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XVI

SOME UPPER CRETACEOUS FORAMINIFERA FROM NEAR COALINGA, CALIFORNIA

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In that part of the Alcalde Hills just west of the town of Coalinga, Fresno County, California, included in Section 2, T. 21 S., R. 14 E., a group of shallow wells has been drilled and oil production has been obtained at a depth of from 500 to 600 feet. The oil is of low gravity, averaging about 18 to 20 degrees Baumé and the production per well at the present time is from one to twelve barrels a day.

In this general area the surface rocks have been mapped as Vaqueros, of Lower Miocene age,[1] but later work indicates that they are much younger, probably Santa Margarita, which is Upper Miocene. These sandy beds are separated from the Chico Cretaceous, and possibly some Tejon Eocene, below by an angular unconformity.

The above mentioned wells are thus known to penetrate a large proportion of sandy beds with interbedded shale above the known oil zone and on drilling deeper the gray clay shales of the Chico are encountered.

Through the kindness of Mr. O. F. Darling of the California Northern Petroleum Co., we received a good set of

[1] Ralph Arnold & Robert Anderson, U. S. Geol. Survey, Bull. 398, 1910.

samples from this company's well No. 19, in Section 2, T. 21 S., R. 14 E. Oil bearing sands were cored at a very shallow depth but the well was deepened with the expectation of locating a deeper, more productive zone. At a depth of 614 feet and on down to the last sample sent in which came from a depth of 1135 feet, gray, fine grained clay shale was cored in which poorly preserved upper Cretaceous fossils were found. Those identified were, *Inoceramus* and *Baculites.* On breaking down and washing this shale, a well preserved fauna of small foraminifera was obtained which a subsequent examination proved to be not only different from that found in the Moreno above, but entirely new to California paleontology. This difference in the fauna as well as the lithology, further strengthened our view that the shale was Chico and not Moreno. The fact that such forms have not heretofore been reported from the upper Cretaceous of California, together with the possibilities of geologic correlation which they offer, makes the discovery of additional interest. This material from 1135 feet has been entered in the records of the California Academy of Sciences' records as Loc. No. 1421.

The brown and lavender organic shales of the uppermost Cretaceous in the Coalinga district known as the Moreno shales are not in evidence here but become increasingly important toward the north until at the type locality, north of Coalinga in Moreno Gulch, on the east flank of the Panoche Hills, the exposure attains a maximum thickness of 2000 feet.[2] Dr. G. D. Hanna, of the California Academy of Sciences, made an extensive collection across this section at the type locality in September, 1925, on which he later published his paper, "Cretaceous Diatoms from California.[3]" At this time he noted the presence of foraminifera, and in a short paper by J. A. Taff & G. D. Hanna, published in the Bulletin of the American Association of Petroleum Geologists in 1926, he has this to say, "The upper 200 feet of the exposure was found to be a dark brown clay shale with much organic matter but very few fossils. This gave way gradually to a light, buff-colored shale about 200 feet thick, which in its most

[2] Robert Anderson & Robert W. Pack, U. S. Geol. Survey, Bull. 603, 1915.
[3] G. D. Hanna, Occ. Pprs. Calif. Acad. Sci., Vol. 13, 1927.

fossiliferous part contained great numbers of impressions of foraminifera, chiefly belonging to the genus *Siphogenerina*. The calcareous tests of the fossils have been completely dissolved away.[4]" Through the kindness of Dr. Hanna a sample of this fossiliferous shale was obtained and good wax impressions of the prominent *Siphogenerina* were made.

This *Siphogenerina* was first listed and figured as a *Sagrina* by F. M. Anderson, along with several genera now known to have come from the Eocene.[5] In a later paper by G. D. Hanna on "The Age and Correlation of the Kreyenhagen Shale in California," reference is made to the genera listed by Anderson in which he says, "The large *Nodosaria* mentioned and the *Cristellaria* (Fig. 19, Plate 13, called *Vaginulina*) appears to be confined to that portion of the Eocene in California above the middle. The species which he identified and pictured as *Sagrina* came from the upper part of the Cretaceous shales which, north of Coalinga, at some places underlie the Eocene shale, with no apparent unconformity or change except in faunal content.[6]"

The foraminifera included in the present paper are of interest, as they represent Cretaceous species most of which were widely distributed in upper Cretaceous seas. The large majority of the species have been already described in papers by d'Orbigny, Reuss, Alth, Egger, Franke, and others, from upper Cretaceous formations of Europe. Many of these species are also present in the upper Cretaceous of Texas and other portions of the Gulf Coastal region. Some of them are known from the uppermost Cretaceous of Mexico and Trinidad. A few of the forms are striking and new, but the number is small compared to the total number of species represented. This is also true of the American Cretaceous in general, and a large proportion of the species will be found to be identical with those described from central Europe. This is not always as apparent from a study of published figures as it is when one compares actual specimens from the two areas.

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[4] J. A. Taff & G. D. Hanna, Bull. American Assoc. Petrol. Geol., Vol. 10, No. 8, 1926, pp. 812-814.

[5] Frank M. Anderson, Calif. Acad. of Sci. Proc. 3rd Ser., 1905, Vol. 2, No. 2.

[6] G. D. Hanna, Bull. American Assoc. Petrol. Geol. Vol. 9, No. 6, 1925, p. 992.

As this fauna probably represents the uppermost Cretaceous corresponding rather closely with the Navarro of Texas and the Velasco of Mexico, a comparison of those two faunas is of interest. In both cases, *Globigerina, Globorotalia* and *Gümbelina* are apparent. It is known that these forms represent pelagic adaptation. It is therefore noteworthy that *Globigerina* and *Gümbelina* are absent in the California collection and that *Globorotalia,* although typical, is rare. It may therefore be inferred that this California locality represents an area perhaps somewhat cut off from the main ocean of that time, and into which pelagic forms were not carried to any great extent.

Family TEXTULARIIDÆ

Genus **Spiroplectammina** Cushman, 1927

1. **Spiroplectammina anceps** (Reuss)

Plate 36, figures 1, 2

Textularia anceps REUSS, Die Verstein. böhm. Kreide, 1845, p. 39, pl. 8, fig. 79, pl. 13, fig. 78; Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 234, pl. 13, figs. 2 *a, b.*—BEISSEL, Abhandl. kön. Preuss. geol. Landes., vol. 3, 1891, p. 68, pl. 13, figs. 14, 16.—EGGER, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, p. 25, pl. 24, figs. 35, 36.

Test much compressed, rapidly increasing in width from the initial end, greatest width near the apertural end; early chambers especially in the microspheric form in a planispiral arrangement, later becoming biserial, chambers low and broad, thickest near the median portion of the test, thence thinning toward the periphery; sutures very slightly depressed, somewhat oblique, nearly straight; wall arenaceous, smoothly finished; aperture elongate, low, at the base of the inner median margin of the last-formed chamber. Length 0.60 mm.; breadth 0.35 mm.; thickness 0.10 mm.

This species is recorded from numerous localities in the upper Cretaceous of Germany and occurs in the equivalent formations of the Gulf Coastal Plain region of the United States.

Family VERNEUILINIDÆ

Genus **Gaudryina** d'Orbigny, 1839

2. **Gaudryina oxycona** Reuss

Plate 36, figures 3, 4

Gaudryina oxycona REUSS, Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 229, pl. 12, figs. 3 *a-c*; vol. 46, 1862 (1863), p. 33.—FRANKE, Abhandl. geol. pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 15, pl. 1, figs. 20 *a, b.*

Test elongate, conical, tapering, nearly circular in transverse section; very early chambers triserial, later ones biserial; sutures distinct, slightly depressed, nearly at right angles with the periphery; wall finely arenaceous, very smoothly finished; aperture elongate, low, at the inner median margin of the chamber in a decided depression. Length 0.55 mm.; breadth 0.30 mm.

The California specimens agree well with European Cretaceous material of this species.

3. **Gaudryina ruthenica** Reuss

Plate 36, figures 5, 6

Gaudryina ruthenica REUSS, in Haidinger's Nat. Abhandl., vol. 4, 1851, p. 25, pl. 4, fig. 4.—FRANKE, Abhandl. geol. pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 16, pl. 1, figs. 25 *a, b.*

Test elongate, tapering, greatest diameter toward the apertural end, earliest chambers triserial, later biserial, adult chambers high, becoming as high or higher than broad; sutures fairly well marked, sloping slightly backward from the center, slightly curved; wall rather coarsely arenaceous, somewhat roughly finished; aperture in the earlier stages at the base of the inner margin of the chamber, in the adult becoming terminal and rounded but without a neck or lip. Length 0.75 mm.; breadth 0.35 mm.; thickness 0.30 mm.

This species is known from several localities in the upper Cretaceous of Germany.

The peculiar change in shape and position of the aperture is characteristic. It resembles *Heterostomella* in the terminal

aperture, but does not have the neck and lip characteristic of many of the species of that genus.

Family SILICINIDÆ

Genus **Silicosigmoilina** Cushman & Church, new genus

Genoholotype, *Silicosigmoilina californica* Cushman & Church, n. sp.

Test in the early stages nearly planispiral, later becoming sigmoid; wall finely arenaceous with siliceous cement; aperture at the end of the tubular chamber without apertural teeth.

This genus strongly resembles *Sigmoilina* in the calcareous imperforate group. *Sigmoilina* has calcareous cement even though the wall is, in some species, encrusted with arenaceous material, and is divided into definite chambers and the aperture typically has a simple, linear tooth.

The strongest acid fails to make any impression on these Californian Cretaceous forms and they occur with such thin-walled calcareous forms as *Bulimina* in great abundance. *Silicosigmoilina* is most closely related to *Rzehakina,* another genus characteristic of the upper Cretaceous.

4. **Silicosigmoilina californica** Cushman & Church, new species

Plate 36, figures 10, 11, 12

Test compressed, nearly circular or oval in side view, somewhat rhomboid in end view, periphery subacute, usually with a definitely marked portion in side view; chambers in the earliest stages planispiral, later sigmoid; sutures fairly well marked, not deeply depressed; wall finely arenaceous, firmly cemented with a siliceous cement, smoothly finished; aperture simple, oval, without a tooth; white or light gray in color. Length 0.75 mm.; breadth 0.55-0.65 mm.; thickness 0.25-0.40 mm.

Holotype: No. 4714; *paratypes:* Nos. 4713, 4715, Mus. Calif. Acad. Sci., from Loc. 1421 (C. A. S.), California Northern Petroleum Company Well No. 19, Sec. 2, T. 21 S., R. 14 E., M. D. M., Fresno County, California; depth, 1135 feet; upper Cretaceous.

This is probably the most abundant species in the collection, and occupies the same place in the fauna that *Rzehakina* does in the upper Cretaceous material of Trinidad.

Family MILIOLIDÆ

Genus **Quinqueloculina** d'Orbigny, 1826

5. **Quinqueloculina** sp.?

Plate 36,. figures 7, 8, 9

There is a single specimen figured here which belongs to *Quinqueloculina,* but lack of further material makes it difficult to place it specifically. It is the only specimen of this family which is rare in most other upper Cretaceous faunas related to this California one.

Family LAGENIDÆ

Genus **Lenticulina** Lamarck, 1804

6. **Lenticulina rotulata** Lamarck

Plate 37, figures 1, 2

Lenticulina rotulata LAMARCK, Ann. Mus., vol. 5, 1804, p. 188; vol. 8, 1806, pl. 62, fig. 11.

The synonymy of this species is very difficult to straighten out without a reference to original specimens representing the various authors' ideas. The type specimens in the Defrance Collection at Caen, France are intact and show that this is a very definite species of the upper Cretaceous. Identical specimens occur in the upper Cretaceous of other parts of Europe and in this country. Very many of the records for the species from Recent seas and from Tertiary deposits do not belong to the species however.

7. **Lenticulina williamsoni** (Reuss)

Plate 36, figures 13, 14

Cristellaria williamsoni REUSS, Sitz. Akad. Wiss. Wien, vol. 44, pt. 1, 1861 (1862), p. 327, pl. 6, fig. 4.—EGGER, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, p. 120, pl. 11, figs. 7, 8.

There are a few specimens in the California collection that are very close to this species of Reuss as developed in the upper Cretaceous of various parts of Germany.

8. **Lenticulina** sp.?

Plate 37, figures 11, 12

The figured specimen is left under the genus only as there are not enough specimens to give full specific characters.

Genus **Robulus** Montfort, 1808

9. **Robulus trachyomphalus** (Reuss)

Plate 37, figures 6, 7

Robulina trachyomphala REUSS, in Haidinger's Nat. Abhandl., vol. 4, pt. 1, 1851, p. 34, pl. 2, fig. 12.

The figured form seems very closely related to Reuss's species from the Cretaceous of Europe. Bagg records the species from the Cretaceous of New Jersey, but no specimens are figured.

10. **Robulus lepidus** (Reuss)

Plate 36, figures 15, 16

Robulina lepida REUSS, Verstein. böhm. Kreide, vol. 2, 1845-46, p. 109, pl. 24, fig. 46.

Cristellaria lepida REUSS, Sitz. Akad. Wiss. Wien, vol. 52, pt. 1, 1865, p. 454; in Geinitz, Palaeontographica, vol. 20, pt. 2, 1874, p. 106, pl. 23, fig. 4.—EGGER, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, pt. 1, 1899, p. 117, pl. 12, figs. 27, 28; Ber. nat. Ver. Passau, 1907, p. 36, pl. 2, figs. 1, 2.—FRANKE, Abhandl. geol. pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 75, pl. 6, figs. 14 *a, b.*—CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 599, pl. 19, figs. 10 *a, b.*

This species has been recorded from numerous localities in the Cretaceous of central Europe. It occurs also in the Cretaceous, Velasco Shale, of Mexico.

Genus **Saracenaria** Defrance, 1824

11. **Saracenaria triangularis** (d'Orbigny)

Plate 37, figures 13, 14

Cristellaria triangularis D'ORBIGNY Mém. Soc. Géol. France, sér. 1, vol. 4, 1840, p. 27, pl. 2, figs. 21, 22.—REUSS, Verstein. Böhm. Kreide, 1845, p. 34, pl. 8, fig. 48; in Geinitz, Grundr. Verstein, 1845-46, p. 663, pl. 24, fig. 29.—D'ORBIGNY, Prod. Pal., vol. 2, 1850, p. 281, No. 1375.—REUSS, Denkschr. Akad. Wiss. Wien, vol. 7, 1854, p. 68; Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, 1862 (1863), pp. 70, 93.—BERTHELIN, Mém. Soc. Géol. France, sér. 3, vol. 1, 1880, p. 55.—BEISSEL, Abhandl. kön. Preuss. geol. Landes., n. ser., vol. 3, 1891, p. 53, pl. 10, figs. 1-9.—MATOUSCHEK, Lotos., vol. 43, 1895, p. 146.—EGGER, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, p. 117, pl. 12, figs. 5, 6; Ber. nat. Ver. Passau, 1907, p. 36, pl. 2, figs. 19-21.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1910, p. 421.—FRANKE, Verh. Nat. Hist. Ver., vol. 59, 1912 (1913), p. 279.—CHAPMAN, Bull. Geol. Surv. W. Australia, No. 72, 1917, p. 30, pl. 9, fig. 80.

Test fairly large, the early portion completely coiled, later chambers somewhat uncoiled and the test becoming triangular in transverse section; chambers distinct, few in number; sutures distinct but not depressed, curved; wall smooth except for the sides of the apertural face which are somewhat thickened; aperture at the angle of the upper end, radiate. Length of figured specimen 0.90 mm.; breadth 0.55 mm.; thickness 0.45 mm.

This species was described by d'Orbigny from the Cretaceous of the Paris Basin and is recorded from the upper Cretaceous of various parts of Europe and Australia. Bagg records it without figures from the Cretaceous of New Jersey.

Genus **Marginulina** d'Orbigny, 1826

12. **Marginulina humilis** (Reuss)

Plate 37, figures 3, 4, 5

Cristellaria humilis REUSS, Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, 1862 (1863), p. 65, pl. 6, figs. 16, 17.—CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 601, pl. 19, fig. 8.

Specimens very similar to those figured from the Velasco Shale of Mexico occur in this California Cretaceous material.

It was described by Reuss from the Cretaceous of Germany, and has been recorded from England in formations of similar age.

13. **Marginulina modesta** Reuss

Plate 37, figures 8, 9, 10

Marginulina modesta REUSS, Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 207, pl. 7, fig. 5.—FRANKE, Verh. Nat. Hist. Ver., vol. 59, 1912 (1913), p. 275.

The specimen figured is a typical one of this species with its rounded transverse section, uncoiling form slightly compressed in the earlier stages. It is already known from the upper Cretaceous of central Europe.

14. **Marginulina elongata** d'Orbigny

Plate 38, figures 1, 2, 3

Marginulina elongata D'ORBIGNY, Mém. Soc. Géol. France, sér. 1, vol. 4, 1840, p. 17, pl. 1, figs. 20-22.—REUSS, Verstein. Böhm. Kreide, vol. 1, 1845-46, p. 29, pl. 13, figs. 28-32; vol. 2, p. 106, pl. 24, fig. 30.—MATOUSCHEK, Lotos, vol. 43, 1895, p. 144.—FRANKE, Verh. Nat. Hist. Ver., vol. 59, 1912 (1913), p. 275; Abhandl. geol. pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 54, pl. 4, fig. 23.

Test elongate, the early chambers close coiled and somewhat compressed; later chambers uncoiling and increasing in thickness so that the last-formed ones are nearly circular in transverse section, chambers increasing in length as added in the uncoiled portion; sutures distinct but only slightly depressed in the last, uncoiled portion; wall smooth; aperture in the adult terminal, radiate. Length of figured specimen, 1.00 mm.; breadth 0.30 mm.; thickness 0.28 mm.

This species is known from the Cretaceous of central Europe, being described originally by d'Orbigny from the Cretaceous chalks of the Paris Basin.

15. **Marginulina bullata** Reuss

Plate 38, figures 4, 5, 6

Marginulina bullata Reuss, Die Verstein. böhm. Kreide, 1845-46, vol. 1, p. 29, pl. 13, figs. 34-38; in Geinitz, Grundr. Verstein, 1845-46, p. 656, pl. 24, fig. 16; Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 205, pl. 6, figs. 4-6.—Matouschek, Lotos, vol. 43, 1895, p. 144.—Egger, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, p. 96, pl. 9, figs. 12, 13 (not 9, 10).—Franke, Verh. Nat. Hist. Ver., vol. 59, 1912 (1913), p. 275; Abhandl. geol. pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 55, pl. 4, fig. 25.—Cushman and Jarvis, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 96, pl. 14, figs. 7, 8.

Test composed of few chambers, the earlier ones close coiled, the last two or three uncoiled and globular, all chambers strongly inflated; sutures distinct, slightly depressed; wall smooth throughout; aperture in the adult terminal, radiate. Length of figured specimen, 0.70 mm.; breadth 0.35 mm.; thickness 0.32 mm.

This species is known from the Cretaceous of Europe and of Trinidad. It also occurs in the upper Cretaceous of Texas.

16. **Marginulina jonesi** Reuss

Plate 38, figures 7, 8, 9

Marginulina jonesi Reuss, Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, 1862 (1863), p. 61, pl. 5, figs. 19 *a, b*.—Berthelin, Mém. Soc. Géol. France, sér. 3, vol. 1, 1880, p. 34.—Chapman, Quart. Journ. Geol. Soc., vol. 50, 1894, p. 709; Journ. Roy. Micr. Soc., 1894, p. 164, pl. 4, fig. 24.—Sherlock, Geol. Mag., dec. 6, vol. 1, 1914, p. 259, pl. 18, fig. 15.—Neaverson, Geol. Mag., 1921, p. 462.

Test elongate, early portion compressed and chambers close coiled, later becoming uncoiled; periphery acute and keeled in the early portion; later chambers nearly circular in section; sutures more or less obscured but the ornamentation of the surface which consists of elongate costæ continuing throughout the length of the test unbroken at the sutures, terminal face smooth; aperture in the adult terminal, radiate, with a slight neck. Length of figured specimen, 0.90 mm.; breadth 0.36 mm.; thickness 0.27 mm.

This species is known from the upper Cretaceous of various parts of Europe and is recorded by Chapman from the Gault.

Genus **Vaginulina** d'Orbigny, 1826

17. **Vaginulina simondsi** Carsey

Plate 38, figure 10

Vaginulina simondsi CARSEY, Bull. 2612, Univ. Texas, 1926, p. 40, pl. 2, fig. 4.

Test elongate, very much compressed, dorsal edge straight, ventral convex; chambers numerous, very elongate, curved, on ventral side extending far toward the base; sutures distinct, raised, broken by short costæ which are, in general, parallel to the dorsal edge which is itself thickened and bicarinate; aperture terminal, radiate. Length nearly 2 mm.

This species occurs commonly in the upper part of the upper Cretaceous of Texas in the Navarro formation. The specimen figured here is very similar to Texas ones in its general characters.

Genus **Frondicularia** Defrance, 1824

18. **Frondicularia decheni** Reuss

Plate 38, figures 11, 12, 13

Frondicularia decheni REUSS, Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 191, pl. 4, fig. 3; Palaeontographica, vol. 20, pt. 2, 1872-75 (1874), p. 96.—EGGER, Ber. Nat. Ver. Passau, 1907, p. 28, pl. 1, figs. 13, 14.—FRANKE, Verh. Nat. Hist. Ver., vol. 59, 1912 (1913), p. 273.—CHAPMAN, Bull. Geol. Surv. W. Australia, No. 72, 1917, p. 24, pl. 6, fig. 53.

Test very much compressed, the proloculum thicker than the remainder of the test; sides nearly parallel, but slightly increasing in width as chambers are added; periphery concave; sutures slightly depressed, distinct; wall ornamented by a few longitudinal costæ, those of each chamber somewhat independent of each other; aperture terminal, radiate.

This species is known from the upper Cretaceous of central Europe, and from Australia. It probably also occurs in the

upper Cretaceous of Mexico, and the Coastal Plain region of the United States.

19. **Frondicularia** sp.?

Plate 38, figure 14

There are broken specimens, one of which is here figured, of a large *Frondicularia* not well enough preserved for a full description. It is figured here for future reference.

Genus **Dentalina** d'Orbigny, 1826

20. **Dentalina** sp.?

Plate 38, figure 15

This fragment of a spinose species is figured here for reference. No complete specimens were obtained.

21. **Dentalina catenula** (?) Reuss

Plate 39, figure 1

The figured fragment representing the terminal chambers of a large species is close to this species of Reuss known from the upper Cretaceous of Europe.

22. **Dentalina polyphragma** Reuss

Plate 39, figure 2

Dentalina polyphragma REUSS, Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 189, pl. 3, fig. 1.—BEISSEL, Abhandl. kön. Preuss. geol. Landes, n. ser., vol. 3, 1891, p. 38, pl. 7, figs. 53-65.—FRANKE, Verh. Nat. Hist. Ver., vol. 59, 1912 (1913), p. 271.

Nodosaria polyphragma EGGER (?), Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, p. 74, pl. 8, fig. 26; pl. 24, fig. 37.

There are fragmentary specimens similar to that figured which have numerous costæ, and the aperture toward one side which may be referred to this species of Reuss known from the upper Cretaceous of numerous localities of Europe.

23. **Dentalina commutata** Reuss

Plate 39, figure 3

Dentalina commutata REUSS, Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 183, pl. 2, fig. 4; vol. 44, pt. 1, 1861 (1862), p. 306; vol. 46, pt. 1, 1862 (1863), p. 42.

The specimen figured is close to Reuss's species which is known from the upper Cretaceous of Germany. The whole test is slightly curved, and the chambers increasing regularly in size as added; wall smooth and the sutures depressed.

Genus **Nodosaria** Lamarck, 1812

24. **Nodosaria nuda** Reuss

Plate 39, figures 4, 5, 6

Nodosaria nuda REUSS, Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, 1862 (1863), p. 38, pl. 2, figs. 8, 9.—EGGER, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, p. 64, pl. 7, fig. 17; 1907, p. 23, pl. 5, fig. 26.—FRANKE, Abhandl. geol. pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 40, pl. 3, fig. 32.

Test small, slender, composed of a few, 5 - 8, chambers, the earlier ones slightly more involute than later ones; sutures distinct, depressed; wall smooth; aperture terminal, radiate. Length 0.60 mm.; diameter 0.10 mm.

Reuss and others have recorded this species from the upper Cretaceous of central Europe.

25. **Nodosaria ewaldi** (?) Reuss

Plate 39, figure 7

There are a few elongate, cylindrical chambers of a *Nodosaria* in this California material, but no complete specimens were found.

Genus **Glandulina** d'Orbigny, 1826

26. **Glandulina cylindracea** Reuss

Plate 39, figures 8, 9

Glandulina cylindracea Reuss, in Haidinger's Nat. Abhandl., vol. 4, pt. 1, 1851, p. 23, pl. 1, fig. 5; Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 190, pl. 4, fig. 1; vol. 44, pt. 1, 1861 (1862), p. 307; Palaeontographica, vol. 20, pt. 2, 1872-75 (1874), p. 89.—Egger, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, p. 84, pl. 5, figs. 19, 20.

Nodosaria cylindracea Reuss, Verstein. böhm. Kreide, 1845, p. 25, pl. 13, figs. 1, 2.

Nodosaria (Glandulina) cylindracea Cushman, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 594, pl. 18, fig. 1.

Figures of two specimens are given, one with the initial end having a spine, the other bluntly rounded. Such forms are common in the upper Cretaceous of many parts of Europe, and occur in the upper Cretaceous of America.

27. **Glandulina manifesta** Reuss

Plate 39, figure 10

Glandulina manifesta Reuss, in Haidinger's, Nat. Abhandl., vol. 4, pt. 1, 1851, p. 22, pl. 1, fig. 4.

The form figured is a megalospheric one and as a result the initial end is broadly rounded whereas in the microspheric form the initial end is much more pointed. The amount of overlap of the chambers is very variable. This form is abundant in the upper Cretaceous of many parts of the world and many names have been applied to the same species. It may be noted that *Nodosaria larva* Carsey (Bull. 2612, Univ. Texas, 1926, p. 31, pl. 2, fig. 2) from the Navarro formation of Texas is the same species, and varies in form in that formation as it does elsewhere.

Genus **Lagena** Walker & Jacob, 1798

28. **Lagena** (?) sp. (?)

Plate 39, figure 11

The specimen figured has some characters which make it seem that it may be a costate *Glandulina,* but the details are obscure, and full determination must await further and better material.

29. **Lagena** sp. (?)

Plate 39, figure 16

This form is too rare to allow full designation of characters, and it must be left under the genus without name for the present.

Family HETEROHELICIDÆ

Genus **Ventilabrella** Cushman, 1928

30. **Ventilabrella ornatissima** Cushman & Church, new species

Plate 39, figures 12, 13, 14, 15

Test compressed, all chambers in one plane, subglobular, the early ones biserial, later ones spreading out irregularly, sides in the adult nearly parallel, periphery rounded; sutures distinct, somewhat depressed; wall calcareous, perforate, the earlier ones ornamented by longitudinal costæ, each somewhat beaded; aperture in the adult irregular, near the base of the chamber.

Holotype: No. 4746; *paratype:* No. 4745, Mus. Calif. Acad. Sci. from Loc. 1421 (C. A. S.), California Northern Petroleum Company Well No. 19, Sec. 2, T. 21 S., R. 14 E., M. D. M., Fresno County, California; depth, 1135 feet; upper Cretaceous.

This is one of the most striking species of the collection. It is in some respects nearer the European than the Coastal Plain Cretaceous species, but is distinct from them all.

Family Buliminidæ

Genus **Bulimina** d'Orbigny, 1826

31. **Bulimina obtusa** d'Orbigny

Plate 39, figures 17, 18, 19

Bulimina obtusa d'Orbigny, Mém. Soc. Géol. France, sér. 1, vol. 4, 1840, p. 39, pl. 4, figs. 5, 6.

Both microspheric and megalospheric forms of this species are figured. There are numerous Cretaceous records for this species but not usually accompanied by illustrations, so without comparing the original material, it is difficult to determine whether or not they all represent one species.

This is apparently the same as the very abundant large species in the middle portion of the upper Cretaceous, Navarro formation of Texas.

Genus **Chrysalogonium** Schubert, 1907

32. **Chrysalogonium cretaceum** Cushman & Church, new species

Plate 39, figures 23, 24

Test uniserial, at least in the adult; chambers elongate, elliptical in side view, the sutures depressed; wall smooth, finely perforate; aperture consisting of numerous pores in a sieve plate at the tip of the last-formed chamber. Length of last-formed chamber 0.40 mm.; diameter 0.18 mm.

Holotype: No. 4762, Mus. Calif. Acad. Sci. from Loc. 1421 (C. A. S.), California Northern Petroleum Company Well No. 19, Sec. 2, T. 21 S., R. 14 E., M. D. M., Fresno County, California; depth, 1135 feet; upper Cretaceous.

This is one of the most interesting species of the collection. The only other known species is *Chrysalogonium polystoma* (Schwager) described from the Pliocene of Kar Nicobar (Schwager, *Novara* Exped., Geol. Theil, vol. 2, 1866, p. 217, pl. 5, fig. 39.) and recorded from the late Tertiary of Kabu, Java (Koch, Bericht Schweiz. Pal. Ges., vol. 18, 1923, p. 346). The Tertiary species has pyriform chambers and the

apertures are more in a ring. The Cretaceous one has elongate, elliptical chambers, and the apertures are scattered over the whole disc composing the apertural face.

Family ELLIPSOIDINIDÆ

Genus **Nodosarella** Rzehak, 1895

33. **Nodosarella coalingensis** Cushman & Church, new species

Plate 39, figures 20, 21, 22

Test elongate, tapering, greatest breadth made by the last-formed chamber; early chambers biserial, later ones irregularly uniserial; sutures distinct, depressed; wall smooth throughout; aperture terminal, semicircular with a curved portion forming the inner margin and standing well above the general contour of the apertural end of the test which is somewhat drawn out. Length of largest specimen 1.15 mm.; diameter 0.40 mm.

Holotype: No. 4751; *paratype:* No. 4750, Mus. Calif. Acad. Sci. from Loc. 1421 (C. A. S.), California Northern Petroleum Company Well No. 19, Sec. 2, T. 21 S., R. 14 E., M. D. M., Fresno County, California; depth, 1135 feet; upper Cretaceous.

This is a much more tapering species than others of the genus. The early biserial portion includes several chambers and when the irregular uniserial chambers are added, they at once start to greatly enlarge in size over the earlier ones.

Genus **Ellipsobulimina** A. Silvestri, 1903

34. **Ellipsobulimina** (?) sp. (?)

Plate 40, figures 1, 2, 3

The figured specimens may belong to this genus, but were not in sufficient quantity to section. There is a possibility that they may represent the largest megalospheric form of the preceding. It is sufficient at present to note their occurrence until more material is available.

Family Rotaliidæ

Genus **Discorbis** Lamarck, 1804

35. **Discorbis cretacea** (Franke) (?)

Plate 40, figures 4, 5, 6

Discorbina cretacea Franke, Abhandl. geol. pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 91, pl. 8, figs. 12 *a-c*.

The figured specimen may belong to this upper Cretaceous species described by Franke. The original figures do not show the complete details and our figured specimen is somewhat broken so that the identification cannot be positively made. The figured specimen is but 0.25 mm. in diameter.

Genus **Eponides** Montfort, 1808

36. **Eponides umbonella** (Reuss)

Plate 40, figures 7, 8, 9

Rotalia umbonella Reuss, Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 221, pl. 11, figs. 5 *a-c*.

Test trochoid, biconvex, seven or eight chambers in the last-formed whorl, periphery acute; chambers distinct, slightly inflated on the ventral side; sutures distinct, on the dorsal side flush with the surface, very slightly limbate, curved, strongly oblique to the periphery, on the ventral side nearly radial, slightly curved; wall smooth; aperture ventral, under the border of the chamber margin. Diameter 0.45 mm.; height 0.22 mm.

Reuss described this species from the upper Cretaceous of Westphalia.

Genus **Gyroidina** d'Orbigny, 1826

37. **Gyroidina depressa** (Alth)

Plate 41, figures 4, 5, 6

Rotalina depressa Alth, in Haidinger's Nat. Abhandl., vol. 3, 1850, p. 266, pl. 13, fig. 21.

Test much compressed, trochoid, biconvex, the dorsal side often nearly flat, periphery rounded, umbilicus often open; chambers numerous, ten to twelve in the last whorl, distinct; sutures distinct, on the dorsal side nearly flush, slightly limbate, curved, ventrally slightly curved, nearly radial, slightly depressed; wall smooth; aperture on the ventral side between the periphery and the umbilicus, low. Diameter of figured specimen 0.25 mm.; height 0.12 mm.

Alth described and figured this species from the upper Cretaceous of Lemberg. The form has since had other names. This same species is common in the upper Cretaceous of the Coastal Plain region of the United States. It is the *Rotalia cretacea* of Carsey (Bull. 2612, Univ. Texas, 1926, p. 48, pl. 5, figs. 1 *a, b*).

38. **Gyroidina quadrata** Cushman & Church, new species

Plate 41, figures 7, 8, 9

Test small, trochoid, six chambers making up the last-formed whorl, dorsal side concave, with a deep sulcus at the spiral suture in the last-formed whorl, ventral side strongly convex, in peripheral view test nearly quadrate, periphery very broad and only slightly curved; chambers distinct, slightly inflated; sutures distinct, depressed, dorsally slightly limbate, slightly curved, ventrally radiate; wall smooth; aperture ventral, between the umbilicus and the periphery. Diameter of holotype 0.20 mm.; height 0.13 mm.

Holotype: No. 4754, Mus. Calif. Acad. Sci. from Loc. 1421 (C. A. S.), California Northern Petroleum Company Well No. 19, Sec. 2, T. 21 S., R. 14 E., M. D. M., Fresno County, California; depth, 1135 feet; upper Cretaceous.

This is a very distinctive small species with its deeply excavated spiral suture, concave dorsal side and quadrate shape in side view.

Genus **Epistomina** Terquem, 1883

39. **Epistomina caracolla** (Roemer)

Plate 41, figures 10(?), 11, 12, 13

Gyroidina caracolla ROEMER, Verstein. Norddeutsch. Kreide, 1840-41, p. 97, pl. 15, fig. 22.

Pulvinulina caracolla CHAPMAN, Journ. Roy. Micr. Soc., 1898, p. 7, pl. 1, figs. 9 *a-c*.

Epistomina caracolla FRANKE, Abhandl. geol. pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 88, pl. 8, figs. 10 *a-c*.

The large specimen figured on Plate 40, figures 11, 12, 13 has many of the characters of Roemer's species although later figures give various interpretations of the specific characters. The sutures are limbate and well marked and there is a thickened keel and large umbo in the ventral umbilical region. The small irregular specimen, figure 10, is figured largely for comparison. It is a slightly eroded specimen, and its characters are not well shown.

Family CHILOSTOMELLIDÆ

Genus **Allomorphina** Reuss, 1850

40. **Allomorphina cretacea** Reuss

Plate 41, figures 12, 13

Allomorphina cretacea REUSS, in Haidinger's Nat. Abhandl., vol. 4, 1851, p. 43, pl. 4, fig. 7; Sitz. Akad. Wiss. Wien, vol. 44, pt. 1, 1861 (1862), p. 320.—FRANKE, Abhandl. geol. pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 28, pl. 2, fig. 26.

The figured form is an irregular one and tends somewhat toward *A. obliqua* Reuss. Both species were described by Reuss from the upper Cretaceous of Lemberg.

Genus **Pullenia** Parker & Jones, 1862

41. **Pullenia quinqueloba** (Reuss)

Plate 41, figures 10, 11

Nonionina quinqueloba REUSS, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 71, pl. 5, fig. 31.

Although described by Reuss from the Middle Oligocene of Germany, this name has been applied to most forms of *Pullenia* that have five chambers in the last-formed coil. Its apparent range is from Cretaceous to Recent at least, and an examination of large series from different formations should be studied to determine the relationships of all these forms. The figured specimen is somewhat collapsed.

Family GLOBOROTALIIDÆ

Genus **Globotruncana** Cushman, 1927

42. **Globotruncana arca** (Cushman)

Plate 41, figures 1, 2, 3

Pulvinulina arca CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, 1926, p. 23, pl. 3, figs. 1 *a-c.*

Globotruncana arca CUSHMAN, l. c., vol. 3, 1927, pl. 19, fig. 11; Journ. Pal., vol. 1, 1927, p. 169, pl. 28, fig. 15.

This abundant and characteristic species of the American upper Cretaceous occurs in the California material. The edges of the chamber are not as ornamented as usual.

Family ANOMALINIDÆ

Genus **Cibicides** Montfort, 1808

43. **Cibicides convexa** (Reuss)

Plate 41, figures 14, 15, 16

Truncatulina convexa REUSS, in Haidinger's Nat. Abhandl., vol. 4, 1851, p. 36, pl. 3, fig. 4.

The figured specimen is very typical of this species figured and described by Reuss from the upper Cretaceous of Lemberg. The dorsal side is concave and the ventral strongly convex. The wall is coarsely perforate and the periphery very broadly rounded.

PLATE 36

Fig. 1. *Spiroplectammina anceps* (Reuss). Plesiotype, No. 4710, C. A. S., × 60; front view; p. 500.

Fig. 2. *Spiroplectammina anceps* (Reuss). Plesiotype, No. 4710, C. A. S., × 60; apertural view; p. 500.

Fig. 3. *Gaudryina oxycona* Reuss. Plesiotype, No. 4711, C. A. S., × 60; front view; p. 501.

Fig. 4. *Gaudryina oxycona* Reuss. Plesiotype, No. 4711, C. A. S., × 60; apertural view; p. 501.

Fig. 5. *Gaudryina ruthenica* Reuss. Plesiotype, No. 4712, C. A. S., × 60; front view; p. 501.

Fig. 6. *Gaudryina ruthenica* Reuss. Plesiotype, No. 4712, C. A. S., × 60; apertural view; p. 501.

Fig. 7. *Quinqueloculina* sp. (?). Plesiotype, No. 4716, C. A. S., × 60; side view; p. 503.

Fig. 8. *Quinqueloculina* sp. (?). Plesiotype, No. 4716, C. A. S., × 60; side view; p. 503.

Fig. 9. *Quinqueloculina* sp. (?). Plesiotype, No. 4716, C. A. S., × 60; end view; p. 503.

Fig. 10. *Silicosigmoilina californica* Cushman & Church, n. sp. Holotype, No. 4714, C. A. S., × 60; side view; p. 502.

Fig. 11. *Silicosigmoilina californica* Cushman & Church, n. sp. Paratype, No. 4713, C. A. S., × 60; side view; p. 502.

Fig. 12. *Silicosigmoilina californica* Cushman & Church, n. sp. Paratype, No. 4715, C. A. S., × 60; transverse section of young specimen; p. 502.

Fig. 13. *Lenticulina williamsoni* (Reuss). Plesiotype, No. 4719, C. A. S., × 60; side view; p. 503.

Fig. 14. *Lenticulina williamsoni* (Reuss). Plesiotype, No. 4719, C. A. S., × 60; apertural view; p. 503.

Fig. 15. *Robulus lepidus* (Reuss). Plesiotype, No. 4718, C. A. S., × 60; side view; p. 504.

Fig. 16. *Robulus lepidus* (Reuss). Plesiotype, No. 4718, C. A. S., × 60; apertural view; p. 504.

All of the specimens illustrated on this plate are from Calif. Acad. Sci. Loc. No. 1421; California Northern Petroleum Company Well No. 19, Section 2, T. 21 S., R. 14 E., near Coalinga, Fresno County, California; depth 1135 feet, upper Cretaceous.

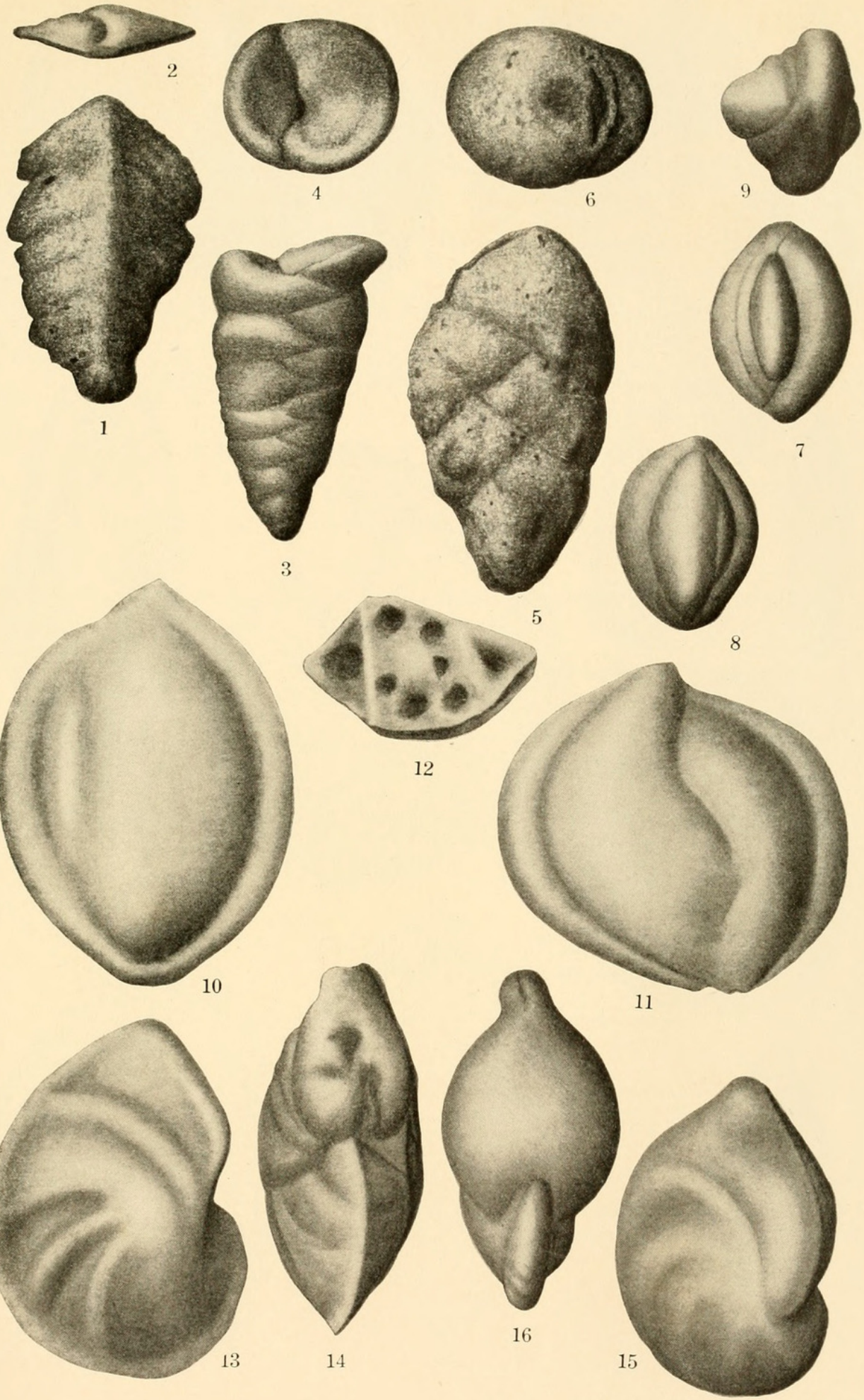
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PLATE 37

Fig. 1. *Lenticulina rotulata* Lamarck. Plesiotype, No. 4717, C. A. S., × 60; side view; p. 503.

Fig. 2. *Lenticulina rotulata* Lamarck. Plesiotype, No. 4717, C. A. S., × 60; apertural view; p. 503.

Fig. 3. *Marginulina humilis* (Reuss). Plesiotype, No. 4725, C. A. S., × 60; side view; p. 505.

Fig. 4. *Marginulina humilis* (Reuss). Plesiotype, No. 4725, C. A. S., × 60; front view; p. 505.

Fig. 5. *Marginulina humilis* (Reuss). Plesiotype, No. 4725, C. A. S., × 60; apertural view; p. 505.

Fig. 6. *Robulus trachyomphalus* (Reuss). Plesiotype, No. 4720, C. A. S., × 30; side view; p. 504.

Fig. 7. *Robulus trachyomphalus* (Reuss). Plesiotype, No. 4720, C. A. S., × 30; apertural view; p. 504.

Fig. 8. *Marginulina modesta* Reuss. Plesiotype, No. 4723, C. A. S., × 60; side view; p. 506.

Fig. 9. *Marginulina modesta* Reuss. Plesiotype, No. 4725, C. A. S., × 60; front view; p. 506.

Fig. 10. *Marginulina modesta* Reuss. Plesiotype, No. 4723, C. A. S., × 60; apertural view; p. 506.

Fig. 11. *Lenticulina* sp. (?). Plesiotype, No. 4721, C. A. S., × 60; side view; p. 504.

Fig. 12. *Lenticulina* sp. (?). Plesiotype, No. 4721, C. A. S., × 60; apertural view; p. 504.

Fig. 13. *Saracenaria triangularis* (d'Orbigny). Plesiotype, No. 4738, C. A. S., × 60; side view; p. 505.

Fig. 14. *Saracenaria triangularis* (d'Orbigny). Plesiotype, No. 4738, C. A. S., × 60; apertural view; p. 505.

All of the specimens illustrated on this plate are from Calif. Acad. Sci. Loc. No. 1421; California Northern Petroleum Company Well No. 19, Sec. 2, T. 21 S., R. 14 E., near Coalinga, Fresno County, California, depth 1135 feet; upper Cretaceous.

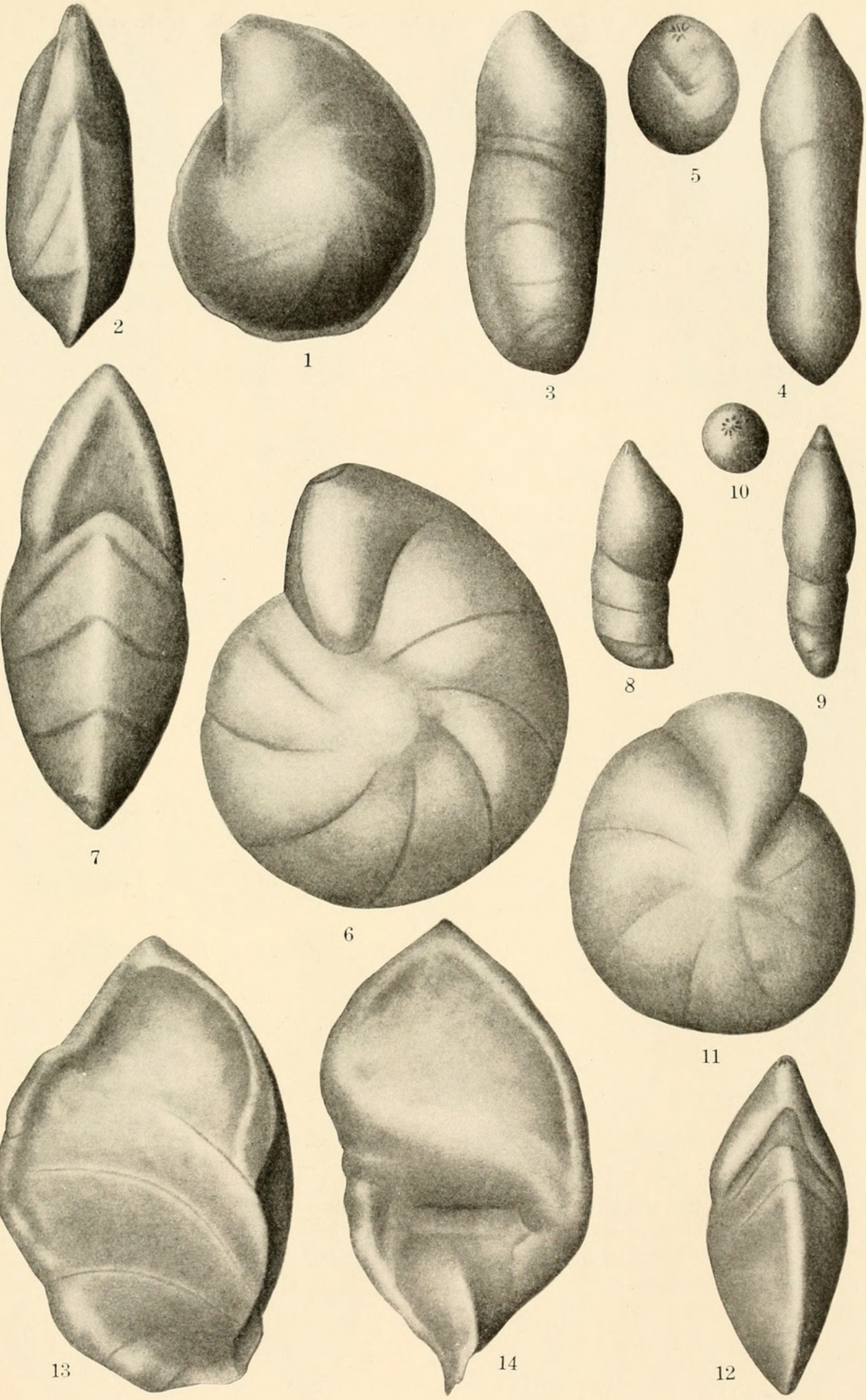
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PLATE 38

Fig. 1. *Marginulina elongata* d'Orbigny. Plesiotype, No. 4726, C. A. S., × 60; side view; p. 506.

Fig. 2. *Marginulina elongata* d'Orbigny. Plesiotype, No. 4726, C. A. S., × 60; front view; p. 506.

Fig. 3. *Marginulina elongata* d'Orbigny. Plesiotype, No. 4726, C. A. S., × 60; apertural view; p. 506.

Fig. 4. *Marginulina bullata* Reuss. Plesiotype, No. 4724, C. A. S., × 60; side view; p. 507.

Fig. 5. *Marginulina bullata* Reuss. Plesiotype No. 4724, C. A. S., × 60; front view; p. 507.

Fig. 6. *Marginulina bullata* Reuss. Plesiotype, No. 4724, C. A. S., × 60; apertural view; p. 507.

Fig. 7. *Marginulina jonesi* Reuss. Plesiotype, No. 4722, C. A. S., × 60; side view; p. 507.

Fig. 8. *Marginulina jonesi* Reuss. Plesiotype, No. 4722, C. A. S., × 60; front view; p. 507.

Fig. 9. *Marginulina jonesi* Reuss. Plesiotype, No. 4722, C. A. S., × 60; apertural view; p. 507.

Fig. 10. *Vaginulina simondsi* Carsey. Plesiotype, No. 4742, C. A. S., × 45; p. 508.

Fig. 11. *Frondicularia decheni* Reuss. Plesiotype, No. 4740, C. A. S., × 45; front view; p. 508.

Fig. 12. *Frondicularia decheni* Reuss. Plesiotype, No. 4740, C. A. S., × 45; apertural view; p. 508.

Fig. 13. *Frondicularia decheni* Reuss. Plesiotype, No. 4740, C. A. S., × 45; p. 508.

Fig. 14. *Frondicularia* sp. (?). Plesiotype, No. 4739, C. A. S., × 30; p. 509.

Fig. 15. *Dentalina* sp. (?). Plesiotype, No. 4736, C. A. S., × 60; p. 509.

All of the specimens illustrated on this plate are from Calif. Acad. Sci. Loc. 1421; California Northern Petroleum Company Well No. 19, Section 2, T. 21 S., R. 14 E., near Coalinga, Fresno County, California; depth, 1135 feet; upper Cretaceous.

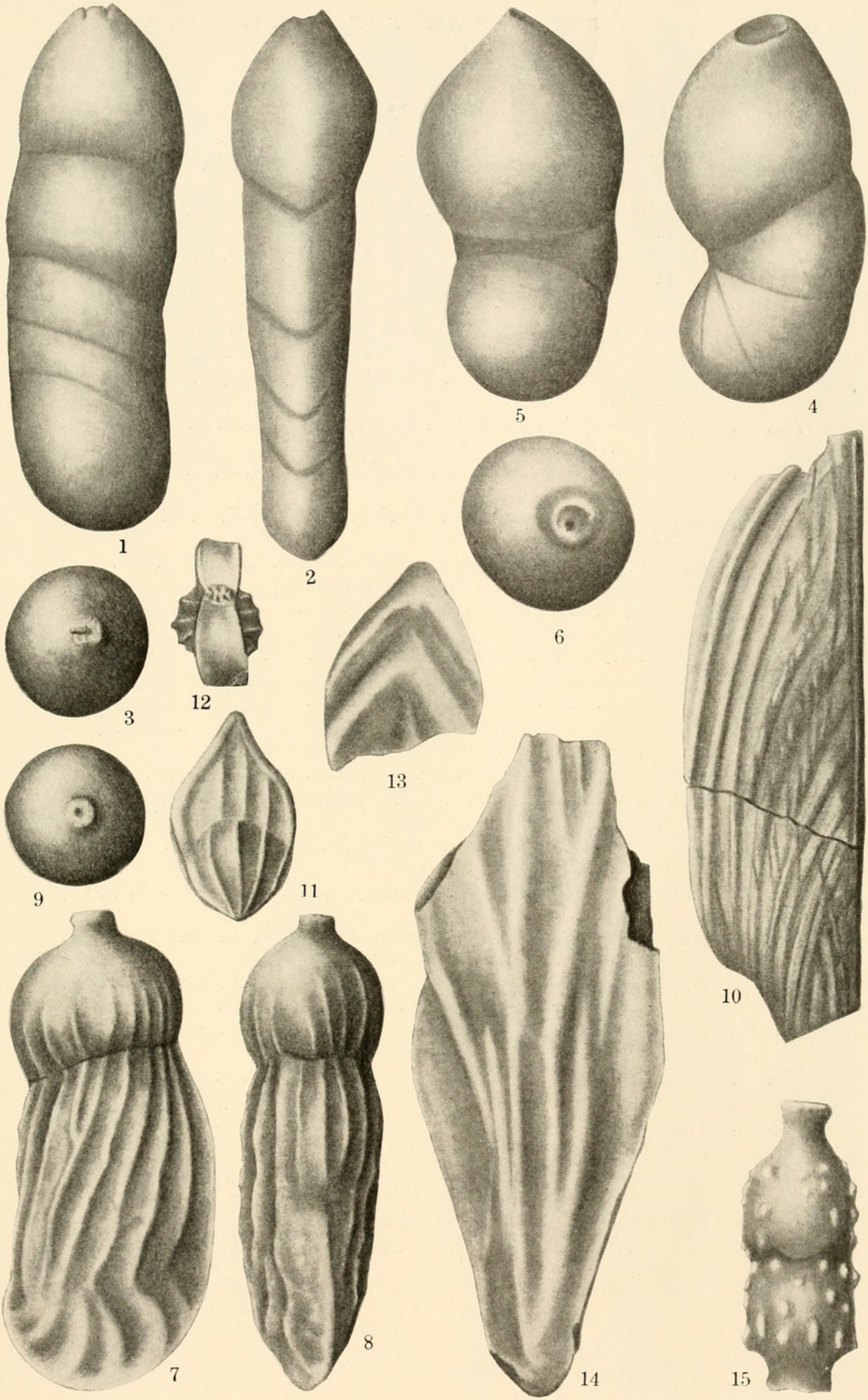
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PLATE 39

Fig. 1. *Dentalina catenula* Reuss. Plesiotype, No. 4729, C. A. S., × 60; p. 509.

Fig. 2. *Dentalina polyphragma* Reuss. Plesiotype, No. 4731, C. A. S., × 60; p. 509.

Fig. 3. *Dentalina commutata* Reuss. Plesiotype, No. 4734, C. A. S., × 60; p. 510.

Fig. 4. *Nodosaria nuda* Reuss. Plesiotype, No. 4733, C. A. S., × 60; p. 510.

Fig. 5. *Nodosaria nuda* Reuss. Plesiotype, No. 4727, C. A. S., × 60; p. 510.

Fig. 6. *Nodosaria nuda* Reuss. Plesiotype, No. 4728, C. A. S., × 60; p. 510.

Fig. 7. *Nodosaria ewaldi* (?) Reuss. Plesiotype, No. 4729, C. A. S., × 60; p. 510.

Fig. 8. *Glandulina cylindracea* Reuss. Plesiotype, No. 4735, C. A. S., × 60; p. 511.

Fig. 9. *Glandulina cylindracea* Reuss. Plesiotype, No. 4732, C. A. S., × 60; p. 511.

Fig. 10. *Glandulina manifesta* Reuss. Plesiotype, No. 4737, C. A. S., × 60; p. 511.

Fig. 11. *Lagena* (?) sp. (?). Plesiotype, No. 4743, C. A. S., × 60; p. 512.

Fig. 12. *Ventilabrella ornatissima* Cushman & Church, n. sp. Holotype, No. 4746, C. A. S., × 60; front view; p. 512.

Fig. 13. *Ventilabrella ornatissima* Cushman & Church, n. sp., Holotype, No. 4746, C. A. S., × 60; side view; p. 512.

Fig. 14. *Ventilabrella ornatissima* Cushman & Church, n. sp. Holotype, No. 4746, C. A. S., × 60; end view; p. 512.

Fig. 15. *Ventilabrella ornatissima* Cushman & Church, n. sp. Paratype, No. 4745, C. A. S., × 60; front view; p. 512.

Fig. 16. *Lagena* sp. (?). Plesiotype, No. 4744, C. A. S., × 60; p. 512.

Fig. 17. *Bulimina obtusa* d'Orbigny. Plesiotype, No. 4748, C. A. S., × 60; megalospheric form; p. 513.

Fig. 18. *Bulimina obtusa* d'Orbigny. Plesiotype, No. 4747, C. A. S., × 60; microspheric form; p. 513.

Fig. 19. *Bulimina obtusa* d'Orbigny. Plesiotype, No. 4747, C. A. S., × 60; apertural view; p. 513.

Fig. 20. *Nodosarella coalingensis* Cushman & Church, n. sp. Holotype, No. 4751, C. A. S., × 45; front view; p. 514.

Fig. 21. *Nodosarella coalingensis* Cushman & Church, n. sp. Holotype, No. 4751, C. A. S., × 45; apertural view; p. 514.

Fig. 22. *Nodosarella coalingensis* Cushman & Church, n. sp. Paratype, No. 4750, C. A. S., × 45; side view; p. 514.

Fig. 23. *Chrysalogonium cretaceum* Cushman & Church, n. sp. Holotype, No. 4762, C. A. S., × 60; front view; p. 513.

Fig. 24. *Chrysalogonium cretaceum* Cushman & Church, n. sp. Holotype, No. 4762, C. A. S., × 60; apertural view; p. 513.

All of the specimens illustrated on this plate are from Calif. Acad. Sci. Loc. No. 1421; California Northern Petroleum Company Well No. 19, Sec. 2, T. 21 S., R. 14 E., near Coalinga, Fresno County, California; depth 1135 feet; upper Cretaceous.

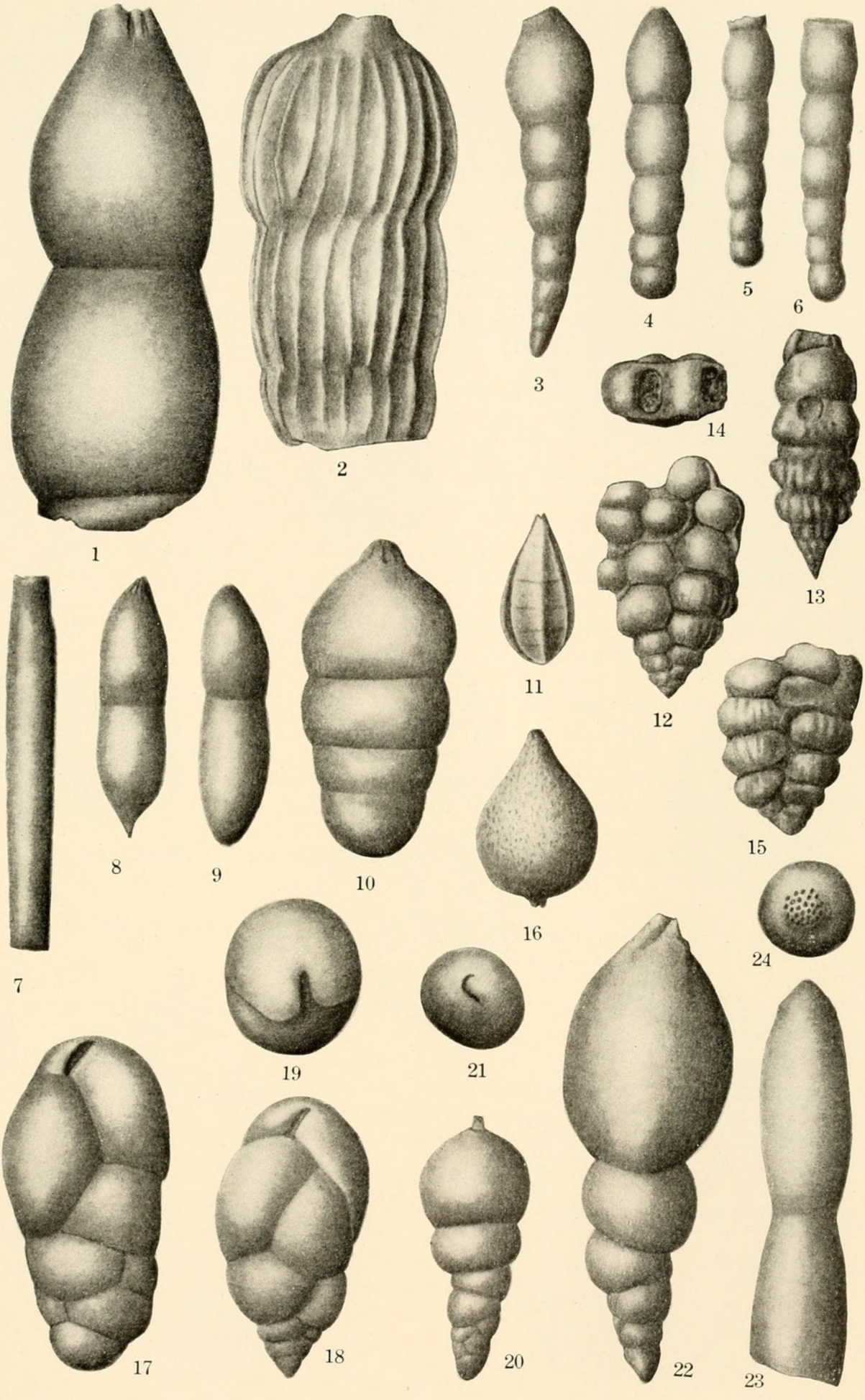
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PLATE 40

Fig. 1. *Ellipsobulimina* (?) sp. (?). Plesiotype, No. 4749-a, C. A. S., × 60; front view; p. 514.

Fig. 2. *Ellipsobulimina* (?) sp. (?). Plesiotype, No. 4749-a, C. A. S., × 60; apertural view; p. 514.

Fig. 3. *Ellipsobulimina* (?) sp. (?). Plesiotype, No. 4749, C. A. S., × 60; front view; p. 514.

Fig. 4. *Discorbis cretacea* (Franke) (?). Plesiotype, No. 4752, C. A. S., × 60; dorsal view; p. 515.

Fig. 5. *Discorbis cretacea* (Franke) (?). Plesiotype, No. 4752, C. A. S., × 60; ventral view; p. 515.

Fig. 6. *Discorbis cretacea* (Franke) (?). Plesiotype, No. 4752, C. A. S., × 60; peripheral view; p. 515.

Fig. 7. *Eponides umbonella* (Reuss). Plesiotype, No. 4757, C. A. S., × 60; dorsal view; p. 515.

Fig. 8. *Eponides umbonella* (Reuss). Plesiotype, No. 4757, C. A. S., × 60; ventral view; p. 515.

Fig. 9. *Eponides umbonella* (Reuss). Plesiotype, No. 4757, C. A. S., × 60; peripheral view; p. 515.

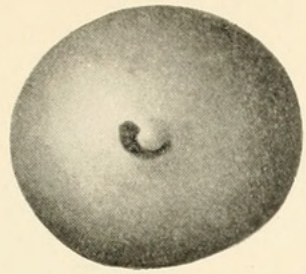
Fig. 10. *Epistomina caracolla* (?) (Roemer). Plesiotype, No. 4756, C. A. S., × 45; (?); p. 517.

Fig. 11. *Epistomina caracolla* (Roemer). Plesiotype, No. 4755, C. A. S., × 45; dorsal view; p. 517.

Fig. 12. *Epistomina caracolla* (Roemer). Plesiotype, No. 4755, C. A. S., × 45; ventral view; p. 517.

Fig. 13. *Epistomina caracolla* (Roemer). Plesiotype, No. 4755, C. A. S., × 45; peripheral view; p. 517.

All of the specimens illustrated on this plate are from Calif. Acad. Sci. Loc. No. 1421; California Northern Petroleum Company Well No. 19, Sec. 2, T. 21 S., R. 14 E., near Coalinga, Fresno County, California; depth 1135 feet; upper Cretaceous.



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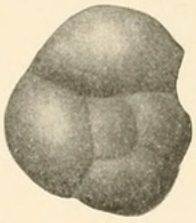

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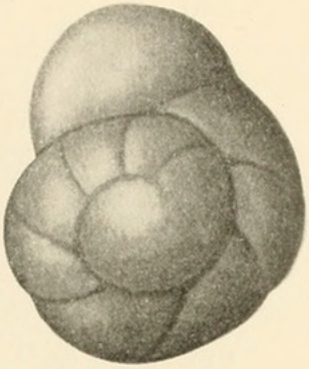

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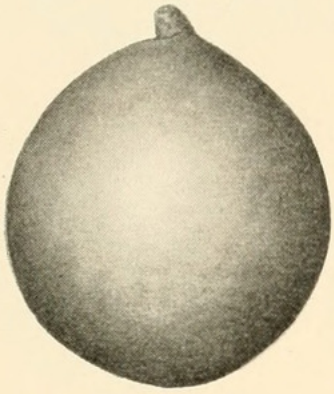

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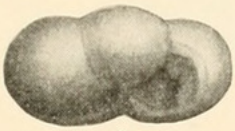

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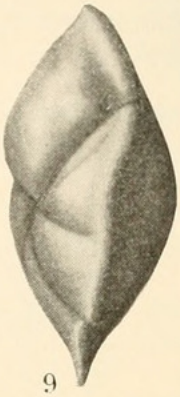

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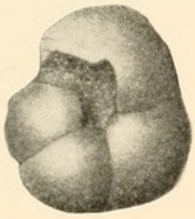

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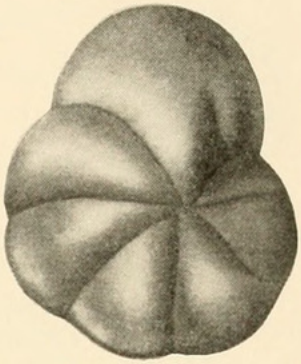

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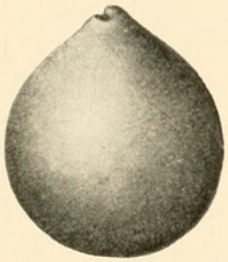

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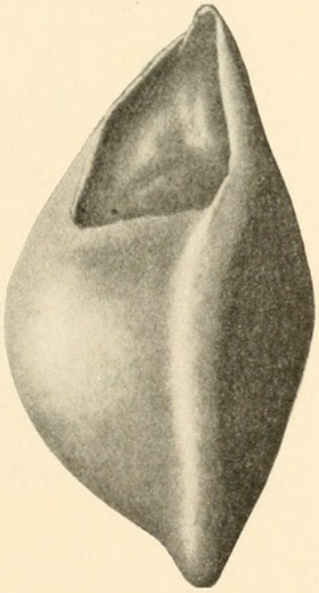

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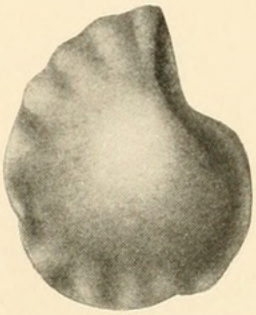

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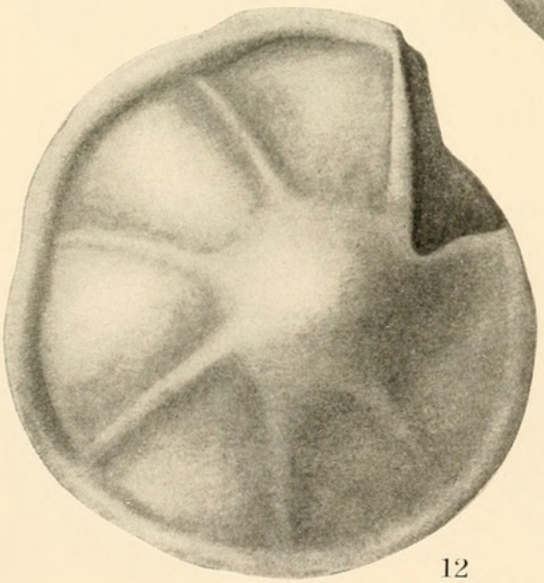

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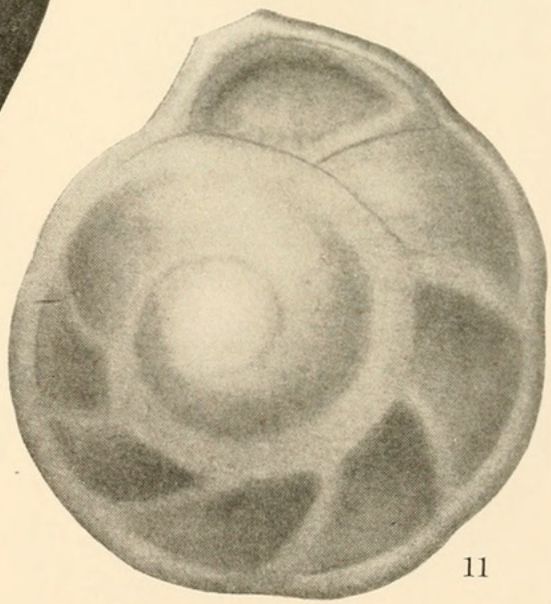

11

PLATE 41

Fig. 1. *Globotruncana arca* (Cushman). Plesiotype, No. 4760, C. A. S., × 60; dorsal view; p. 518.

Fig. 2. *Globotruncana arca* (Cushman). Plesiotype, No. 4760, C. A. S., × 60; ventral view; p. 518.

Fig. 3. *Globotruncana arca* (Cushman). Plesiotype, No. 4760, C. A. S., × 60; peripheral view; p. 518.

Fig. 4. *Gyroidina depressa* (Alth). Plesiotype, No. 4753, C. A. S., × 60; dorsal view; p. 515.

Fig. 5. *Gyroidina depressa* (Alth). Plesiotype, No. 4753, C. A. S., × 60; ventral view; p. 515.

Fig. 6. *Gyroidina depressa* (Alth). Plesiotype, No. 4753, C. A. S., × 60; peripheral view; p. 515.

Fig. 7. *Gyroidina quadrata* Cushman & Church, n. sp. Holotype No. 4754, C. A. S., × 60; dorsal view; p. 516.

Fig. 8. *Gyroidina quadrata* Cushman & Church, n. sp. Holotype, No. 4754, C. A. S., × 60; ventral view; p. 516.

Fig. 9. *Gyroidina quadrata* Cushman & Church, n. sp. Holotype, No. 4754, C. A. S., × 60; peripheral view; p. 516.

Fig. 10. *Pullenia quinqueloba* (Reuss). Plesiotype, No. 4759, C. A. S., × 60; side view; p. 517.

Fig. 11. *Pullenia quinqueloba* (Reuss). Plesiotype, No. 4759, C. A. S., × 60; peripheral view; p. 517.

Fig. 12. *Allomorphina cretacea* Reuss. Plesiotype, No. 4758, C. A. S., × 60; side view; p. 517.

Fig. 13. *Allomorphina cretacea* Reuss. Plesiotype, No. 4758, C. A. S., × 60; opposite side; p. 517.

Fig. 14. *Cibicides convexa* (Reuss). Plesiotype, No. 4761, C. A. S., × 60; dorsal view; p. 518.

Fig. 15. *Cibicides convexa* (Reuss). Plesiotype, No. 4761, C. A. S., × 60; ventral view; p. 518.

Fig. 16. *Cibicides convexa* (Reuss). Plesiotype, No. 4761, C. A. S., × 60; peripheral view; p. 518.

All of the specimens illustrated on this plate are from Calif. Acad. Sci. Loc. No. 1421; California Northern Petroleum Company Well No. 19, Sec. 2, T. 21 S., R. 14 E., near Coalinga, Fresno County, California; depth, 1135 feet; upper Cretaceous.

Cushman, Joseph A. and Church, Clifford Carl. 1929. "Some Upper Cretaceous foraminifera from near Coalinga, California." *Proceedings of the California Academy of Sciences, 4th series* 18, 497–530.

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