of steep ridge near crest. About 70 ft above base of formation.

232—NW¼, sec. 36, T 5N, R 16W. Same location as 231 but 15 ft stratigraphically higher, at top of ridge.

233—NW¼, sec. 36, T 5N, R 16W. 1500 ft W of Haskell Canyon, 900 ft S of N sec. line. North slope of dip slope ridge near head of canyon. A few feet stratigraphically above 232.

234—E½, sec. 32, T 5N, R 16W. 75 ft W of E section line NW of 1900-ft hill on E section line; coarse-grained sandstone bed.

277—W¼, SW¼, NW¼, sec. 18, T 5N, R 16W. W bank at junction of Castaic and Elizabeth Lake Canyons. Mudstone.

279—NW¼, sec. 7, T 5N, R 16W. W side of northerly trending tributary to Elizabeth Lake Canyon.

1623—E½, sec. 6, T 4N, R 15W. Roadcut north side of Bouquet Canyon Road, SW side of low hill W of 1429.

1624—NW¼, sec. 36, T 5N, R 16W. Top central portion of central ridge in ampitheatre on anticline axis. 75 ft above base of formation; 100 yrds SE of 232. Coarse-grained sandstone.

1626—NW¼, NW ¼, sec. 2, T 3N, R 15W. 150 ft S of N section line on S end of hill 2323. Diatomaceous mudstone.

1627—NE¼, sec. 27, T 4N, R 15W. On NW trending ridge, S 34° W from NE section corner. Pebbly sandstone.

1663—W¼, NW¼, SW¼, sec. 27, T 4N, R 15W. S side of W trending ridge, 150 ft E of W section line, 75 ft N of S edge of Humphreys Quad. sheet.

1670—Center of SW¼, SE¼, SE¼, sec. 26, T 5N, R 16W. N side of small W trending valley E of Dry Canyon Dam. Pebbly sandstone bed in mudstone.

1671—E edge of SE¼, NE¼, SE¼, sec. 26, T 5N, R 16W. Bottom of small canyon tributary to Haskell Canyon. 1500 ft N of SE section corner. Fine-grained sandstone.

1849—SW¼, SE¼, sec. 35, T 4N, R 15W. On ridge W of junction of Reynier and Sand Canyons. S 24° W of NW section corner.

2069—W¼, NW¼, SW¼, sec. 27, T 4N, R 15W. S edge of Humphreys Quad. sheet, 150 ft E of W section line. Down slope from 1663. Basal pebble conglomerate.

2070—E bank of S trending tributary to Castaic Creek. 3100 ft N 9.5° E from SW corner sec. 25, T 6N, R17W. Basal pebble conglomerate.

2071—E bank near mouth of same canyon as 2070. 2400 ft N 11° E from SW corner sec. 25, T 6N, R 17W. Fossiliferous sandstone and conglomerate unit interbedded in mudstone.

2072—NE bank of Castaic Canyon just outside mouth of tributary canyon containing 2070, 2071. 2300 ft N 12° E from SW corner sec. 25, T 6N, R 17W. Sandstone bed in mudstone; 15 ft stratigraphically above 2071.

2074—WSW of shelter house in upper Castaic Canyon, Redrock Mtn. Quad. on ridge top SW of hill 2734 where 118°40′ line crosses ridge. Basal pebble conglomerate.

2075—W¼, NE¼, NW¼, sec. 31, T 6N, R 16W. N side of W flowing tributary to Elderberry Canyon. Massive pebble conglomerate bed overlying basal cobble conglomerate.

2077—NW¼, SE¼, NW¼, sec. 31 T 6N, R 16W. Crest of ridge SE of Elderberry Canyon. S 41° E from NW section corner. Pebbly sandstone.

2081—SE¼, NE¼, NW¼, sec. 31, T 6N, R 16W. Sandstone bed capping ridge summit.

2082—E¼, NE¼, NW¼, sec. 31, T 6N, R 16W. 2650 ft S74° E from NW section corner. Basal pebble conglomerate.

2083—These localities and 2102 and 2103 are on a broad flat ridge NW of Castaic Creek, at the N
to edge of sec. 26, T 6N, R 17W and just under
2089 the ON in National on the Violin Canyon Quadrangle map. All localities are in the basal sandstone to conglomerate member of the formation.

All distances and directions measured from NW corner sec. 26, T 6N, R 17W.

2083—2190 ft N 86° E. Lowest unit exposed in stream-cut bank at W end of ridge. Cobble conglomerate.

2084—2200 ft N 85 ° E. 10 ft N of 2084, face of small cliff. Pebbly sandstone overlying 2083.

2085—2220 ft N 88° E. SE end of small cross ridge. Pebbly conglomerate overlying 2084.

2086—2210 ft N 86° E. Top of small cross ridge, top of cliff above 2083. Fine to pebbly sandstone overlying bed containing 2085.

2087—2400 ft S 88° E. Dip slope of sandstone underlying conglomerate of 2083.

2088—2900 ft N 78.5° E. Cliff on N side of ridge. Pebbly sandstone tongue in cobble conglomerate. Correlative with beds containing localities 2084–2086.

2089—3250 ft N 78.5° E. E side of ridge top below saddle. Pebbly coarse-grained sandstone.

2090—NW¼, sec. 31, T 6N, R 16W. Ridge top at 2100 ft elev., 3150 ft S 63° E from NW section corner. Pebbly sandstone bed.

2091—NE¼, SW¼, sec. 31, T 6N, R 16W. Rim of small canyon SW of hill 1986. 1800 ft elev. N 45° E from SW section corner. Pebbly sandstone.

2092—NW¼, NE¼, sec. 26, T 6N, R 17W. E side Castaic Canyon, S 71° W from NE section corner at 1700 ft elev. Dip slope of upper surface, basal conglomerate.

2093—NE side of Castaic Canyon, at 1860 ft elev., 2550 ft N 8° E from BM 1458, sec. 25, T 6N, R 17W. Basal conglomerate.

2094—SE bank of main tributary entering Castaic Creek N of Cordova Ranch, sec. 36, T 6N, R 17W. 1500 ft N 31° E from Ranch. Mudstone.

2095—E side Castaic Canyon, 2010 ft elev. 3000 ft S 82° E from intersection of 118°40′ and N edge, Violin Canyon Quad. map. N side of ridge top. Pebbly basal sandstone.

2096—NE¼, NE¼, sec. 36, T 6N, R 17W. 1710 ft elev. 1600 ft N 83° E from Cordova Ranch. Pebblv sandstone bed in mudstone. Correlative with 2077, 2081, 2107.

2097—SW¼, SE¼, sec. 1, T 5N, R 17W. N bank of narrow canyon, 2350 ft N 60.5° E from Daries Ranch. Sandstone.

2098—NE¼, sec. 12, T 5N, R 17W. E bank of Castaic Creek under low stream terrace. 3500 ft S 58.5° E from Daries Ranch. Friable coarse-grained sandstone.

2099—3750 ft N 72.5° E from Cordova Ranch, sec. 36, T 6N, R 17W. 2025 ft elev. Sandstone bed with abundant *Crassostrea titan*. Within the basal sandstone-conglomerate member.

2100—100 ft E of 2099, on ridge summit. Pebble conglomerate. Overlying the basal cobble conglomerate.

2101—W side of Castaic Creek, Redrock Mtn. Quad.

2100 ft elev. 4250 ft N 30° W from 1668 BM at Castaic Creek-Fish Creek junction. Dip slope of upper surface of basal member of formation. Medium-grained sandstone.

2102—$NW\frac{1}{4}$, $NE\frac{1}{4}$, sec. 26, T 6N, R 17W. 2830 ft S 82.5° E from NW section corner. S end of ridge containing locs. 2083–2089 and 2103. Ridge top S of small gulley cut into ridge.

2103—2850 ft N 81° E from NW corner sec. 26, T6 N, R 17W. Cliff on N side of ridge. 100 ft S of 2088 in same pebbly sandstone bed.

2104—E of junction of Castaic and Fish Creeks. 1750 ft elev. 350 ft S 55° E from 1668 BM. Pebble conglomerate 4 ft above basal contact.

2105—E of junction of Castaic and Fish Creeks. 1825 ft elev. 600 ft S 42° E from 1668 BM. Dip slope upper surface of basal conglomerate.

2106—75 ft NE of loc. 2099. Ridge crest north of Elderberry Canyon. Sandstone bed stratigraphically midway between 2099 and 2100.

2107—$SW\frac{1}{4}$, $NW\frac{1}{4}$, sec. 31, T 6N, R 16W. 2100 ft S 21.5° E from NW section corner. Pebbly sandstone bed containing also 2077, 2081, 2096.

2108—$NE\frac{1}{4}$, sec. 26, T 6N, R 17W. 1650 ft elev. S 75° W from NE section corner. 225 feet NW from 2092. Basal pebbly sandstone.

REFERENCES

ADDICOTT, W. O., & VEDDER, J. G., 1963, Paleotemperature inferences from late Miocene mollusks in the San Luis Obispo-Bakersfield area, California: U. S. Geol. Survey Prof. Paper 475C, p. C63–C68.

ARNOLD, RALPH, 1903, The paleontology and stratigraphy of the marine Pliocene and Pleistocene of San Pedro, California: Calif. Acad. Sci. Mem., v. 3, p. 1–420.

——, 1906, The Tertiary and Quaternary pectens of California: U. S. Geol. Survey Prof. Paper 47, 264 p.

——, 1907, New and characteristic species of fossil mollusks from the oil-bearing Tertiary formations of southern California: U. S. Natl. Mus. Proc., v. 32, p. 525–546.

——, 1910, Paleontology of the Coalinga district, Fresno and Kings Counties, California: U. S. Geol. Survey Bull. 396, p. 1–173.

BARTSCH, PAUL, 1911, The Recent and fossil mollusks of the genus *Bittium* from the west coast of America: U. S. Natl. Mus. Proc., v. 40, p. 383–414.

CLARK, B. L., 1915, Fauna of the San Pablo Group of middle California: Univ. Calif. Pub., Bull. Dept. Geology, v. 8, p. 385–572.

CONRAD, T. A., 1837, Descriptions of marine shells from upper California, collected by Thomas Nuttall, Esq.: Acad. Natl. Sci. Phila. Jour., v. 7, p. 227–268.

——, 1857a, Description of the Tertiary fossils collected on the survey: Pacific R.R. Repts., v. 6, pt. 2, p. 69–73.

——, 1857b, Report on the paleontology of the survey: Pacific R.R. Repts., v. 7, pt. 2, p. 189–196.

DALL, W. H., 1871, Descriptions of sixty new forms of mollusks from the west coast of America and the north Pacific Ocean, with notes on others already described: Am. Jour. Conch., v. 7, pt. 2, p. 93–160.

——, 1898, Contributions to the Tertiary fauna of Florida . . . : Wagner Free Inst. Sci. Trans., v. 3, pt. 4, p. 571–947.

DEHLINGER, PETER, 1952, Geology of the southern Ridge Basin, Los Angeles County, California: Calif. Div. Mines Special Rept. 26, 11 p.

DIBBLEE, T. W., JR., 1954, Geology of the Imperial Valley region, California: Calif. Div. Mines Bull. 170, chap. 2, p. 21–28.

DURHAM, J. W., 1948, Age of post-Mint Canyon marine beds: Geol. Soc. America Bull., v. 59, p. 1386.

——, 1950a, 1940 *E. W. Scripps* cruise to the Gulf of California. Part II. Megascopic paleontology and marine stratigraphy: Geol. Soc. America Mem. 43, p. 1–216.

——, 1950b, Cenozoic marine climates of the Pacific Coast: Geol. Soc. America Bull., v. 61, p. 1243–1264.

——, 1954, The marine Cenozoic of southern California: Calif. Div. Mines Bull. 170, chap. 3, p. 23–31.

——, JAHNS, R. H., & SAVAGE, D. E., 1954, Marine-nonmarine relationships in the Cenozoic section of California: Calif. Div. Mines Bull. 170, chap. 3, p. 59–71.

EATON, J. E., GRANT, U. S., & ALLEN, H. B., 1941, Miocene of Caliente Range and environs, California: Am. Assoc. Petroleum Geologists Bull., v. 25, p. 193–262.

ENGLISH, W. A., 1914a, The Fernando Group near Newhall, California: Univ. Calif. Pub., Bull. Dept. Geology, v. 8, p. 203–218.

——, 1914b, The *Agasoma*-like gastropods of the California Tertiary: Univ. Calif. Pub., Bull. Dept. Geology, v. 8, p. 243–256.

ETHERINGTON, T. J., 1931, Stratigraphy and fauna of the Astoria Miocene of southwest Washington: Univ. Calif. Pub., Bull. Dept. Geol. Sci., v. 20, p. 31–142.

GABB, W. M., 1866, Tertiary invertebrate fossils: Paleontology of California, v. 2, sec. 1, pt. 1, p. 1–38.

GALE, H. R., 1928, West Coast species of *Hinnites:* San Diego Soc. Natl. History Trans., v. 5, p. 91–94.

GRANT, U. S., & GALE, H. R., 1931, Catalogue of the marine Pliocene and Pleistocene Mollusca of California and adjacent regions: San Diego Soc. Natl. History Mem., v. 1, p. 1–1036.

——, & HERTLEIN, L. G., 1938, The west American Cenozoic Echinoidea: Univ. Calif. Los Angeles, Pub. Math. and Phys. Sci., v. 2, p. 1–226.

HALL, C. A., 1960, Displaced Miocene molluscan provinces along the San Andreas fault, California: Univ. Calif. Pub. Geol. Sci., v. 34, p. 281–308.

——, 1962, Evolution of the echinoid genus *Astrodapsis:* Univ. Calif. Pub. Geol. Sci., v. 40, p. 47–180.

——, 1964, *Arca* (*Arca*) *leptogrammica*, a new late Tertiary pelecypod from the San Luis Obispo region, California: Jour. Paleontology, v. 38, p. 87–88.

HANNA, G. D., 1926, Paleontology of Coyote Mountain, Imperial County, California: Calif. Acad. Sci. Proc., v. 14, p. 427–503.

HARMER, F. W., 1914, The Pliocene Mollusca of Great Britain, Part I: Paleontographical Soc. Mon., v. 67, p. 1–200, issued for 1913.

HERTLEIN, L. G., 1925, New species of marine fossil Mollusca from western North America: Southern Calif. Acad. Sci. Bull., v. 24, p. 39–46.

JAHNS, R. H., 1940, Stratigraphy of the eastern-most Ventura Basin, California, . . . : Carnegie Inst. Washington Pub. 514, p. 145–194.

JORDAN, E. K., 1936, The Pleistocene fauna of Magdalena Bay, Lower California: Contr. Dept. Geology Stanford Univ., v. 1, p. 107–173.

KEEN, A. M., 1943, New mollusks from the Round Mountain Silt (Temblor) Miocene of California: San Diego Soc. Natl. Hist. Trans., v. 10, p. 25–60.

——, 1958, Sea shells of tropical west America; marine mollusks from Lower California to Colombia: 624 p. Stanford, Calif., Stanford Univ. Press.

——, 1962, Nomenclatural notes on some west American mollusks, with proposal of a new species name: Veliger, v. 4, no. 4, p. 178–180.

——, & BENTSON, HERDIS, 1944, Checklist of California Tertiary marine Mollusca: Geol. Soc. America Special Paper 56, 280 p.

KEW, W. S. W., 1924, Geology and oil resources of part of Los Angeles and Ventura Counties, California: U. S. Geol. Survey Bull. 753, 202 p.

MACNEIL, F. S., 1957, Cenozoic megafossils of northern Alaska: U. S. Geol. Survey Prof. Paper 294C, p. 99–126.

MATTOX, N. T., 1955, Observations on the brachiopod communities near Santa Catalina Islands: Essays in the natural sciences in honor of Captan Allan Hancock on the occasion of his birthday July 26, 1955, Los Angeles, Univ. Southern Calif. Press, p. 73–86.

MERRIAM, C. W., 1942, Fossil turritellas from the Pacific Coast region of North America: Univ. Calif. Pub., Bull. Dept. Geol. Sci., v. 26, p. 1–214.

NELSON, E. T., 1870, On the molluscan fauna of the later Tertiary of Peru: Conn. Acad. of Arts and Sciences Trans., v. 2, no. 1, p. 186–206.

NEWELL, I. M., 1948, Marine molluscan provinces of western North America: A critique and a new analysis: Am. Philos. Soc. Proc., v. 92, p. 155–166.

NOMLAND, J. O., 1917, Fauna of the Santa Margarita beds in the north Coalinga region of California: Univ. Calif. Pub., Bull. Dept. Geology, v. 10, p. 293–326.

OAKESHOTT, G. B., 1958, Geology and mineral deposits of San Fernando quadrangle, Los Angeles County, California: Calif. Div. Mines Bull. 172, 147 p.

OGLE, B. A., 1953, Geology of the Eel River Valley area, Humboldt County, California: Calif. Div. Mines Bull. 164, 128 p.

OLSSON, A. A., 1961, Mollusks of the tropical eastern, Pacific, Panamic Pacific Pelecypoda: Paleont. Research Inst., Ithaca, New York 574 p.

OSMONT, V. C., 1905, Arcas of the California Neocene: Univ. Calif. Pub., Bull. Dept. Geology, v. 4, p. 89–100.

PACK, R. W., 1909, Notes on echinoids from the Tertiary of California: Univ. Calif. Pub., Bull. Dept. Geology, v. 5, p. 275–284.

PALMER, K. V. W., 1958, Type specimens of marine Mollusca described by P. P. Carpenter from the West Coast (San Diego to British Columbia): Geol. Soc. America Mem. 76, 376 p.

PASCHALL, R. H., & OFF, THEODORE, 1961, Dip-slip versus strike-slip movement on San Gabriel fault, southern California: Am. Assoc. Petroleum Geologists Bull., v. 45,p. 1941–1956.

REEVE, Lovel, 1843, Conchologia Iconica, v. 17, *Crassatella.*

REINHART, P. W., 1943, Mesozoic and Cenozoic Arcidae from the Pacific slope of North America: Geol. Soc. America Special Paper 47, 117 p.

SPIEKER, E. M., 1922, The paleontology of the Zorritos Formation of the north Peruvian oil fields: Johns Hopkins Univ. Studies in Geology, no. 3, 197 p.

STEARNS, R. E. C., 1873, Descriptions of new marine mollusks from the west coast of North America: Calif. Acad. Sci. Proc., v. 5, p. 78–82.

——, 1890, Scientific results of explorations by the U. S. Fish Commission steamer *Albatross*—XVII, Descriptions of new west American land, freshwater, and marine shells, with notes and comments: U. S. Natl. Mus. Proc., v. 13, p. 205–225.

STEWART, R. B., 1927, Gabb's California fossil type gastropods: Acad. Natl. Sci. Phila. Proc., v. 78, p. 287–447.

——, 1930, Gabb's California Cretaceous and Tertiary type lamellibranchs: Acad. Natl. Sci. Phila. Special Pub. 3, 314 p.

STRONG, A. M., 1934, West American species of the genus *Liotia:* San Diego Soc. Natl. History Trans., v. 7, p. 429–452.

VALENTINE, J. W., 1955, Upwelling and thermally anomalous Pacific Coast Pleistocene molluscan faunas: Am. Jour. Sci., v. 253, p. 462–474.

——, 1961, Paleoecologic molluscan geography of the Californian Pleistocene: Univ. Calif. Pub. Geol. Sci., v. 34, p. 309–442.

VEDDER, J. G., 1960, Previously unreported Pliocene Mollusca from the southeastern Los Angeles Basin: U. S. Geol. Survey Prof. Paper 400B, p. B326–B328.

WEAVER, C. E., 1942, Paleontology of the marine Tertiary formations of Oregon and Washington: Univ. Wash. Pub. Geology, v. 5, 790 p.

WHITE, R. C., & BUFFINGTON, E. C., 1948, Age of the Modelo(?) beds in Haskell and Dry Canyons, northern Los Angeles County, California: Geol. Soc. America Bull., v. 59, p. 1389.

WINTERER, E. L., & DURHAM, D. L., 1962, Geology of southeastern Ventura Basin, Los Angeles County, California: U. S. Geol. Survey Prof. Paper 334H, p. 275–366.

WOODRING, W. P., 1930, Age of the Modelo Formation of the Santa Monica Mountains, California: Geol. Soc. America Bull., v. 41, p. 155.

——, 1957, Geology and paleontology of Canal Zone and adjoining parts of Panama: U. S. Geol. Survey Prof. Paper 306A, p. 1–146.

——, BRAMLETTE, M. N., & KEW, W. S. W., 1946, Geology and paleontology of Palos Verde Hills, California: U. S. Geol. Survey Prof. Paper 207, 145 p.

WRIGHT, L. A., 1948, Age of the basal Modelo(?) Formation in Reynier Canyon: Geol. Soc. America Bull., v. 59, p. 1390.

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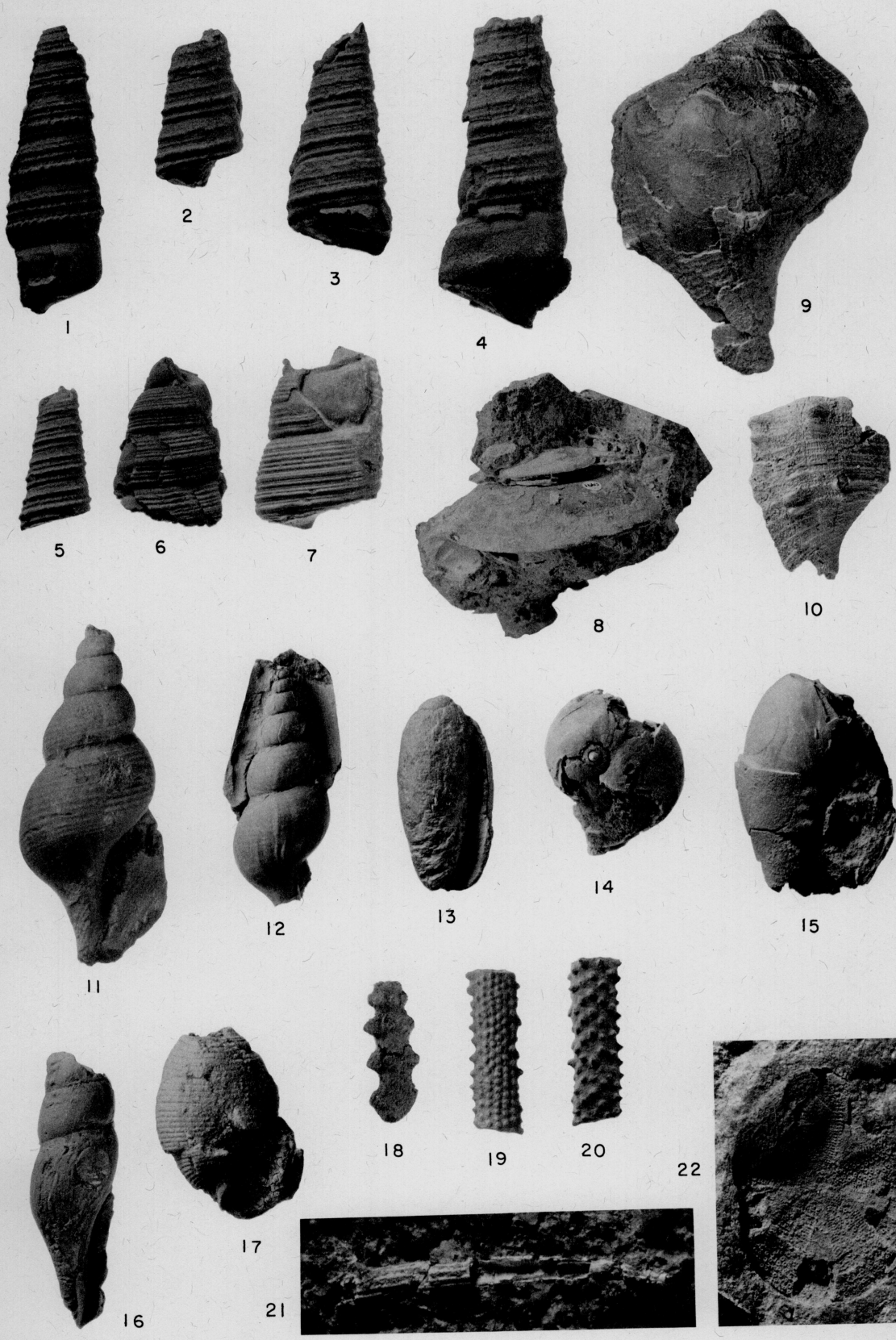
(*Explanation of Plate 7 is on following page*)

EXPLANATION OF PLATE 7

FIGS. *1–5*—*Turritella cooperi* Carpenter, ×2, CIT locality 1849, showing variability in sculpture.
6,7—*Turritella* aff. *T. freya* Nomland, ×2, CIT locality 1849.
8—*Trochita* cf. *T. trochiformis* (Born), ×0.5, CIT locality 1663; body whorl preserved as internal mold with only a small amount of shell preserved; infilled and bored apex visible above.
9,10—*Fiscus* (*Trophosycon*) *ocoyana* (Conrad); *9*, ×1, CIT locality 279, typical form; *10*, ×1, CIT locality 2069, specimen approaching variety *contignata* in sculpture.
11,12—*Anomalosipho* sp., CIT locality 1671; *11*, ×2, *12*, ×1.
13—*Oliva spicata* (Röding), ×1, CIT locality 230.
14,15—*Marginella* cf. *M. albuminosa* Dall, ×1.5, CIT locality 2069; lateral and apical views of same specimen.
16—*Antiplanes* sp., ×0.5, CIT locality 1849.
17—*Acteon* cf. *A. boulderana* Etherington, ×2, CIT locality 2093.
18–20—Cidarid spines; *18*, ×2, CIT locality 2069, spine with annular nodes; *19*, *20*, ×2, CIT locality 2094, opposite sides of single specimen.
21—*Dentalium* sp., ×2, CIT locality 1670.
22—*Astrodapsis fernandoensis* Pack, ×1, CIT locality 1671, mold of dorsal surface.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