; first three lateral lobes subequal, others gradually smaller; lobes narrower than saddles, rather rounded and with narrow bases. Elements of suture relatively simple.

The specimen from the Eagle sandstone has the narrow siphonal lobe, wide first lateral saddle, rounded lateral lobes, and simple open saddles of *P. syrtale* and also the relatively strong sculpture, though the inner row of nodes is on the umbilical shoulder. The size of the umbilicus and the form of the cross section of the whorl fit *P. intercalare* better perhaps than *P. syrtale*. A specimen figured by Hyatt[85] as *P. intercalare* because its suture was more like *P. meeki*, though its sculpture and form were that of *P. syrtale*, is much like the present specimen in form.

Morton's type is said to have come "from the older Cretaceous deposits of Greene County, Ala.," possibly the modern Eutaw formation. The species is believed to occur also in the Taylor marl or the Austin chalk of Texas. Forms identified as *P. syrtale* in the European and Asiatic Cretaceous characterize the Santonian, particularly the upper part. The writer, following Hyatt,[86] doubts the specific identity of these forms with the American *P. syrtale* though the close relationship is beyond doubt.

Occurrence: Eagle sandstone on road from mouth of Little Horn River, 7 miles northeast of Hardin, Big Horn County, Montana.

[84] Hyatt says that at any given stage *P. intercalare* is stouter than *P. syrtale*, but Hyatt's figure of the type of the latter species shows a stouter shell than any of his figures of the former.

[85] Hyatt, Alpheus, Pseudoceratites of the Cretaceous: U. S. Geol. Survey Mon. 44, p. 210, pl. 36, fig. 5; pl. 37, figs. 1, 2, 1903.

[86] Idem, pp. 237-239, 241, 242.

Placenticeras newberryi Hyatt

Plate 31, Figures 3–5; Plate 32; Plate 33, Figures 1–4

1903. *Placenticeras newberryi* Hyatt, U. S. Geol. Survey Mon. 44, pp. 203–205, pl. 31, figs. 3–5.

1910. *Stantonoceras newberryi* (Hyatt). Grabau and Shimer, North American index fossils, p. 221, fig. 1499.

Hyatt describes this species, in part, as follows:

The type is a cast with small patches of shell. Diameter is 120 millimeters, to which must be added perhaps 5 millimeters for depression of outer volution. The diameter of the whole coil one-fourth of a volution younger and not altered by depression is 94 millimeters. The outer volution at aperture is 54 millimeters and transverse is 39 millimeters, the umbilicus is 24 millimeters and the opposite part of the same volution is 42 millimeters and transverse 28 millimeters. The last volution begins with transverse diameter of 19 millimeters, enlarges in the next quarter of a volution to 28 millimeters, and just beyond this the large gerontic tubercles begin. The transverse diameter continues to increase until the last quarter apicad of the aperture is reached, and then it diminishes between the last two tubercles, which are widely separated, and still further diminution takes place at the aperture. In another specimen there is no diminution in the rate of growth of the transverse diameter apparent to the eye, but this specimen has not a complete living chamber. The almost scaphitean aspect of the living chamber in some specimens is misleading and is in part due to depression. Nevertheless, this only exaggerates the gerontic metamorphoses of this interesting species. Small nodes are present in an early ephebic substage on the umbilical shoulders and continue to increase, becoming very large suddenly in the anagerontic substage. Elongated tubercles are present on either side of the venter in the ephebic stage, but the age of introduction was not ascertained; apparently it is later than that of the tubercles on the umbilical shoulders.

The latter are widely separated at all stages, but the ventral tubercles are close together. There are foldlike costae, some of them dichotomous, on the outer part of the outer volution on the cast, but these leave no perceptible middle row of tubercles in the ephebic stage. The venter increases in the gerontic stage from being 5 millimeters wide between the lines of tubercles to 20 millimeters on the first half of the outer volution, and this continues to grow broader and more convex until near the aperture, where there is an apparent diminution. As the venter broadens, the costae are brought to the edges of the venter, and their terminations become enlarged into rows of nodes as the gerontic stage progresses but disappear in the paragerontic substage as the venter broadens and the surface of this becomes smooth on the casts.

The living chamber is somewhat less than one-half of a volution in length. It has very deep sinuses on the umbilical zones and prominent lateral crests. The form of the ventral margin was not seen. The umbilicus is deep, the internal volution visible, the umbilical shoulders are prominent, the umbilical zones are steep and broad, as in other species of the genus, from a comparatively early age.

The sutures are of the guadalupaean *syrtale* type and well separated, becoming approximated only in extreme age.

This species is characterized by stout later whorls, approaching the form of *P. guadalupae;* very weak sculpture in the earlier stages but the sudden acquisi-

tion late in life of a few strong distant umbilical tubercles; middle row of tubercles lacking in early stages, weak and rather distant in the later stages; final stage smooth and rounded; the flanks of the whorls apparently nearly flat until the final stage. It differs from *P. guadalupae* in having a less stout whorl and much weaker sculpture, acquired only late in life and not retained; from *P. sancarlosense* chiefly in the weaker sculpture of the early whorls and in acquiring a strong sculpture only at a late stage and not retaining it; from *P. syrtale* in having a stout whorl with a subquadrate stage in the adult and weak sculpture in the younger stages; from *P. planum* in having the stout later whorls and a stage with strong sculpture, though the young stages are much alike.

Two specimens from New Mexico fit the description of *P. newberryi* very well and are referred to it. They have younger stages much like *P. planum*, then suddenly become stout with broad flattened venter and acquire distant umbilical nodes and weak, distant lateral nodes. The final stage is not preserved, but the whorl appears to become round ventered in one specimen.

Hyatt's specimens came from Presidio del Norte, Mexico.

Occurrence: Uppermost part of Mancos shale near the Omera mine, east flank of Ortiz Mountains, Santa Fe County, New Mexico.

Placenticeras sancarlosense Hyatt

Plate 33, Figures 5–11; Plates 34–36; Plate 37, Figures 3–5

1872. *Ammonites guadalupae* Roemer. Gabb, Acad. Nat. Sci. Philadelphia Proc. for 1872, p. 264, pl. 9, fig. 1; pl. 10, figs. 1, 1a.

1903. *Placenticeras sancarlosense* Hyatt, U. S. Geol. Survey Mon. 44, p. 200, pl. 30, figs. 1–3; pl. 31, figs. 1, 2.

1903. *Placenticeras rotundatum* Johnson, Columbia Univ. School of Mines Quart., vol. 24, p. 135, pl. 9, figs. 28 a, b.

Hyatt's description is as follows:

> This (species) is represented by a series of specimens * * * that fade into true *guadalupae*.
>
> The typical forms differ in having smaller tubercles, the compressed stage is more prolonged and the ephebic volutions are never so stout nor the venter so broad as in *guadalupae*. The stage in which the venter is broad and bounded by the second line of nodes and similar to that of *guadalupae* is short and is often distinctly confined to the anagerontic substage. Some specimens of this form are closely similar to *P. syrtale* * * * [which] has, however, so far as known, no stage in which the venter resembles that of *guadalupae*.

The following notes are based largely on Hyatt's type material, supplemented by the inner whorls of another specimen from the type locality.

Shell rather stout for the genus at all stages but especially in the larger stages; attains moderately large size, the largest seen by the writer being 240 millimeters in diameter; forms a stout disk. The line of involution coincides with the inner line of tubercles.

At a diameter of 4 millimeters the cross section is broadly rounded; the whorl is 2.5 millimeters high and 2 millimeters wide; flanks rounded; venter 0.5 millimeter wide, flat, and sharply limited. At a diameter of 6 millimeters, a half whorl later, the cross section is subtriangular; the whorl is 3 millimeters high and 2 millimeters wide; flanks more gently rounded; venter 0.7 millimeter wide, slightly concave; umbilical wall merges gradually into the flank. A half whorl later, at a diameter of 11 millimeters, the whorl is 6.5 millimeters high and 3.3 millimeters wide; flanks nearly flat; venter 1 millimeter wide, concave; umbilicus separated from the flank by a rounded shoulder. A half whorl later, at a diameter of 20 millimeters, the whorl is 10.5 millimeters high and 5 millimeters wide; flanks gently arched; venter 1.3 millimeters wide, concave; umbilicus separated from flank by a definite rounded shoulder. A half whorl later, at a diameter of 33 millimeters, the whorl is 18 millimeters high and 8 millimeters wide; flanks still gently rounded; venter 1.5 millimeters wide and only slightly concave; umbilical shoulder rather broadly rounded. A half whorl later, at a diameter of 51 millimeters, the whorl is 26 millimeters high and 13 millimeters wide; venter 2.5 millimeters wide, flat; flanks swollen slightly near the umbilical shoulder and near the venter; umbilical wall inclined to the axis of the shell and not sharply separated from the flank. Up to this stage the cross section has had the general form of a high triangle with the angles truncated. In the succeeding half volution the whorl swells rapidly and at 70 millimeters has a stout oval cross section. The whorl is 33 millimeters high and 23 millimeters wide, avoiding the tubercles; the venter is 8 millimeters wide and merges into the flanks by well-rounded ventrolateral areas; the umbilicus likewise merges into the flank by broadly rounded shoulders. In a cross section through the tubercles the flanks are much swollen at the lines of umbilical and lateral tubercles. At 88 millimeters, a quarter volution later, the cross section is like that of *P. guadalupae*, with the ventral aspect broad and gently arched and the lateral tubercles on its borders. The cross section, avoiding the tubercles, is almost subquadrate; the whorl is 40 millimeters high and 32 millimeters wide; the ventral aspect is 22 millimeters wide; a cross section through the tubercles is rudely hexagonal. A quarter whorl later, at a diameter of 105 millimeters, the gerontic form of *P. sancarlosense* is evident. The lateral tubercles have begun to pass inward again, and the ventral aspect becomes more highly arched. In still later stages the form of the cross section of the whorl is that of a stout oval swollen somewhat at the lines of tubercles. The species therefore attains the form of whorl of *P. guadalupae* but loses it quickly and becomes well rounded. In a large specimen from New Mexico, at the maximum diameter of 240 millimeters, the whorl

is well rounded but not so stout as the rounded gerontic stage of *P. guadalupae*. The umbilicus of this species is approximately one-fourth the diameter of the shell in width.

The surface of the whorl appears to be smooth to the diameter of 20 millimeters for the shell. Between 20 and 30 millimeters in diameter rather poorly defined nodes appear, elongated radially and bent into a crescent with concave side forward. From a diameter of 6 to 30 millimeters the venter is concave and bordered by continuous keels. At about 40 millimeters small nodes appear on the umbilical shoulders, and the venter is flat with just a suggestion of alternating nodes on its border. At 50 millimeters the umbilical nodes are well defined, the crescentic lateral nodes have become obscure sinuous ribs, best defined on the outer third of the flank, and the venter is bordered by well-defined elongated alternating nodes. At 70 millimeters the umbilical tubercles have become prominent and have moved outward from the umbilical shoulder somewhat, the lateral ribs have acquired distinct low conical tubercles on the outer third of the flank, and the ventral tubercles have become more distant. In the later stages the three rows of tubercles are very distinct; the inner row consists of rather stout, blunt spines; the lateral rows of low conical nodes, connected by obscure ribs with the inner row; the ventral rows lower and less defined. On the largest specimen in hand the umbilical nodes of the last whorl have passed into coarse rounded costae; the lateral nodes remain round and distinct almost to the end of the specimen, though they finally become elongated radially and become ill-defined secondary ribs at the very end of the specimen. The venter at this stage shows no trace of the ventral tubercles nor the flattened venter, though this may be due to the state of preservation.

The suture is of the *guadalupae-syrtale* type, with siphonal lobe relatively narrow, first lateral saddle wide, the first three lateral lobes subequal and included saddles subequal, remaining elements gradually smaller; all elements rounded and relatively simple.

Placenticeras sancarlosense is characterized by having a fairly stout shell at all stages, with venter broad but well rounded except for a short stage when the whorl has a subquadrate form like *P. guadalupae* (Roemer); relatively wide umbilicus; strong sculpture; and simple suture. It differs from *P. guadalupae* in having the shell less stout at any given stage, in its weaker sculpture, and particularly in having the subquadrate form for only a small period of its growth; from *P. newberryi* Hyatt in having a somewhat stouter shell and particularly more numerous nodes, which arise much earlier and persist much longer; from *P. sancarlosense* var. *pseudosyrtale* Hyatt in its greater involution, which reaches the inner line of nodes, and in having a subquadrate stage; from *P. syrtale* (Morton) in its much stouter shell at all stages, in its much stronger sculpture, and in having a subquadrate stage; from *P. planum* Hyatt in its stout shell and prominent sculpture. *P. sancarlosense* is connected by intermediate forms with all the species listed above, and the assignment of some specimens is difficult.

Hyatt's specimens came from San Carlos, Presidio County, Tex.

Occurrence: At 9 localities—uppermost part of Mancos shale and basal part of Mesaverde formation in upper Rio Grande valley, New Mexico. (See table, p. 2.)

Placenticeras sancarlosense var. pseudosyrtale Hyatt

Plate 37, Figures 1–2

1903. *Placenticeras sancarlosense* var. *pseudosyrtale* Hyatt, U. S. Geol. Survey Mon. 44, pp. 200–202, pl. 32; pl. 33, fig. 1.

Hyatt's description of this form is as follows:

The type of this variety is a well-preserved cast 200 millimeters in whole diameter. * * * The tubercles of first inner row alternate with those of the opposite side; the outer row is more numerous than the inner, and there are slight indications of bifurcated ridges of costae connecting them on the cast. The ventral tubercles are irregularly alternate with the second row and there may have been ridges bifurcating more or less between these, but there are no indications of these on the cast.

* * * The inner lines of tubercles do not appear until the ephebic stage and are at first very minute but rapidly enlarge in the remainder of the ephebic and gerontic stage, disappearing suddenly before the outer ones at the beginning of the parageronic stage. They recede from the umbilical shoulders outwardly in the parephebic and gerontic stages and have an inner costation or ridge inclined apicad.

The outer line of tubercles disappears in the parageronic substage immediately after the inner line. The ventral lines of tubercles disappear on the cast in the metageronic substage. These tubercles are present on a bit of thick ventral shell in the ephebic stage. These are almost linear, alternating and widely separated, and border a slightly concave ventral zone, which is, however, flat upon the cast at the same age. The ventral zone continues well defined and flat upon this cast until quite close to the aperture in the extreme of the parageronic substage. The contraction of the gerontic volution is very marked, beginning, even in the parephebic substage, before the gerontic septa appear and apicad of the base of the gerontic living chamber.

The sutures have the aspect of those of *syrtale*, but the outlines are more complex and the third lateral lobes longer and more pointed. * * * There are eleven lobes and twelve saddles on each side in anageronic septa; the innermost saddle is narrow and apparently entire, all the remainder divided and bifurcate except the first laterals. In these the inner arm extends inwardly and, being itself bifurcated, gives a trifurcated aspect to each of these saddles. The inner lobes are bifurcated and broaden outwardly, being somewhat blunt or rounded except in the third lateral, which is pointed and apparently of the bifurcated type, as are also the other lobes. * * *

The living chamber is one-half of a volution in length. The outer part of the aperture is preserved, showing a blunt, broad, rounded ventral crest, or slight rostrum, ventrolateral sinuses in the second line of tubercles, and the appearances indicate broad lateral crests, but the margins were broken away inside of this.

Placenticeras sancarlosense var. *pseudosyrtale* is marked by its rather stout shell, which does not have the subquadrate stage of *guadalupae* and *sancarlosense*, the position of the line of involution well outside of the line of umbilical tubercles, the strong sculpture, and the simple suture. It differs from *P. guadalupae* in having a less stout shell and a rounded cross section; from *P. sancarlosense* in having the lateral nodes larger and more quickly developed and the ventral tubercles more widely separated, in lacking the subquadrate stage, and in the involution leaving the umbilical nodes completely uncovered; from *P. syrtale* in that the shell is stouter, the ventral tubercles are more elongated and more distant, and the second line of nodes is less prominent and nearer the venter.

This species is intermediate between *P. sancarlosense* and *P. syrtale.*

The writer has one specimen 250 millimeters in diameter that seems to belong to this variety of *P. sancarlosense.* It is partly crushed but shows the characters fairly well.

The exact locality of Hyatt's specimen is in doubt, though it seems surely to have come from Texas.

Occurrence: Uppermost part of Mancos shale, 1 mile east of head of Canyon del Yeso, Santa Fe County, New Mexico.

Placenticeras guadalupae (F. Roemer) Meek

Plates 38–41

1849. *Ammonites guadalupae* Roemer, Texas, pp. 416–417, Bonn.

1852. *Ammonites guadalupae* Roemer, Die Kreide von Texas und ihre organische Einschlüss, p. 32, pl. 2, figs. 1a, b, Bonn.

1876. *Placenticeras guadaloupae* (Roemer). Meek, U. S. Geol. Survey Terr. Rept., vol. 9, p. 463.

1903. *Placenticeras guadalupae* (Roemer). Hyatt, U. S. Geol. Survey Mon. 44, pp. 197–199, pl. 29, figs. 1–4.

1903. ?*Stantonoceras guadalupae* (Roemer). Johnson, Columbia Univ. School of Mines Quart., vol. 24, p. 137.

1903. *Stantonoceras pseudocostatum* Johnson, idem, pp. 137–139, pl. 10, fig. 29a; pl. 11, figs. 29b, c.

1910. *Stantonoceras guadalupae* (Roemer). Grabau and Shimer, North American index fossils, p. 221, fig. 1500.

1910. *Stantonoceras pseudocostatum* Johnson. Grabau and Shimer, idem, p. 221, fig. 1501.

Not 1872. *Ammonites guadalupae* Roemer. Gabb, Acad. Sci. Philadelphia Proc. for 1872, p. 264, pl. 9, fig. 1; pl. 10, figs. 1a, b.

Not *Placenticeras guadalupae* of other than North American strata, cited by many authors.

Roemer's original description (translated) is as follows:

Shell stout, forming a thick disk, widely umbilicate, nodose; whorls increasing rapidly in height, more slowly in width; flanks and venter swollen; involution more than half the height; ornamented with several rows of nodes. Two rows of rather small elongated nodes stand on the venter near the middle line. A row of stronger rounded nodes (20 in each row) borders on each side the swelling of the venter, and finally there is on either side at almost the middle of the flank, though sometimes nearer the umbilicus, a row of very stout, low, conical, distant nodes (10 on each side of a whorl), which almost regularly stand opposite each two nodes of the row bordering the venter. The concealment of the whorl by the later whorls reaches exactly to this middle row. The cross section of the whorl is oval, almost heart-shaped. The row of small nodes of the venter, and much more the rows of greater nodes, form shoulders on the whorl. The sutures are relatively little incised; the lobes are numerous, shallow and decrease, with the exception of a few, gradually from the venter to the umbilicus. The two branches of the siphonal lobe are separated by a broad space and diverge strongly. The branches of all the lobes are little incised and end with short extremities. The short blunt ends of the lobes have the appearance of having been changed by weathering or wear, which is not the case.

Hyatt's remarks on the species are in part as follows:

The best specimen I have seen has a diameter of about 145 millimeters. Outer volution on gerontic living chamber about halfway to the aperture is 63 millimeters and the transverse diameter 47 millimeters, the same volution opposite is 43 millimeters, the transverse being 34 millimeters, avoiding the tubercles. * * * The involution covers the inner volutions to the inner line of tubercles. * * * The venter is very broad, so that the second line of tubercles are on its lateral angles and the first lateral saddles and lobes are on the ventral aspect. The alternating ventral tubercles and the flat ventral zone between them are retained on the venter throughout the ephebic stage. The inner row consists of large acute spines, solid at the tips only, which are large nodes on the cast, at the start, when the umbilicus is only 25 millimeters in diameter. These recede outwardly with age. * * * The venter is convex and elevated in the gerontic stage and had a ventral zone as described above. * * * The young is more compressed and slender than the outer volutions, although in most Ammonitinae the reverse of this is true. The rounded nepionic volutions were followed as in other species by the compressed and deeply involute volutions of the neanic stage, and these acquired first the flattened venter and helmet-shaped section, and then, as the ventrodorsal diameters lengthened, the hollow venter bordered by smooth ridges and general aspect of *Protengonoceras.* * * * The auxiliaries [of the suture] * * * in the neanic stage were of the *syrtale* type, but their simple outlines showed that in the preceding *Protengonoceras* age they must have been very simple in outline and perhaps similar to those of *Engonoceras.* The nodes on the cast did not begin to appear on the umbilical shoulders until the shell was about 35 to 40 millimeters in diameter and had entered upon the ephebic stage. The outer row of spines were not visible until later. * * * The ephebic stage has a stout volution with gibbous sides with proportions entirely different from those of the gerontic stage. At diameter of 26 millimeters from line of involution to venter the transverse diameter of umbilical shoulders is 15 millimeters, and at 6 millimeters distant from the venter the transverse diameter is 11 millimeters. The lateral zones are nearly flat and only slightly convergent and then converge rapidly but convexly to the venter, which is broad, being here 5 millimeters. The last part of the neanic stage 11.5 millimeters by 5 millimeters at the umbilical shoulders and the convergence of the faintly convex lateral zones outwardly is constant to the venter, which is 1.5 millimeters in breadth. The gerontic volution in the same section is 45.5 by 35.5 millimeters at the umbilical shoulders and between tubercles. The ventral line of tubercles and the concave area or ventral zone disappear in the gerontic stage, and the last measurements were taken after their disappearance near the basal suture of the living chamber.

Roemer's figures * * * show a specimen * * * just entering the anagerontic substage.

There were 11 saddles and 10 lobes on the older sutures, with less complicated outlines than in *pseudosyrtale* but otherwise similar. * * * The ventral lobes are deeper and narrower and the siphonal saddles more prominent and distinct than in any other species except * * * *P. uhligi.* It stands between this primitive form and *P. pseudosyrtale* and other American species, all of which have very broad ventral lobes and less prominent siphonal saddles.

The following notes are based largely on material from San Carlos, Tex., studied and identified by Hyatt as typical specimens of *P. guadalupae*, and on specimens from New Mexico:

Shell very stout for the genus, attaining moderately large size, the largest specimen seen by the writer having a maximum diameter of 320 millimeters, though only part of the living chamber is preserved; forms a thick disk. Involution covers the inner whorls to the inner line of tubercles. At a diameter of about 20 millimeters for the shell the whorl is 10 millimeters high and 5 millimeters wide; the venter 1.5 millimeters wide, concave; flanks gently arched; umbilicus fairly well separated from the flanks by a shoulder. At a diameter of 32 millimeters, a half whorl later, the whorl is 15 millimeters high and 8 millimeters wide; venter 2.5 millimeters wide, slightly concave; flanks well curved; umbilical wall inclined to the axis with shoulder less distinct. At 46 millimeters, a half whorl later still, the whorl is 23 millimeters high and 14 millimeters wide; venter 4 millimeters wide, flat; flanks swollen somewhat near the umbilical shoulders and near the venter, though flat between the swellings. The whorl swells rapidly in the following stages. At 70 millimeters, a half whorl later, the whorl is about 35 millimeters high and 22 millimeters wide, avoiding the tubercles; the whorl has a stout oval cross section with flanks highly arched; in a cross section through the tubercles the flanks are swollen at the lines of tubercles near the umbilicus and near the venter. At 90 millimeters, a half whorl later, the whorl is round-oval between the tubercles and roughly hexagonal through them; the whorl is 45 millimeters high and 36 millimeters wide; the ventral aspect of the whorl is 25 millimeters wide and gently arched. This is the adult form and is retained until a very late stage, when the whorl becomes broadly rounded through the changing of the nodes into ribs. In the larger stages above 50 or 60 millimeters the separation between flank and umbilicus is purely arbitrary. The umbilicus of the larger specimens is in width approximately one-fourth the diameter of the shell.

The sculpture of the whorl at 20 millimeters consists of faint tubercles on the umbilical shoulder, still fainter ones on the outer half of the flank, and continuous keels bordering the concave venter. At 32 millimeters it is much the same, though the nodes are a little stronger. At 46 millimeters the nodes are still stronger and the keels bordering the venter have broken into alternating elongated nodes. Both of the inner rows of nodes have migrated outward a little. At 70 millimeters the inner nodes have become strong, the outer less so, and the ventral nodes are perhaps less distinct. At 90 millimeters and in the rest of the adult stage the inner nodes are very stout, blunt spines and have migrated nearly to the middle of the flank; the second row are low and rounded and border the broad ventral aspect. Obscure ribs connect the inner and the second rows. There are about three tubercles in the second row for each tubercle of the inner row. The ventral nodes are low and not very distinct, though the trace of the flat venter which they border is distinct until a very late stage. In the largest specimens at hand the inner and the second rows of tubercles have elongated radially and joined to form coarse rounded, forked ribs on the flanks. The venter at this stage is smooth and rounded.

The suture is, as described by Hyatt, of the *syrtale* type and relatively simple.

The most diagnostic characters of typical examples of *Placenticeras guadalupae* are the stoutness of the shell at all stages; the subquadrate form of the whorl, acquired early and retained until a very late stage; the relatively wide umbilicus; the strong sculpture; and the simple suture. From its nearest relative, *P. sancarlosense* Hyatt, it differs in having a stouter shell at all stages, stronger sculpture, and a much longer possession of the quadrate form of the whorl. From *P. newberryi* Hyatt it differs in its stouter shell and its stronger and much more numerous nodes, which are acquired early and retained throughout life.

From the species of the Santonian of Europe and Asia, referred to *P. guadalupae* by many authors, it differs, as pointed out by Hyatt,[87] enough to deserve separation, though obviously related.

The writer believes that the form described by Johnson [88] as *Stantonoceras pseudocostatum* is only the senile form of *P. guadalupae*, and that there is not sufficient ground for separating them as distinct species.

The writer has nine specimens from New Mexico that are undoubtedly *P. guadalupae.* They possess all the characters of the species as shown by Roemer's and Hyatt's specimens from Texas and can not be separated from them. Stephenson[89] reports *P. guadalupae* from many localities in the *Mortoniceras texanum* subzone of the eastern Gulf region, a horizon somewhat older than that of the specimens in the writer's hands.

[87] Hyatt, Alpheus, Pseudoceratites of the Cretaceous: U. S. Geol. Survey Mon. 44, pp. 237, 241, 1903.

[88] Johnson, D. W., The geology of the Cerrillos Hills, New Mexico: Columbia Univ. School of Mines Quart., vol. 24, p. 137, pl. 10, fig. 29a; pl. 11, figs. 29b, c, 1903.

[89] Stephenson, L. W., Cretaceous deposits of the eastern Gulf region and species of *Exogyra* from the eastern Gulf region and the Carolinas: U. S. Geol. Survey Prof. Paper 81, p. 24, tables 2-9, 1914.

Occurrence: At 5 localities—upper part of Mancos shale, east-central Utah and San Juan Basin and upper Rio Grande valley, New Mexico. (See table, p. 2.)

Placenticeras sp. undet.

Fragments or indeterminable specimens of species of *Placenticeras* were collected at a number of localities, which are listed in the table (p. 2).

Family PRIONOTROPIDAE

Genus MORTONICERAS Meek

Shell discoid; periphery with a simple, low, central keel and a more or less defined sulcus on each side of it; the sulci being generally each margined externally by a row of compressed nodes; umbilicus wide; volutions narrow, slightly embracing, and ornamented by regular, simple, straight, tuberculated costae. Septa in the typical species with three lateral lobes on each side, the first one being longer than the siphonal lobe, with tripartite extremity, the terminal division being deeply bifid; second and third lobes much smaller and more or less tripartite or dentate; first and second lateral sinuses more or less nearly equally bipartite or bilobate at the ends.—Meek.[90]

Meek took *Ammonites vespertinus* Morton as the type of the genus, believing it identical with *Ammonites texanus* Roemer. Later authors consider *A. vespertinus* distinct and take *A. texanus* as the real genotype. Grossouvre[91] describes the genus as follows:

Shells with cross section of the whorls higher than wide, subquadrate, with external border broad and ornamented on the siphonal line by a low rounded keel.

The suture resembles in some respects that of *Acanthoceras*, except that the first lateral lobe is rounded at its extremity and has digitations of almost equal size, so that one can not distinguish, or at least not very clearly, the terminal fork characteristic of *Acanthoceras*. The reduced suture has only two lateral lobes and the siphonal lobe. The bases of the lobes lie on a line perpendicular to the periphery. [Translated.]

Pervinquière's description[92] is as follows:

Shell discoid, with wide umbilicus; cross section of the whorls quadrangular, with external border wide, ornamented by a low keel, bordered by two furrows more or less deep, bordered themselves, externally, by a row of elongated tubercles; whorls little embracing, bearing straight, tuberculated, simple or bifurcated ribs.

Sutures recalling those of *Acanthoceras*, composed of a very small number of elements; beside the siphonal and antisiphonal lobes, there are generally on each side four saddles (one internal) and three lobes; all the saddles have the same height; the first lateral lobe has much the same length as the siphonal lobe, but it is much longer than the others; this first lobe is bifid or ends in two equal points. [Translated.]

Since its establishment *Mortoniceras* has suffered at the hands of some writers a very great and scarcely warranted extension in scope. It is more useful and probably nearer the truth to restrict the name to the compact group of forms closely allied to *M. texanum* both in characters and in age. Within this typical group some recent students would draw still finer lines of division. Spath[93] proposes to use *Submortoniceras* for the Campanian forms allied to *M. woodsi* Spath and *M. delawarense* Morton, which would include *M. omeraense* Reeside, n. sp., described below. Spath says:

The Campanian forms differ from the earlier true *Mortoniceras* (genotype *M. texanum* Roemer sp.) * * * chiefly in the more continuous keel and progressive decline of ornamentation as well as of other characters.

The writer can not see these distinctions in the specimens now available to him and for the present, at least, prefers to keep them all under the original name.

Mortoniceras omeraense Reeside, n. sp.

Plate 42, Figures 3–4; Plate 43, Figures 1–2

This species is based on two specimens, of which the larger is taken as the type. The smaller preserves two and one-half whorls and is 125 millimeters in maximum diameter. The larger preserves one and one-half whorls and is 300 millimeters in maximum diameter.

The form of the inner whorls, beneath 60 millimeters, of the smaller specimen is not well displayed. At a diameter of 60 millimeters the whorl is stout, about as wide as high in cross section, with nearly flat flanks. A whorl later, at a diameter of 125 millimeters, it is a little higher than wide in cross section. The umbilicus is 50 millimeters wide with steep walls and a subangular umbilical shoulder. The larger specimen has not retained the whorls below a diameter of about 120 millimeters. From 120 to approximately 300 millimeters in diameter the whorls are a little higher than wide—the proportion is about 9 to 8. The flanks are convex. At 300 millimeters the umbilicus is 130 millimeters wide and still has the steep wall and subangular shoulder. The entire shell forms a stout disk.

The sculpture on the earlier whorls of the smaller specimen is well enough preserved to show that there are numerous bifurcating ribs and three rows of tubercles on the exposed part of the whorl at as early a stage as 15 millimeters. At a diameter of 60 millimeters and all the later stages where the entire whorl is visible there are five rows of tubercles. The inner row is situated on the umbilical shoulder; the next two on the flank, at about equal distances apart; the fourth is at the end of the ribs at the ventrolateral margin; and the fifth borders the ventral furrow. The third, fourth, and fifth tubercles of each rib are evenly spaced and somewhat closer together than the first, second, and third. The first four tubercles are conical in form, only the fifth or outer one being elongated transverse to the rib. The number of bifurcating ribs de-

[90] Meek, F. B., Invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. Survey Terr. Rept., vol. 9, p. 448, 1876.

[91] De Grossouvre, Albert, Les ammonites de la Craie supérieure, p. 66, 1894.

[92] Pervinquière, Léon, Études de paléontologie tunisienne; I, Céphalopodes des terrains secondaires, p. 227, 1907.

[93] Spath, L. F., On new ammonites from the English chalk: Geol. Mag., vol. 63, p. 79, 1926.

creases progressively with increase in size. On the last whorl of the smaller specimen there are 22 umbilical nodes and 32 ventral nodes, showing that the alternate ribs fork. Some of the forking occurs at the umbilical row of tubercles, some of it at the second row. On the first half whorl of the larger specimen the proportion of bifurcating ribs is less than on the smaller specimen—there are 12 umbilical tubercles and 16 ventral tubercles. On the succeeding whorl of the larger specimen the ribs are nearly all simple, there being 29 umbilical tubercles and 31 ventral tubercles. The ribs and interspaces of this last whorl are about equal.

The sutures are poorly preserved, and none are complete enough or distinct enough to draw. They are, however, of the type normal for the genus.

Mortoniceras omeraense may be distinguished by the combination of a relatively stout whorl with ribs that are forked in the younger stages and simple in the large adults, ornamented with five rows of tubercles, the inner four conical, the outer row transversely elongated, and that show no grouping of the tubercles. The umbilicus is narrow for the genus. The only species near enough to need comparison are *M. pseudotexanum* Grossouvre, *M. texanum* (Roemer), and *M. delawarense* (Morton) (including probably *M. campaniense* Grossouvre). *M. texanum* has five rows of tubercles, of which the outer three are elongated transverse to the rib and the inner two conical in form; the outer pair are set close together. The ribs are simple, only a few forked ribs being present in even the younger stages. The umbilicus is not sharply set off from the flank. The whorls are relatively high and the umbilicus wide. *M. pseudotexanum* is like *M. texanum* except that the tubercles are evenly spaced. *M. delawarense* has five rows of tubercles, of which the inner four are conical and the outer one transversely elongated. Many of the ribs fork. The umbilical shoulder is sharply defined, subangular. The whorls are relatively stout and the umbilicus narrow. It will be seen that *M. omeraense* resembles *M. texanum* only in having simple ribs at a very large stage and differs in all the other essential characters. It resembles *M. pseudotexanum* in the spacing of the tubercles and in having simple ribs in the large stages but differs in the form of the whorl, the form of the third and fourth tubercles, and the width of umbilicus. For both *M. texanum* and *M. pseudotexanum* the published figures of specimens and the material in the writer's hands for comparison show at a diameter of 125 millimeters—the size of the smaller specimen of *M. omeraense*—only simple ribs, whereas *M. omeraense* shows many forked ribs, so that the resemblance in the type of rib is not really very marked. *M. omeraense* is certainly very close to *M. delawarense*. The specimen shown in the published figure of the latter species and the material in the writer's hands for comparison are all medium-sized individuals, about 125 millimeters in diameter. These do not differ greatly from *M. omeraense* at this stage, except that it has perhaps more ribs to the whorl. The larger individual differs in having only simple ribs on the outer whorl. Possibly a specimen of *M. delawarense* at a diameter of 300 millimeters would show the same characters as *M. omeraense*, but as none such have been yet described the writer prefers to use a separate name for the present specimens, based chiefly on the presence of simple rather than forked ribs in the large specimen.

The writer has in hand specimens from San Carlos, Tex., which are so close to *M. omeraense* as to permit the application of the same name. The faunal association of that locality is very similar. The writer has also in hand, throughout the courtesy of L. W. Stephenson, two collections containing somewhat deformed specimens of *Mortoniceras*. One is from the top of a tongue of the Austin chalk at a locality 2 miles east-northeast of Savage, Fannin County, Tex. It has specimens with apparently three rows of tubercles, one of the umbilical shoulder and two, separated, on the ventrolateral area. The ribs appear to be simple. The other lot is from the same tongue of the Austin chalk at a locality 4 miles north of Broadway, Lamar County, Tex. It has specimens with four rows of tubercles, one on the umbilical shoulder, a pair at the ends of the ribs, and a fourth bordering the venter, and one fragment showing five rows of tubercles, evenly spaced, conical in form, except for the outer one. These two occurrences are of great interest in showing the presence of *Mortoniceras* in the Gulf series well above the zone of *M. texanum* (lower part of Austin chalk), though the species differ from those in the writer's collection.

The specific name is derived from the type locality of the species.

Occurrence: Uppermost part of Mancos shale, Omera mine, east flank of Ortiz Mountains, Santa Fe County, New Mexico.

Genus PERONICERAS De Grossouvre [94]

A group of forms showing close relationship to *Mortoniceras* and *Gauthiericeras* but distinguished by three keels on the venter and by a suture much more incised and more slender which recalls that of *Stoliczkaia:* the first lateral lobe, as in this last genus, rather narrow and terminated by a distinct fork. The third lateral saddle has its extremity well below those of the two first. [Translated.[95]]

Grossouvre chose as genotype the species *P. moureti* Grossouvre.

[94] *Peronoceras* Hyatt of the Liassic (The fossil cephalopods of the Museum of Comparative Zoology: Harvard Coll. Mus. Comp. Zoology Bull., vol. 1, p. 85, 1867) is a very distinct group of ammonites, as is also *Paroniceras* Bonarelli of the Toarcian (Osservazioni sul toarciano d'Aleniano: Soc. geol. italiana Boll., vol. 12, 1893).

[95] De Grossouvre, Albert, Les ammonites de la Craie supérieure, p. 93, 1894.

Peroniceras is a rare genus in the American Cretaceous. Gabb [96] described a species from the Cretaceous of California as *Ammonites tehamaensis*, which was referred to *Peroniceras* by Grossouvre.[97] No other published record of the genus in North America is known to the writer, though specimens from the Austin chalk on Seco Creek, Medina County, Tex., collected by L. W. Stephenson are undoubted *Peroniceras* related to *Peroniceras czörnigi* (Redtenbacher) Grossouvre.[98] Two other specimens from the Austin chalk in the bed of Sabinal River near Dillard's ranch, Uvalde County, Tex., collected by T. W. Vaughan, are closest to *P. westphalicum* Schlüter.[99] Another specimen from the Austin chalk on Tequesquite Creek, Maverick County, Tex., collected by L. W. Stephenson, is of the *P. czörnigi* type.

The presence of *Peroniceras* in the fauna here described apparently extends the range of the genus above that recorded in the European literature, where it is assigned chiefly to the Coniacian, with one species in the Turonian. There is no reason to question the authenticity of the occurrence other than the theoretical improbability of its extension to such a late horizon and association with the species with which it was found.

Peroniceras leei Reeside, n. sp.

Plate 42, Figures 1–2; Plate 43, Figures 3–4

The inner whorls of this species are unknown. The specimen in hand preserves parts of two whorls. The earliest part is at a diameter of perhaps 65 millimeters and shows the ventral half of the whorl only. It has much the same form and sculpture as that of the succeeding whorl. This is represented by the quarter whorl between a diameter of about 110 millimeters and 125 millimeters for the entire shell. The cross section is subquadrate with flanks arched gently and with ventrolateral and ventral facets well defined. Umbilicus wide, in width more than half the diameter of the shell. Umbilical shoulders well defined and umbilical wall steep, parallel to the axis of the shell. An entire shell would be compressed, discoid.

The sculpture consists of a row of conical tubercles situated directly on the umbilical shoulder, from which one or occasionally two low rounded ribs pass with slight forward inclination to the ventrolateral region, each there rising into a transversely elongated tubercle. There are 9 umbilical and 11 ventrolateral tubercles on the quarter whorl of the type preserved. Just ventrad of the ventrolateral row of tubercles there is a third row of low, poorly defined, transverse tubercles on the ventrolateral facet of the whorl. The venter has the three well-defined rounded keels of the genus. The three keels are of equal strength in this species.

The suture shows the characteristics described for the genus: It has two lateral lobes and three saddles; the first lateral lobe is long and narrow and terminates in a fork; the third lateral saddle is well below the first and second; the whole suture is relatively much incised. The dorsal suture consists of a long pointed dorsal lobe with one saddle and lobe on each side of it.

Peroniceras leei is closest to *P. subtricarinatum* (D'Orbigny) Grossouvre.[100] It differs in possessing a third row of tubercles, in having keels of equal strength, and in the form and position of the umbilical tubercles. *P. subtricarinatum* is characteristic of the Coniacian (Emscherian), an older horizon than that of *P. leei*. The other American forms of the genus are quite unlike *P. leei*, and are from older horizons. *P. tehamaensis* (Gabb) has strongly inclined ribs, all of which are simple, and differs in cross section. The unnamed species from the Austin chalk of Medina County, Tex., mentioned above, has a relatively small umbilicus, compressed whorls, and numerous simple ribs; the species from Uvalde County, Tex., has simple ribs, no real tubercles on the umbilical shoulder, and the central keel stronger than the other two.

The species is named for Mr. W. T. Lee, who collected the type specimen.

Occurrence: Upper part of Mancos shale, Omera mine, east flank of Ortiz Mountains, Santa Fe County, New Mexico.

[96] Gabb, W. M., California Geol. Survey, Paleontology, vol. 1, p. 60, pl. 10, fig 4, 1864; vol. 2, p. 132, 1869.

[97] Op. cit., p. 104.

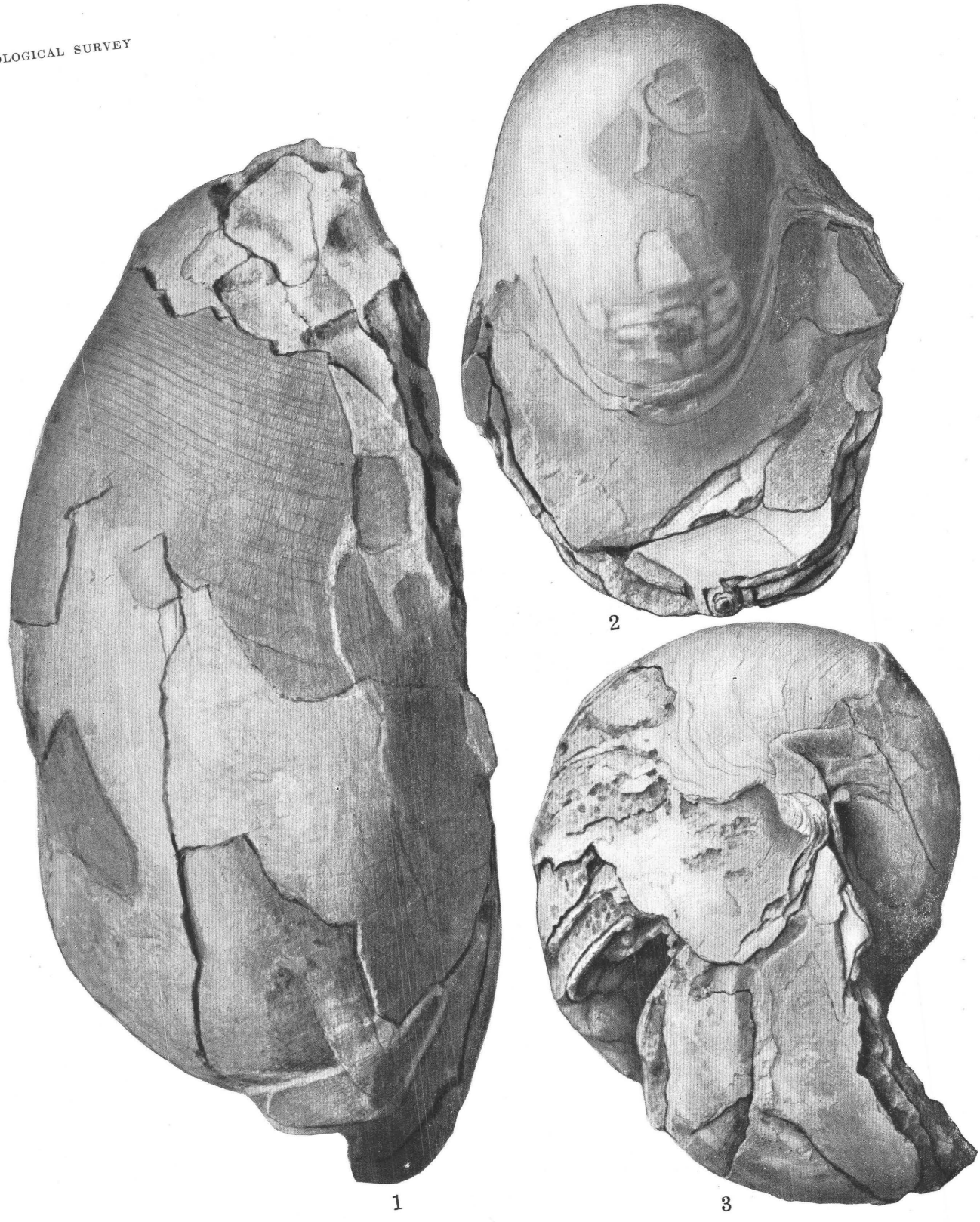
[98] Op. cit., p. 103, pl. 11, fig. 2, 1894.

[99] Schlüter, Clemens, Cephalopoden der oberen deutschen Kreide, p. 45, pl. 13, figs. 5, 6, Cassel, 1872.

[100] De Grossouvre, Albert, Les ammonites de la Craie supérieure, pp. 94–98, pl. 10, figs. 1–3; pl. 11, fig. 1, 1894.

PLATES

PLATE 1



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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 2

PLATE 3

Page

FIGURES 1–5. *Eutrephoceras alcesense* Reeside, n. sp 7

1–2. Front and side views of an internal cast (U. S. Nat. Mus. catalogue No. 73282) from Elk Basin sandstone member of Telegraph Creek formation in T. 57 N., R. 95 W., Big Horn County, Wyo.

3–4. Side and front views of type (U. S. Nat. Mus. catalogue No. 73283), an internal cast with fragments of shell, from Elk Basin sandstone member of Telegraph Creek formation in sec. 25, T. 58 N., R. 100 W., Park County, Wyo.

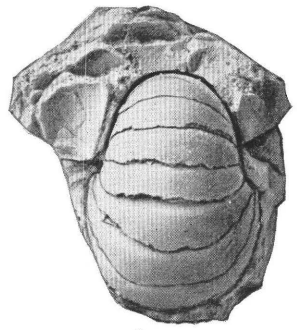
5. Front view of small specimen from same locality as last.

FIGURES 6–7. *Hamites* sp., side and inner views of an internal cast (U. S. Nat. Mus. catalogue No. 73284) from upper part of Mancos shale 3 miles northwest of Waldo, Santa Fe County, N. Mex 8

FIGURES 8–10. *Helicoceras rubeyi* Reeside, n. sp 14

8. Side view of a specimen (U. S. Nat. Mus. catalogue No. 73285) from Steele shale, 1,120 feet above base, in sec. 7, T. 26 N., R. 88 W., near Mahoney ranch, Carbon County, Wyo.

9–10. Outer and side views of a specimen (U. S. Nat. Mus. catalogue No. 73286) from Mancos shale, 4,042 feet above base in SW. ¼ NE. ¼ sec. 12, T. 10 N., R. 101 W., Moffat County, Colo.



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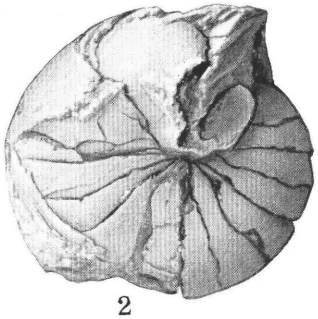

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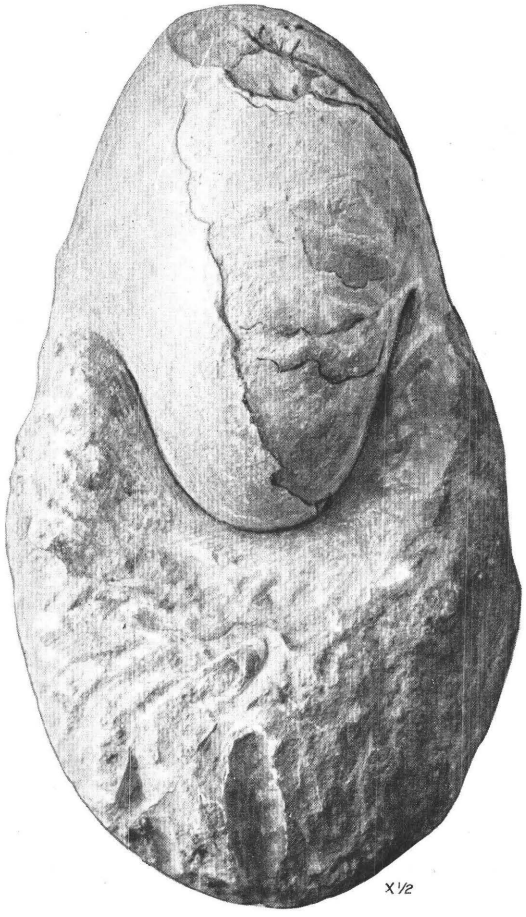

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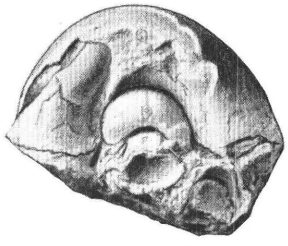

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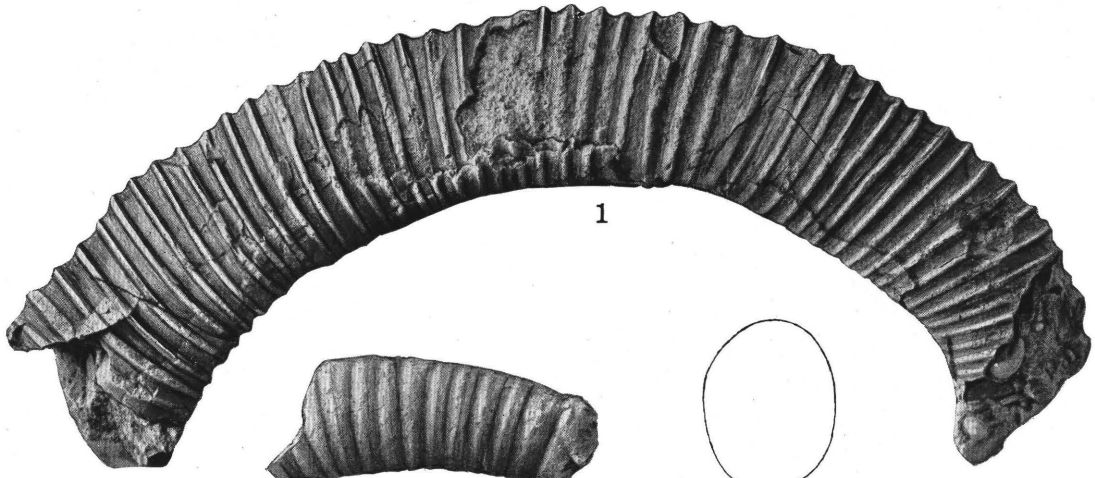
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



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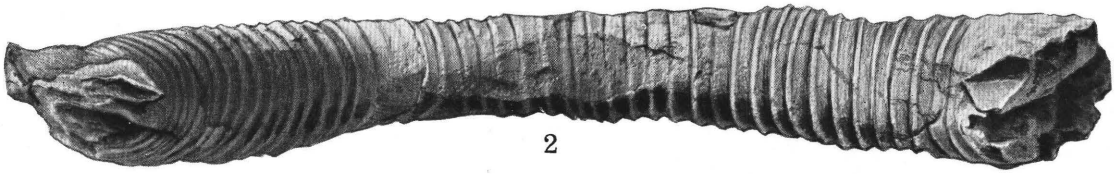

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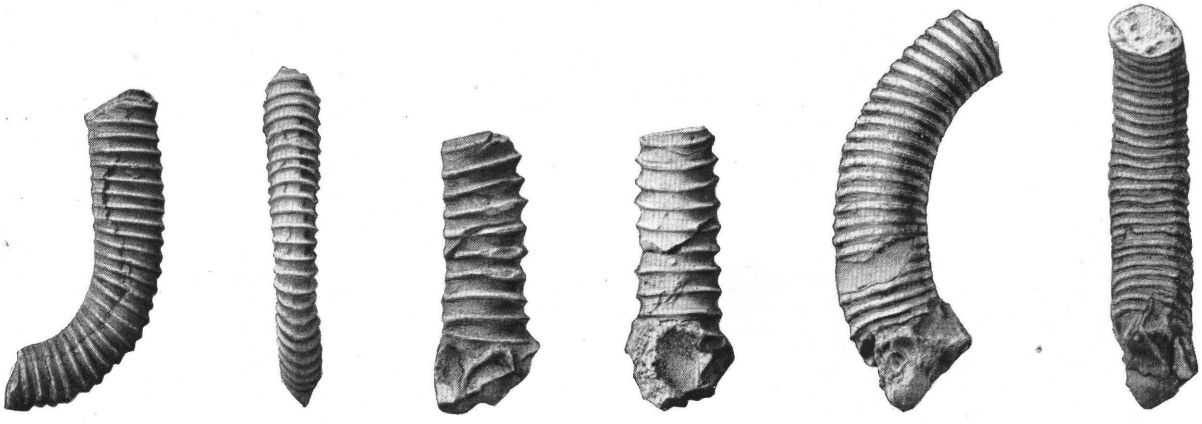

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 4

Page

FIGURES 1–6. *Hamites novimexicanus* Reeside, n. sp. 8

1–4. Side, inner, and outer views and cross section of the type (U. S. Nat. Mus. catalogue No. 73287), an internal cast, from upper part of Mancos shale 3 miles northwest of Waldo, Santa Fe County, N. Mex.

5–6. Side and outer views of an internal cast (U. S. Nat. Mus. catalogue No. 73287) from the type locality.

FIGURES 7–11. *Hamites* sp. 8

7–8. Side and inner views of an internal cast (U. S. Nat. Mus. catalogue No. 73288) from upper part of Mancos shale at same locality as Figures 1–6.

9–10. Side and inner views of an internal cast (U. S. Nat. Mus. catalogue No. 73290) from basal part of Mesaverde formation three-fourths mile north of Copper City, Sandoval County, N. Mex.

11. Side view of a specimen (U. S. Nat. Mus. catalogue No. 73289) from upper part of Mancos shale 3 miles northwest of Waldo, Santa Fe County, N. Mex.

PLATE 5

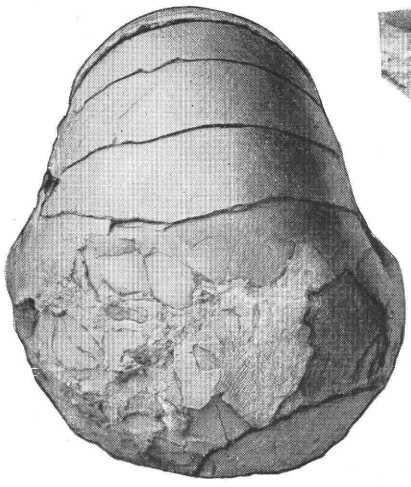
Page

FIGURES 1–2. *Eutrephoceras alcesense* Reeside, n. sp., rear and side views of an internal cast with fragments of shell (U. S. Nat. Mus. catalogue No. 73291) from upper part of Mancos shale 1 mile southwest of Waldo, Santa Fe County, N. Mex. ---- 7

FIGURES 3–11. *Helicoceras rubeyi* Reeside, n. sp., from lower part of Pierre shale in NW. ¼ sec. 30, T. 56 N., R. 67 W., Crook County, Wyo. ---- 14

3. Side view of squeeze of fragment near aperture (U. S. Nat. Mus. catalogue No. 73292).
4–5. Side view and nucleus of a septate specimen (U. S. Nat. Mus. catalogue No. 73292).
6–7. Side view and view of earliest part of squeeze of type specimen (U. S. Nat. Mus. catalogue No. 73292).
8–9. Side view of a specimen (U. S. Nat. Mus. catalogue No. 73292) preserving septate and unseptate parts of shell and the last suture.
10–11. Outer and side views of a fragment of the later part of the shell (U. S. Nat. Mus. catalogue No. 73292).

FIGURES 12–13. *Baculites ovatus* Say, side and end views of an internal cast (U. S. Nat. Mus. catalogue No. 73293) from Steele shale, 1,400 feet below top, in NW. ¼ sec. 13, T. 49 N., R. 83 W., Johnson County, Wyo. ---- 9



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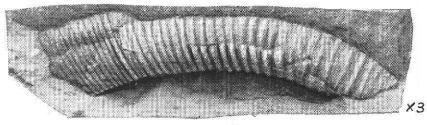

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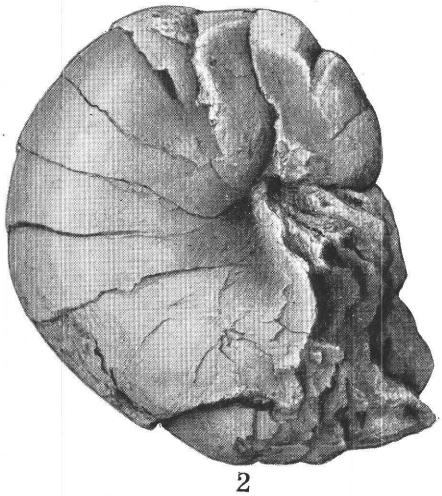

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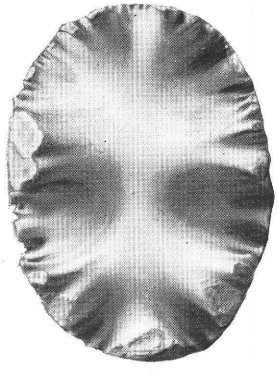

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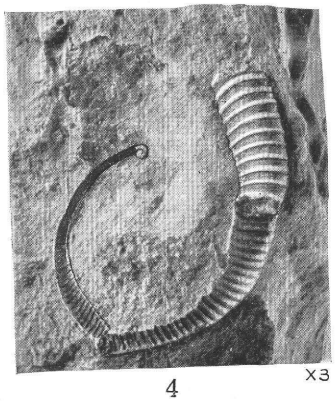

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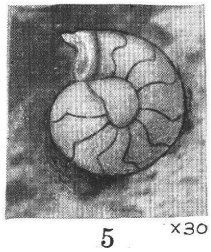

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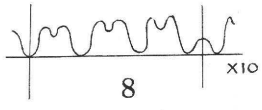

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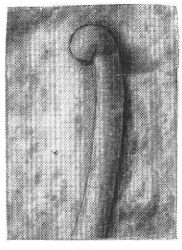

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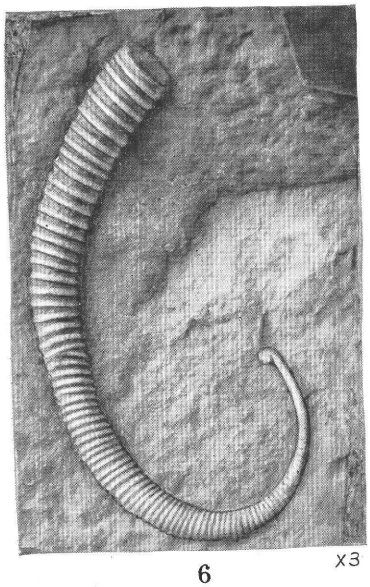

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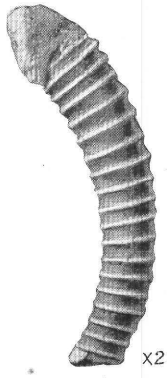

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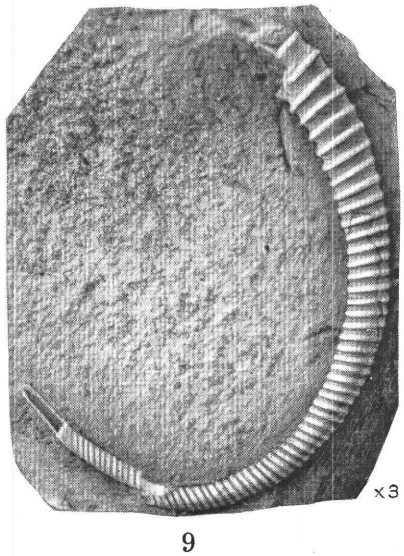

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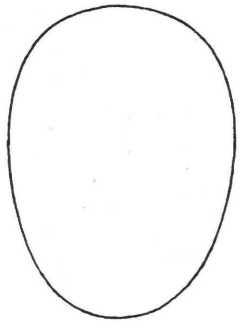
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



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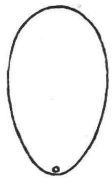

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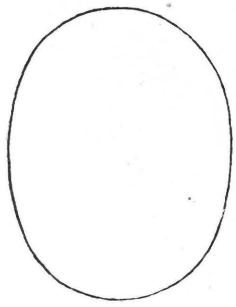

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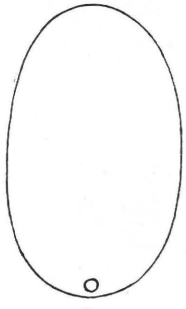

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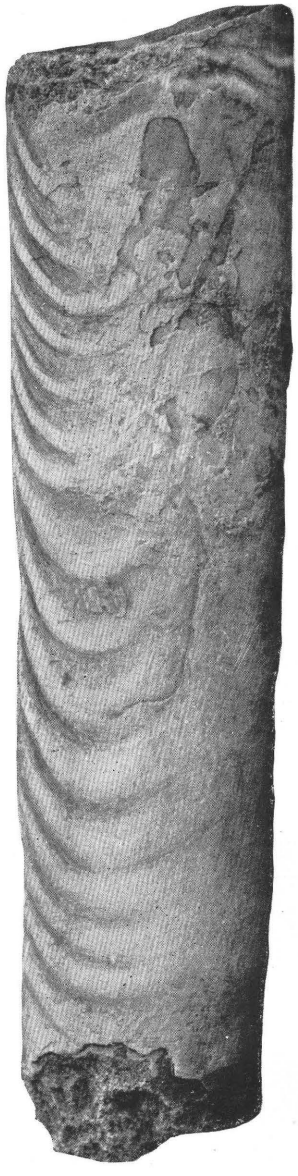

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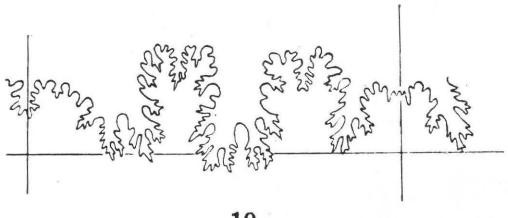

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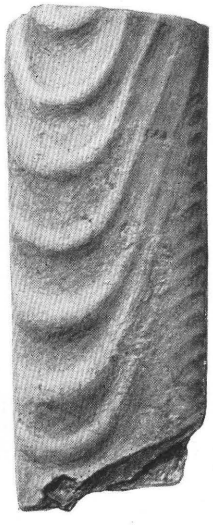

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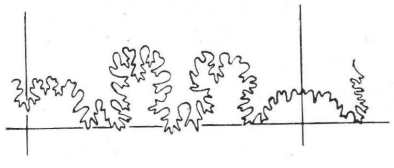

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 6

Page

FIGURES 1–4. *Baculites ovatus* Say 9

1–2. Side view and cross section of a characteristic medium-sized specimen (U. S. Nat. Mus. catalogue No. 73294) from sandstone 900 feet below top of Steele shale on Pass Creek, 2 miles northeast of Slack, Sheridan County, Wyo.

3–4. Side view and cross section of nodose living chamber of a specimen (U. S. Nat. Mus. catalogue No. 73295) from Elk Basin sandstone member of Telegraph Creek formation in T. 57 N., R. 98 W., Park County, Wyo.

FIGURES 5–10. *Baculites ovatus* var. *haresi* Reeside, n. var 10

5–6. Side view and cross section of an internal cast (U. S. Nat. Mus. catalogue No. 73296) from Elk Basin sandstone member of Telegraph Creek formation in sec. 2, T. 7 S., R. 23 E., Carbon County, Mont.

7–8. Side and end views of an internal cast (U. S. Nat. Mus. catalogue No. 73297) from Cody shale 250 feet below top, in NE. ¼ SW. ¼ sec. 5, T. 50 N., R. 92 W., Big Horn County, Wyo.

9–10. Cross section and suture of a relatively large internal cast (U. S. Nat. Mus. catalogue No. 73297) from same locality as Figures 7–8.

FIGURES 11–13. *Baculites aquilaensis* Reeside, n. sp., side view, suture, and cross section of a specimen (U. S. Nat. Mus. catalogue No. 73298) from sandstone in Steele shale 900 feet below top, 2 miles northeast of Slack, Sheridan County, Wyo 12

PLATE 7

Page

FIGURES 1–8. *Baculites ovatus* Say 9

1. Group of young individuals (U. S. Nat. Mus. catalogue No. 73299) from Eagle sandstone, near top, in sec. 34, T. 16 N., R. 28 E., Fergus County, Mont.
2. Group of very young individuals (U. S. Nat. Mus. catalogue No. 73294) from sandstone in Steele shale, 900 feet below top, on Pass Creek, 2 miles northeast of Slack, Sheridan County, Wyo.

3–5. Side view, cross section, and suture of an internal cast (U. S. Nat. Mus. catalogue No. 73299) from Eagle sandstone, near top, in sec. 34, T. 16 N., R. 28 E., Fergus County, Mont.

6. Initial coil of specimen (U. S. Nat. Mus. catalogue No. 73294) from sandstone in Steele shale, 900 feet below top, on Pass Creek, 2 miles northeast of Slack, Sheridan County, Wyo.
7. Initial coil and early stages of shell (U. S. Nat. Mus. catalogue No. 73300) from Eagle sandstone 7 miles northeast of Hardin, Big Horn County, Mont.
8. Initial coil and early stages of shell (U. S. Nat. Mus. catalogue No. 73294) from sandstone in Steele shale, 900 feet below top, on Pass Creek, 2 miles northeast of Slack, Sheridan County, Wyo.

FIGURES 9–10. *Baculites ovatus* var. *haresi* Reeside, n. var., side view and cross section of the type, an internal cast (U. S. Nat. Mus. catalogue No. 73296) from Elk Basin sandstone member of Telegraph Creek formation in sec. 2, T. 7 S., R. 23 E., Carbon County, Mont 10

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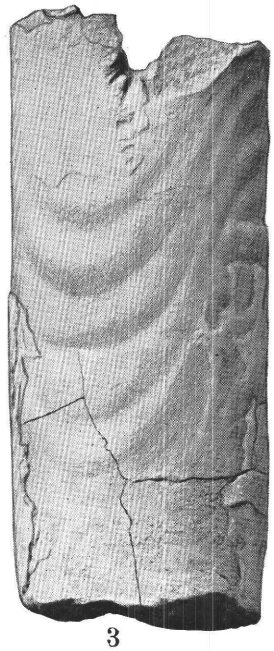

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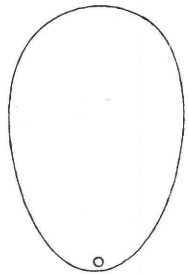

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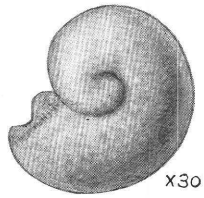

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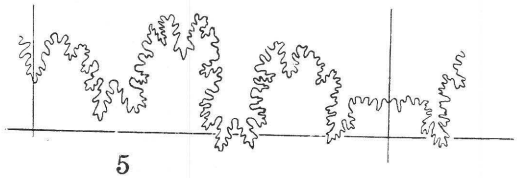

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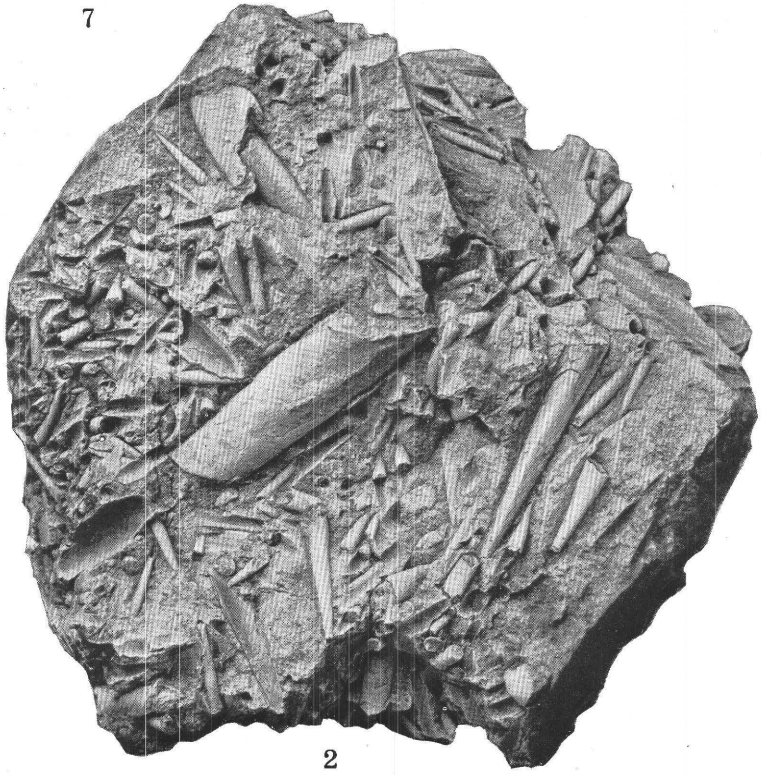

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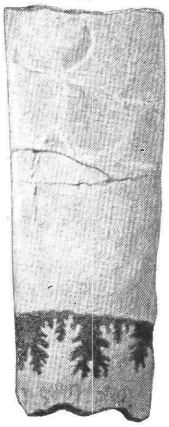

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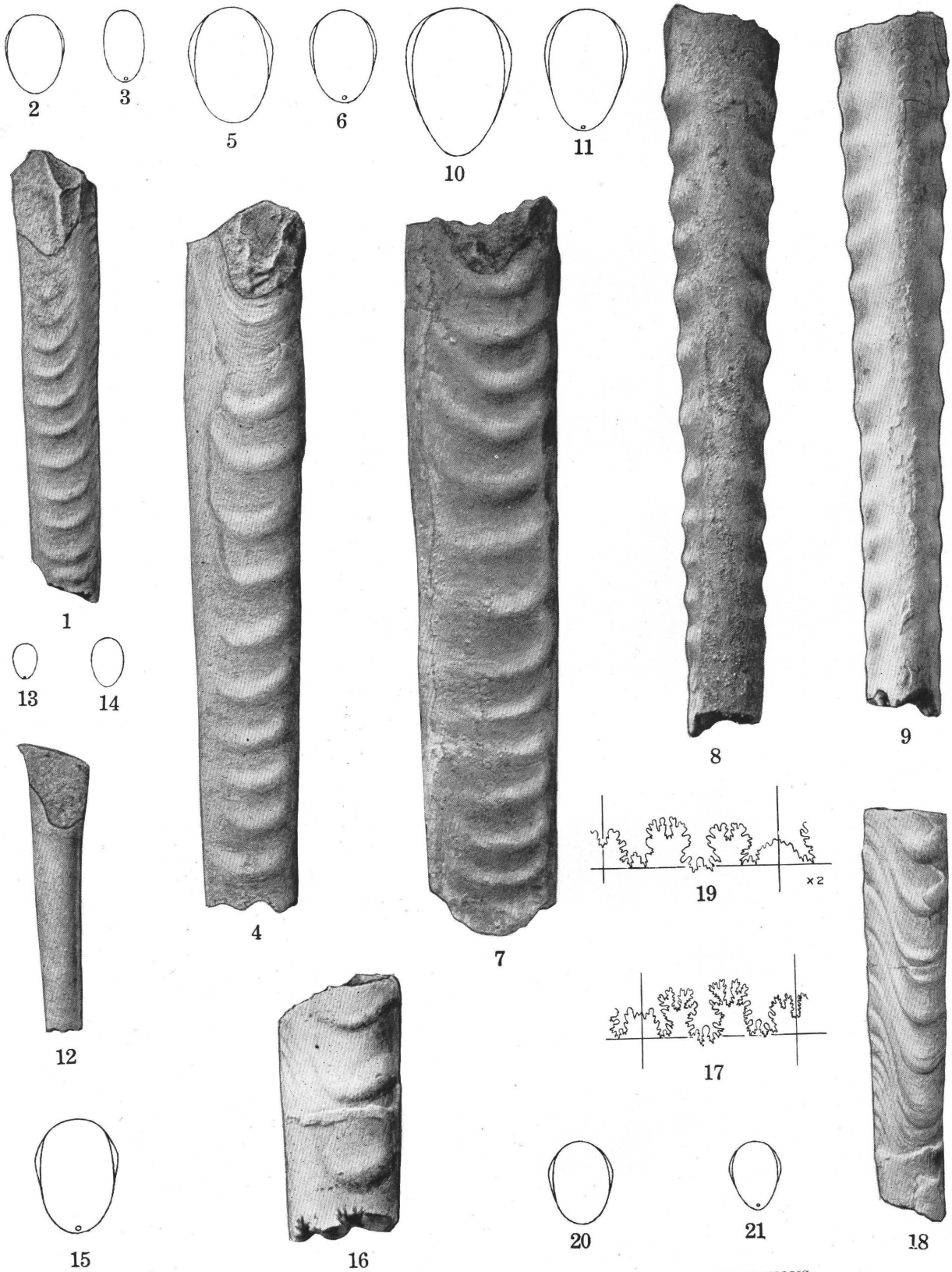
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 8

Page

FIGURES 1–14. *Baculites aquilaensis* Reeside, n. sp., from sandstone in Steele shale, 900 feet below top, 2 miles northwest of Slack, Sheridan County, Wyo 12

1–3. Side view and cross sections at the ends of the living chamber of a specimen (U. S. Nat. Mus. catalogue No. 73298).

4–6. Side view and cross sections at the ends of the living chamber of another specimen (U. S. Nat. Mus. catalogue No. 73298).

7–11. Side, antisiphonal, and siphonal views and cross sections at the ends of type, an internal cast preserving nearly all of the living chamber (U. S. Nat. Mus. catalogue No. 73298).

12–14. Side view and cross sections at the ends of the living chamber of a young shell (U. S. Nat. Mus. catalogue No. 73298).

FIGURES 15–21. *Baculites aquilaensis* var. *separatus* Reeside, n. var 12

15–17. Side view, cross section, and suture of an internal cast (U. S. Nat. Mus. catalogue No. 73301) from Cody shale, 8 miles southeast of Lovell, Big Horn County, Wyo.

18–21. Side view, cross sections, and suture of the type, an internal cast (U. S. Nat. Mus. catalogue No. 73302) from sandstone in Steele shale, 1,040 feet below top, in sec. 32, T. 58 N., R. 87 W., Sheridan County, Wyo.

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PLATE 9

Page

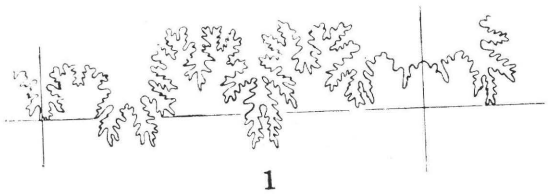
FIGURES 1–5. *Baculites compressus* Say, antisiphonal, siphonal, and side views, suture, and cross sections of a specimen retaining part of the shell (U. S. Nat. Mus. catalogue No. 73304) from Eagle sandstone in sec. 34, T. 16 N., R. 28 E., Fergus County, Mont 10

FIGURES 6–15. *Baculites aquilaensis* var. *separatus* Reeside, n. var 12

6–10. Side, siphonal, and antisiphonal views and cross sections at the ends of internal cast (U. S. Nat. Mus. catalogue No. 73302) from sandstone in Steele shale, 1,040 feet below top, in sec. 32, T. 58 N., R. 87 W., Sheridan County, Wyo.

11–12. Side view and cross section of an internal cast with fragments of shell (U. S. Nat. Mus. catalogue No. 73303) from Elk Basin sandstone member of Telegraph Creek formation, in sec. 25, T. 58 N., R. 100 W., Park County, Wyo.

13–15. Side view, cross section, and suture of an internal cast (U. S. Nat. Mus. catalogue No. 73303) with fragments of shell from same locality as Figures 11–12.



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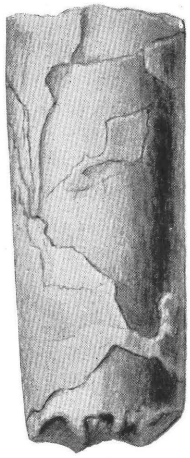

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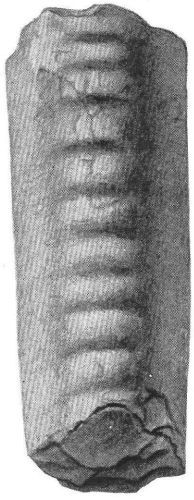

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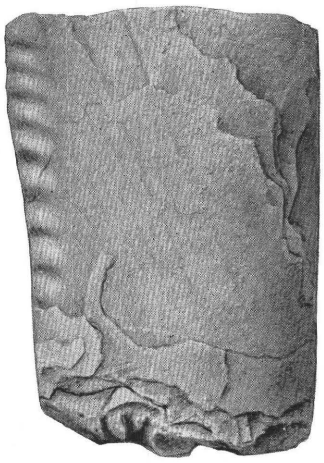

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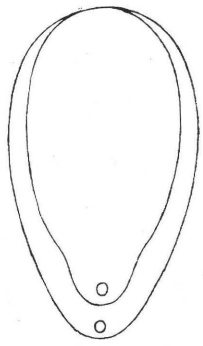

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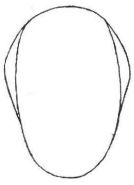

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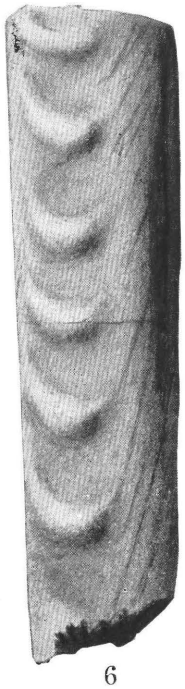

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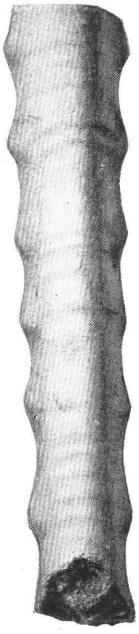

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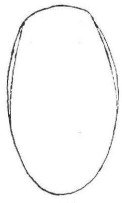

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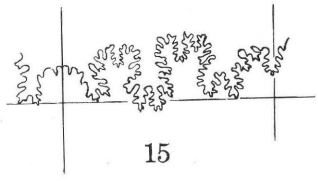

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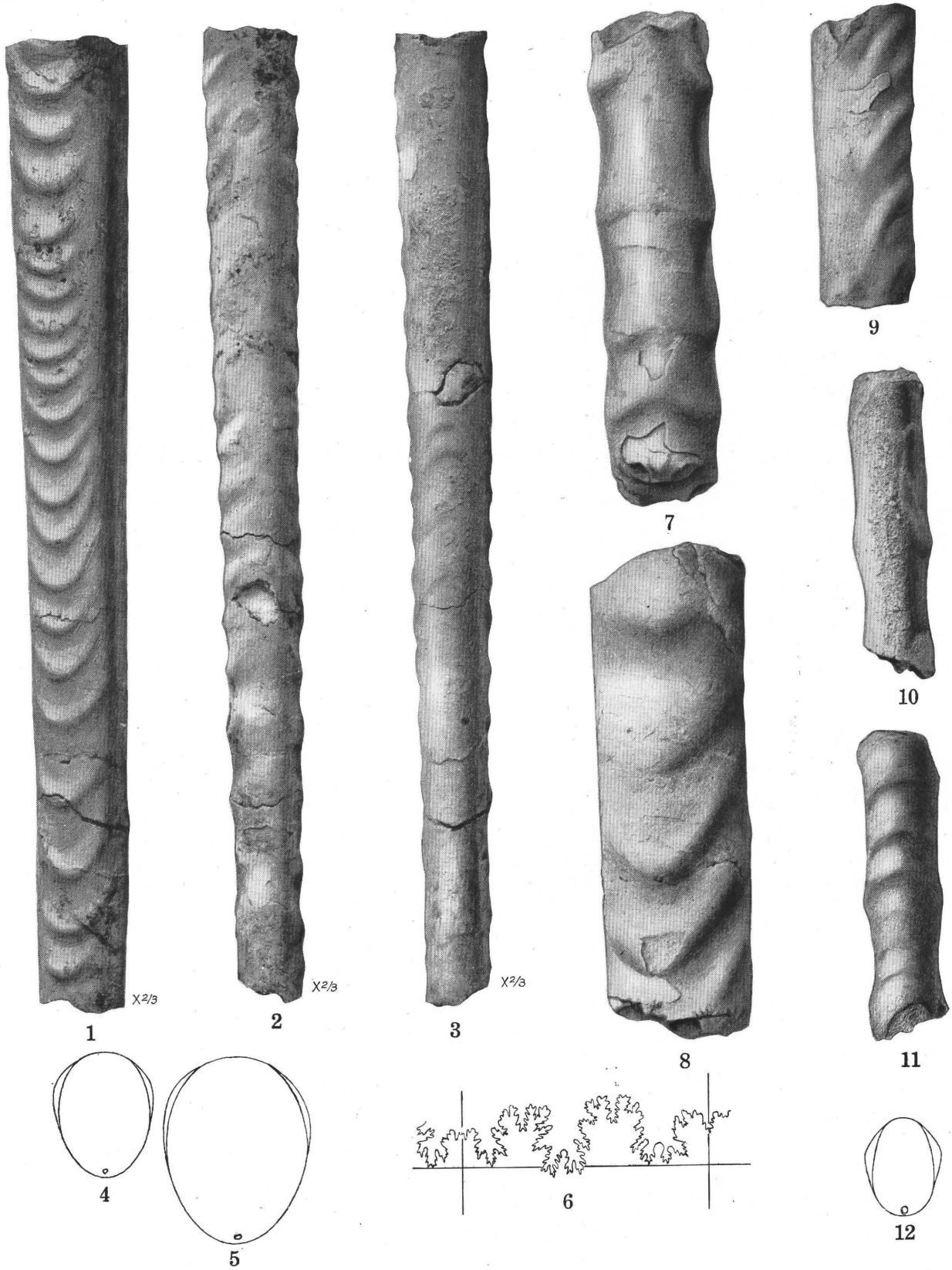
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 10

Page

FIGURES 1–8. *Baculites aquilaensis* var. *obesus* Reeside, n. var 12

1–6. Side, antisiphonal, and siphonal views, cross sections at the ends, and suture of type, an internal cast (U. S. Nat. Mus. catalogue No. 73305), from sandstone in Steele shale, 1,000 feet below top, in SW. ¼ sec. 19, T. 58 N., R. 87 W., Sheridan County, Wyo.

7–8. Side and antisiphonal views of an internal cast (U. S. Nat. Mus. catalogue No. 73306) from basal part of Mesaverde formation three-fourths mile north of Copper City, Sandoval County, N. Mex.

FIGURES 9–12. *Baculites asper* Morton, side, antisiphonal, and siphonal views and cross section of an internal cast (U. S. Nat. Mus. catalogue No. 73307) from Elk Basin sandstone member of Telegraph Creek formation in T. 57 N., R. 98 W., Park County, Wyo 13

PLATE 11

Page

FIGURES 1–4. *Desmoscaphites novimexicanus* Reeside, n. sp., side, front, and rear views and suture of type (U. S. Nat. Mus. catalogue No. 73312) from uppermost part of Mancos shale 1 mile east of head of Canyon del Yeso, Santa Fe County, N. Mex 17

FIGURES 5–16. *Baculites asper* Morton 13

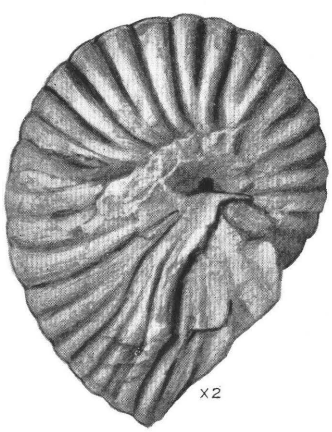
5–7. Side view, cross section, and suture of a specimen partly preserving the shell (U. S. Nat. Mus. catalogue No. 73308) from Elk Basin sandstone member of Telegraph Creek formation in SW. ¼ sec. 26, T. 1 S., R. 27 E., Yellowstone County, Mont.

8. Side view of another specimen showing the shell (U. S. Nat. Mus. catalogue No. 73308) from same locality as Figures 5–7.

9. Side view of an internal cast (U. S. Nat. Mus. catalogue No. 73309) from basal part of Mesaverde formation three-fourths mile north of Copper City, Sandoval County, N. Mex.

10–13. Side, antisiphonal, and siphonal views of an internal cast (U. S. Nat. Mus. catalogue No. 73310) from Eagle sandstone 3 miles above mouth of Dog Creek, Fergus County, Mont.

14–16. Side view, suture, and cross section of a partly crushed internal cast (U. S. Nat. Mus. catalogue No. 73311) from Steele shale in SE. ¼ SE. ¼ sec. 36, T. 34 N., R. 95 W., Fremont County, Wyo.



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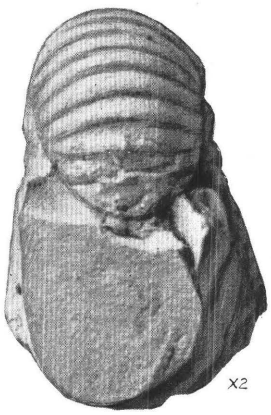

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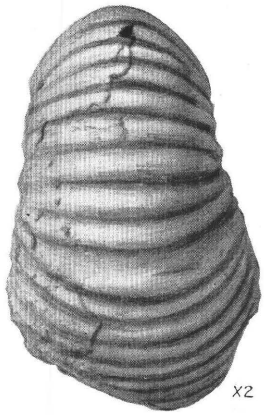

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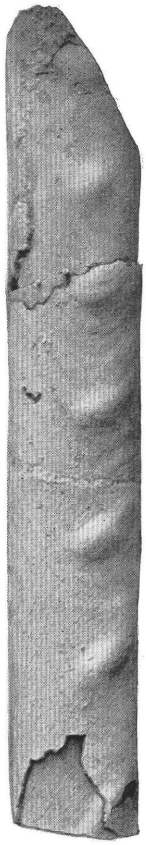

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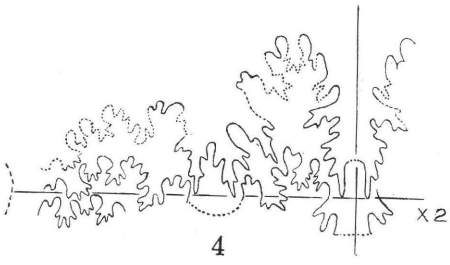

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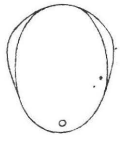

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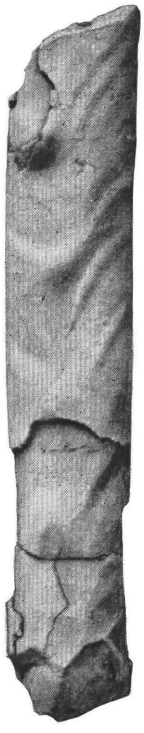

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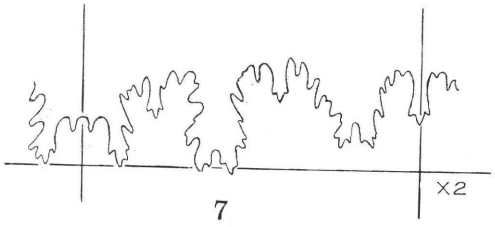

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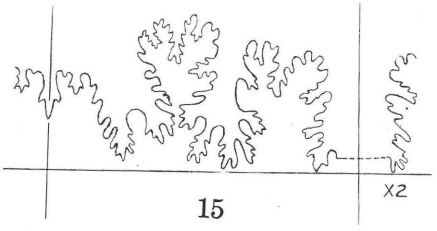

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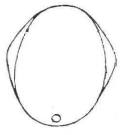

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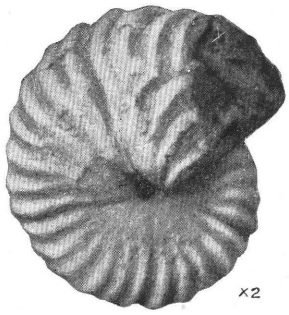
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



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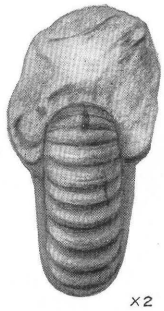

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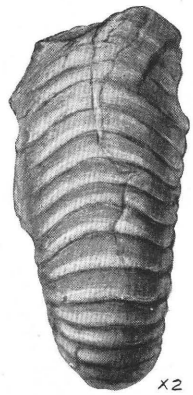

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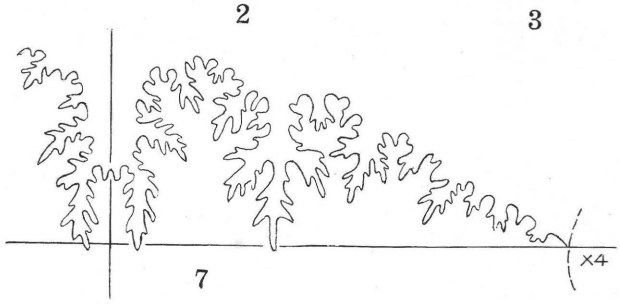

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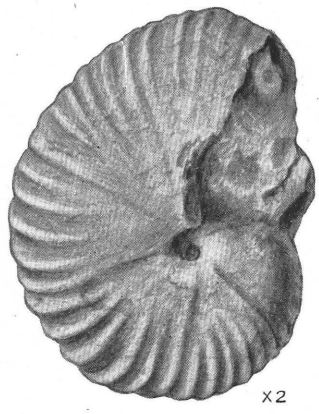

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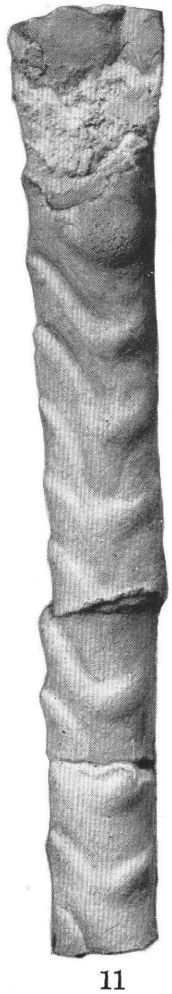

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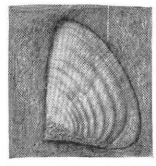

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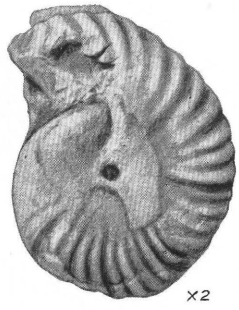

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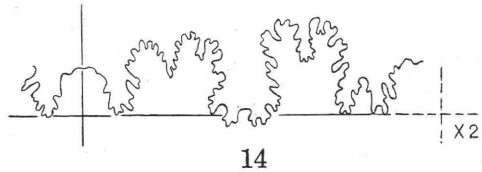

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 12

Page

FIGURES 1–8. *Puzosia (Latidorsella) mancosensis* Reeside, n. sp 15

1–3. Side, rear, and front views of an internal cast (U. S. Nat. Mus. catalogue No. 73313) from Elk Basin sandstone member of Telegraph Creek formation in SW. ¼ sec. 26, T. 1 S., R. 27 E., Yellowstone County, Mont.

4–7. Rear and side views, suture, and cross section of type, an internal cast (U. S. Nat. Mus. catalogue No. 73314) from Mancos shale, 160 feet below top, just west of Hogback Mountain and 1 mile north of Shiprock-Farmington Road, San Juan County, N. Mex.

8. Side view of an internal cast (U. S. Nat. Mus. catalogue No. 73314) from same locality as Figures 4–7.

FIGURES 9–14. *Baculites thomi* Reeside, n. sp 13

9–13. Antisiphonal, siphonal, and side views and cross sections at the ends of the type, a specimen preserving the shell (U. S. Nat. Mus. catalogue No. 73315) from Elk Basin sandstone member of Telegraph Creek formation in sec. 27, T. 1 S., R. 30 E., Big Horn County, Mont.

14. Suture of another specimen from the type locality (U. S. Nat. Mus. catalogue No. 73315).

FIGURE 15. Aptychus of *Scaphites* sp., view of specimen (U. S. Nat Mus. catalogue No. 73316) from which most of the original substance is lost, from lower part of Pierre shale in sec. 2, T. 58 N., R. 16 W., Crook County, Wyo 27

PLATE 13

Page

FIGURES 1–14. *Haresiceras placentiforme* Reeside, n. gen. and sp. ---------- 18

1–4. Side, front, and rear views and suture of type (U. S. Nat. Mus. catalogue No. 73317) from Elk Basin sandstone member of Telegraph Creek formation in sec. 25, T. 58 N., R. 100 W., Park County, Wyo.

5–6. Side and rear views of an internal cast (U. S. Nat. Mus. catalogue No. 73318) from Elk Basin sandstone member of Telegraph Creek formation in T. 57 N., R. 95 W., Big Horn County, Wyo.

7–13. Side and rear views, cross section, suture at diameter of 2, 6, and 13 millimeters, dorsal suture at diameter of 30 millimeters of a somewhat weathered internal cast (U. S. Nat. Mus. catalogue No. 73317) from Elk Basin sandstone member of Telegraph Creek formation in T. 56 N., R. 98 W., Park County, Wyo.

14. Cross section of the inner whorls of a specimen from same locality as Figures 7–13.

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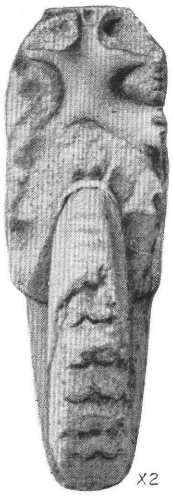

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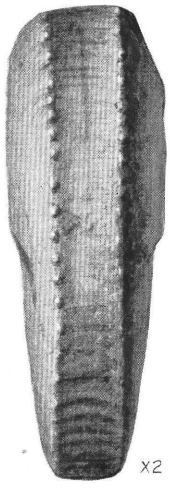

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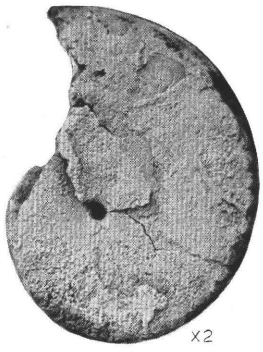

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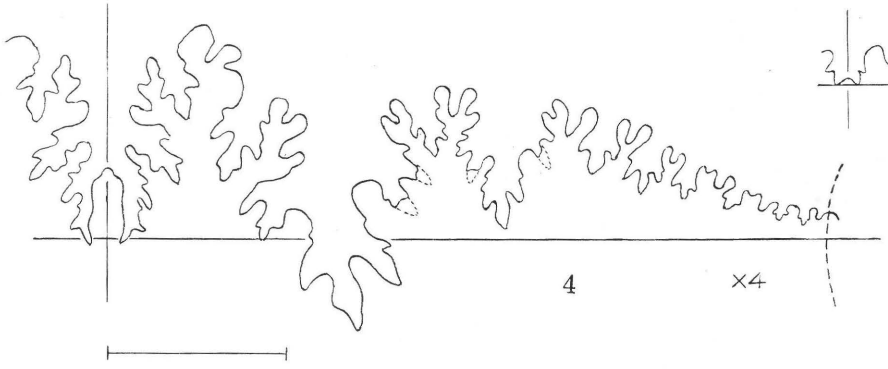

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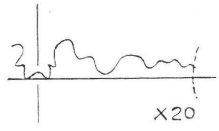

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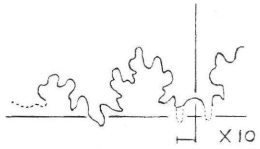

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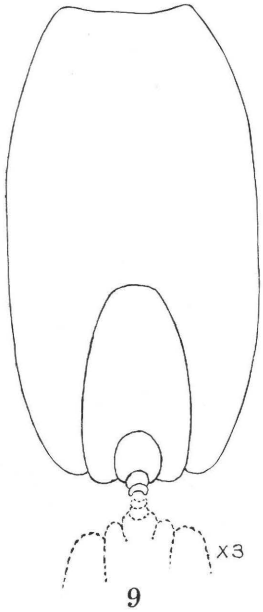

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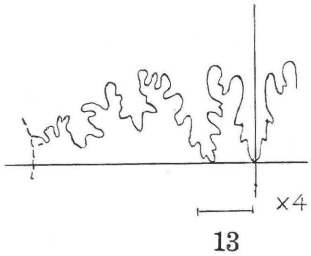

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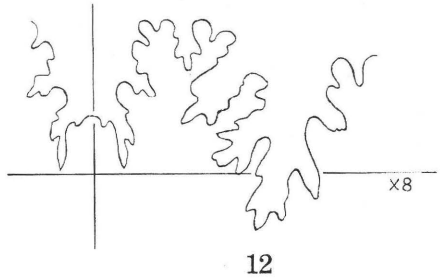

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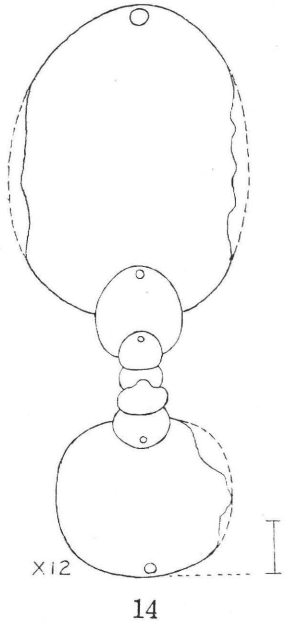

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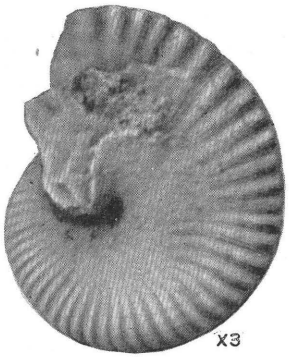
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



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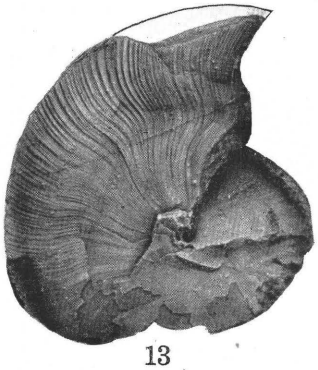
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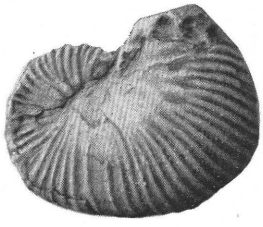
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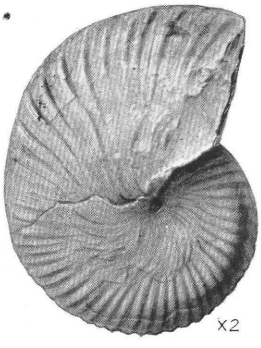

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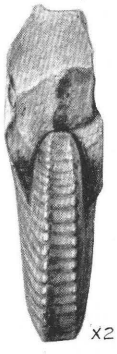

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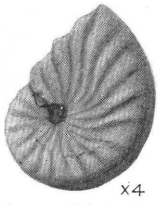

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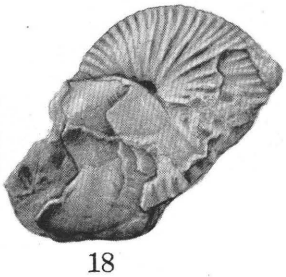
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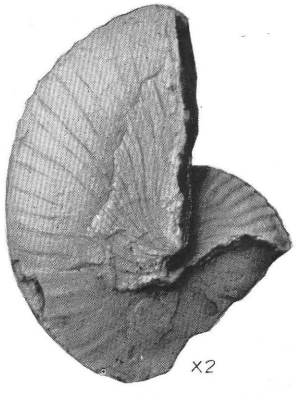

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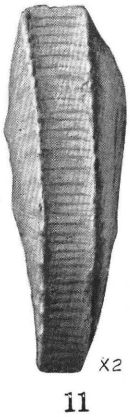

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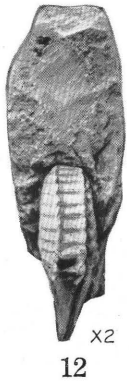

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 14

Page

FIGURES 1–3. *Haresiceras placentiforme* var. *parvum* Reeside, n. var., side, rear, and front views of type, an internal cast (U. S. Nat. Mus. catalogue No. 73319) from Cody shale, 250 feet below top, 5 miles southwest of junction of Buffalo and Nowood Creeks, Washakie County, Wyo 19

FIGURES 4–16. *Haresiceras natronense* Reeside, n. sp., from Steele shale, 200 feet below Shannon sandstone member, half a mile west of Castle Rock, Salt Creek oil field, Natrona County, Wyo 19

4–6. Side, front, and rear views of the type, an internal cast (U. S. Nat. Mus. catalogue No. 73320).

7–9. Side, rear, and front views of another specimen retaining part of the shell (U. S. Nat. Mus. catalogue No. 73320).

10–12. Side, rear, and front views of another specimen retaining part of the shell (U. S. Nat. Mus. catalogue No. 73320).

13. Side view of a large individual preserving part of the aperture (U. S. Nat. Mus. catalogue No. 73320).

14–16. Side, front, and rear views of a young individual (U. S. Nat. Mus. catalogue No. 73320).

FIGURES 17–20. *Scaphites hippocrepis* (DeKay) 22

17. Side view of an internal cast (U. S. Nat. Mus. catalogue No. 73321) from Steele shale between forks of Crazy Woman Creek, half a mile northwest of Klondike, Johnson County, Wyo.

18. Side view of a specimen retaining the shell (U. S. Nat. Mus. catalogue No. 73322) from Steele shale, 1,120 feet above base, in sec. 12, T. 26 N., R. 90 W., Sweetwater County, Wyo.

19–20. Side and rear views of a specimen retaining the shell (U. S. Nat. Mus. catalogue No. 73323) from sandstone in Steele shale, 1,040 feet below top, in sec. 32, T. 58 N., R. 98 W., Sheridan County, Wyo.

PLATE 15

Page

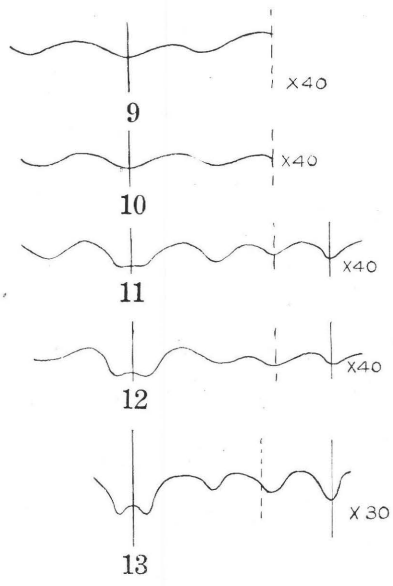
FIGURES 1–20. *Scaphites hippocrepis* (DeKay) 22

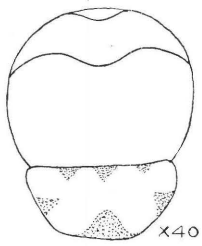
1–4. Side, front, and top views and suture of a specimen retaining parts of the shell (U. S. Nat. Mus. catalogue No. 73324) from Elk Basin sandstone member of Telegraph Creek formation, in sec. 25, T. 58 N., R. 100 W., Park County, Wyo.

5–17. Side and rear views, two views of the nucleus, four early sutures, suture at 1½, 3, 4, 5, and 5½ whorls of a specimen (U. S. Nat. Mus. catalogue No. 73325) from Elk Basin sandstone member of Telegraph Creek formation, 6 miles northeast of Lovell, in T. 57 N., R. 95 W., Big Horn County, Wyo.

18. Side view of a specimen retaining the shell (U. S. Nat. Mus. catalogue No. 73326) from Elk Basin sandstone member of Telegraph Creek formation in SW. ¼ sec. 26, T. 1 S., R. 27 E., Yellowstone County, Mont.

19–20. Side and rear views of an internal cast (U. S. Nat. Mus. catalogue No. 73327) from Mancos shale, 800 feet below top, in NE. ¼ SE. ¼ SE. ¼ sec. 24, T. 35 N., R. 10 W., La Plata County, Colo.





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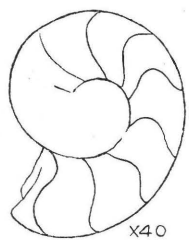

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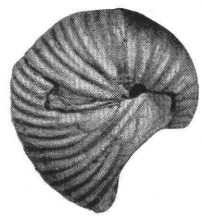
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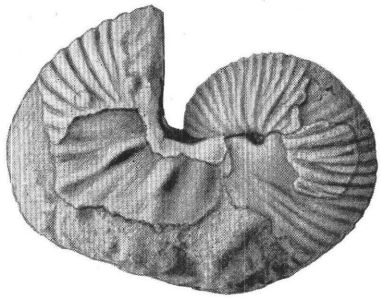
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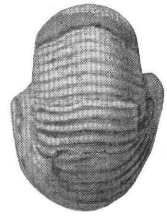
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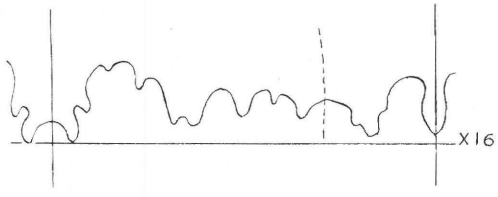

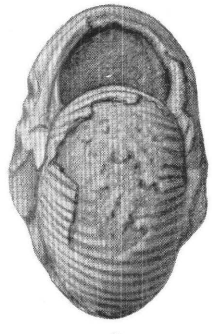
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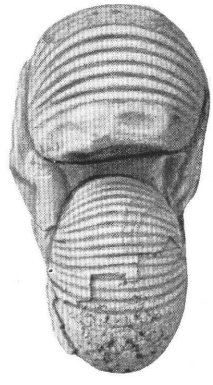
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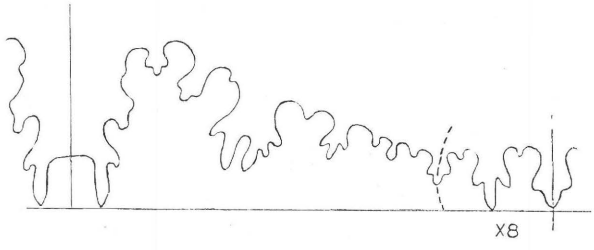

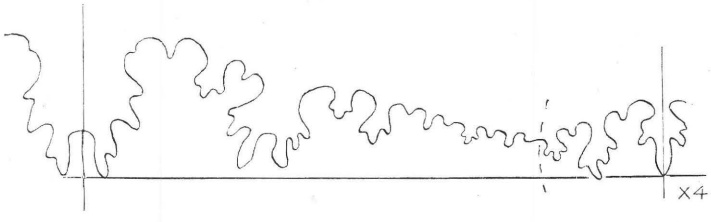

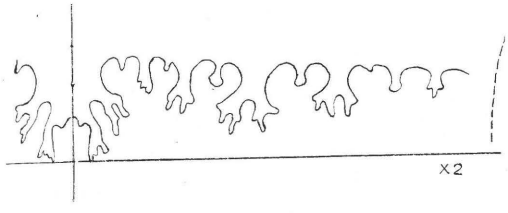

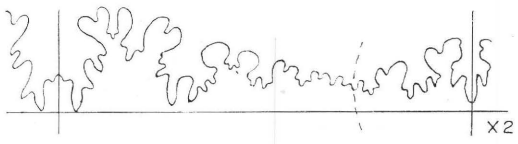


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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

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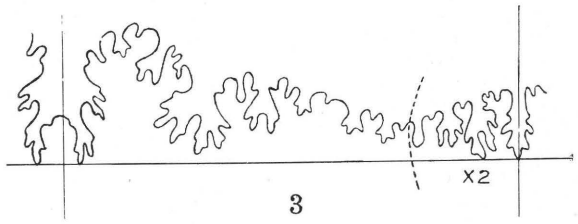

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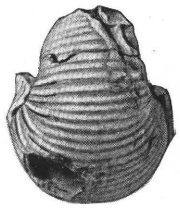

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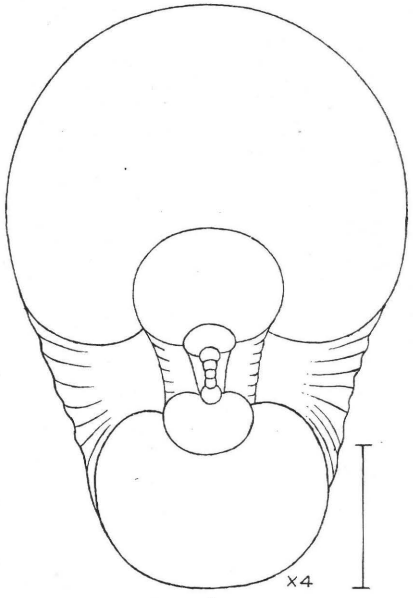

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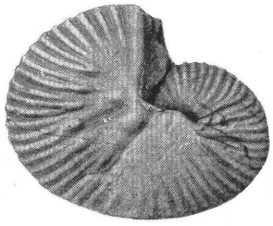

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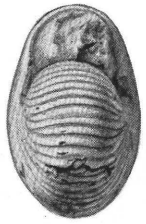

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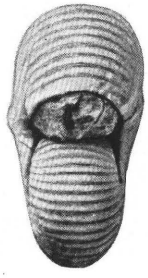

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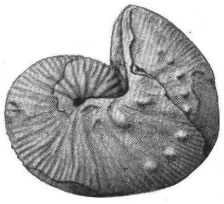

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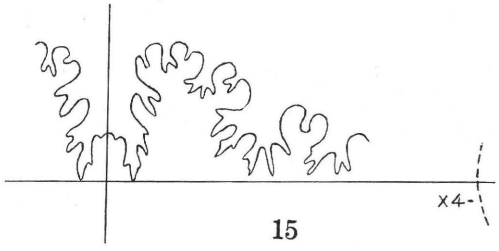

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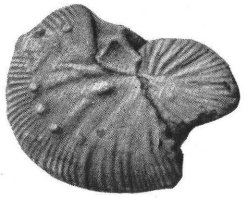

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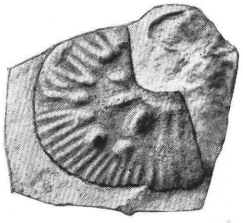

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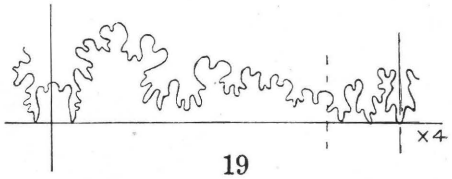

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 16

Page

FIGURES 1–10. *Scaphites hippocrepis* (DeKay) 22

1–4. Side and rear views, suture, and cross section of an internal cast (U. S. Nat. Mus. catalogue No. 73328) from Eagle sandstone on road from mouth of Little Horn River, 7 miles northeast of Hardin, Big Horn County, Mont.

5–9. Side, rear, front, bottom, and top views of a specimen (U. S. Nat. Mus. catalogue No. 73329) from Cody shale, 250 feet below top, 5 miles southwest of junction of Buffalo and Nowood Creeks, Washakie County, Wyo.

10. Side view of a squeeze of part of a living chamber (U. S. Nat. Mus. catalogue No. 73327) from Mancos shale, 800 feet below top, in NE. ¼ SE. ¼ SE. ¼ sec. 24, T. 35 N., R. 10 W., La Plata County, Colo.

FIGURES 11–16. *Scaphites hippocrepis* var. *tenuis* Reeside, n. var 23

11. Side view of flattened internal cast (U. S. Nat. Mus. catalogue No. 73330) from lower part of Pierre shale, 2½ miles southeast of Clifton House and about 10 miles southeast of Raton, Colfax County, N. Mex.

12–13. Bottom and side views of the type, a specimen retaining much of the shell (U. S. Nat. Mus. catalogue No. 73331) from Steele shale, 1,728 feet above base, in sec. 7, T. 26 N., R. 88 W., near Mahoney ranch, Carbon County, Wyo.

14–15. Side view and suture of an internal cast (U. S. Nat. Mus. catalogue No. 73332) from sandstone in Steele shale, 900 feet below top, on Pass Creek, 2 miles northeast of Slack, Sheridan County, Wyo.

16. Side view of an internal cast (U. S. Nat. Mus. catalogue No. 73333) from Eagle sandstone on road from mouth of Little Horn River, 7 miles northeast of Hardin, Big Horn County, Mont.

17–19. Side and rear views and suture of an internal cast (U. S. Nat. Mus. catalogue No. 73332) from sandstone in Steele shale, 900 feet below top, on Pass Creek, 2 miles northeast of Slack, Sheridan County, Wyo.

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PLATE 17

Page

FIGURES 1–5. *Scaphites hippocrepis* var. *pusillus* Reeside, n. var., side, front, top, and rear views and suture of type, an internal cast (U. S. Nat. Mus. catalogue No. 73334) from Elk Basin sandstone member of Telegraph Creek formation, in sec. 25, T. 58 N., R. 100 W., Park County, Wyo 23

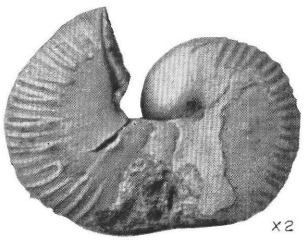
FIGURES 6–15. *Scaphites hippocrepis* var. *crassus* (Reeside), n. var 23

6–7. Side and rear views of a specimen retaining part of the shell (U. S. Nat. Mus. catalogue No. 73335) from sandstone in Cody shale, 200 feet below top, at center of sec. 25, T. 47 N., R. 89 W., Washakie County, Wyo.

8–13. Rear, bottom, side, front, and top views and suture of type, an internal cast (U. S. Nat. Mus. catalogue No. 73336) from Steele shale at southwest corner of sec. 33, T. 58 N., R. 87 W., 2 miles west of Parkman, Sheridan County, Wyo.

14–15. Rear and side views of an internal cast (U. S. Nat. Mus. catalogue No. 73337) from upper part of Mancos shale at Omera mine, Santa Fe County, N. Mex.

FIGURES 16–21. *Scaphites stantoni* Reeside, n. sp., bottom, top, side, rear, and front views and suture of the type, a specimen retaining the shell (U. S. Nat. Mus. catalogue No. 73338) from Eagle sandstone, near base, on Willow Creek, 6 miles above old Fort Maginnis-Junction City road, Fergus County, Mont 23



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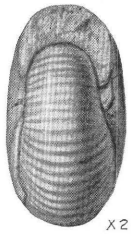

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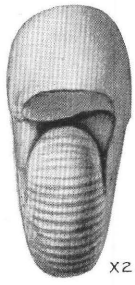

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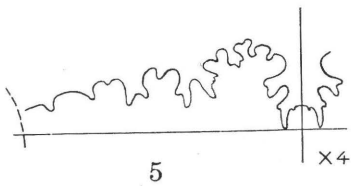

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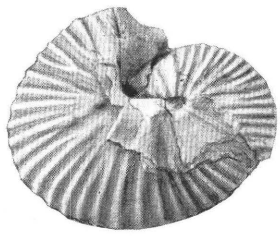

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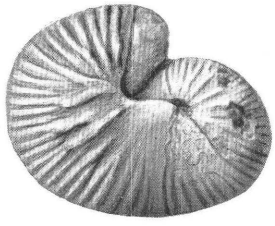

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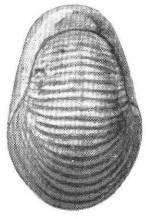

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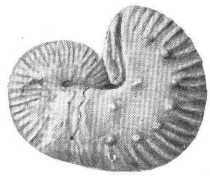

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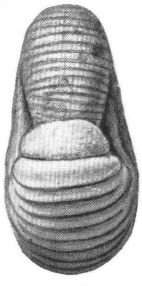

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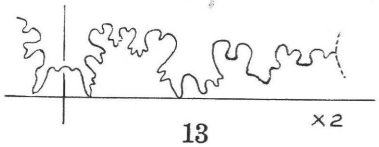

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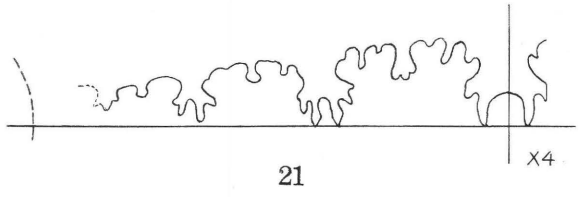

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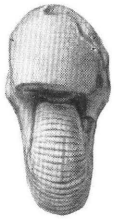

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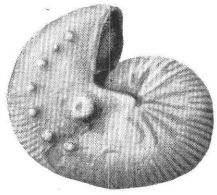

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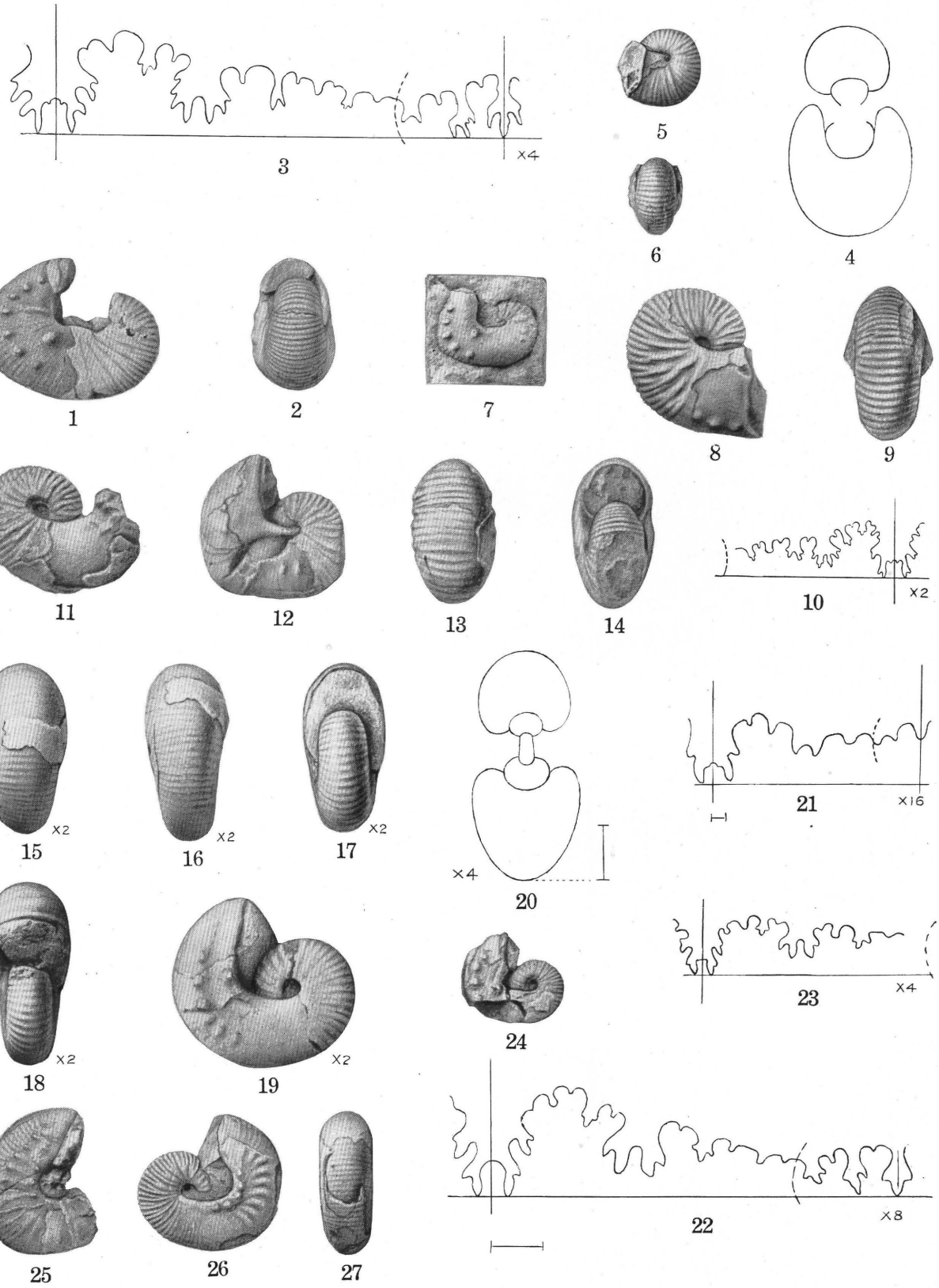
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 18

PLATE 19

Page

FIGURES 1–7. *Scaphites aquilaensis* Reeside, n. sp. ---- 25

1–5. Top, bottom, and side views, suture, and cross section of type, a specimen preserving the shell (U. S. Nat. Mus. catalogue No. 73348) from Eagle sandstone, near base, on Willow Creek 6 miles above old Fort Maginnis-Junction City road, Fergus County, Mont.

6, 7. Side and rear views of a specimen retaining the shell (U. S. Nat. Mus. catalogue No. 73349) from sandstone in Steele shale, about 1,000 feet beneath top, in SW. ¼ sec. 19, T. 58 N., R. 87 W., Sheridan County, Wyo.

FIGURES 8–13. *Scaphites aquilaensis* var. *costatus* Reeside, n. var. ---- 25

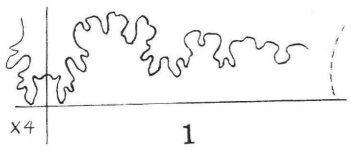
8–9. Side and rear views of a specimen (U. S. Nat. Mus. catalogue No. 73350) from Elk Basin sandstone member of Telegraph Creek formation in sec. 27, T. 7 S., R. 23 E., Carbon County, Mont.

10–13. Two side, rear, and top views of the type, an internal cast (U. S. Nat. Mus. catalogue No. 73351) from Elk Basin sandstone member of Telegraph Creek formation in sec. 25, T. 58 N., R. 100 W., Park County, Wyo.

FIGURES 14–21. *Scaphites aquilaensis* var. *nanus* Reeside, n. var. ---- 26

14–19. Side, front, top, bottom, and rear views and suture of type, an internal cast (U. S. Nat. Mus. catalogue No. 73352) from Elk Basin sandstone member of Telegraph Creek formation in sec. 25, T. 58 N., R. 100 W., Park County, Wyo.

20–21. Side and front views of another specimen from the type locality.



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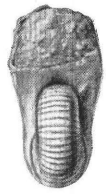

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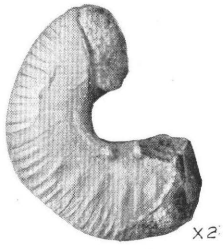

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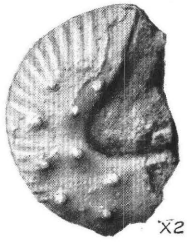

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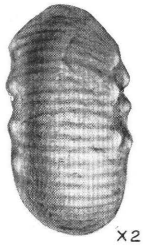

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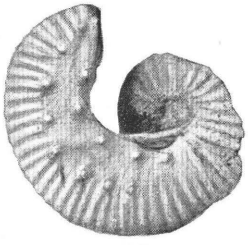

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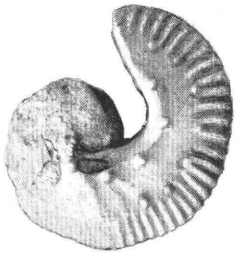

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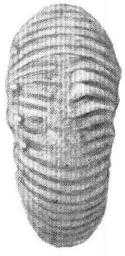

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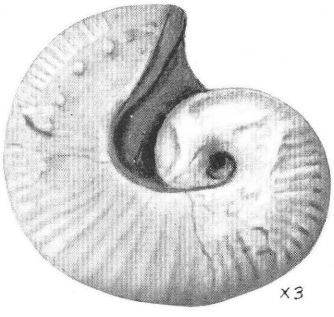

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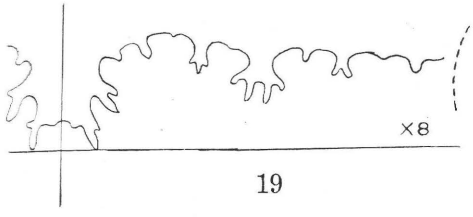

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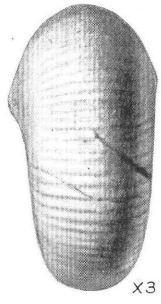

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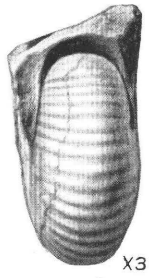

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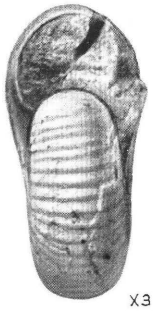

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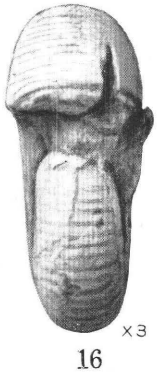

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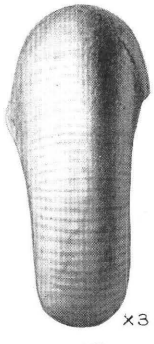

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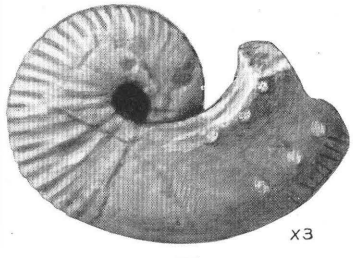

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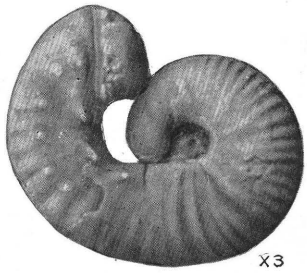
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



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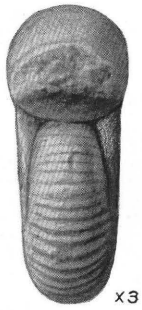

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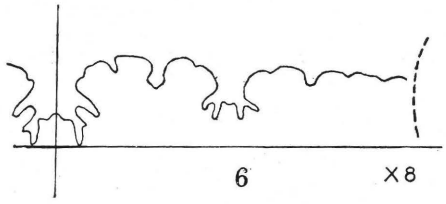

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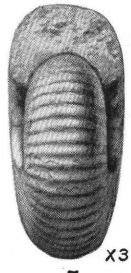

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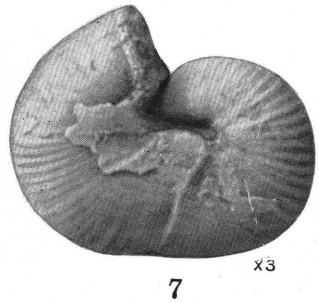

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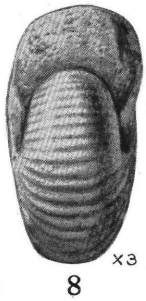

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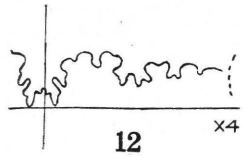

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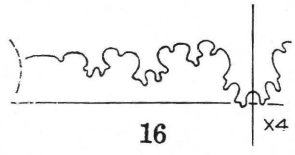

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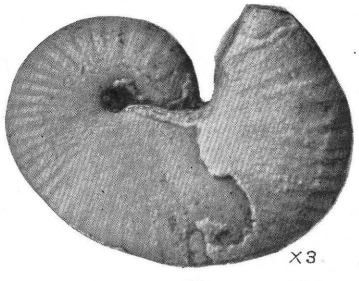

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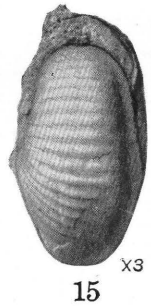

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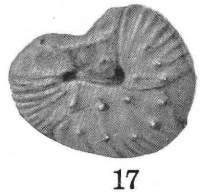
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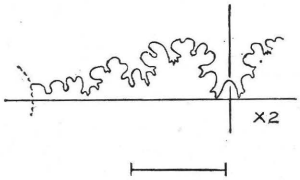

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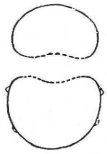
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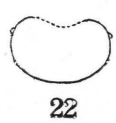
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19

CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 20

Page

FIGURES 1–6. *Scaphites aquilaensis* var. *nanus* Reeside, n. var., side, rear, top, bottom, and front views and suture of a specimen (U. S. Nat. Mus. catalogue No. 73352) from Elk Basin sandstone member of Telegraph Creek formation in sec. 25, T. 58 N., R. 100 W., Park County, Wyo 26

FIGURES 7–16. *Scaphites levis* Reeside, n. sp., from Elk Basin sandstone member of Telegraph Creek formation in sec. 25, T. 58 N., R. 100 W., Park County, Wyo 26

7–12. Side, front, rear, top, and bottom views and suture of the type, an internal cast (U. S. Nat. Mus. catalogue No. 73353).

13–16. Side, rear, and front views and suture of another internal cast (U. S. Nat. Mus. catalogue No. 73353).

FIGURES 17–22. *Scaphites leei* Reeside, n. sp., side, bottom, and rear views, suture, and cross sections through the beginning of the bend of living chamber and the aperture and through the middle of the bend of the type, an internal cast (U. S. Nat. Mus. catalogue No. 73354) from uppermost part of Mancos shale 1 mile southwest of Waldo, Santa Fe County, N. Mex 26

PLATE 21

Page

FIGURES 1–7. *Scaphites leei* Reeside, n. sp., rear, top, and side views, cross sections through beginning of bend of living chamber and the aperture and through the middle of the bend, cross section of the coiled whorls, and suture of an internal cast (U. S. Nat. Mus. catalogue No. 73355) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex.. 26

FIGURES 8–16. *Scaphites leei* var. *parvus* Reeside, n. var. 27

8–14. Side, top, bottom, rear, and front views, suture, and cross section of living chamber of the type, an internal cast (U. S. Nat. Mus. catalogue No. 73356) from Mesaverde formation, near base, three-quarters of a mile north of Copper City, Sandoval County, N. Mex.

15–16. Side and rear views of an internal cast (U. S. Nat. Mus. catalogue No. 73357) from Mesaverde formation at Hagan coal mine, Sandoval County, N. Mex.

FIGURES 17–21. *Desmoscaphites bassleri* Reeside, n. sp. 16

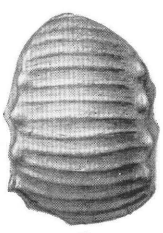
17. Side view of type, an internal cast (U. S. Nat. Mus. catalogue No. 73358) from Mancos shale 280 feet below top, just west of Hogback Mountain and 1 mile north of Shiprock-Farmington road, San Juan County, N. Mex.

18. Side view of a specimen flattened in shale (U. S. Nat. Mus. catalogue No. 73359) from Mancos shale, 1,000 feet below top, in NW. ¼ SE. ¼ SE. ¼ sec. 13, T. 35 N., R. 10 W., La Plata County, Colo.

19. Side view of a specimen flattened in shale (U. S. Nat. Mus. catalogue No. 73360) from Mancos shale, 1,000 feet below top, at center of sec. 13, T. 35 N., R. 10 W., La Plata County, Colo.

20. Fragment of shell (U. S. Nat. Mus. catalogue No. 73361) from Eagle [Virgelle] sandstone (?) in NW. ¼ sec. 27, T. 31 N., R. 11 W., Blackfoot Indian Reservation, Mont.

21. Fragment doubtfully assigned to this species (U. S. Nat. Mus. catalogue No. 73362) from Eagle [Virgelle] sandstone (?) at top of ridge south of Lake City, 2 miles east of Basin Mountain, Blackfoot Indian Reservation, Mont.



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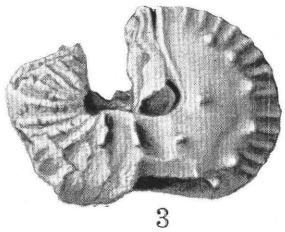

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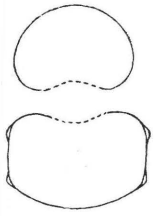

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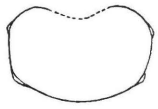

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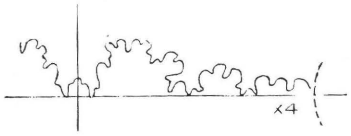

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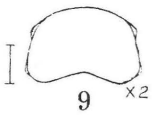

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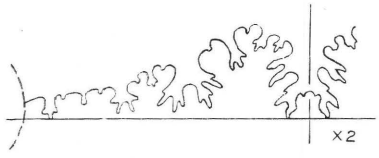

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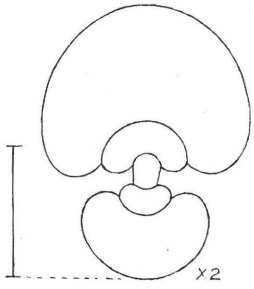

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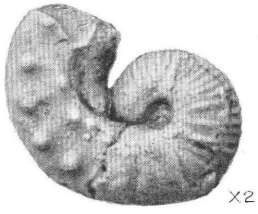

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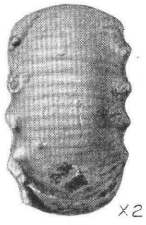

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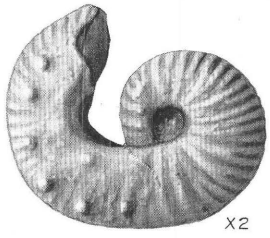

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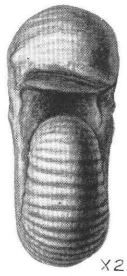

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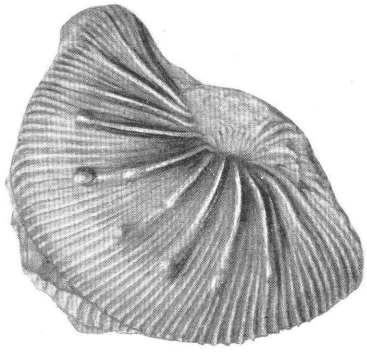

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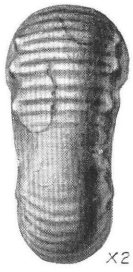

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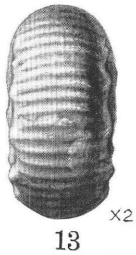

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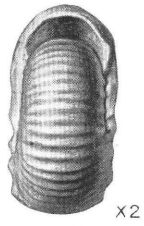

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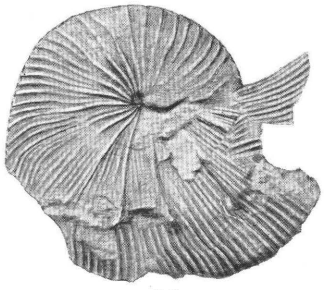

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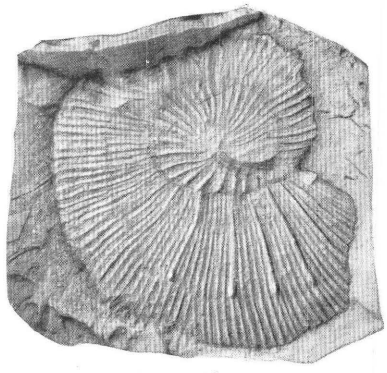

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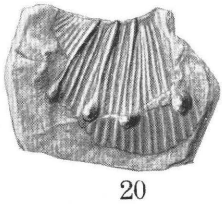

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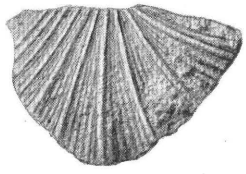

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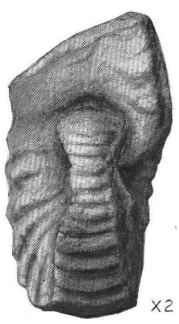
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



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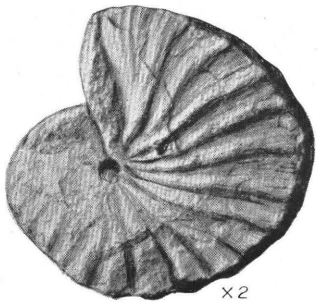

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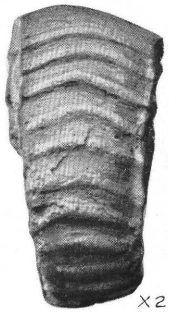

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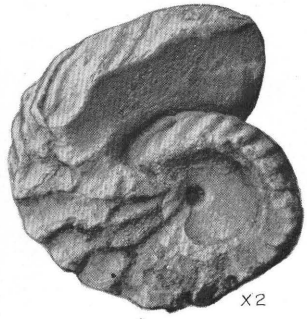

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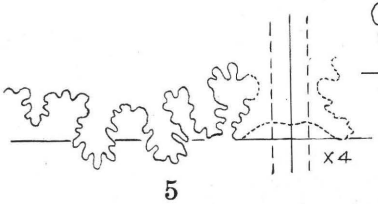

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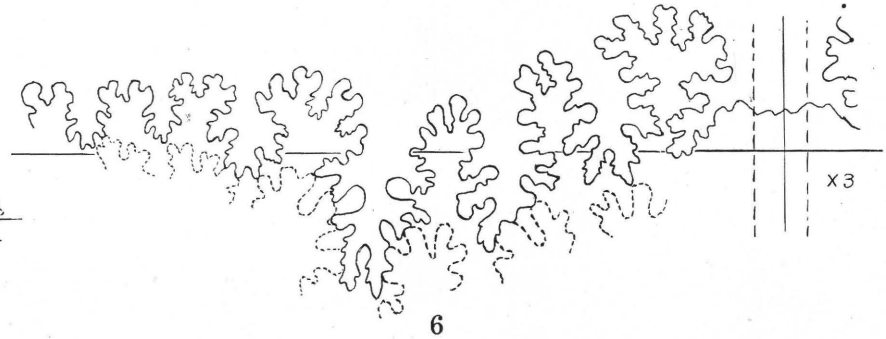

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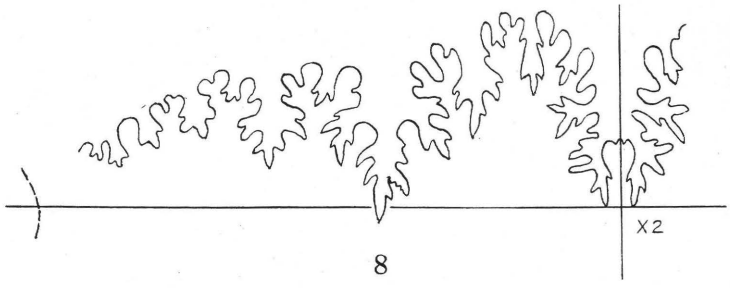

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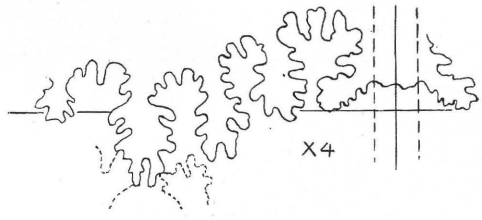

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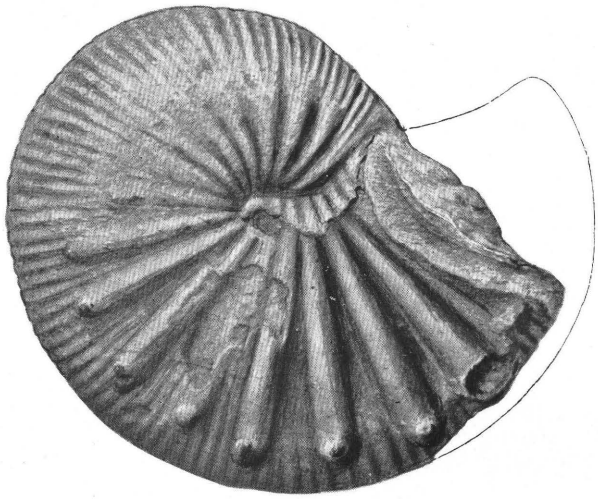

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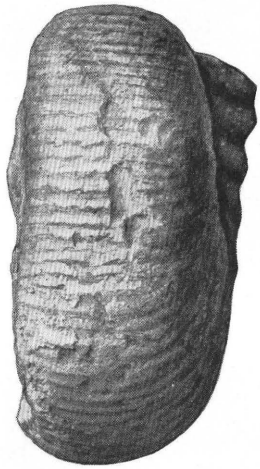

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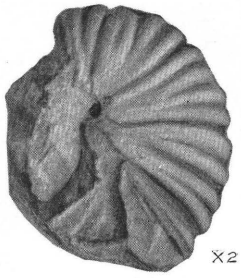

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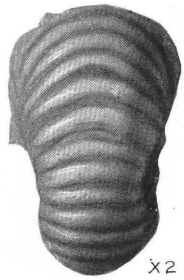


12

CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 22

Page

FIGURES 1–4. *Acanthoceras? montanaense* Reeside, n. sp., front, right, and left side, and rear views of the type, an internal cast (U. S. Nat. Mus. catalogue No. 73364) from Elk Basin sandstone member of Telegraph Creek formation in sec. 27, T. 7 S., R. 23 E., Carbon County, Mont 20

FIGURES 5–7. *Placenticeras meeki* Boehm, suture at 20, 30, and 65 millimeters in diameter of the internal cast shown as Figures 1–3, Plate 23 (U. S. Nat. Mus. catalogue No. 73365), from Elk Basin sandstone member of Telegraph Creek formation in T. 57 N., R. 95 W., 6 miles northeast of Lovell, Big Horn County, Wyo 29

FIGURES 8–12. *Desmoscaphites bassleri* Reeside, n. sp., from Elk Basin sandstone member of Telegraph Creek formation in sec. 27, T. 1 S., R. 30 E., Big Horn County, Mont 16

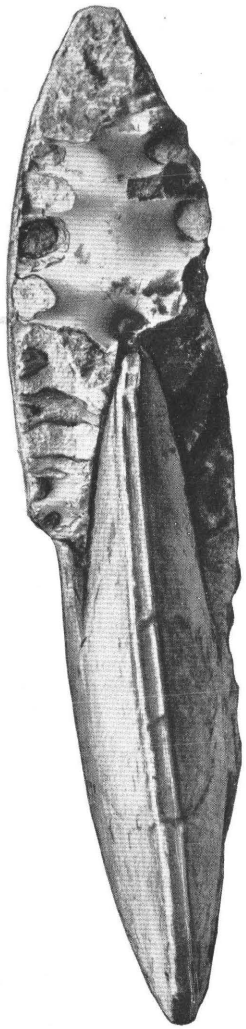
8–10. Side and front views and suture of an internal cast (U. S. Nat. Mus. catalogue No. 73363). The ribs on this cast appear coarse and rounded, but on the corresponding natural mold of the exterior they show the normal sharpness and fasciculation. Outline restored from the mold.

11–12. Side and rear views of the inner whorls of another specimen.

PLATE 23

Page

FIGURES 1–3. *Placenticeras meeki* Boehm, front, side, and rear views of an internal cast (U. S. Nat. Mus. catalogue No. 73365) from Elk Basin sandstone member of Telegraph Creek formation in T. 57 N., R. 95 W., 6 miles northeast of Lovell, Big Horn County, Wyo 29



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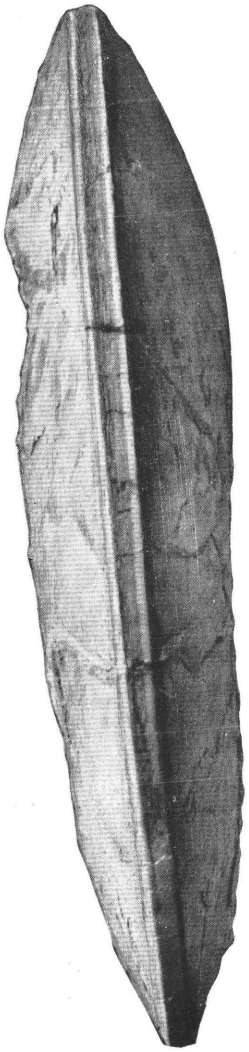

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

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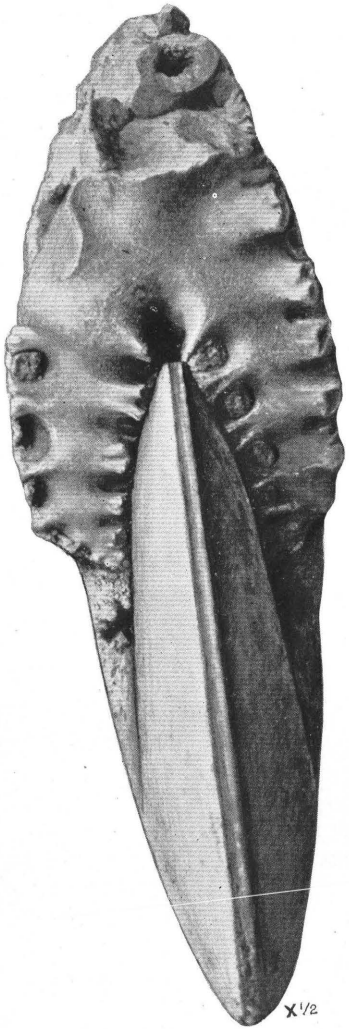

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 24

PLATE 25

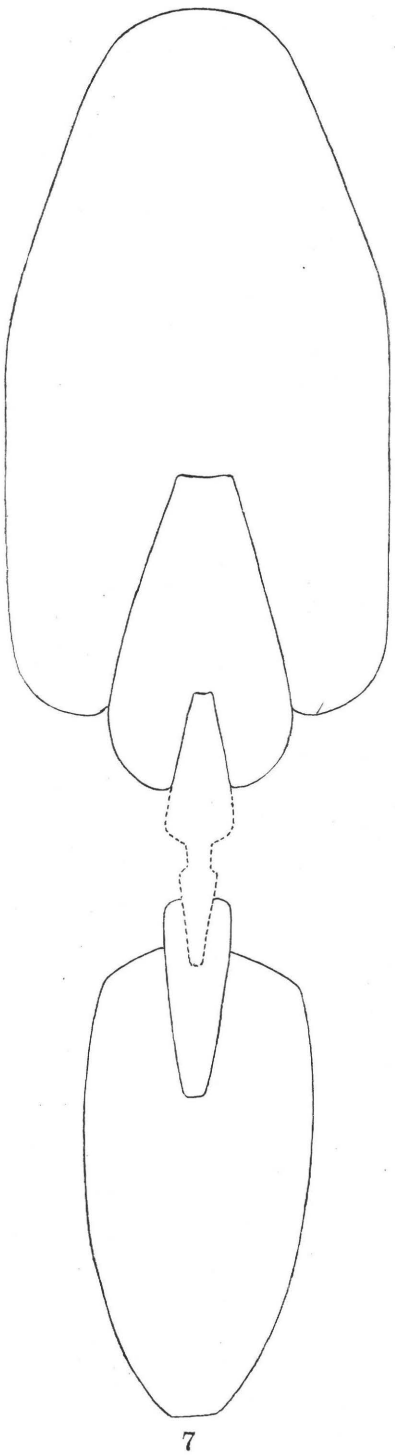
Page

FIGURES 1–2. *Placenticeras meeki* Boehm, front and side views of an internal cast (U. S. Nat. Mus. catalogue No. 73367) from Elk Basin sandstone member of Telegraph Creek formation at center of sec. 35, T. 8 S., R. 24 E., Carbon County, Mont 29

FIGURES 3–7. *Placenticeras planum* Hyatt 31

3–6. Side and rear views, cross section, and suture of a specimen retaining the shell (U. S. Nat. Mus. catalogue No. 73368) from Elk Basin sandstone member of Telegraph Creek formation in T. 56 N., R. 98 W., 12 miles west of Lovell, Park County, Wyo.

7. Cross section of the internal cast shown as Figures 1–2, Plate 26 (U. S. Nat. Mus. catalogue No. 73369) from Mesaverde formation, near base, three-quarters of a mile north of Copper City, Sandoval County, N. Mex.



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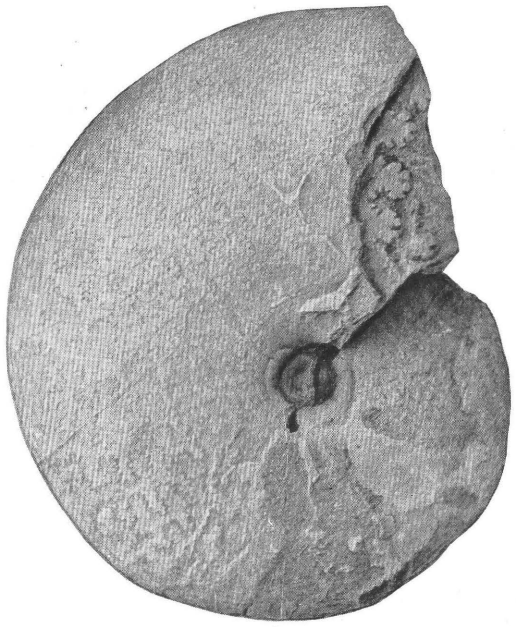

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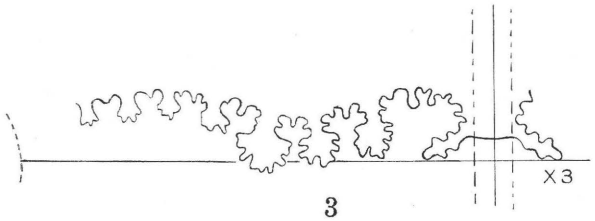

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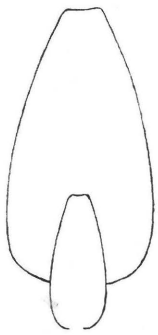

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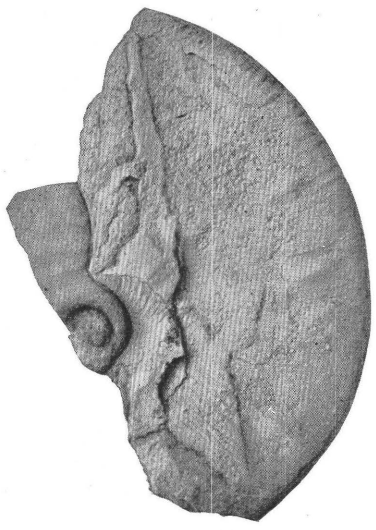

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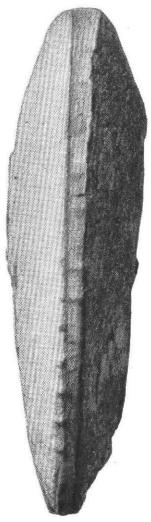

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

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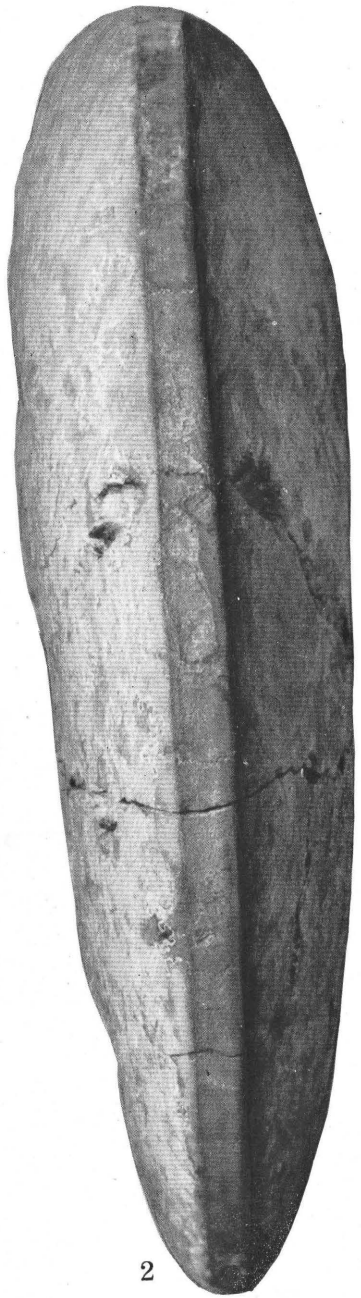

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 26

Page

FIGURES 1–2. *Placenticeras planum* Hyatt, side and rear views of an internal cast (U. S. Nat. Mus. catalogue No. 73369) from Mesaverde formation, near base, three-quarters of a mile north of Copper City, Sandoval County, N. Mex 31

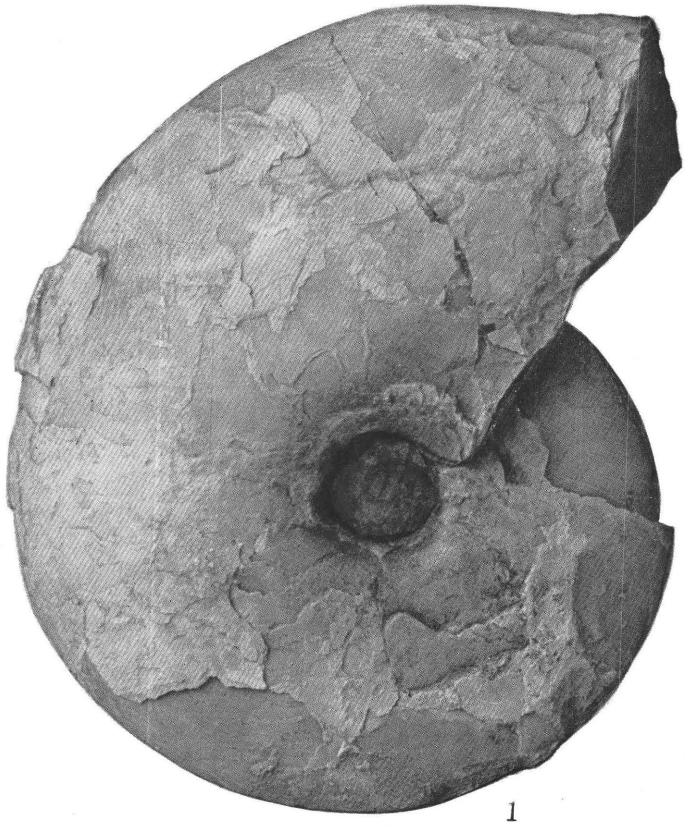
PLATE 27

Page

FIGURES 1–5. *Placenticeras planum* Hyatt 31

1–2. Side and front views of a specimen retaining part of the shell (U. S. Nat. Mus. catalogue No. 73370) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex.

3–5. Side and rear views and cross section of a somewhat weathered specimen (U. S. Nat. Mus. catalogue No. 73371) from Elk Basin sandstone member of Telegraph Creek formation in sec. 25, T. 58 N., R. 100 W., Park County, Wyo.



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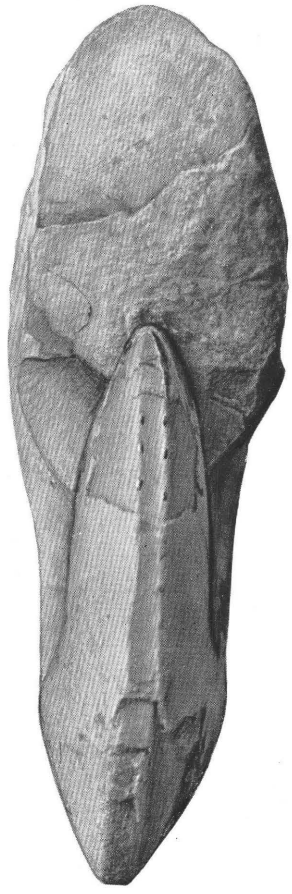

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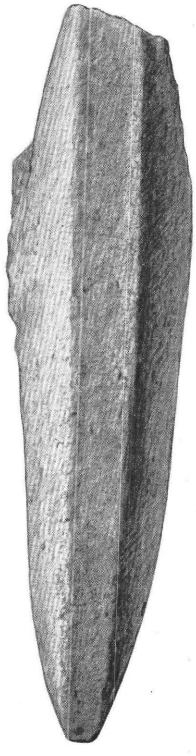

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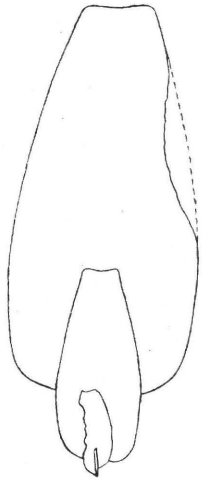

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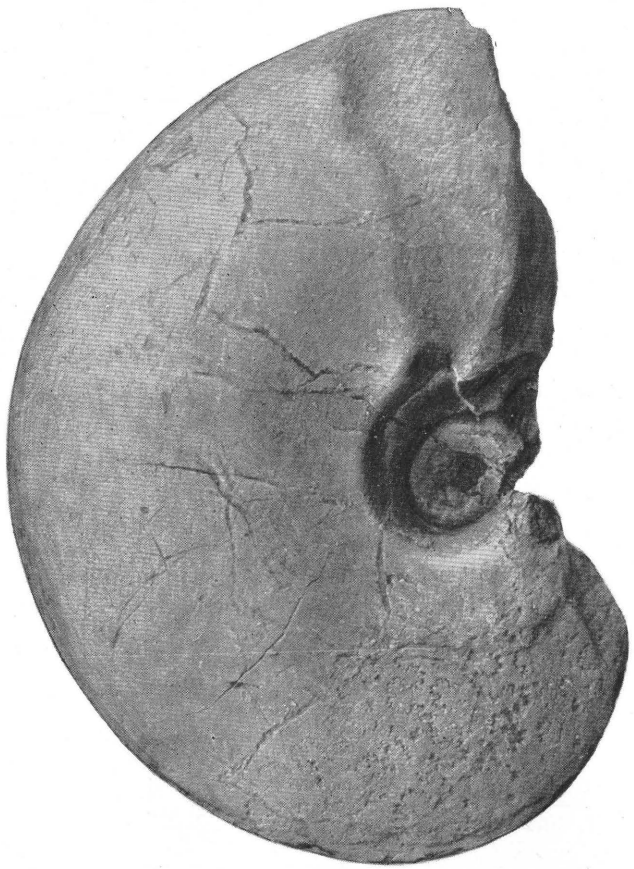
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



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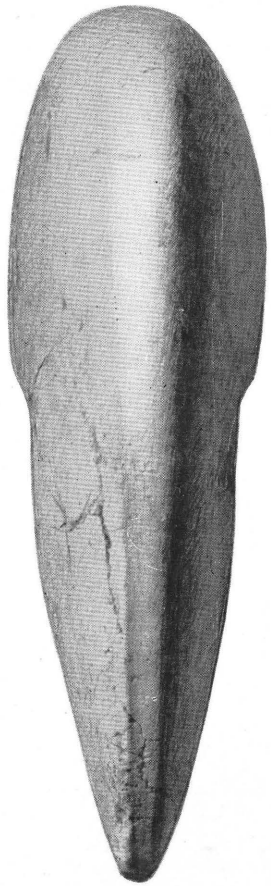

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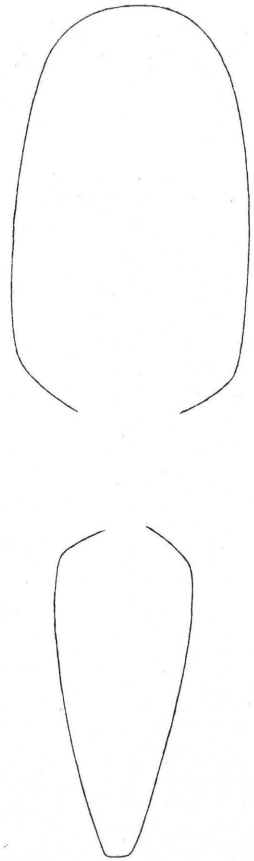

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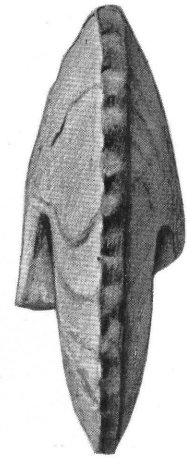

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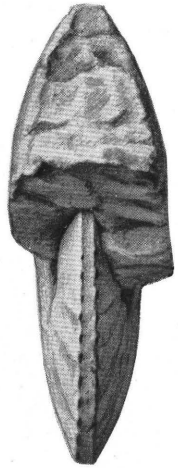

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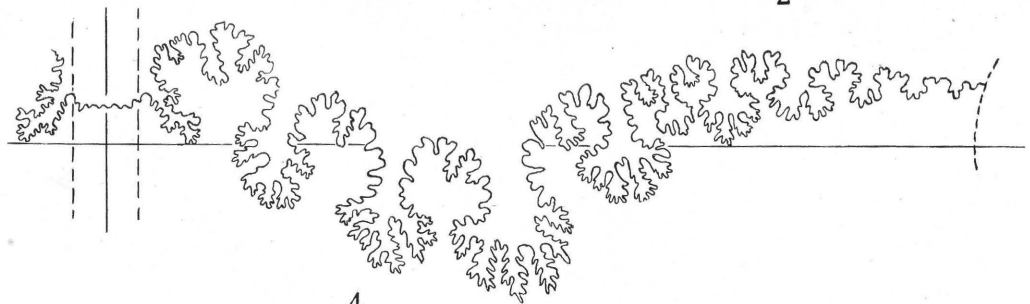

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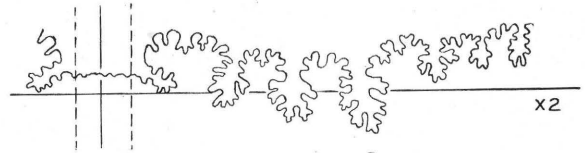

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 28

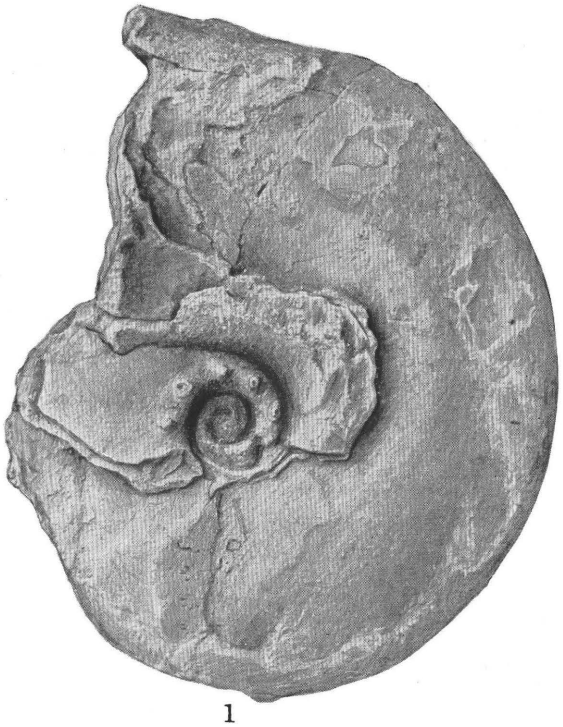
PLATE 29

Page

FIGURES 1–8. *Placenticeras planum* Hyatt 31

1–3. Side and rear views and suture of a partly crushed specimen retaining parts of the shell (U. S. Nat. Mus. catalogue No. 73373) from Elk Basin sandstone member of Telegraph Creek formation near east quarter corner of sec. 16, T. 7 S., R. 23 E., Carbon County, Mont.

4–8. Side and rear views of outer whorl, side and rear views of a squeeze of the inner whorl, and cross section of a variety approaching *P. sancarlosense* Hyatt (U. S. Nat. Mus. catalogue No. 73374) from Mesaverde formation near base three-quarters of a mile north of Copper City, Sandoval County, N. Mex.



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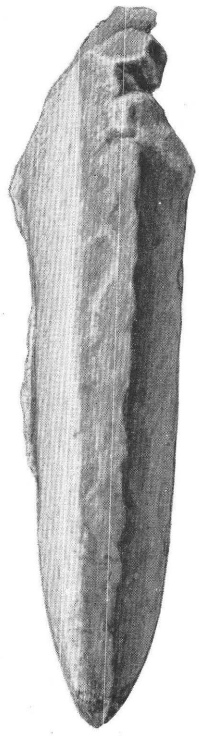

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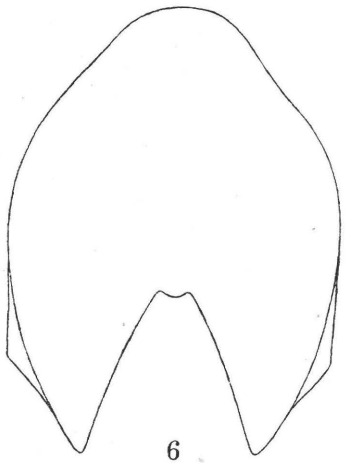

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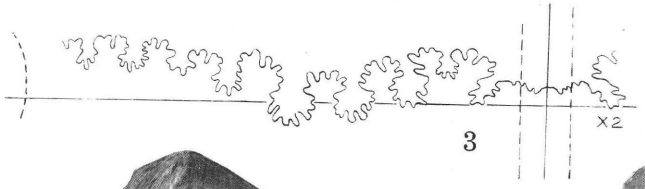

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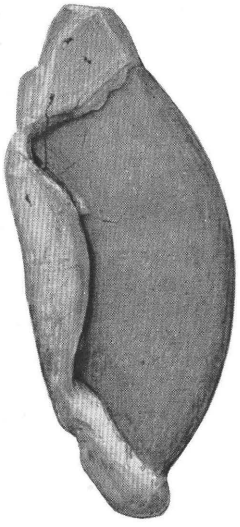

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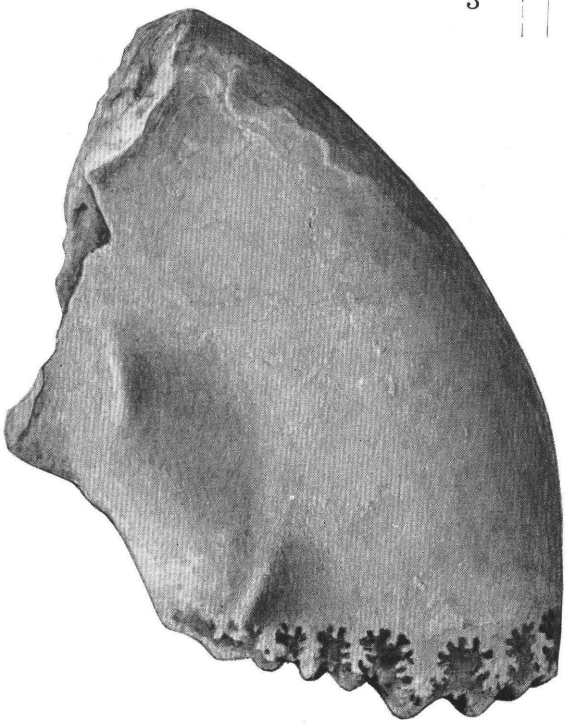

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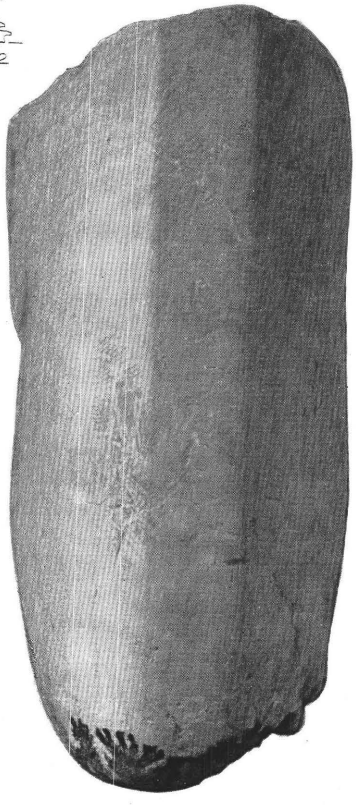

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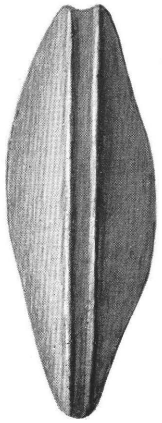

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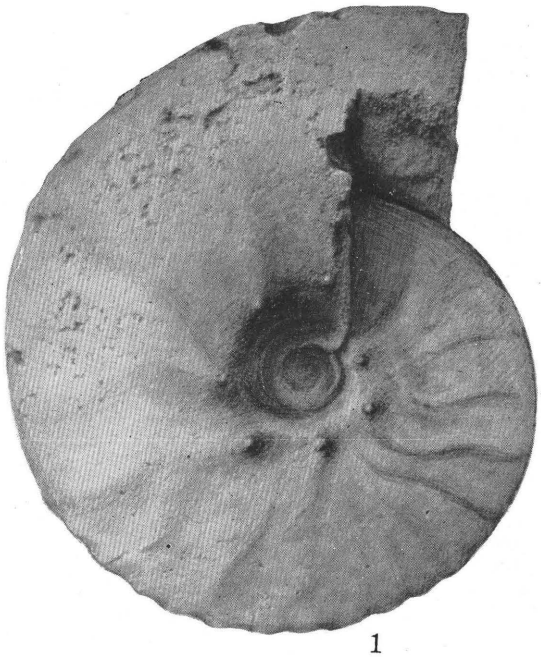
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



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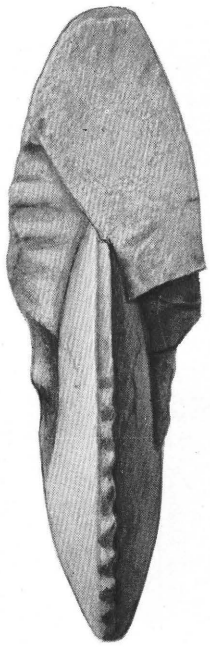

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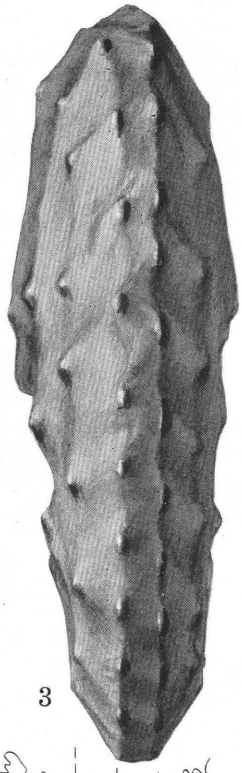

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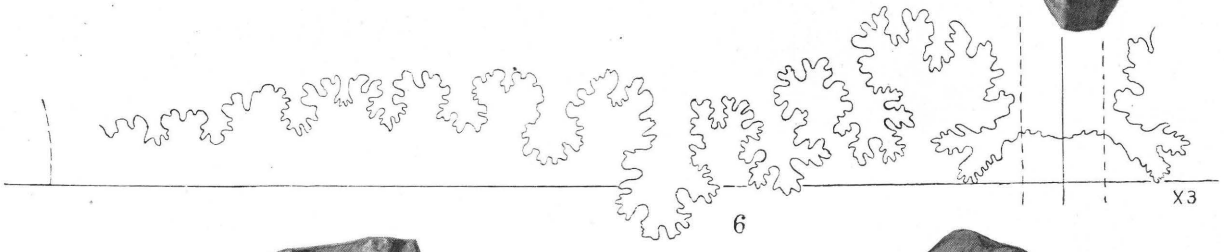

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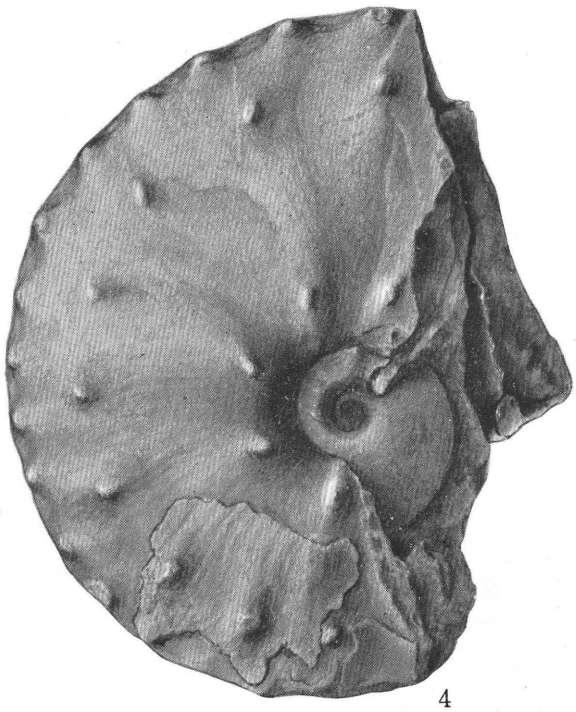

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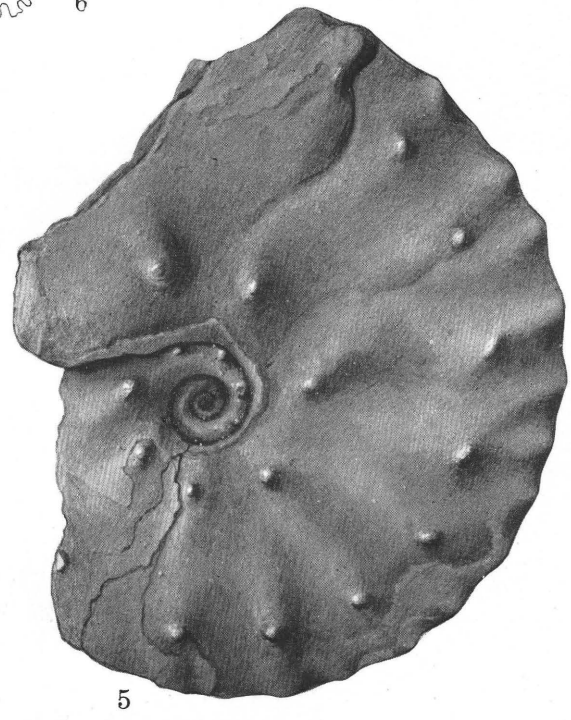

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 30

Page

FIGURES 1–2. *Placenticeras planum* Hyatt, side and front views of an internal cast (U. S. Nat. Mus. catalogue No. 73370) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex. ---- 31

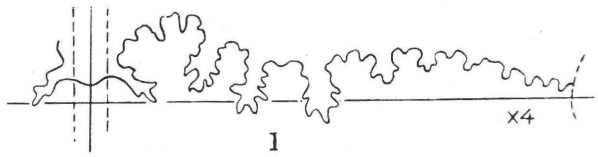
FIGURES 3–6. *Placenticeras syrtale* (Morton), rear, right, and left side views and suture at diameter of 65 millimeters of a specimen preserving parts of the shell (U. S. Nat. Mus. catalogue No. 73375) from Eagle sandstone on road from mouth of Little Horn River, 7 miles northwest of Hardin, Big Horn County, Mont. ---- 32

PLATE 31

Page

FIGURES 1–2. *Placenticeras syrtale* (Morton), suture at diameter of 25 millimeters and cross section of specimen shown in Figures 3–6, Plate 30 (U. S. Nat. Mus. catalogue No. 73375)---------- 32

FIGURES 3–5. *Placenticeras newberryi* Hyatt, front and rear views and suture at diameter of 105 millimeters of a specimen retaining parts of the shell (U. S. Nat. Mus. catalogue No. 73376) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex---------- 33



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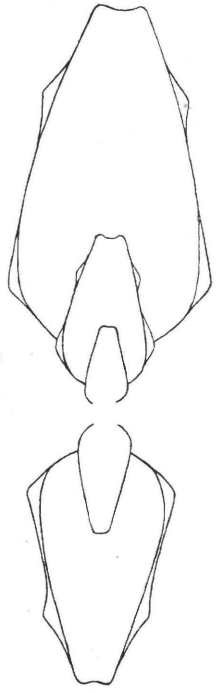

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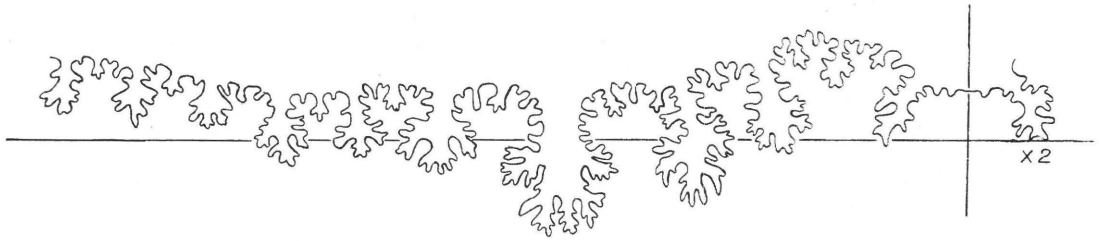

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 32

3130—27——9

PLATE 33

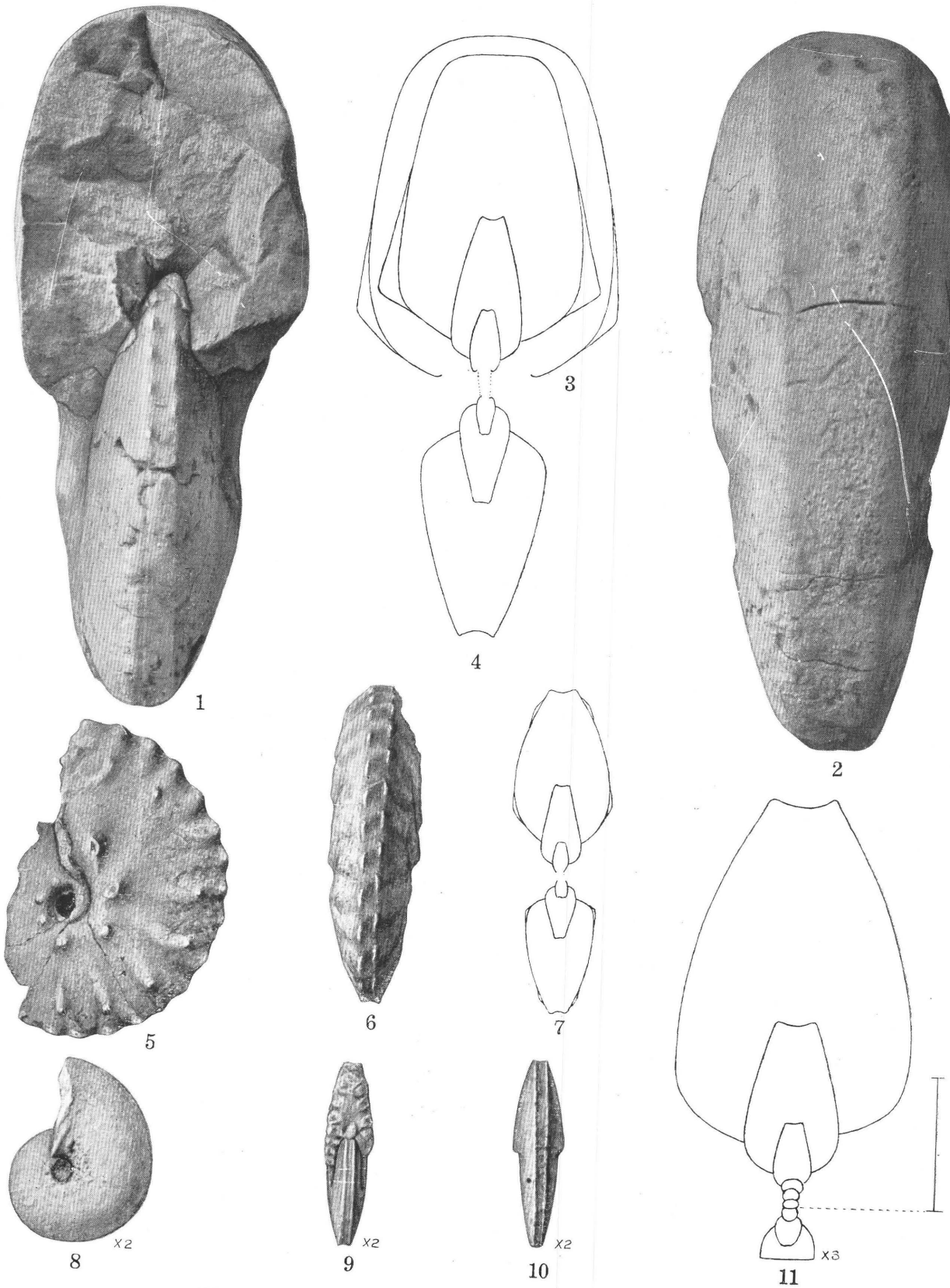
Page

FIGURES 1–4. *Placenticeras newberryi* Hyatt, front and rear views, cross section at diameter of 98 millimeters, and cross section of outer whorl at diameter of 125 millimeters of the internal cast shown as Figure 2, Plate 32 (U. S. Nat. Mus. catalogue No. 73376), from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex ---------- 33

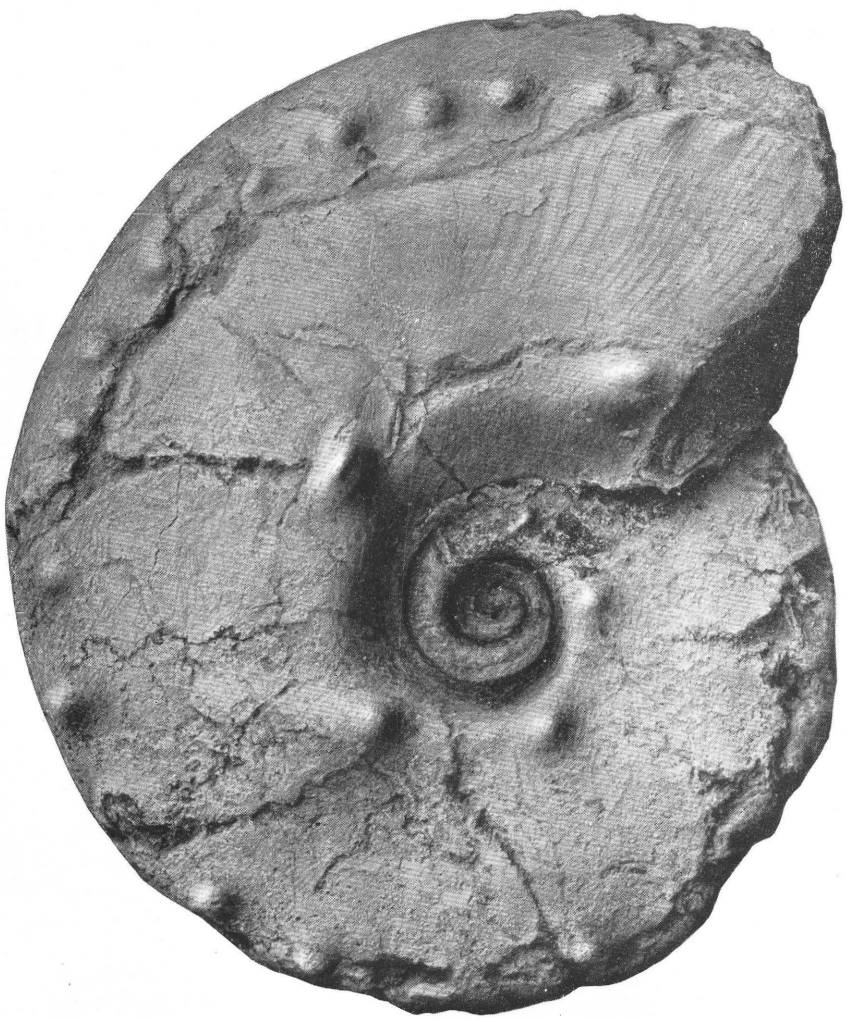
FIGURES 5–11. *Placenticeras sancarlosense* Hyatt ---------- 34

5–10. Side and rear views of outer whorl, side, front, and rear views of inner whorl and cross section of an internal cast (U. S. Nat. Mus. catalogue No. 73377) from lower part of Mesaverde formation at Hagan coal mine, in T. 13 N., R. 6 E., Sandoval County, N. Mex.

11. Cross section of inner whorls of a specimen (U. S. Nat. Mus. catalogue No. 73377) from same locality as Figures 5–10.



CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



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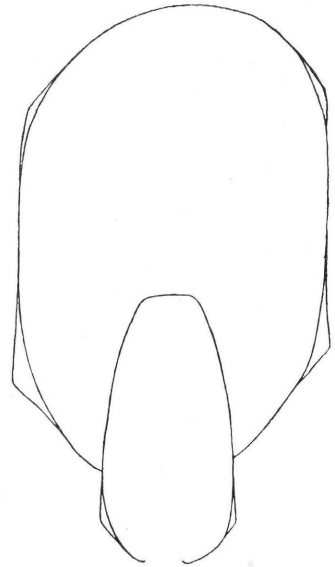

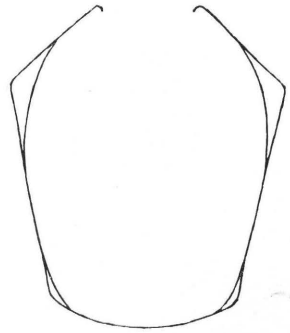

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 34

FIGURES 1–3. *Placenticeras sancarlosense* Hyatt, side and rear views and cross section of an internal cast (U. S. Nat. Mus. catalogue No. 73378) from upper part of Mancos shale 1 mile southeast of Waldo, Santa Fe County, N. Mex. Page 34

PLATE 35

Page

FIGURES 1–4. *Placenticeras sancarlosense* Hyatt, side and rear views, cross section, and suture of an internal cast (U. S. Nat. Mus. catalogue No. 73379) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex ---------- 34

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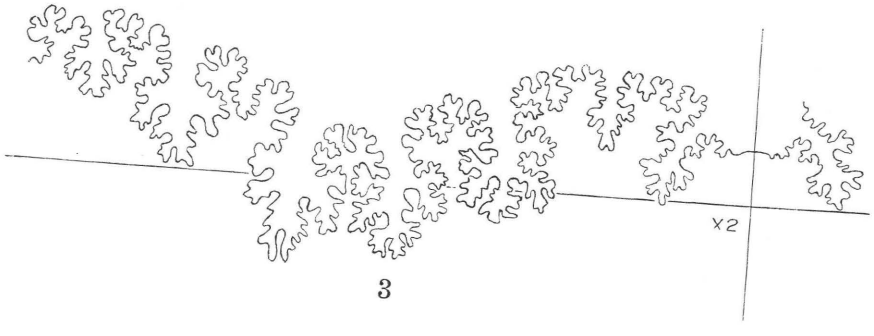

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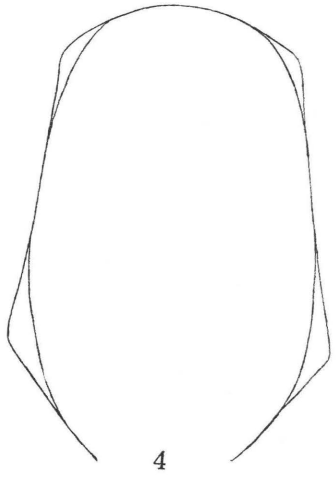

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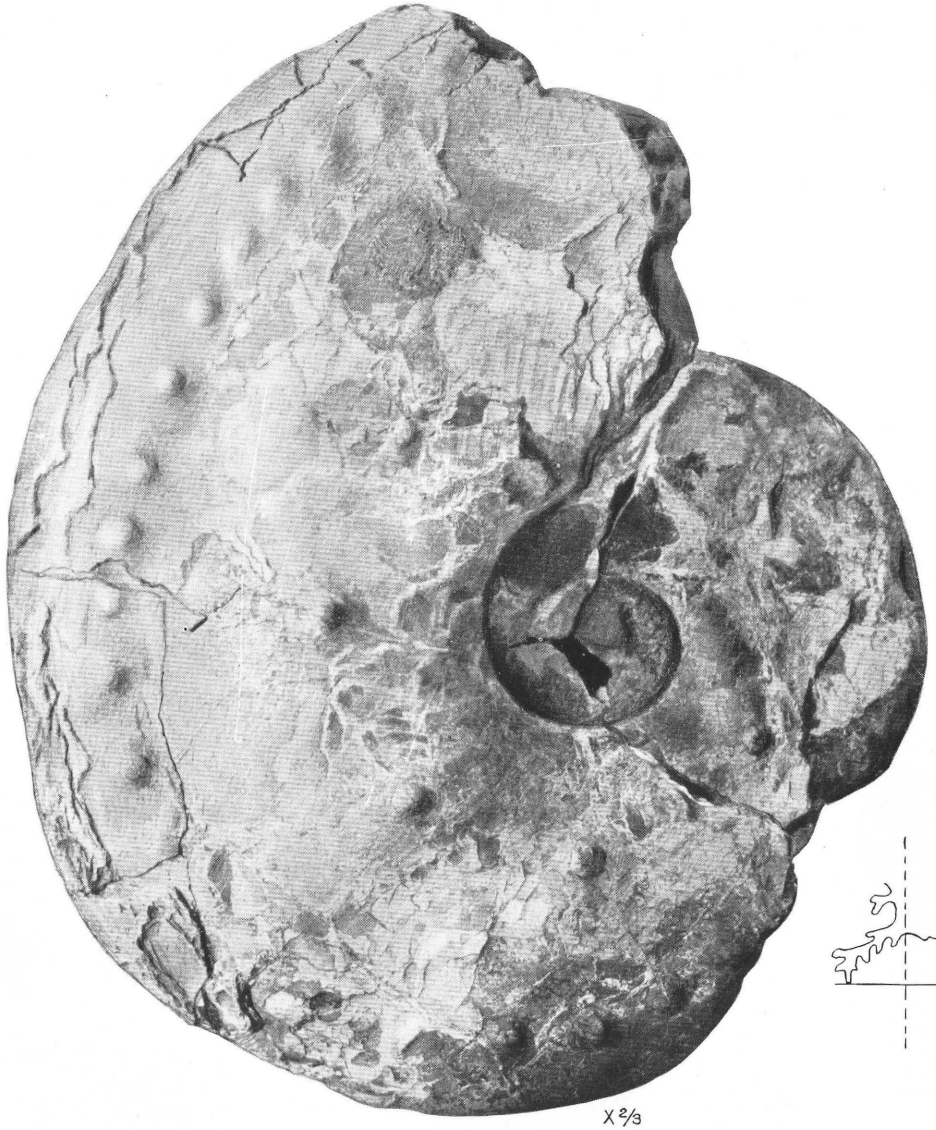

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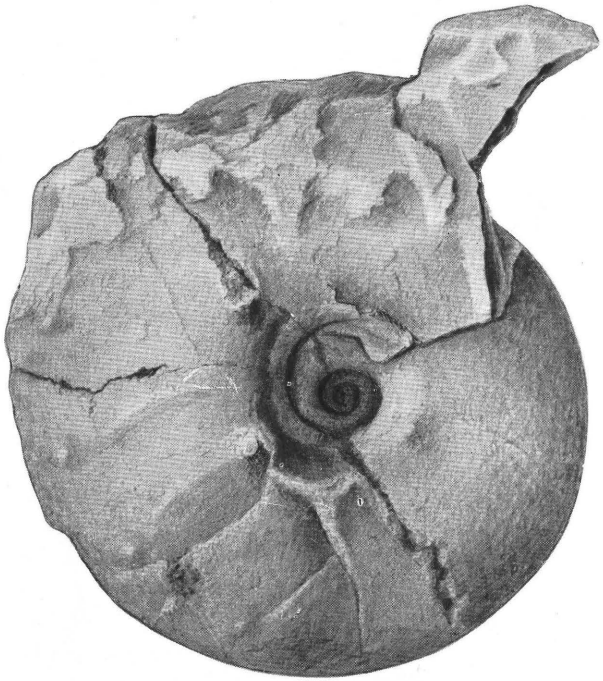

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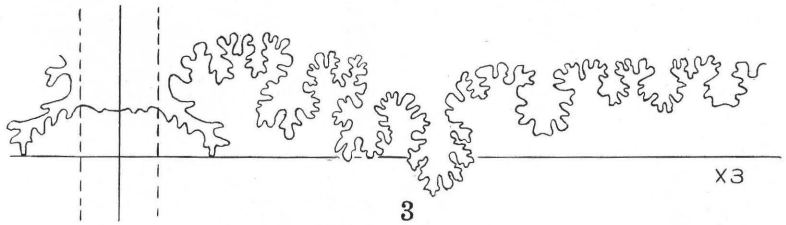

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 36

Page

FIGURES 1–3. *Placenticeras sancarlosense* Hyatt 34

1. Side view of a large specimen, somewhat crushed and retaining parts of the shell (U. S. Nat. Mus. catalogue No. 73379) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex.

2–3. Side view and suture of an internal cast (U. S. Nat. Mus. catalogue No. 73379) from same locality as Figure 1.

PLATE 37

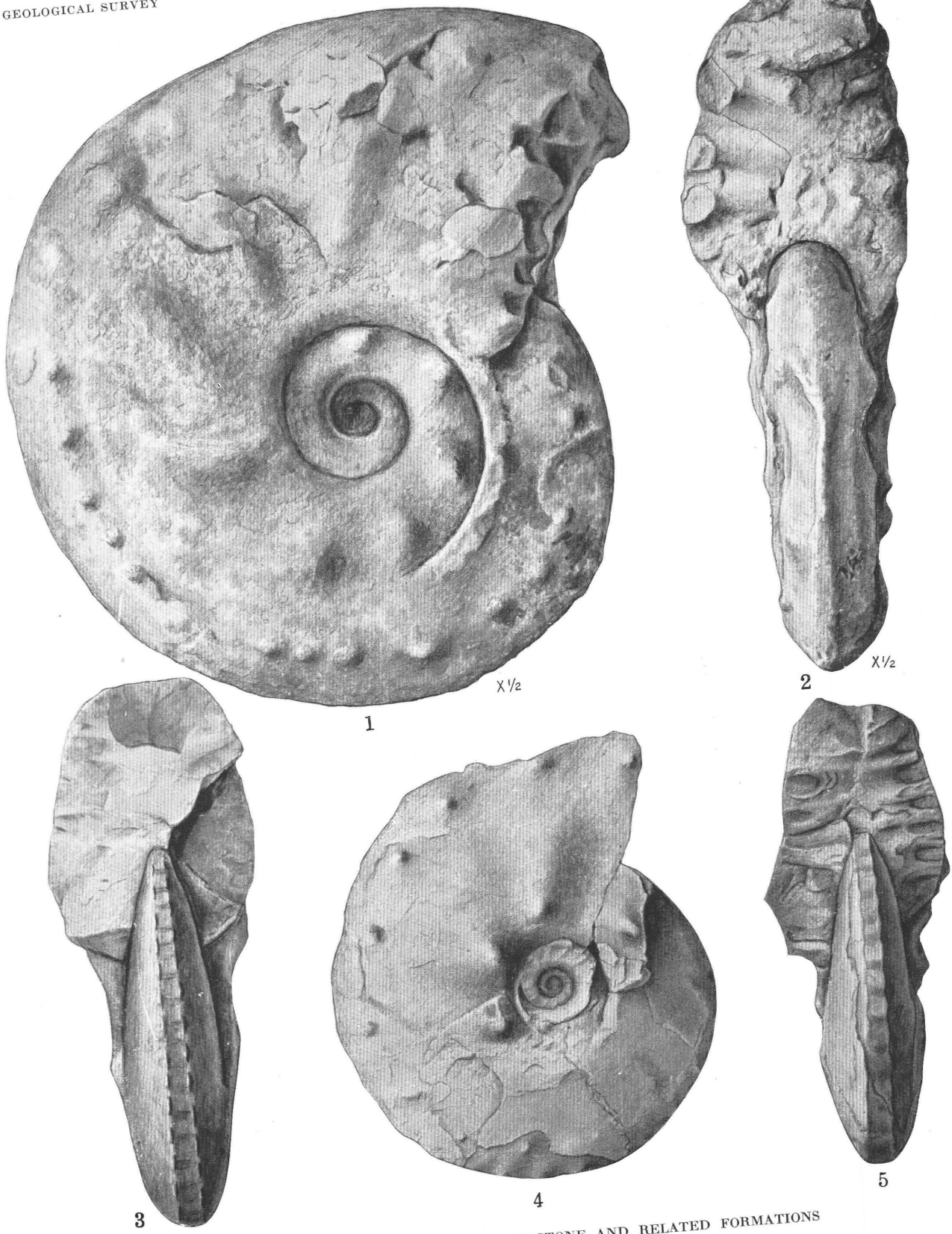
Page

FIGURES 1–2. *Placenticeras sancarlosense* var. *pseudosyrtale* Hyatt, side and front views of a somewhat crushed internal cast (U. S. Nat. Mus. catalogue No. 73380) from uppermost part of Mancos shale 1 mile north of Galisteo Creek and 1 mile east of head of Canyon del Yeso, Santa Fe County, N. Mex.. 35

FIGURES 3–5. *Placenticeras sancarlosense* Hyatt..... 34

3. Front view of the specimen shown as Figure 2, Plate 36.

4–5. Side and front views of an internal cast (U. S. Nat. Mus. catalogue No. 73379) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex.



CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

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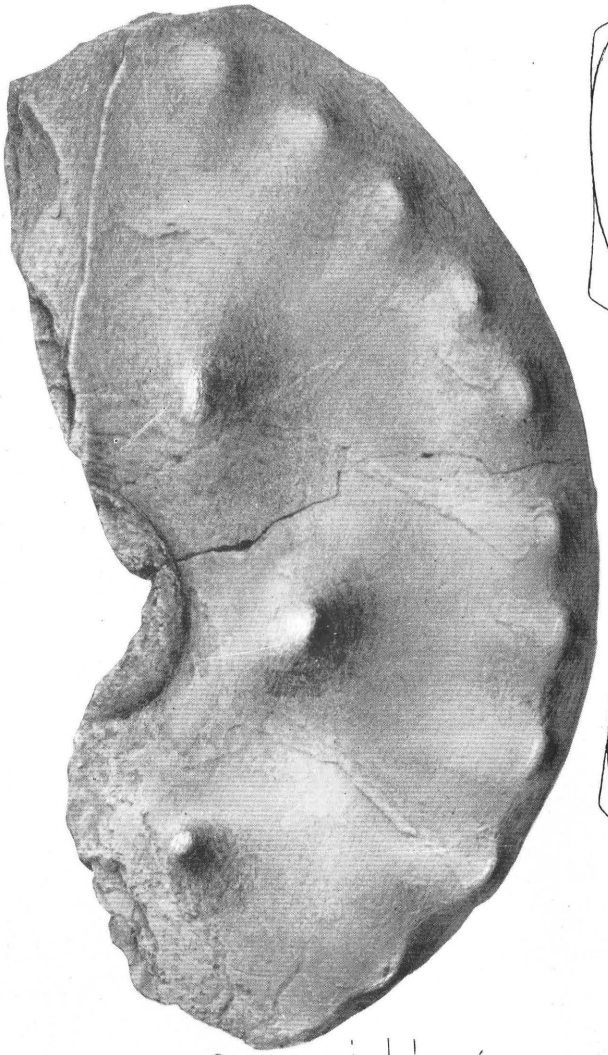

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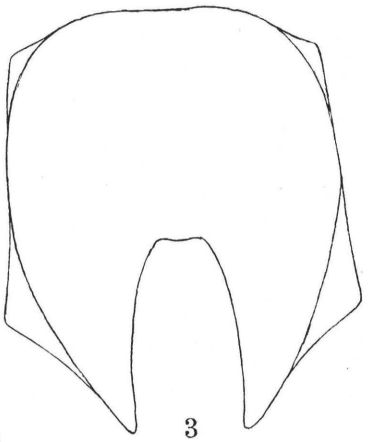

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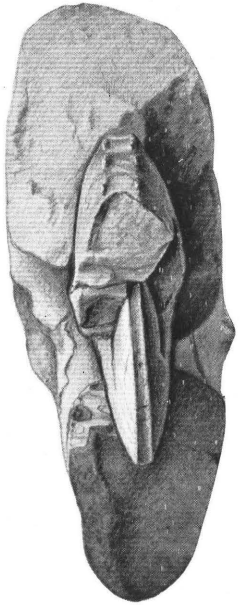

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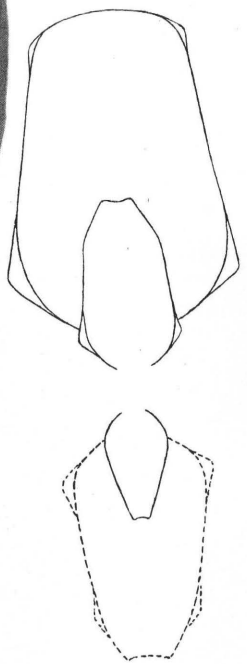

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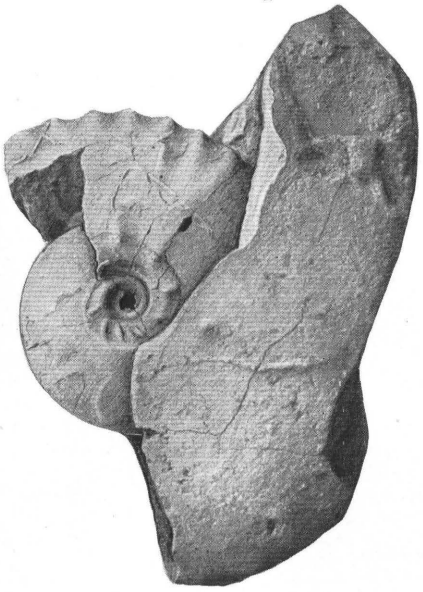

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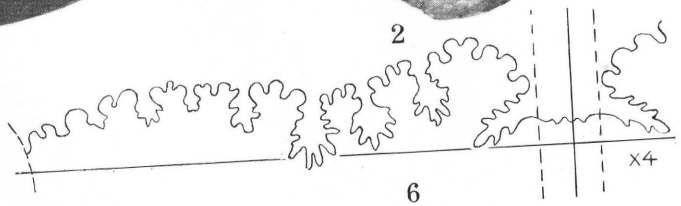

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 38

Page

FIGURES 1–7. *Placenticeras guadalupae* (Roemer) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex. 36

1–3. Side and rear views and cross section of an internal cast (U. S. Nat. Mus. catalogue No. 73381).

4–7. Front and side views, cross section, and suture at diameter of 30 millimeters of another internal cast (U. S. Nat. Mus. catalogue No. 73381).

PLATE 39

Page

FIGURES 1–3. *Placenticeras guadalupae* (Roemer), rear, side, and front views of an internal cast (U. S. Nat. Mus. catalogue No. 73381) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex. ---------- 36

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

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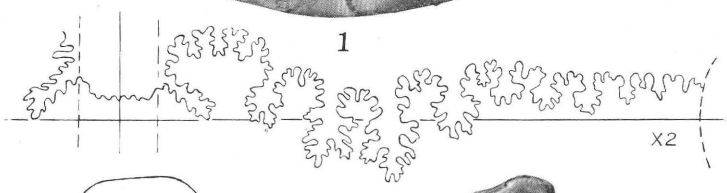

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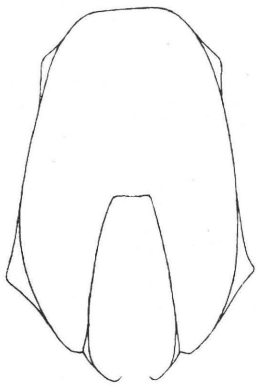

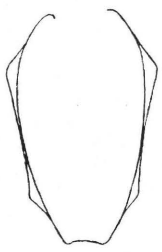

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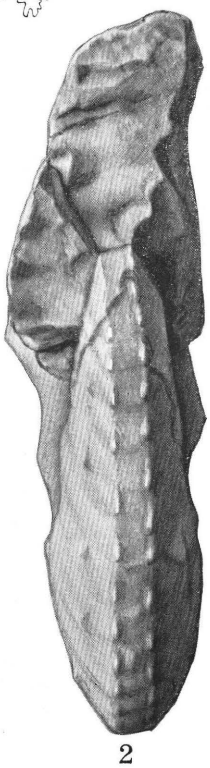

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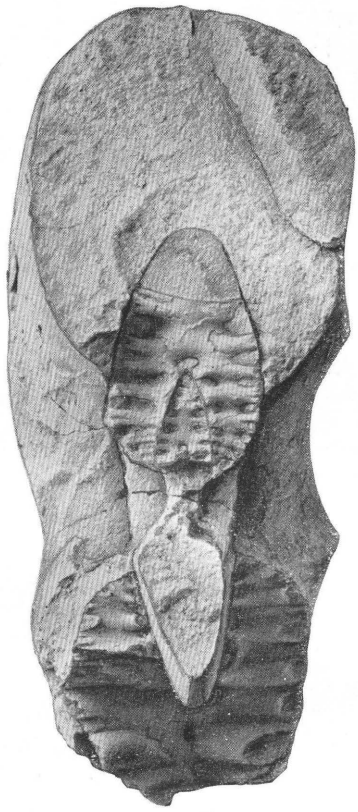

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 40

Page

FIGURES 1–6. *Placenticeras guadalupae* (Roemer) 36

1–4. Side, front views, suture, and cross section of a somewhat crushed internal cast (U. S. Nat. Mus. catalogue No. 73381) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex.

5–6. Front and side views of an internal cast (U. S. Nat. Mus. catalogue No. 73382) from upper part of Mancos shale 1 mile southwest of Waldo, Santa Fe County, N. Mex.

3130—27——10

PLATE 41

Page

FIGURES 1–2. *Placenticeras guadalupae* (Roemer), side and rear view of a verys large specimen retaining parts of the shell (U. S. Nat. Mus. catalogue No. 73383) from uppermost part of Mancos shale, 1 mile north of Galisteo Creek and 1 mile east of the head of Canyon del Yeso, Santa Fe County, N. Mex 36

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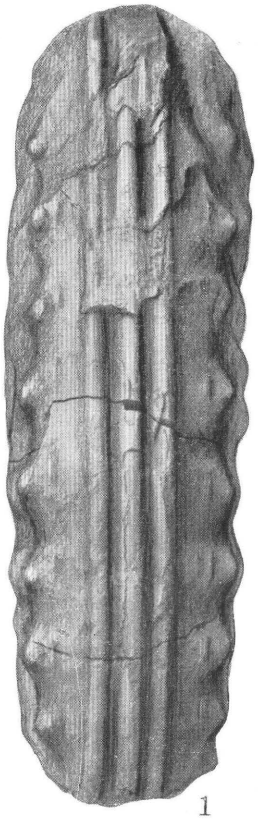
CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS



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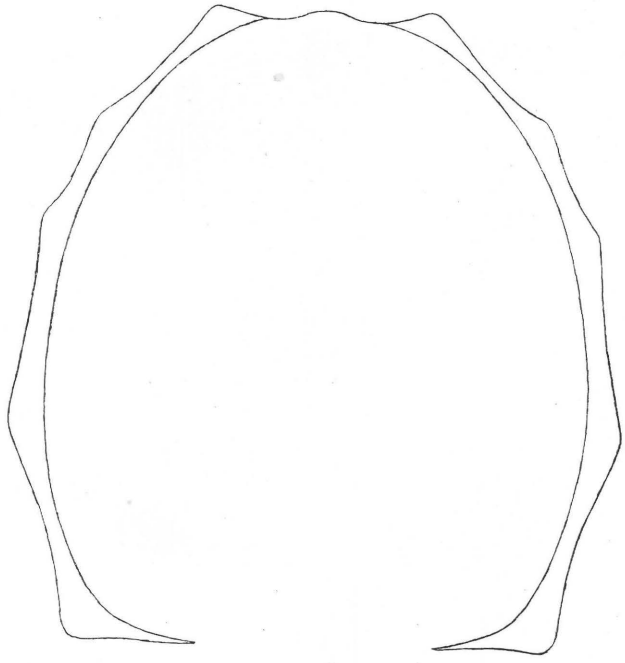

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 42

Page

FIGURES 1–2. *Peroniceras leei* Reeside, n. sp., rear and side views of the type specimen, an internal cast with fragments of shell (U. S. Nat. Mus. catalogue No. 73384) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex 40

FIGURES 3–4. *Mortoniceras omeraense* Reeside, n. sp., from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex 38

3. Side view of a medium-sized, somewhat weathered specimen (U. S. Nat. Mus. catalogue No. 73385).
4. Cross section of the type specimen (U. S. Nat. Mus. catalogue No. 73385).

PLATE 43

Page

FIGURES 1–2. *Mortoniceras omeraense* Reeside, n. sp., side and rear views of the type, a large internal cast (U. S. Nat. Mus. catalogue No. 73385) from uppermost part of Mancos shale at Omera mine, Ortiz Mountains, Santa Fe County, N. Mex 38

FIGURES 3–4. *Peroniceras leei* Reeside, n. sp., suture and two cross sections of the type, the specimen shown as Figures 1–2, Plate 42 40

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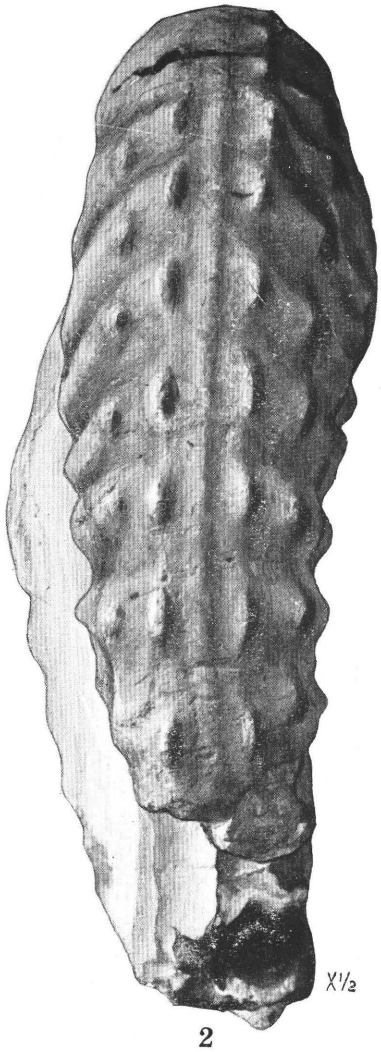

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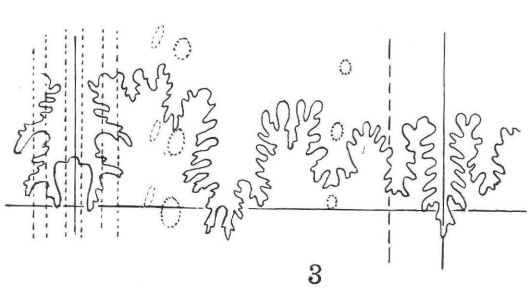

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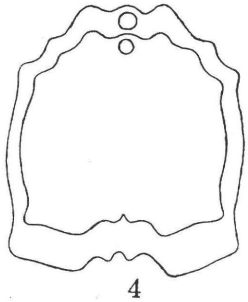

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CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

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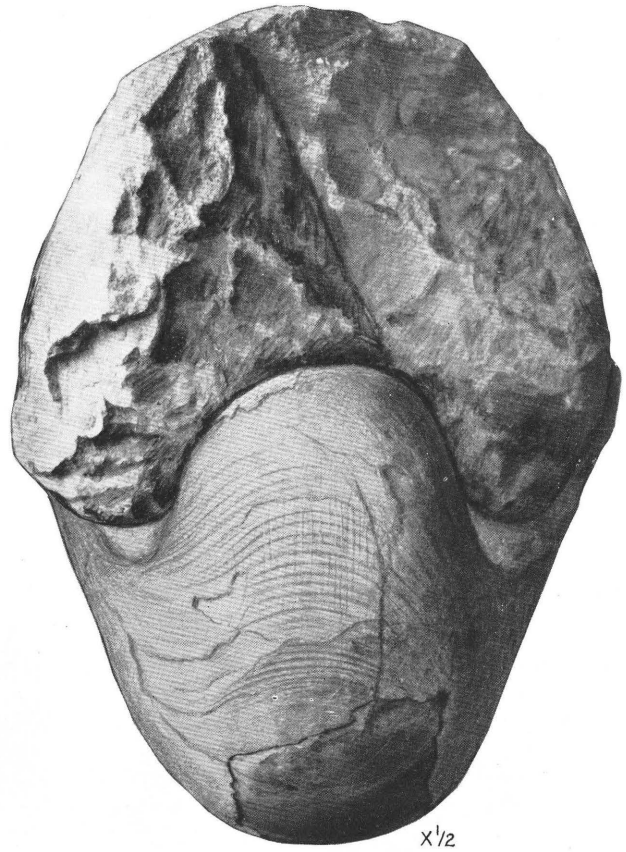


2

CEPHALOPODS OF THE EAGLE SANDSTONE AND RELATED FORMATIONS

PLATE 44

Page

FIGURES 1–2. *Eutrephoceras thomi* Reeside, n. sp., side and front views of type, an individual retaining most of the shell (U. S. Nat. Mus. catalogue No. 73386), from Eagle sandstone in NW. ¼ sec. 8, T. 9 S., R. 35 E., Big Horn County, Mont 7

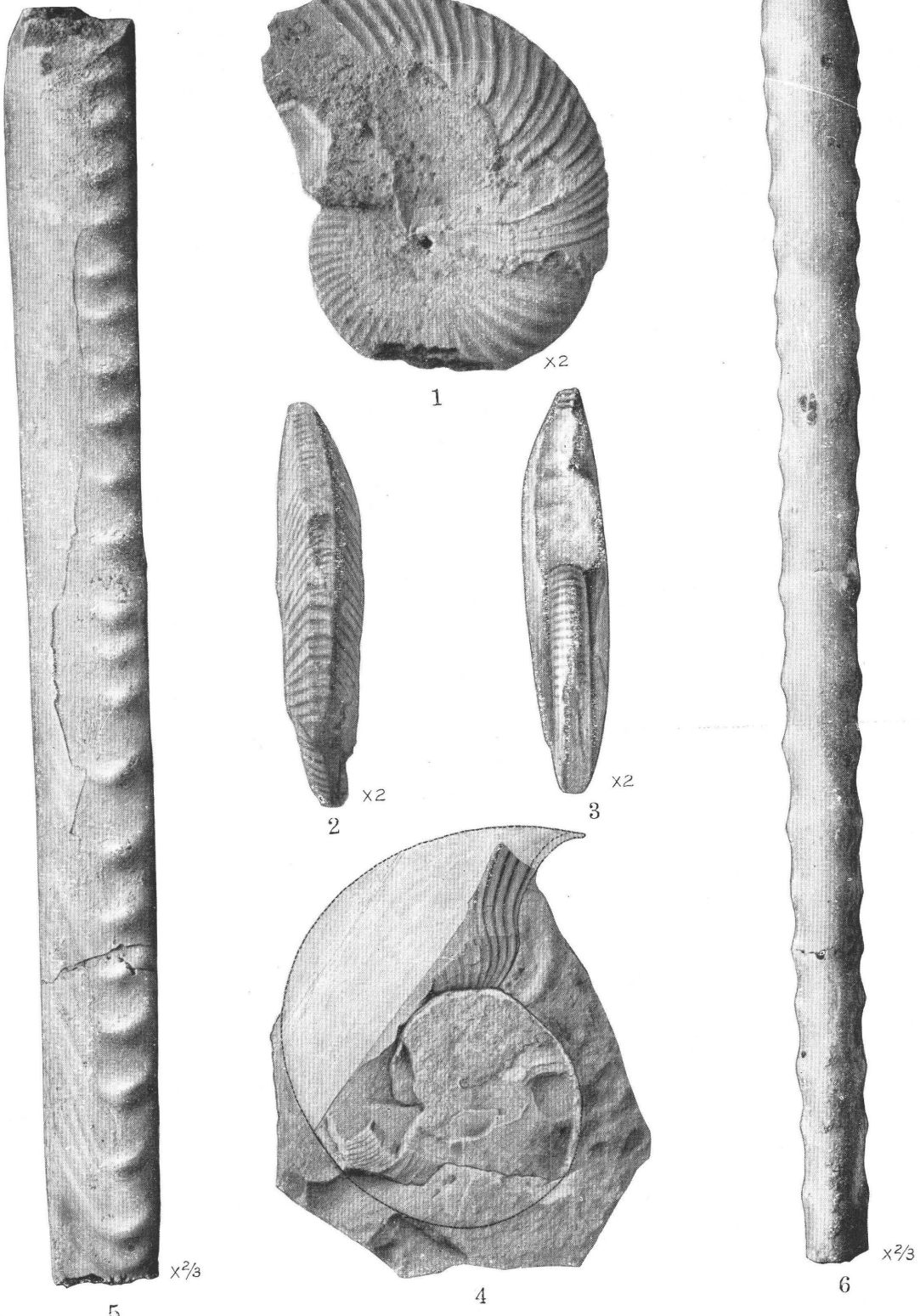
PLATE 45

Page

FIGURES 1–3. *Haresiceras fisheri* Reeside, n. sp., side, front, and rear views of type, an internal cast (U. S. Nat. Mus. catalogue No. 73387) from upper part of Mancos shale in NW. ¼ sec. 18, T. 21 S., R. 18 E., Emery County, Utah 19

FIGURE 4. *Haresiceras placentiforme* Reeside, n. sp., side view of a large specimen preserving part of the aperture (U. S. Nat. Mus. catalogue No. 73388) from basal part of Pierre shale in W. ½ sec. 11, T. 8 S., R. 5 E., Butte County, S. Dak 18

FIGURES 5–6. *Baculites aquilaensis* var. *separatus* Reeside n. var., side and siphonal views of a large specimen (U. S. Nat. Mus. catalogue No. 73389) from Eagle sandstone in NW. ¼ sec. 8, T. 9 S., R. 35 E., Big Horn County, Mont 12



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INDEX