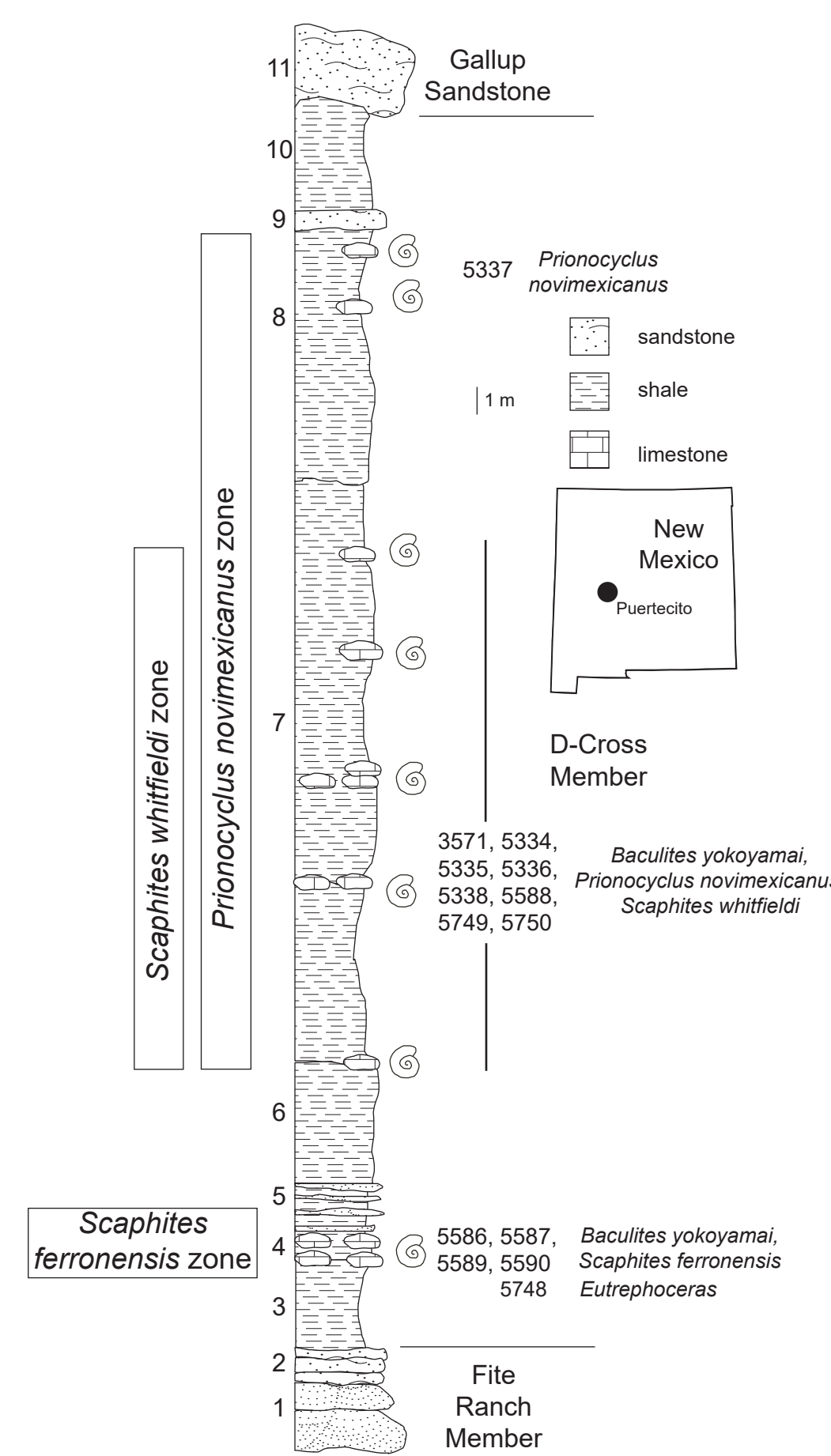


THE NAUULOID *EUTREPHOCERAS* SP. FROM THE CRETACEOUS OF NEW MEXICO LIKELY REPRESENTS MULTIPLE SPECIES

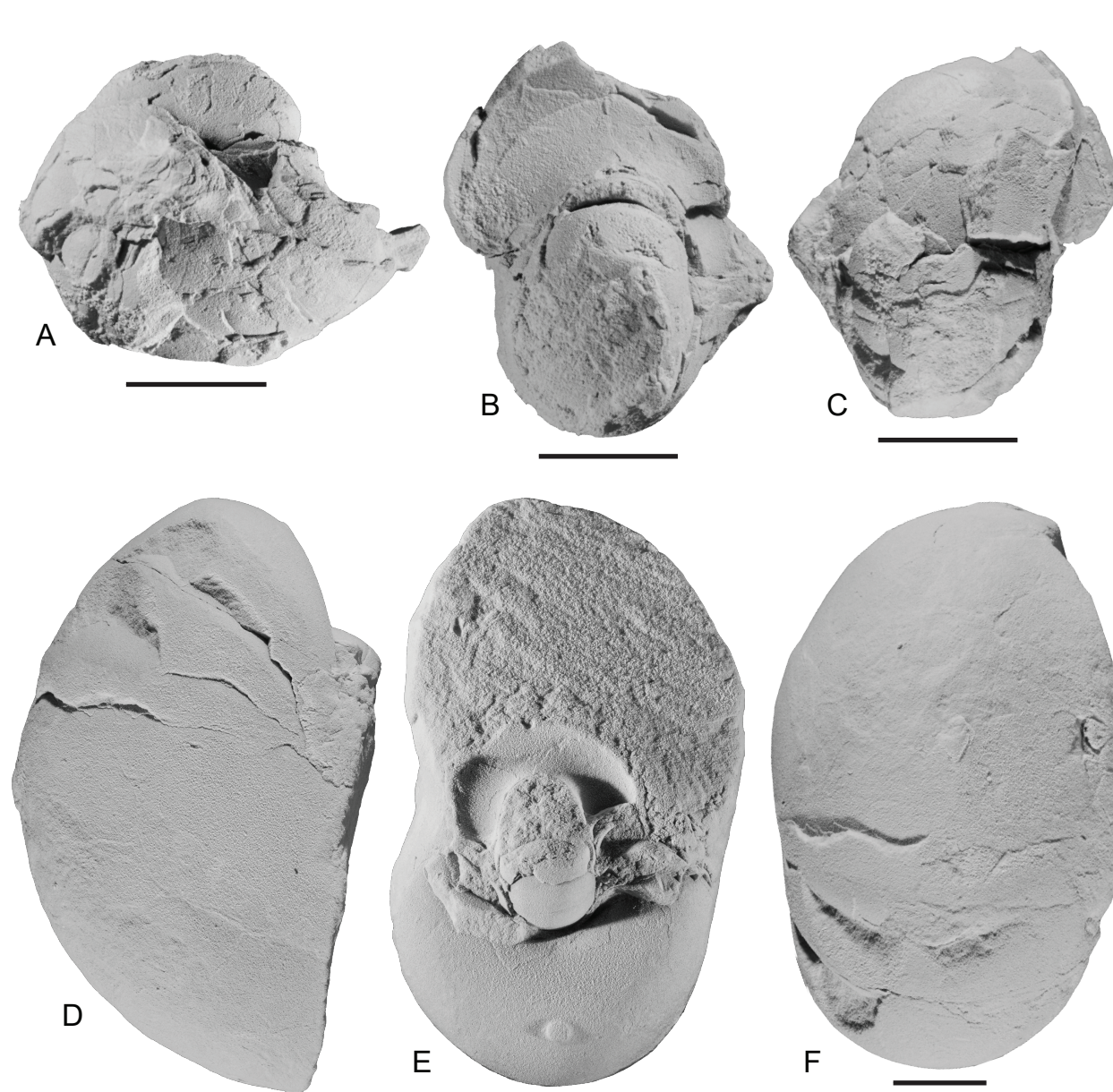
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Compared to ammonites, Cretaceous nautiloids are relatively rare in New Mexico, and *Eutrephoceras* sp. is the most common nautiloid of that age in the state. The genus *Eutrephoceras* ranges from the Late Jurassic to the Middle Miocene worldwide. In New Mexico, *Eutrephoceras* sp. has been reported from the Turonian and Campanian (e.g. Scott et al., 1986), Santonian and Campanian (Sealey and Lucas, 2019, 2022), *E. alcesense* Reeside has been reported from the Santonian, and *E. montanaensis* (Meek) from the lowermost Maastrichtian (Sealey and Lucas, 2019, 2022). Morphological features of many New Mexico specimens of *Eutrephoceras* sp. are similar to *Eutrephoceras dekayi*. However, Landman et al. (2018) stated that the lowest occurrence of *E. montanaensis* from the Cedar Creek Anticline in Montana—the uppermost Campanian *Baculites eliasi* Zone or the lower part of the lowermost Maastrichtian *B. baculus* Zone—is below that of *E. dekayi*, and that their ranges may overlap. Given that the stratigraphically highest known specimen of *Eutrephoceras* sp. in New Mexico is from the middle upper Campanian *B. compressus* Zone, specimens from the state are best not assigned to *E. dekayi*. Furthermore, *E. dekayi* has been a “wastebasket” taxon for North American Cretaceous nautiloids (Neal Larson, written communication, 2018).

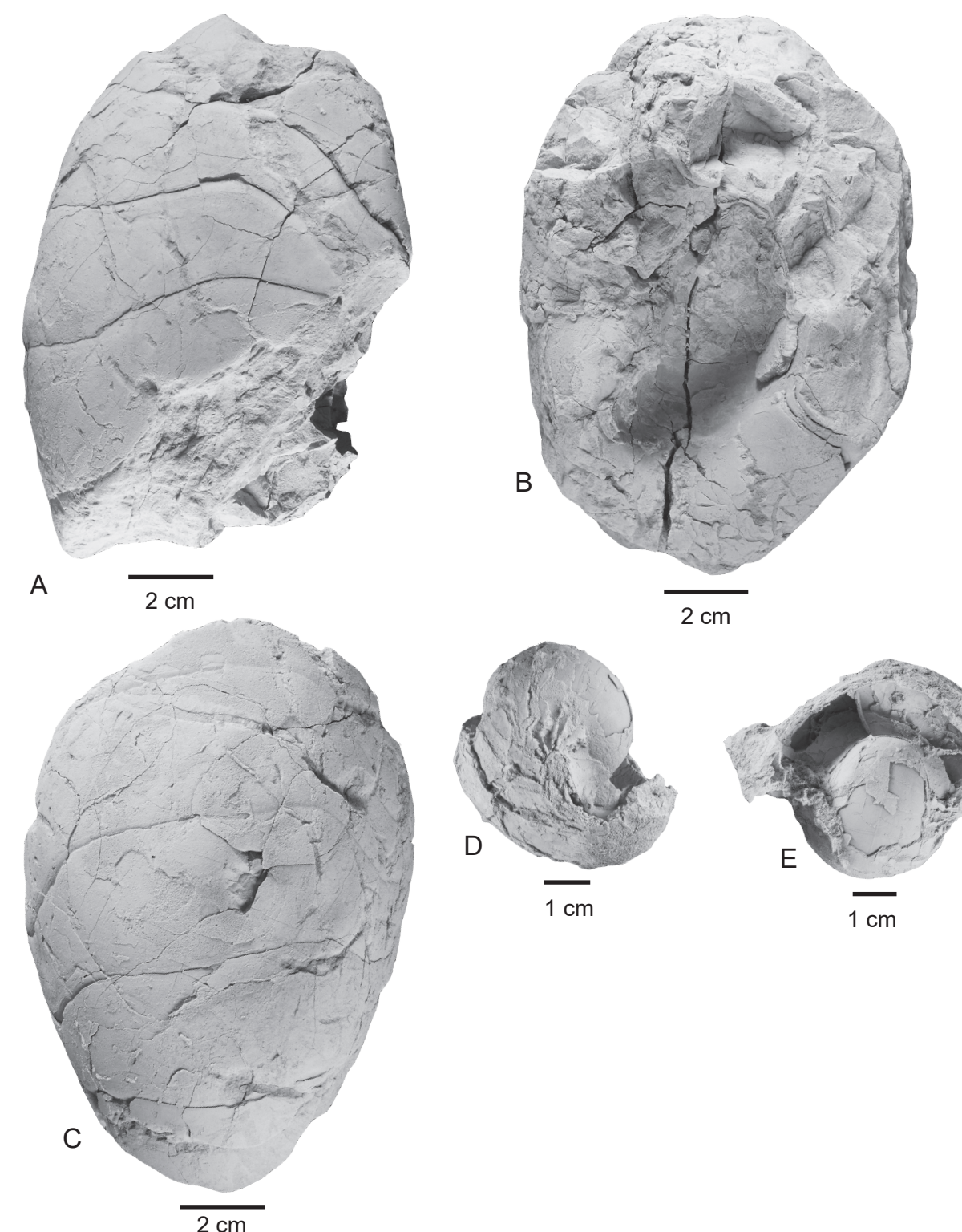
Eutrephoceras sp. is present in the D-Cross Member of the Mancos Shale and Gallup Sandstone in Socorro County, the Satan Tongue of the Mancos Shale in Sandoval County, the Lewis Shale in Rio Arriba and San Juan counties and the Fort Hays Limestone Member of the Niobrara Formation and the Pierre Shale in Colfax County. In New Mexico, *Eutrephoceras* sp. has been found in the upper Turonian *Scaphites ferronensis* and *Prionocyclus novimexicanus* zones, the lower Campanian *S. hippocrepis* II Zone, the middle Campanian *Baculites gregoryensis* Zone, the upper Campanian *Didymoceras nebrascense*, *Exiteloceras jenneyi*, *D. cheyennense* and *B. compressus* zones and unknown zones. The Satan Tongue occurrences are Santonian in age. These Turonian, Santonian and Campanian occurrences of *Eutrephoceras* sp. from many different ammonite zones in New Mexico likely represent multiple species, and we propose that further study is needed.



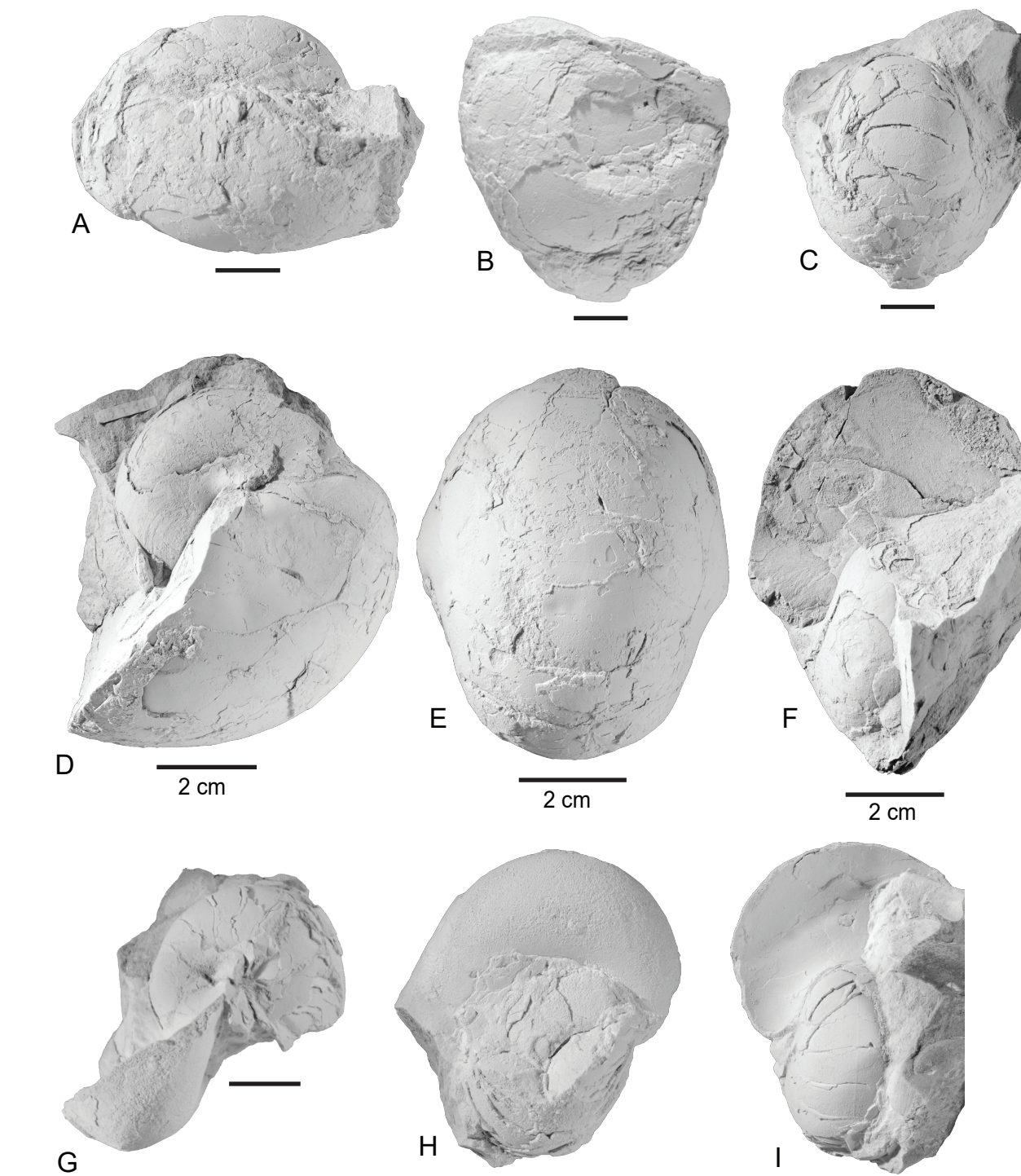
Stratigraphic section of the D-Cross Member of the Mancos Shale near Puertecito with the biostratigraphic ranges of ammonites and the nautiloid *Eutrephoceras* sp. The nautiloid is from the upper Turonian *Scaphites ferronensis* Zone.



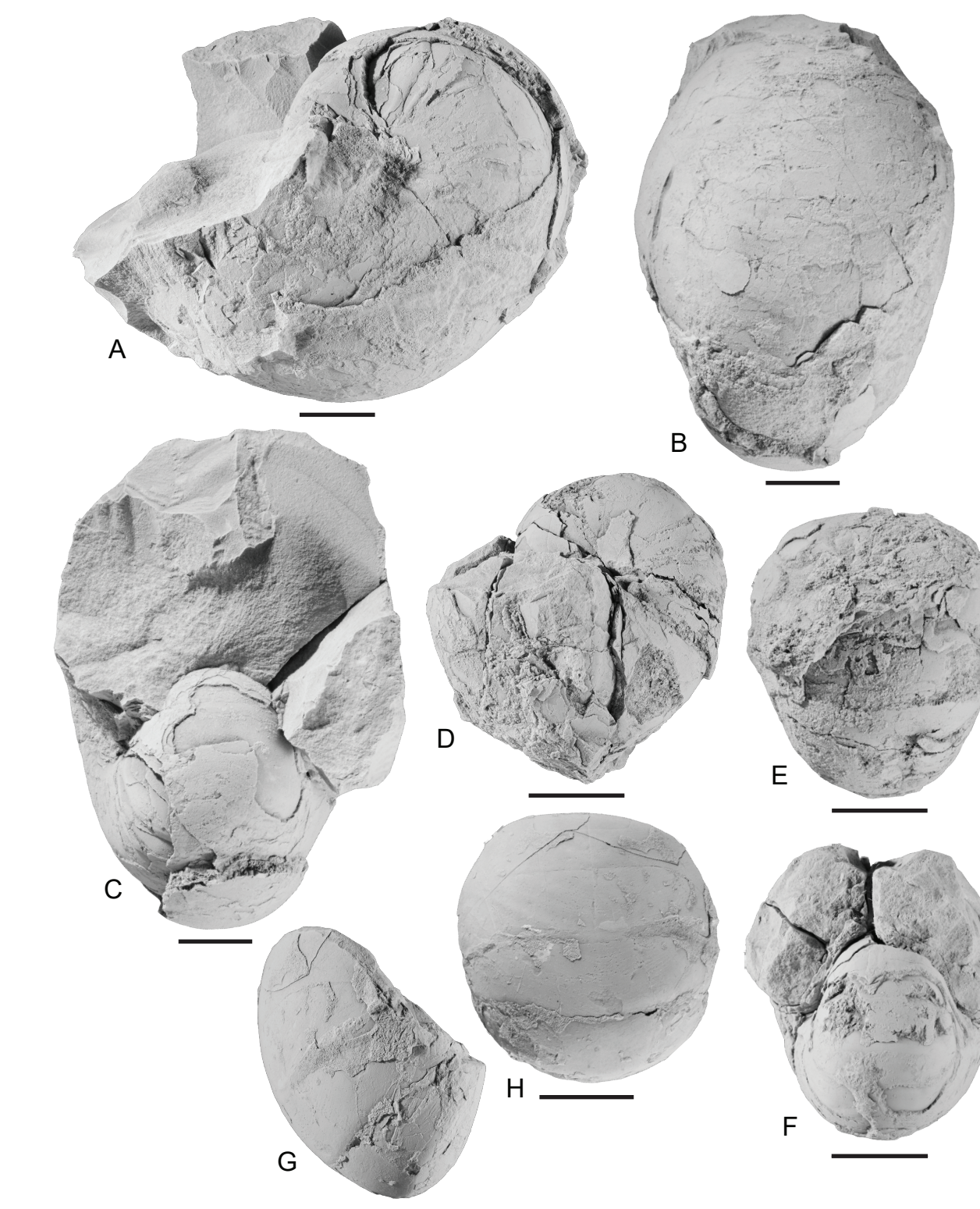
Eutrephoceras sp., A-C, A, lateral, B, apertural and C, ventral views of a partial inner whorl, NMMNH P-43731; D-F, D, lateral, E, apertural and F, ventral views of a partial, adult shell, NMMNH P-50504. Upper Turonian *Scaphites ferronensis* Zone (see Figure to left). Scales equal 2 cm.



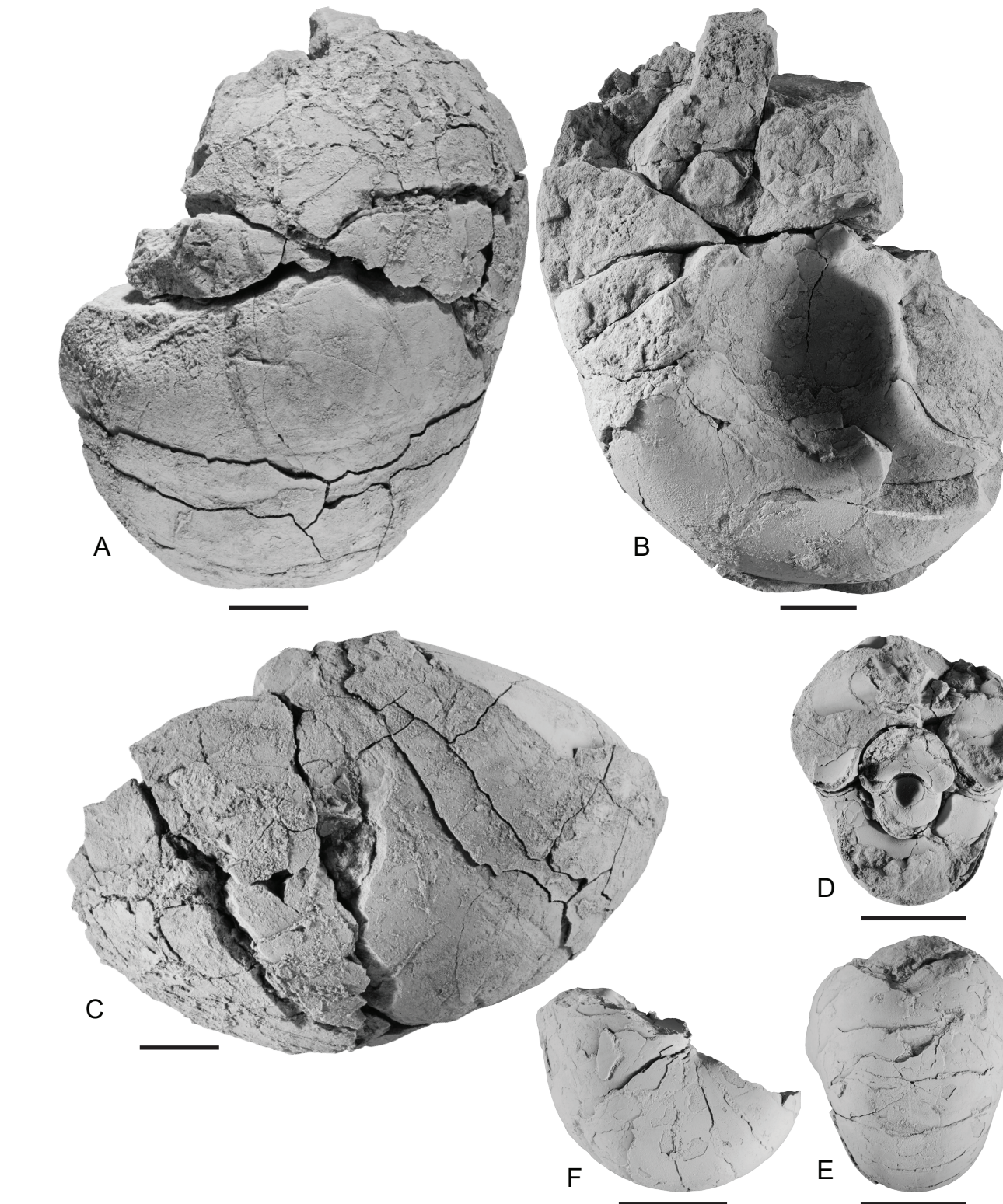
The nautiloid *Eutrephoceras* Hyatt from the Satan Tongue of the Mancos Shale in the southeastern San Juan Basin. A-C, *Eutrephoceras alcesense* Reeside, A, lateral, B, anterior and C, ventral views of a large fragment, NMMNH P-68531 from locality 8945; D-E, *Eutrephoceras* sp., D, lateral and E, anterior views of a fairly small phragmocone, NMMNH P-68528 from locality 9091. Scales as indicated.



A-C, *Eutrephoceras* spp., A, lateral, B, ventral and C, apertural views of a crushed phragmocone, USNM 717017 from USGS locality D4078; D-F, D, lateral, E, ventral and F, apertural views, USNM 717018 from USGS locality D5116; G-I, G, lateral, H, ventral and I, apertural views, NMMNH P-79956 from locality 10680. A-C, Upper Campanian *Didymoceras nebrascense* Zone; D-F, Upper Campanian *Didymoceras cheyennense* Zone; G-I, Middle Campanian *Baculites gregoryensis* Zone, Lewis Shale, eastern San Juan Basin. Scales equal 1 cm unless noted otherwise.



Eutrephoceras spp., A-C, A, lateral, B, ventral and C, apertural views, USNM 772637 from USGS locality 8351; D-F, D, lateral, E, ventral and F, apertural views, USNM 10222 from locality 12022; G-H, G, lateral and H, ventral views, NMMNH P-81000 from locality 12047. All from Pierre Shale, Raton Basin. A-F, unknown zone, G-H, *Exiteloceras jenneyi* Zone. Scales equal 2 cm.



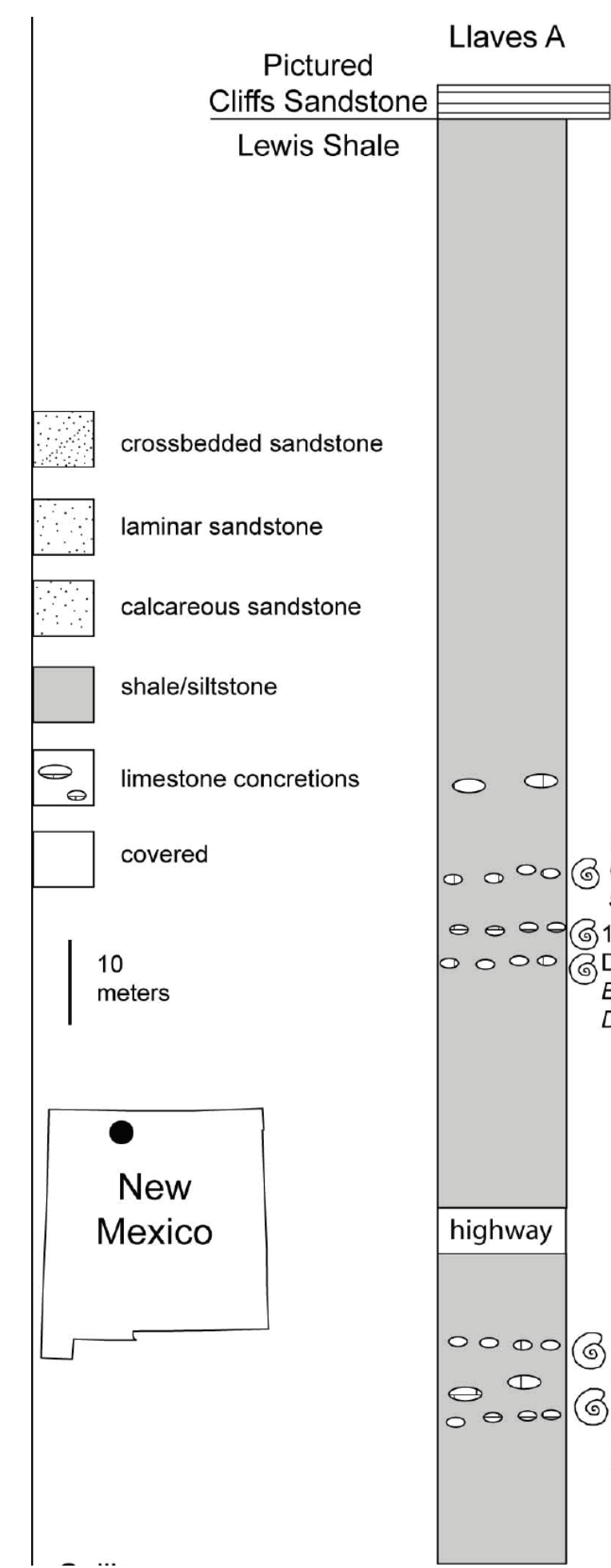
A-C, *Eutrephoceras montanaensis* (Meek), A, ventral, B, anterior and C, lateral views, NMMNH P-81045 from locality 12230; D-F, *Eutrephoceras* sp., D, cross sectional, E, ventral and F, lateral views, NMMNH P-83645 from locality 12053. A-C, Lowermost Maastrichtian *Baculites baculus* Zone, D-F, unknown zone. Both from the Pierre Shale, Raton Basin. Scales equal 2 cm.

REFERENCES

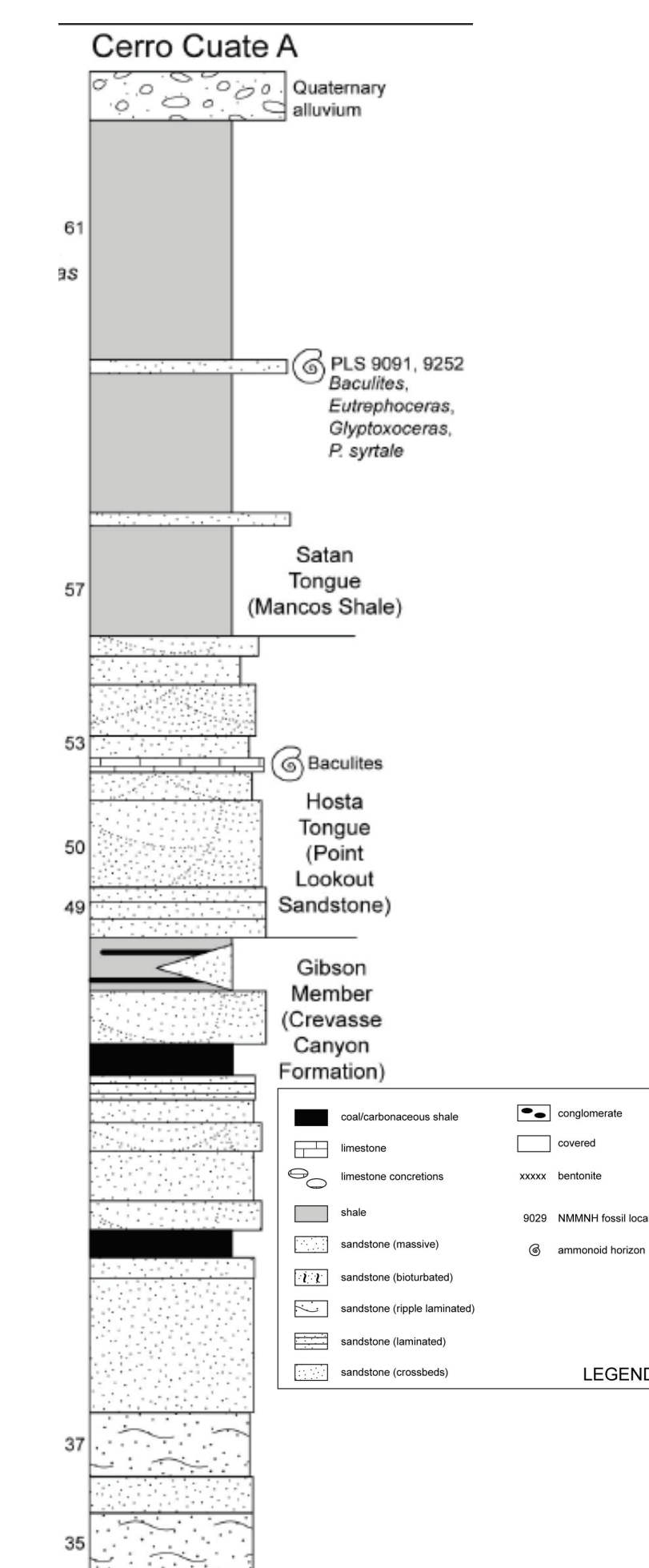
Cobban, W. A., Walaszczyk, I., Obradovich, J. D. and McKinney, K. C., 2006, A USGS zonal table for the Upper Cretaceous Middle Cenomanian-Maastrichtian of the Western Interior of the United States based on ammonites, inoceramids, and radiometric ages: U. S. Geological Survey, Open-File Report 2006-1250, 45 p.
 Cobban, W. A., Hook, S. C. and McKinney, K. C., 2008, Upper Cretaceous molluscan record along a transect from Virden, New Mexico, to Del Rio, Texas: *New Mexico Geology*, v. 30, no. 3, p. 75-92.
 Kummel, B., 1956, Post-Triassic nautiloid genera: Bulletin of the Museum of Comparative Zoology, v. 114, p. 324-494, pls. 1-28.
 Landman, N. H., Grier, J. W., Cochran, J. K., Grier, J. C., Petersen, J. G. and Towbin, W. H., 2018, Nautilid nurseries: hatchlings and juveniles of *Eutrephoceras dekayi* from the lower Maastrichtian (Upper Cretaceous) Pierre Shale of east-central Montana: *Lethaia*, vol. 51, p. 48-74.
 Merewether, E. A., Cobban, W. A. and Obradovich, J. D., 2011, Biostratigraphic data from Upper Cretaceous formations—eastern Wyoming, central Colorado, and northeastern New Mexico: U.S. Geological Survey, Scientific Investigations Map 3175, 2 shs., pamphlet, 10 p.
 Plint, A. G., Hooper, E. A., Grifi, M. D., Walaszczyk, I., Landman, N. H., Gröcke, D. R., Alexandre, J. P. T. and Jarvis, I., 2017, Chapter 1: Integrated, high-resolution allostratigraphic, biostratigraphic and carbon-isotope correlation of Cretaceous strata (Upper Cretaceous), Western Alberta and Northern Montana: Bulletin of the American Museum of Natural History, no. 414, p. 9-52.
 Scott, G. R., Cobban, W. A. and Merewether, E. A., 1986, Stratigraphy of the Upper Cretaceous Niobrara Formation in the Raton Basin, northeastern New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bulletin 115, 34 p.
 Sealey, P. L. and Lucas, S. G., 2019, Late Cretaceous (Cenomanian-Campanian) ammonite systematic paleontology and biostratigraphy, southeastern San Juan Basin, Sandoval County, New Mexico: *New Mexico Museum of Natural History and Science Bulletin* 80, 245 p.
 Sealey, P. L. and Lucas, S. G., 2022, Late Cretaceous (Campanian-Maastrichtian) ammonites from the Pierre Shale, Raton Basin, northeastern New Mexico and southeastern Colorado: *New Mexico Museum of Natural History and Science Bulletin* 91, 183 p.
 Walaszczyk, I., Plint, A. G., and Landman, N. H., 2017, Inoceramid bivalves from the Coniacian and basal Santonian (Upper Cretaceous) of the Western Canada Foreland Basin: *Bulletin of the American Museum of Natural History*, no. 414, p. 53-103.

Stage	substage	Ammonite Zone	Inoceramid Zone	Formation/Member
Campanian (pars)	Upper (pars)	<i>Baculites compressus</i> *	" <i>Inoceramus</i> " <i>altus</i> **	<i>E. jenneyi</i> and <i>B. compressus</i> zones in Pierre Shale <i>D. cheyennense</i> Zone in Lewis Shale
		<i>Didymoceras cheyennense</i> *		
		<i>Exiteloceras jenneyi</i> *	<i>Sphaeroceras pertenuiformis</i> **	
		<i>Didymoceras stevensi</i>		
		<i>Didymoceras nebrascense</i> *		<i>B. gregoryensis</i> and <i>D. nebrascense</i> zones in Lewis Shale <i>B. gregoryensis</i> Zone in Pierre Shale
	Middle	<i>Baculites scotti</i>	" <i>Inoceramus</i> " <i>tenuilineatus</i> **	
		<i>Baculites reducius</i>		
		<i>Baculites gregoryensis</i> *		
		<i>Baculites perlerus</i>	<i>Cataceramus subcompressus</i>	
		<i>Baculites</i> sp. (smooth species)		
Lower	<i>Baculites asperformis</i>			
	<i>Baculites maclearni</i>			
	<i>Baculites oblongus</i>	" <i>Inoceramus</i> " <i>acerbaydjanensis</i>		
	<i>Baculites</i> sp. (weak flank ribs)			
	<i>Baculites</i> sp. (smooth)	<i>Cataceramus balticus</i> **		
	<i>Scaphites hippocrepis</i> III		Smoky Hill Shale Member	
	<i>Scaphites hippocrepis</i> II*			
	<i>Scaphites hippocrepis</i> I			
	<i>Scaphites leei</i> III			
	<i>Desmoscapites bassleri</i>	<i>Sphaeroceras lundbreckensis</i>		
Santonian	Upper	<i>Desmoscapites erdmanni</i>	<i>Cordiceramus muelleri</i>	
	Middle	<i>Chioscapites chiosensis</i>	<i>Cordiceramus bueltenensis</i>	
	Lower	<i>Chioscapites saxionianus</i>	<i>Cladoceras undulatopectatus</i>	
Coniacian	Upper	<i>Scaphites depressus</i>	<i>Mogadiceramus crenelatus</i>	
	Middle	<i>Scaphites ventricosus</i>	<i>Mogadiceramus subquadratus</i>	
		<i>Scaphites ventricosus</i>	<i>Tovliceras involatus</i>	
Lower	<i>Scaphites ventricosus</i>	<i>Inoceramus loeoni</i>		
Turonian	Upper	<i>Scaphites marianensis</i>	<i>Cremnoceras waltersdorfensis</i>	
		<i>Prionocyclus gormari</i>	<i>Mytiloides scupinii</i>	
		<i>Prionocyclus quadratus</i> *	<i>Mytiloides incertus</i> **	Fort Hays Limestone Member
		<i>Scaphites whitfieldi</i>	<i>Inoceramus dakotensis</i>	
		<i>Scaphites whitfieldi</i>	<i>Inoceramus perplexus</i>	
	Middle	<i>Scaphites ferronensis</i> *	<i>Inoceramus dimidius</i> **	D-Cross Member
		<i>Scaphites warreri</i>		
		<i>Prionocyclus macombi</i>	<i>Inoceramus aff. dimidius</i>	
		<i>Prionocyclus hyatti</i>	<i>Inoceramus howelli</i>	
		<i>Collignoniceras praxex</i>	<i>Mytiloides hercynicus</i>	
Lower	<i>Collignoniceras woolfieri</i>	<i>Mytiloides subhercynicus</i>		
	<i>Mammites nodosoides</i>	<i>Mytiloides mytiloides</i>		
	<i>Vascoceras birchbyi</i>	<i>Mytiloides kossmati</i>		
	<i>Pseudaspidoceras flexuosum</i>	<i>Mytiloides flexuosus</i>		
	<i>Watinoceras devonense</i>	<i>Mytiloides pubbioensis</i>		

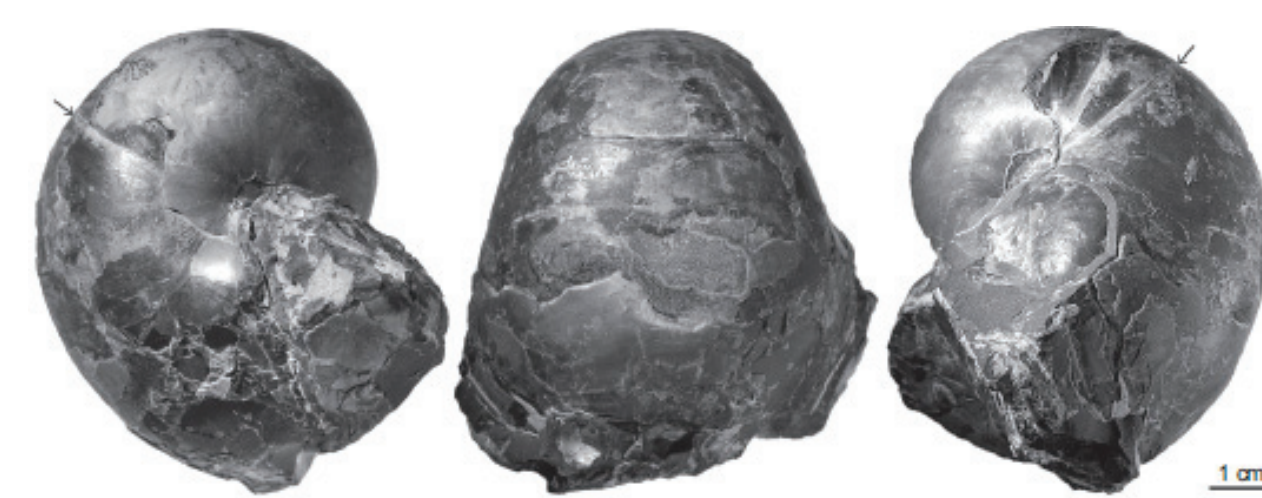
Western Interior biostratigraphic zonal table showing upper Turonian and Campanian ammonite zones where *Eutrephoceras* sp. was reported. A single asterisk refers to the ammonite zone and a double asterisk signifies to an inferred zone. Table modified from Cobban et al. (2006, 2008), Merewether et al. (2011, fig. 2), Plint et al. (2017) and Walaszczyk et al. (2017, p. 57, figs. 2-3).



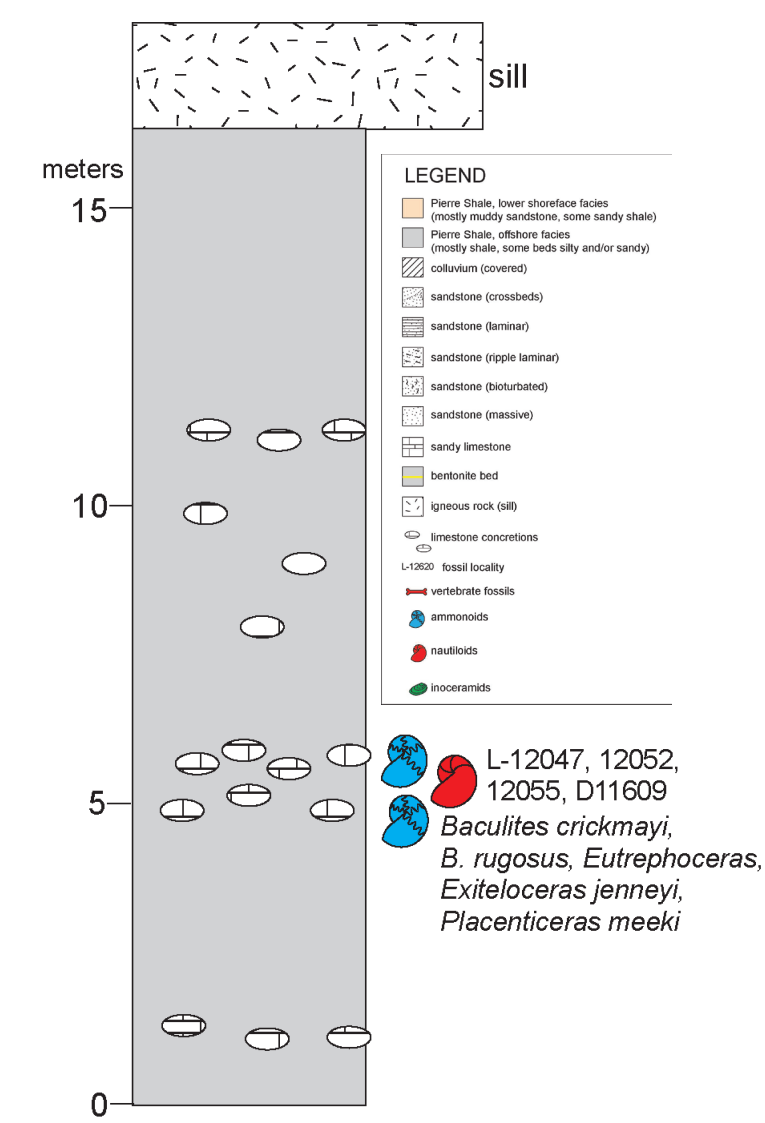
Measured stratigraphic section of selected outcrop of the Lewis Shale in the eastern San Juan Basin showing distribution of ammonites and some associated fossils. *Eutrephoceras* sp. is from the middle Campanian *Baculites gregoryensis* Zone.



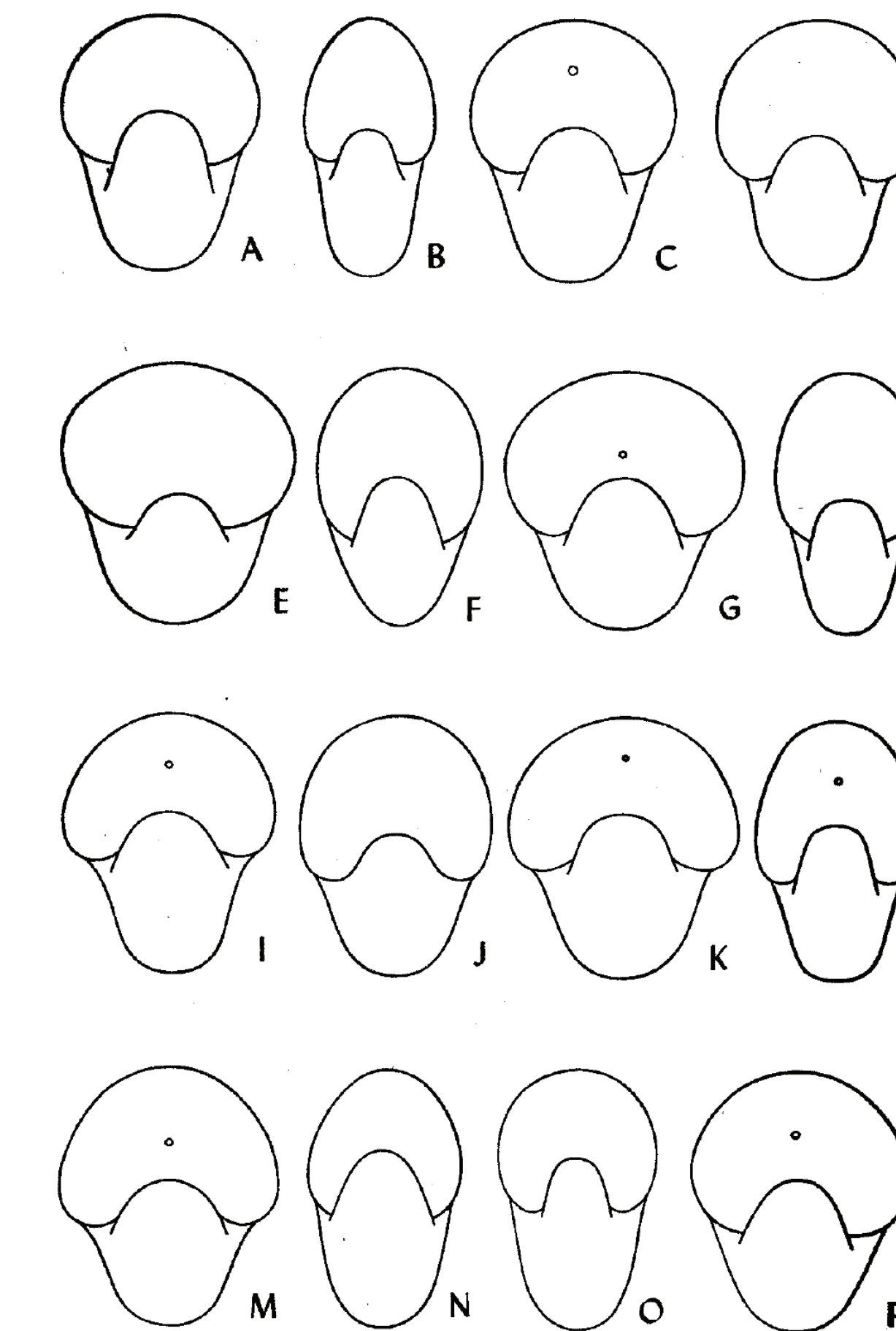
Measured stratigraphic section of the interval from the Gibson Member of the Crevasse Canyon Formation through the Satan Tongue of the Mancos Shale in the southeastern San Juan Basin showing ammonites and *Eutrephoceras* sp. Satan Tongue fossils are Santonian in age.



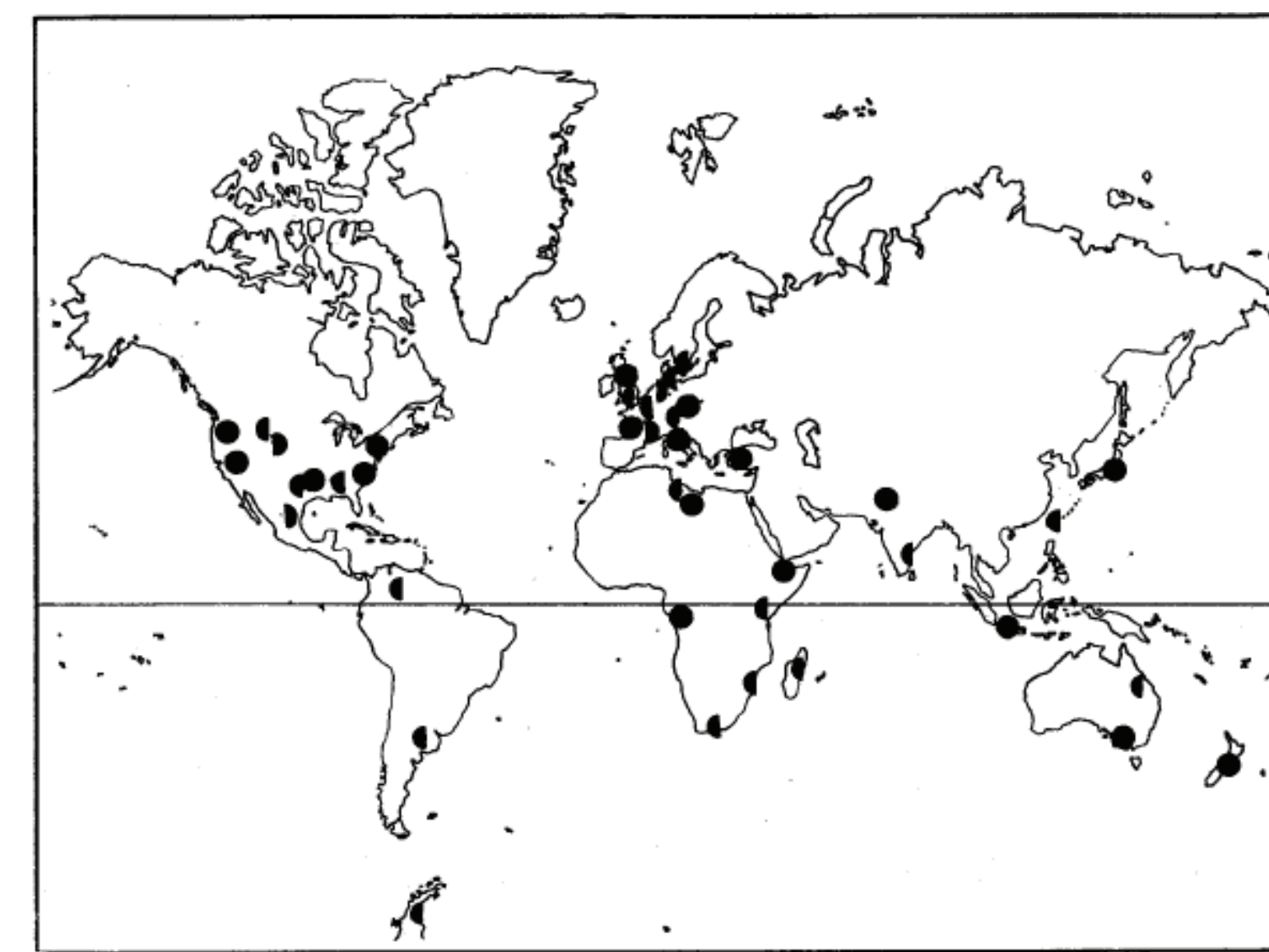
Large juvenile of *Eutrephoceras dekayi* from the Pierre Shale in the Maastrichtian of east-central Montana (modified from Landman et al., 2018, fig. 10x-z). Morphological features of many New Mexico specimens of *Eutrephoceras* sp. are similar to *Eutrephoceras dekayi*. However, the stratigraphically highest known specimen of *Eutrephoceras* sp. in New Mexico is from the middle upper Campanian *Baculites compressus* Zone. Arrows indicate base of body chamber. Scale as indicated.



Measured stratigraphic section of part of the Pierre Shale in the Raton Basin showing ammonites and *Eutrephoceras* sp. from the upper Campanian *Exiteloceras jenneyi* Zone.



Cross sections of the conch of various species of *Eutrephoceras* showing the wide variability of conch shape (from Kummel, 1956, fig. 13).



Geographic distribution of species of the genus *Eutrephoceras* in formations of Upper Jurassic, Cretaceous, and Tertiary age. Circles = Tertiary; left half-circles = Cretaceous; right half-circles = Jurassic (from Kummel, 1956, fig. 7).