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No. 25

THE RECENT PECTINIDAE

BY

LEO GEORGE HERTLEIN

Assistant Curator, Department of Paleontology,
California Academy of Sciences

Eleven species of pectens are present in the collection made by the Templeton Crocker Expedition to the Galapagos Islands in 1932.

The writer wishes to express his appreciation to Mr. Templeton Crocker whose interest and generosity provided the collection. Acknowledgment is also due Dr. G. Dallas Hanna for photography of the specimens illustrated in this paper. Mr. W. M. Grant also assisted with the preparation of certain of the photographs. The author also acknowledges the kindness of Dr. Alexander Wetmore, Assistant Secretary, Smithsonian Institution, who furnished photographs of certain specimens in the U. S. National Museum.

The genus *Pecten* is attributed to Müller whose valid usage of the name is rather generally accepted. The type species is *Ostrea maxima* Linnaeus. A few authors have accepted Osbeck's¹ usage as valid, but that author's use of the name has been discussed by Dall², Iredale³, and by Winckworth⁴, all of whom rejected it.

It is not definitely known what species was represented by Osbeck's reference to "*Pecten adscensionensis*." Iredale suggested it might even be a *Spondylus*, and Winckworth suggested it might be *Spondylus powelli* Smith. Under the circumstances it seems far better to accept Müller as the author of the genus *Pecten*.

¹ See Grant IV, U. S., and H. R. Gale, Mem. San Diego Soc. Nat. Hist., vol. 1, 1931, pp. 157, 158.

² Dall, W. H., Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 400.

³ Iredale, T., Trans. New Zealand Inst., vol. 49, pt. 3, 1915, p. 194.

⁴ Winckworth, R., Jour. Conch., vol. 20, no. 2, 1934, p. 51.

Pecten (Pecten) diegensis Dall

Plate 19, figures 5, 6

Pecten floridus Hinds, Zool. Voy. *Sulphur*, Moll., pt. 3, 1844 [dated January, 1845 on cover of pt. 3], p. 60, pl. 17, figs. 6, 6a. "Inhab. San Diego, California. In five fathoms among mud."

Not *Ostrea* [= *Pecten*] *florida* Gmelin, Linn. Syst. Nat., Ed. 13, vol. 1, pt. 6, 1790, p. 3330. "Habitat . . .". (Reference given to Gaultieri, Test., T. 74, f. Q.).—Kobelt, Syst. Conchyl.-Cab., Bd. 7, Abt. 2, *Spondylus* und *Pecten*, 1887, p. 212, Taf. 57, fig. 2. Earlier record cited.

Pecten (Pecten) diegensis Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, 1898, p. 710. New name for *P. floridus* Hinds, not *Ostrea* [= *Pecten*] *florida* Gmelin.—Arnold, U. S. Geol. Survey, Prof. Paper 47, 1906, p. 127, pl. 51, figs. 1, 1a, 1b. Pleistocene at San Diego, California. Recent from Monterey to San Diego, California.—I. S. Oldroyd, Stanford Univ. Publ., Univ. Ser. Geol. Sci., vol. 1, no. 1, 1924, p. 51, pl. 29, fig. 5; pl. 41, fig. 3.

Range: Monterey Bay, California to the San Benito Islands, Lower California. Fossil in the Pleistocene.

A fragment of the right valve of *Pecten diegensis* was dredged by the Templeton Crocker Expedition at Loc. 27603 (C. A. S.) in 30 to 50 fathoms off San Nicolas Island, California. Mr. H. N. Lowe has collected the species at San Benito Islands, Lower California, at a depth of 10 fathoms.

The stronger, squarer and slightly narrower ribs and the slightly narrower interspaces on the right valve, and the strongly rounded, and more closely spaced ribs in the adult stage of the left valve, separate this species from the more southern *P. sericeus* Hinds. The ribs and interspaces of *P. diegensis* are crossed by imbricating lamellae.

The smaller number and greater height of the ribs and the relatively longer hinge line separate *P. diegensis* from *P. stearnsii* Dall which occurs in the Pliocene. Related forms which occur as fossils, include *P. beali* Hertlein, *P. bösei* Hanna & Hertlein, and *P. bakeri* Hanna & Hertlein. The last two forms are quite distinct and not synonymous as indicated by Grant and Gale. Bavay⁵ has mentioned a similarity between *P. diegensis* and a fossil form found in Patagonia.

Pecten soror codercola Harris⁶ from the later Tertiary of Venezuela, belongs to the present group. *P. soror* Gabb⁷ from the medial Tertiary of Santo Domingo, and *P. hemicyclus* Ravenel⁸ from the

⁵ Journ. de Conchyl., vol. 54, no. 1, 1906, p. 10.

⁶*Pecten soror codercola* Harris, Bull. Amer. Paleol., vol. 13, Bull. 49, 1927, p. 23, pl. 13, fig. 3; pl. 14, figs. 1, 5; pl. 15, fig. 7. "Districts of Democracia and Colina, State of Falcón, locality numbers 69, 123." Venezuela. "Miocene and Pliocene."

⁷*Janira soror* Gabb, Trans. Amer. Phil. Soc., vol. 15, 1873, p. 257. Santo Domingo.

Pecten soror Gabb, Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, vol. 73, pt. 2, 1922, p. 410, pl. 44 figs. 1, 2.

⁸*Janira hemicycla* Ravenel, in Tuomey & Holmes, Pleiocene Fossils of South-Carolina, 1857, p. 25, pl. 8, figs. 1, 2, 3, 4. "Grove, Cooper River."

Pecten (Chlamys) kathrinepalmærae Tucker, (Proc. Indiana Acad. Sci., vol. 40, 1931, p. 244, pl. 1, figs. 2, 5. "Near Baileys Ferry, Fla." "Chipola Miocene.") has been compared to *P. hemicyclus*, by Tucker.

later Tertiary of South Carolina, also bear some resemblance to the present group.

P. diegensis shows some resemblance to *P. fraterculus* Sowerby of the *P. besseri* group, which occurs in the later Tertiary of the Mediterranean region.

Pecten (Pecten) sericeus Hinds

Plate 18, figures 14, 15; plate 19, figures 3, 4

Pecten sericeus Hinds, Zool. Voy. *Sulphur*, Moll., pt. 3, 1844 [dated January, 1845 on cover of pt. 3], p. 60, pl. 17, figs. 1, 1a. "Inhab. Bay of Panama. In fifty fathoms, on a muddy floor."—Reeve, *Conch. Icon.*, vol. 8, *Pecten*, 1852, sp. 23, pl. 5, fig. 23. "Bay of Panama (on a muddy floor at the depth of fifty-three fathoms); Belcher."—Kobelt, *Syst. Conchyl.-Cab.*, Bd. 7, Abt. 2, *Spondylus* und *Pecten*, 1887, p. 211, Taf. 57, fig. 1. Original record cited.—Dall, *Bull. Mus. Comp. Zool.*, vol. 43, no. 6, 1908, p. 400. "Panama Bay, 53 fathoms, Hinds." Also "near Cocos Island, Gulf of Panama, in 66 fathoms, rocky bottom, temperature 58°.4F."

Not *Pecten sericeus* Verneuil, Keyserling, *Wissenschaftliche Beobachtungen auf einer Reise in das Petschora-Land, im Jahre 1843*, (St. Petersburg), 1846, p. 246, Tab. 10, fig. 12. "Aus den Permischen Schichten im grauen Mergelkalke an der Uchta des Wymm, und im Kalksteine am Wel bei dem Dorfe Kischerma." (= *Avicula sericea* Verneuil, in Murchison, Verneuil & Keyserling, *Geol. Russia*, vol. 2, Aug. 1845, p. 321, Tab. 20, fig. 5.)

Not *Pecten sericeus* Grönwall & Harder, *Danmarks Geol. Undersøg.*, ser. 2, vol. 18, 1907, p. 28.—Ravn, *Mem. l'Acad. Roy. Sci. et Lett. Danemark*, Copenhagen, Sect. Sci., ser. 9, vol. 5, no. 2 (D. Kgl. Danske Vidensk. Selsk. Skrifter, Naturv. og Math., Afd. 9, Række 5, No. 2), 1933, p. 20. Denmark. Danian, upper Cretaceous.

Range: Panama to Acapulco and Mazatlan, Mexico. Cocos Island; Lat. 23° 03' to 23° 06' N., Long. 109° 31' to 109° 36' W.; and Maria Madre Island, Tres Marias Group, Mexico.

Templeton Crocker Expedition:

Loc. 27527 (C. A. S.), dredged in Acapulco Bay, Mexico.

Loc. 27584 (C. A. S.), dredgings about 10 miles due east of San Jose del Cabo, Lower California, Lat. 23° 03' to 23° 06' N., Long. 109° 31' to 109° 36' W. 20-220 fathoms.

Also in the collections of the California Academy of Sciences:

Loc. 23779 (C. A. S.), off Maria Madre Island, Tres Marias Group, Mexico, in five to ten fathoms. G. D. Hanna & E. K. Jordan, colls.

Loc. 27202 (C. A. S.), dredged in Acapulco Bay, Mexico. L. G. Hertlein, coll.

Loc. 27223 (C. A. S.), Mazatlan, Sinaloa, Mexico. L. G. Hertlein, coll.

The shell of *P. sericeus* resembles that of *P. diegensis* Dall. The right valve is usually somewhat less brightly colored than the left. The ribs on the right valve are somewhat lower and broader and separated by slightly wider interspaces than those of *P. diegensis* Dall. Young specimens of the two species are very similar. The development of stronger, narrower and more squarish ribs, crossed by sharp, concentric, raised lines, appears to take place earlier on the right valve of *P. diegensis* than on *P. sericeus*. According to Reeve, the ribs on the large left valve of the type specimen of *P. sericeus* are sharply triangular. The specimens of *P. sericeus*, at hand, are small forms, and the ribs on the left valves are not especially triangular, but they are less prominent and wider spaced than those on *P. diegensis*. In very large specimens of *P. diegensis*, the ribs on the left valve show a slight tendency toward a triangular shape in the later stages of growth.

It seems probable that *P. sericeus*, a southern species, intergrades with the northern *P. diegensis*.

The single, small valves found at Locs. 23779 (C. A. S.), from Maria Madre Island, Mexico, and 27223 (C. A. S.), Mazatlan, Mexico, seem referable to *P. sericeus* rather than to *P. diegensis*.

Pecten (Pecten) vogdesi Arnold

Plate 19, figures 16, 17

Pecten dentatus G. B. Sowerby, Proc. Zool. Soc. London, 1835, p. 109. "*Hab. ad Sanctam Elenam.*" "Among sand and stones in twelve fathoms."—Kobelt, Syst. Conchyl.-Cab. Bd. 7, Abt. 2, *Spondylus* und *Pecten*, 1887, p. 155, Taf. 44, figs. 1, 2. Original record cited.—Olsson, Nautilus, vol. 37, no. 4, 1924, p. 127. "Lobitos," Peru. "Salinas," Ecuador.

Not *Pecten dentatus* J. Sowerby, Miner. Conch. Great Britain, vol. 6, 1829, p. 143, Tab. 574, fig. 1. Fossil at "Bugbrook and Staverton, in Northamptonshire."

Pecten (Pecten) excavatus Anton, Arnold, U. S. Geol. Survey, Prof. Paper 47, 1906, p. 134, pl. 46, figs. 1, 1a, 1b. Gulf of California. Recent.

Not *Pecten excavatus* Anton, Verzeich. der Conchyl., 1839, p. 19, no. 710. China.

Pecten (Pecten) vogdesi Arnold, U. S. Geol. Survey, Prof. Paper 47, 1906, p. 100, pl. 33, figs. 1, 1a; pl. 34, fig. 1, "San Pedro formation (Pleistocene), San Pedro, Los Angeles County Calif." Also other localities.

Pecten (Euvola) cataractes Dall, Nautilus, vol. 27, no. 11, p. 121, 1914. New name for *P. dentatus* G. B. Sowerby, not *P. dentatus* J. Sowerby.

Pecten (Janira) vogdesi Arnold, Grant & Gale, Mem. San Diego Soc. Nat. Hist., vol. 1, 1931, p. 228, pl. 3, figs. 3a, 3b.

Range: Magdalena Bay, Lower California; Gulf of California and south to Paita, Peru. Pliocene and Pleistocene of California and Lower California.

Templeton Crocker Expedition:

Loc. 27581 (C. A. S.), between Isabel Island and Mazatlan, Mexico.

Loc. 27584 (C. A. S.), dredged about 10 miles due east of San Jose del Cabo, Lower California, Lat. $23^{\circ} 03'$ to $23^{\circ} 06'$ N., Long. $109^{\circ} 31'$ to $109^{\circ} 36'$ W.

Also in the collections of the California Academy of Sciences from:

Loc. 23802 (C. A. S.), San Luis Gonzaga Bay, Gulf of California.

Loc. 27229 (C. A. S.), Bahia Honda, Veragua, Panama, in three to nine fathoms. L. G. Hertlein coll.

Loc. 27827 (C. A. S.), Puerto Bellandra, Carmen Island, Gulf of California.

Loc. 23779 (C. A. S.), Maria Madre Island, Tres Marias Group, Mexico.

Pecten vogdesi is well known in the Recent fauna from Magdalena Bay, Lower California, and the Gulf of California, south to Peru.

The highly arched right valve, which is ornamented by low rounded ribs, and the flat or concave lower valve easily distinguish this species from others in the Recent fauna of tropical North America. Exteriorly the shell is usually colored light brown or reddish brown.

The fewer ribs, and greater convexity of the right valve of *P. hartmanni* Hertlein from the Pliocene of Lower California, easily separate it from *P. vogdesi*.

P. vogdesi and *P. hartmanni* appear to belong to the *P. benedictus* group which occurs in the Miocene and Pliocene of the Mediterranean region.

***Pecten (Chlamys) amandi* Hertlein, new name**

Pecten australis Philippi, Archiv f. Naturgesch., Jahrg. 11, Bd. 1, 1845, p. 56.
"Patria: Insulae Chonos."

Not *Pecten australis* Sowerby, Thes. Conch., vol. 1, 1842, p. 76, pl. 19, figs. 210, 220.
"Swan River," Australia.

Pecten rosaceus Stempel, Zool. Jahrb., Suppl.-Bd. 6, 1902 (Fauna Chilensis), p. 228. "Fundort: Calbuco," Chile, Recent. New name for *P. australis* Philippi, not *P. australis* Sowerby.—Dall. Proc. U. S. Nat. Mus., vol. 37, 1909, p. 256. "Calbuco, Chiloë, and the Chonos Islands."

Not *Pecten rosaceus* Deshayes, Conchyl. d. l'Ile d. Réunion, 1863, p. E-31. [No description.]

Not *Pecten distortus* Da Costa var. *rosacea* Locard, Contrib. a. 1. Faune Malacol. Franc., 11, Prod. Genr. Pecten, 1888, p. 46; not *P. tigrinus* var. *rosacea* Locard, p. 117; not *P. laevis* Pennant var. *rosacea* Locard, p. 120; not *P. varius* var. *rosacea* Locard, p. 34.

Range: Calbuco; Chiloë; and the Chonos Islands (Dall).

This species is not present in the collection of the Templeton Crocker Expedition, but it is listed here because it is known farther south in the fauna of Chile and Peru. It was originally named *Pecten australis* by Philippi, but due to an earlier usage of that name by Sowerby, Stempell proposed *P. rosaceus* for Philippi's species. Stempell's name *P. rosaceus* is also preoccupied in the genus *Pecten*; therefore the name *Pecten amandi* is here proposed in honor of Dr. Rudolph Amandus Philippi⁹, in recognition of his work on the natural history of Chile.

According to Philippi, the species bears some resemblance to the Caribbean *P. ornatus* Lamarck.¹⁰

***Pecten* (*Chlamys*) *zeteki* Hertlein, new name**

Plate 19, figure 9

Pecten digitatus Hinds, Zool. Voy. *Sulphur*, Moll., pt. 3, 1844, [date on cover given as January, 1845], p. 61, pl. 17, fig. 2. "Bay of Guayaquil. In twenty-three fathoms."—Reeve, *Conch. Icon.*, vol. 8, 1853, *Pecten*, sp. 172, pl. 35, fig. 172. Hinds' record cited.—Kobelt, *Syst. Conchyl.-Cab.*, Bd. 7, Abt. 2, *Spondylus* und *Pecten*, 1888, p. 227, Taf. 60, fig. 8. Earlier record cited.—Paetel, *Cat. Conch.-Samml.*, Ed. 4. Abt. 3, 1890, p. 229 "Guayaq."—Dall, *Proc. U. S. Nat. Mus.*, vol. 37, 1909, p. 256. "Bay of Guayaquil."—Zetek, *Los Mol. Republ. Panama. Revista Nueva*, nos. 1 & 2, 1918, p. 52. Probably Panama.

Not *Pecten digitatum* Perry, *Conch.*, April, 1811, no. 2 on Expl. to pl. 55, pl. 55, fig. 2. "A native of Amboyna and the Eastern Seas."

Range: Guayaquil, Ecuador (Hinds; Reeve); probably Panama (Zetek).

This species is not present in the collection made by the Templeton Crocker Expedition. The valves of the species are said to be very similar and are ornamented by nine rounded, grooved ribs. Dall¹¹ has mentioned that probably the species is only a young specimen of *P. subnodosus* Sowerby. A comparison of young specimens of *P. subnodosus* Sowerby with Hinds' figure of *P. "digitatus,"* however, indicates that Sowerby's species has a very much larger anterior ear on the right valve and the shell is rounder in outline.

Zetek in 1918 cited the species as one which probably occurs at Panama.

⁹ See Fürstenberg, P., *Verhandl. d. Deutschen Wiss. Ver. zu Santiago de Chile*, Bd. 5, Heft 2, 1906, pp. 233-271.—Also, M. E. McLellan, *Auk*, vol. 44, 1927, pp. 158-159.

¹⁰ *Pecten ornatus* Lamarck, *Hist. Nat. Anim. s. Vert.*, vol. 6, 1819, p. 176. "Habite l'Océan Atlantique austral."—Sowerby, *Thes. Conch.*, vol. 1, *Pecten*, 1842, [the date on the title page is 1847, but according to Sherborn this part was issued prior to November, 1842.] p. 72, pl. 14, figs. 77, 78, 79. "Atlantic Ocean."—Reeve, *Conch. Icon.*, vol. 8, *Pecten*, 1873, sp. 68, pl. 19, fig. 68. "Hab. Barbados."—Maury, *Bull. Amer. Paleo.*, vol. 8, Bull. 34, 1920, p. 59 (27). North Carolina to Brazil.

Pecten (*Chlamys*) *ornatus* Lamarck, Dall, *Nautilus*, vol. 38, no. 4, 1925, p. 118 [but probably not all of his synonymy].

¹¹ Dall, W. H., *Nautilus*, vol. 27, no. 11, March, 1914, p. 122.

Dautzenberg and Bavay¹² have pointed out the great resemblance between *P. digitatus* Hinds and *P. vexillus* Reeve.¹³ The only differences noticed by them, in the two species, were the slightly less height of the shell, and the presence of nine ribs in Hinds' species rather than ten in *P. vexillus*.

Possibly the locality "Bay of Guayaquil," given by Hinds for *P. digitatus*, is incorrect, although that is not definitely known. *P. vexillus* Reeve is known from New Caledonia, Nouméa, Island of Nou, Lifou, Madagascar, and the Philippine Islands.

Dautzenberg and Bavay pointed out that *P. distans* Reeve (not Lamarck), which was renamed *P. janus* Montrouzier¹⁴ (not Münster), can be considered to be a synonym of *P. vexillus* Reeve. The true *P. distans* of Lamarck¹⁵ is considered to be a variety of *P. glaber* Linnaeus, a Mediterranean species.

The name *Pecten digitatus* Hinds, is preoccupied by the earlier usage by Perry. In view of the conflicting evidence regarding this form, the name *zeteki* is substituted for the species described by Hinds.

Possibly this species could be included in the subgenus *Decadopen* Rüppell in Sowerby.

Pecten (*Chlamys*) *hastatus* Sowerby

Pecten hastatus Sowerby, Thes. Conch., vol. 1, 1842, [the date on the title page is 1847, but according to Sherborn this part was issued prior to November, 1842.], p. 72, pl. 20, fig. 236. [No locality given.]—Kobelt, Syst. Conchyl.-Cab., Bd. 7, Abt. 2, *Spondylus* und *Pecten* 1888, p. 233, Taf. 62, figs. 1, 2. Northwest coast of North America.

Pecten (*Chlamys*) *hastatus* Sowerby, Arnold, U. S. Geol. Survey, Prof. Paper 47, 1906, p. 108, pl. 41, fig. 4; pl. 42, figs. 1, 1a, 2, 2a. Pliocene and Pleistocene. Recent, from Quatsino Sound, British Columbia to San Diego, California.—I. S. Oldroyd, Stanford Univ. Publ., Univ. Ser. Geol. Sci., vol. 1, no. 1, 1924, p. 53, pl. 29, figs. 1, 3. Monterey Bay to San Pedro, California.

¹² Dautzenberg, P., & A. Bavay, *Siboga-Expeditie*, Mon. 53b, Les Lamellibranches de L'Expédition du *Siboga*, Partie Syst. 1, Pectinidés, 1912, p. 26.

¹³ *Pecten vexillum* Reeve, Conch. Icon., vol. 8, *Pecten*, May, 1853, sp. 114, pl. 27, figs. 114a, 114b. "Hab. —?"

Pecten (*Pallium*) *vexillum* Reeve, Dautzenberg & Bavay, *Siboga-Expeditie*, Mon. 53b, 1912, p. 26. "Nouvelle Calédonie (Marie, Rossiter), Nouméa (Bougier, Culliéret, Rossiter), Ile Nou (Bougier), Lifou (Musée de Boulogne), Philippines (collect. Bavay)."

Chlamys vexillum Reeve, Dautzenberg, Journ. de Conchyl., vol. 76, no. 1, 1932, p. 91. "Diego-Suarez," Madagascar. Recent.

¹⁴ *Pecten distans* Lamarck, Reeve, Conch. Icon., vol. 8, *Pecten*, February, 1853, sp. 49, pl. 13, fig. 49. "Hab. Philippine Islands; Cumings."

Pecten janus Montrouzier in Fischer, Journ. de Conchyl., vol. 7, (ser. 2, vol. 3), 1858, p. 340. "Hab. Ile Art. C. C." Caledonian Archipelago.—Lischke (Jap. Meeres-Conchyl., Bd. 2, 1871, p. 159) pointed out that *P. janus* Montrouzier = *P. distans* cited by Reeve, not *P. distans* Lamarck.

Not *P. janus* Münster in G. A. Goldfuss, Petref. Germaniae, Bd. 2 (pt. 4), 1833, p. 62. "Findet sich im tertiären Sande zu Baden bei Wien."

¹⁵ *Pecten distans* Lamarck, Hist. Nat. Anim. s. Vert., vol. 6, 1819, p. 169. "Habite l'Océan atlantique."—See also Bucquoy, Dautzenberg & Dollfus, Moll. Marins du Roussillon, vol. 2, fasc. 3, 1889, p. 88.

Range: Monterey to San Pedro, California. Also fossil in the Pliocene and Pleistocene.

A single left valve of *Pecten hastatus* was dredged by the Templeton Crocker Expedition at Loc. 27603 (C. A. S.), at the west end of San Nicolas Island, California, in 30 to 50 fathoms. *P. hastatus* is known from Pliocene to Recent.

The right valve is characterized by about nine pairs of strongly individualized ribs which are ornamented by prominent spines. There are nine narrow, prominent spiny ribs on the left valve. The right valve of the northern species, *hericius*, is ornamented by fascicules of three spiny riblets which are nearly equal, although the central riblet is slightly more prominent and spiny; while in *P. hastatus* there is a central spiny rib, with from two to four small scaly riblets between the major rib and the central riblet of the interspace.

P. hericius pugetensis I. S. Oldroyd,¹⁶ is close to *P. hericius* but it is a smaller form; it has fewer ribs, a broader, anterior ear on the right valve, and the notch on the anterior ear of the left valve is less developed. It has been recorded from Puget Sound, and it has been collected at Craig, and at Ketchikan, in southeastern Alaska by Mr. George Willett of Los Angeles, California.

A subspecies, *P. hastatus* var. *ingeniosa* Yokoyama,¹⁷ has been described from the Pliocene of Japan. *P. hindsii* Carpenter is also related to *P. hastatus* but is easily distinguished by the character of the ribbing.

Vaillant's record of Recent *P. hastatus* from Suez, which was referred to *P. laetus* by Fischer, has been referred by Lamy,¹⁸ who studied the original specimens, to *P. squamosa* var. *decoriata* Jousseaume.

***Pecten (Chlamys) lowei* Hertlein, new species**

Plate 19, figures 1, 2, 7, 8

Shell moderately small, nearly equivalve, higher than long. Right valve with the exterior surface ornamented with 20 to 22 roundly triangular ribs; the ribs are crossed by strong imbricating lamellae which are fused to form a row of spinose nodes on the top of each rib; toward the ventral margin traces of small riblets appear on each side of the major ribs about halfway between the tops of the ribs and the bottoms of the interspaces; interspaces narrower than the ribs and in each, a

¹⁶ *Pecten islandicus pugetensis* I. S. Oldroyd, Nautilus, vol. 33, no. 4, April, 1920, p. 136, pl. 4, figs. 5, 6. —I. S. Oldroyd, Stanford Univ. Publ., Univ. Ser. Geol. Sci., vol. 1, no. 1, 1924, p. 55, pl. 12, figs. 4, 5. "Type locality, off San Juan Island, Washington." Puget Sound.

Pecten (Pecten) hastatus Sowerby var. *pugetensis* I. S. Oldroyd, Grant & Gale, Mem. San Diego Soc. Nat. Hist., vol. 1, 1931, p. 168. Type locality cited. Also ? middle Pliocene, southeast of Pico Canyon, Los Angeles County, California.

¹⁷ Imper. Geol. Survey of Japan, Rept. 104, 1929, p. 5, pl. 6, fig. 2. "near Nanao." Pliocene.

¹⁸ Lamy, E., Bull. Mus. d'Hist. Nat., vol. 34, 1928, no. 2, p. 170.—See also Cox, Proc. Malacol. Soc. London, vol. 18, pt. 5, 1929, p. 204.

Lischke (Jap. Meer. Conch., Th. 2, 1871, pp. 157-158) also pointed out that the Red Sea species could not be *P. laetus* Gould.

spinose riblet is present. Ears unequal, the anterior ear large, ornamented by about four to five riblets which are crossed by imbricating spines; a distinct byssal notch is present and a ctenolium consisting usually of four to five spines; posterior ear very small and ornamented by four to six spinose riblets. Left valve ornamented similarly to right; anterior ear with eight to ten spinose riblets, while on the posterior ear there are four to six riblets. The color in the living shells is generally gray toward the umbos flecked with brown spots, but grading to brown toward the ventral margin. Some specimens are reddish or orange brown. Type specimen, altitude 13.8 mm.; longitude 11.5 mm.; diameter of both valves 4.5 mm.

Range: Gulf of California; Galapagos Islands. ?Catalina Island, California.

Holotype: No. 6878 (Mus. Calif. Acad. Sci. Paleo.); paratype, No. 6879 (Mus. Calif. Acad. Sci. Paleo.), and paratypes in H. N. Lowe collection, from **Carmen Island, Gulf of California**, from a depth of 20 fathoms; H. N. Lowe collector.

In the Lowe collection there were eight paired valves from Carmen Island and 16 unpaired valves of *P. lowei* from Angel de la Guardia Island in the Gulf of California; there are three specimens with paired valves from Loc. 27587 (C. A. S.) in the collection made by the Templeton Crocker Expedition, off Cape San Lucas, Lower California, in 20 to 25 fathoms; one left valve from Loc. 27232 (C. A. S.) was collected on the Hancock Expedition by L. G. Hertlein at Conway Bay, Indefatigable Island, Galapagos Group. A single worn valve of this species in the collection at Stanford University came from Tagus Cove, Albemarle Island, Galapagos Group. One left valve is present from Loc. 25610 (C. A. S.), said to have been dredged on the north side of Catalina Island, California, in 30 to 80 fathoms. There seems no reason to doubt this locality, although the range is longer than that of most west American pectens. The characters of the new species are rather constant in all the specimens, the largest of which attains an altitude of 14.5 mm.

Pecten lowei is very close to *Pecten sancti-ludovici* Anderson & Martin¹⁹ from the upper Miocene Santa Margarita formation of San Luis Obispo County California, and from the Pliocene of Alverson Cañon, Imperial County, California. Possibly the species here described as new, may be a living *P. sancti-ludovici* but on the adult fossil form there are three beaded riblets ornamenting the ribs and three in the interspaces. From the specimens of *P. sancti-ludovici* at hand, it appears that the development of the beaded riblets takes place earlier than on the corresponding forms of equal size in *P. lowei*. Furthermore *P. lowei* has much smaller posterior ears.

P. collazoensis Hubbard²⁰ from the Miocene of Porto Rico,

¹⁹ *Pecten sancti-ludovici* Anderson & Martin, Proc. Calif. Acad. Sci., ser. 4, vol. 4, December 30, 1914, p. 55, pl. 3, figs. 10a, 10b. . . . "from the Santa Margarita formation along the west side of the San Juan River about one half mile above the mouth of Navajoa Creek, northeastern San Luis Obispo County, California."—G. D. Hanna, Proc. Calif. Acad. Sci., ser. 4, vol. 14, no. 18, 1926, p. 473, pl. 22, figs. 1, 2, 3, Coral reef of Alverson Cañon, Imperial County, California. Pliocene.

²⁰ *Pecten (Chlamys) collazoensis* Hubbard, New York Acad. Sci., Sci. Surv. Porto Rico and the Virgin Islands, vol. 3, pt. 2, 1920, p. 87, pl. 11, fig. 1, "Collazo Falls", "Lower? San Sebastian shale," Porto Rico. Referred to lower Oligocene.

appears to have somewhat similar sculpture, but the scales on the ribs are apparently not fused into small spinose nodes as in *P. lowei*, and the form from Porto Rico has much larger posterior ears. Several species in the Miocene of the Caribbean region have ornamentation similar to *P. sancti-ludovici*.

P. sancti-ludovici resembles closely *P. plurinominis* Pilsbry & Johnson,²¹ from the Miocene of Santo Domingo. The subspecies *Pecten plurinominis morantensis* Woodring²² from the Bowden Miocene, has also been questionably recorded by Trechtmann²³ from beds referred to the Pliocene, on St. Kitts Island in the West Indies.

Pecten oxygonus optimus Brown & Pilsbry²⁴ from the Miocene of Costa Rica and Panama and *P. oxygonus canalis* Brown & Pilsbry²⁵ from the Miocene of Panama, possess shells in which the ribs and interspaces are ornamented by spinose beaded riblets. In the Miocene of Venezuela, *P. buchivacoanus* F. & H. Hodson,²⁶ *P. buchivacoanus maracaibensis* F. & H. Hodson,²⁷ and *P. buchivacoanus falconensis* F. & H. Hodson,²⁸ likewise possess spiny beaded riblets. *P. hodgii* Hubbard,²⁹ from the Miocene of Porto Rico, has squarer ribs than *P. sancti-ludovici*.

Pecten exasperatus Sowerby,³⁰ now living in the Caribbean region has ornamentation similar to *P. sancti-ludovici* and others of that group.

²¹ *Pecten plurinominis* Pilsbry & Johnson, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, September, 1917, p. 193. New name for *P. oxygonum* Sowerby, Gabb, Trans. Amer. Phil. Soc., vol. 15, 1873, p. 256. Not *P. oxygonum* Sowerby, Quart. Jour. Geol. Soc., vol. 6, 1850, p. 52. San Domingo. Tertiary.—Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, vol. 73, pt. 2, 1922, p. 411, pl. 45, figs. 1, 2. Gabb's collection from Santo Domingo. [According to Gardner (U. S. Geol. Survey, Prof. Paper 142-A, 1926, p. 46) "*Pecten pleurininominis* Woodring = *P. thetidus* Dall."]

²² *Chlamys* (*Aequipecten*) *plurinominis morantensis* Woodring, Carnegie Inst. Washington, Publ. 366, May, 1925, p. 67, pl. 8, figs. 4, 5. Bowden, Jamaica. Miocene.

²³ *Chlamys* (*Aequipecten*) cf. *plurinominis* Woodring, Trechtmann, Geol. Mag., vol. 69, no. 816, 1932, pp. 249, 253, pl. 15, fig. 3. Brimstone Hill, St. Kitts Island. Pliocene.

²⁴ *Pecten oxygonum optimum* Brown & Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, vol. 64, January 30 1913, p. 511, pl. 24 [cited in text as pl. 23], fig. 2. "Reventazon River, Costa Rica." [Miocene]. (= *P. paranensis* d'Orbigny, Gabb. Not *P. Paranensis* d'Orbigny). This species has been recorded from the Miocene of Lower California by Dickerson (Proc. Calif. Acad. Sci., ser. 4, vol. 7, no. 8, 1917, p. 202.—Bull. Geol. Soc. Amer., vol. 28, 1917, p. 231) and by Clark & Arnold (Bull. Geol. Soc. Amer., vol. 28, 1917, p. 224). According to Woodring (Carnegie Inst. Washington, Publ. 385, 1928, p. 95) Dickerson's record probably refers to *P. canalis* Brown & Pilsbry.

²⁵ *Pecten oxygonum canalis* Brown & Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, vol. 64, January 30, 1913, p. 511, pl. 24 [cited in text as pl. 23], fig. 3. "Tower N, Culebra Cut, Canal Zone."

²⁶ *Pecten* (*Chlamys*) *buchivacoanus* F. & H. Hodson, Bull. Amer. Paleo., vol. 13, Bull. 49, October 1927, p. 29, pl. 16, figs. 6, 8, 10, 11. "Districts of Buchivacoa, Miranda and Petit, State of Falcón", Venezuela. "Oligocene." [Probably Miocene].

²⁷ *Pecten buchivacoanus maracaibensis* F. & H. Hodson, Bull. Amer. Paleo., vol. 13, Bull. 49, October, 1927, p. 30, pl. 17, fig. 6. "Districts of Democracia, Miranda, Colina and Acosta, State of Falcón", Venezuela. "Miocene."

²⁸ *Pecten buchivacoanus falconensis* F. & H. Hodson, Bull. Amer. Paleo., vol. 13, Bull. 49, October, 1927, p. 31, pl. 17, figs. 2, 3, 4, 5, 7. "Common in the state of Falcón", Venezuela. "Miocene."

²⁹ *Pecten* (*Chlamys*) *hodgii* Hubbard, New York Acad. Sci., Sci. Surv. Porto Rico and the Virgin Islands, vol. 3, pt. 2, 1920, p. 93, pl. 12, fig. 5. "Quebradillas limestone (rare)", Porto Rico. Referred to upper Oligocene. [Probably Miocene].

³⁰ *Pecten exasperatus* Sowerby, Thes. Conch., vol. 1, *Pecten*, 1842 [on title page date given as 1847, but according to Sherborn, this part was issued prior to November, 1842], p. 54, pl. 18, figs. 183 to 186. "Medi-

Pecten coccymelus Dall³¹ bears only a general resemblance to *P. lowei*, and has much narrower ribs, wider interspaces and a larger posterior ear, as well as differing in details of ornamentation.

Pecten varius Linnaeus,³² common in northern Europe and in the Mediterranean region, possesses more ribs and lacks the interribs which are present in *P. lowei*.

This new species is named for Mr. Herbert N. Lowe, of Long Beach, California, in recognition of his work on west American mollusks.

***Pecten (Plagioctenium) circularis* Sowerby**

Pecten tumidus Sowerby, Proc. Zool. Soc. London, 1835, p. 109. "*Hab.* ad Sanctam Elenam et ad Salango, Columbiae Occidentalis." "Found in sandy mud at from six to ten fathoms.—G. B. S."

Not *Pecten tumidus* Turton, Conch. Insul. Brit., 1822, p. 212 "Taken from the *Serpula tubularia*, in Torbay." (= *Ostrea tumida* Turton, Conch. Dict., 1819, p. 132).

Not *Pecten tumidus* Hartmann in C. H. v. Zieten, Petrif. Wurt., (9), 1833, p. 68.

Not *Pecten tumidus* Dujardin, Mem. Soc. Geol. France, II (2), 1832, p. 214 [according to Sherborn].

Pecten circularis Sowerby, Proc. Zool. Soc. London, 1835, p. 110. "*Hab.* ad Sinum Californiae (Guaymas)." "Found in sandy mud at a depth of seven fathoms.—G. B. S."—Li, Bull. Geol. Soc. China, vol. 9, no. 3, 1930, p. 254, pl. 2, figs. 9, 9a. Bay of Panama, Recent.

Not *Pecten circularis* Goldfuss, Petref. Germaniae, Bd. 2 (pt. 5), 1836, p. 76, pl. 99, figs. 10a, 10b. "Ex arena viridi Westphaliae." Cretaceous.

Pecten ventricosus Sowerby, Thes. Conch., vol. 1, 1842 [the date on the title page is 1847, but according to Sherborn this part was issued prior to November, 1842], *Pecten*, p. 51, pl. 12, figs. 18, 19, 26. "St. Elena" [The record from the Philippines is erroneous]. New name for *P. tumidus* Sowerby, not *P. tumidus* Turton, nor *P. tumidus* Zieten, 1830.—Reeve, Conch. Icon., vol. 8, *Pecten*, 1852, sp. 31, pl. 7, figs. 31a, 31b. Earlier records cited.—Küster, Syst. Conchyl.-Cab., Bd. 7, Abt. 2, *Spondylus* und *Pecten*, 1859, p. 100, Taf. 28 [plate 28 issued 1858], figs. 1, 2. "West-Columbia." [Fig. 3 is referred to *P. ventricosus* in the text, but in the explanation to the plate it is referred to *P. gibbus*, which it apparently represents.]—Olsson, Nautilus, vol. 37, no. 4, 1924, p. 128. "Negritos, Lobitos, Mancora, Zorritos," Peru. "Salinas," Ecuador.

Pecten (Dentipecten) circularis Sowerby, Kobelt, Syst. Conchyl.-Cab., Bd. 7, Abt. 2, *Spondylus* und *Pecten*, 1887, p. 188, Taf. 51, figs. 5, 6, 7, 8. California to Mazatlan, Mexico.

terranean." [Locality erroneous].—Reeve, Conch. Icon., vol. 8, *Pecten*, 1852, sp. 7, pl. 2, figs. 7, 8a, 8b; pl. 26, fig. 108; pl. 29, fig. 127. [pls. 26 and 29 issued in 1853]. "*Hab.* Island of St. John, West Indies."—Brown & Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, vol. 65, 1913, p. 496. "Oyster-shell Layers from the Black swamp near Mount Hope", Isthmus of Panama. Pleistocene.—Maury, Bull. Amer. Paleo., vol. 8, Bull. 34, 1920, p. 59 (27) Cape Hatteras to Guadalupe Island; also Yucatan Strait. Pliocene to Recent. It has also been reported from the Bermuda Islands and Porto Rico. Also fossil at Barbados Island.

³¹ *Pecten (Chlamys) coccymelus* Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, 1898, p. 741, pl. 34, fig. 1. "Miocene of Plum Point, Maryland; Clark."—Glenn, Maryland Geol. Survey, Miocene, 1904, p. 374, pl. 99, fig. 3. Several localities in the Calvert formation, Maryland. Miocene.

³² It is interesting to note that Dautzenberg has recorded this species from the coast of Venezuela. (Mem. Zool. Soc. France, vol. 13, 1900, p. 224). "Golfe de Maracaibo, Stn. 39; ile Tortuga, Stn. 36."

Pecten (*Plagiectenium*) *circularis* Sowerby, Arnold, U. S. Geol. Survey, Prof. Paper 47, 1906, p. 125, pl. 42, figs. 3, 4, 5, 6; pl. 44, figs. 6, 6a, 6b, 7. Pliocene and Pleistocene. Recent from the Gulf of California to Santa Elena, Ecuador.

Pecten cf. *circularis* Sowerby, Li, Bull. Geol. Soc. China, vol. 9, no. 3, 1930, p. 255, pl. 1, fig. 8. Bay of Panama. "Probably Gatun formation." [According to Pilsbry, (Proc. Acad. Nat. Sci. Philadelphia, vol. 83, 1931, p. 429) "Two right valves of *P. ventricosus* Sowb."]

Pecten filitextus Li, Bull. Geol. Soc. China, vol. 9, no. 3, 1930, p. 255, pl. 2, fig. 10. Panama Bay. "Probably Gatun formation." [According to Pilsbry (Proc. Acad. Nat. Sci. Philadelphia, vol. 83, 1931, p. 429) "a left valve of *Pecten ventricosus* Sowb., in which the fine sculpture is well preserved."]

Pecten purpuratus Lamarck, Pilsbry & Lowe, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, 1932, p. 139. "San Juan del Sur and Montijo Bay." "Taboga Island." "Corinto." [Not *P. purpuratus* Lamarck.]

For further synonymy of *P. circularis*, see Arnold, 1906, and E. K. Jordan & Hertlein, (Proc. Calif. Acad. Sci., ser. 4, vol. 15, no. 14, 1926, p. 439). See also remarks by Grant & Gale (Mem. San Diego Soc. Nat. Hist., vol. 1, 1931, p. 218).

Range: Monterey, California to Paita, Peru (Dall). Fossil in Pliocene and Pleistocene.

This well known species was collected at a number of localities by the Templeton Crocker Expedition.

Loc. 27527 (C. A. S.), dredged in Acapulco Bay, Mexico.

Loc. 27557 (C. A. S.), dredged between Punta Arenas and Bat Island, just off Punta Arenas, Costa Rica.

Loc. 27566 (C. A. S.), dredged in 35 fathoms in Lat. $14^{\circ} 15' N.$, Long. $92^{\circ} 28' W.$

Loc. 27568 (C. A. S.), dredged in 35 fathoms in Lat. $14^{\circ} 52' N.$, Long. $93^{\circ} 04' W.$

Loc. 27569 (C. A. S.), dredged in 28 fathoms in Lat. $15^{\circ} 40' N.$, Long. $93^{\circ} 49' W.$

Loc. 27571 (C. A. S.), dredged in Lat. $16^{\circ} 38' N.$ to $16^{\circ} 39' N.$, Long. $99^{\circ} 24' 30''$ to $99^{\circ} 27' 30'' W.$

Loc. 27580 (C. A. S.), dredged one-half mile east of Isabel Island, between Isabel Island and Mazatlan, Mexico.

Loc. 27581 (C. A. S.), dredged between Isabel Island and Mazatlan, Mexico.

Loc. 27583 (C. A. S.), dredged in 10-17 fathoms, Lat. $22^{\circ} 44' N.$, Long. $105^{\circ} 59' W.$

Loc. 27584 (C. A. S.), dredged about 10 miles due east of San Jose del Cabo, Lower California, Lat. $23^{\circ} 03' N.$ to $23^{\circ} 06' N.$, Long. $109^{\circ} 31' N.$ to $109^{\circ} 36' W.$

The species was also collected in Braxilito Bay, Costa Rica, and as a fossil in the Pleistocene beds on Maria Madre Island, Mexico. In

the collections of the California Academy of Sciences, the species is present from many other localities.

There appears to be all gradations between typical *circularis* and the form *ventricosus* Sowerby from western Colombia and Ecuador, with no practical method of separating the two forms, and Arnold, who studied a large series of the species in the U. S. National Museum, came to the same conclusion. Mörch³³ described a scarlet colored variety from Costa Rica, which can apparently be considered to be one of the variations of *P. circularis*. Records of *P. circularis* from the Asiatic region³⁴ can evidently be referred to some other species. The species described by Li from Panama Bay as *P. filitextus*, can apparently be referred to *P. circularis*.

The subspecies *P. circularis aequisulcatus* Carpenter from southern California, and western Lower California, attains a larger size when adult, the shell is thinner and flatter, the ribs narrower, and the coloration is more subdued.

P. abietis E. K. Jordan & Hertlein, in the Pliocene of Maria Madre Island, and Lower California, is closely related to *P. circularis*, but can be distinguished by the triangular shaped ribs.

P. gibbus Linnaeus, found living along the Atlantic Coast of North America is also closely related to *P. circularis*. Members of the *circularis* group, also occur in beds referred to the Miocene and Pliocene in Venezuela. (See Bull. Amer. Paleo. vol. 13, Bull. 49, 1927. *P. circularis venezuelanus* F. & H. Hodson, p. 25, pl. 14, fig. 6; pl. 15, figs. 2, 4, 5; pl. 17, fig. 1; *P. circularis cornellanus* F. & H. Hodson, p. 26, pl. 14, fig. 2; pl. 15, figs. 3, 10; pl. 16, fig. 3; *P. circularis caucanus* F. & H. Hodson, p. 27, pl. 15 figs. 1, 8).

P. demiurgus Dall³⁵ from the upper Miocene of Trinidad is close to *P. circularis*.

Zetek³⁶ has indicated that the east American *P. gibbus ampliacostatus* Dall, might occur in the fauna of western Panama, but it seems likely that this record can be referred to some of the numerous variants of *P. circularis*.

³³ *Pecten (Argus) ventricosus* Sow. var. *coccinea* Mörch, Malakzool. Blätter, Bd. 7, 1861, p. 210.

"Var. *coccinea*; valva dextra lituris atris, intus alba. Sow. thes. f. 26.—Puntarenas ad prof. 14 org. Long. 16, alt. 17 mill."

³⁴ Campbell, A. S., [Identification attributed to H. A. Pilsbry], Jour. Entomol. and Zool., vol. 15, no. 3, 1923, p. 40. Near Canton, and at Chung Chow, Hong Kong territory, China. Recent.

³⁵ *Pecten (Plagiocentrum) demiurgus* Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, 1898, p. 718, pl. 26, fig. 3. "From the Caroni Series of Trinidad at Savanetta; Guppy." Miocene.

³⁶ Zetek, J., Los Mol. Republ. Panama. Revista Nueva, nos. 1 & 2, 1918, p. 52.

Pecten (Leptopecten) latiauratus Conrad

Pecten latiauratus Conrad, Jour. Acad. Nat. Sci. Philadelphia, vol. 7, 1837, p. 238, pl. 18, fig. 9. "Inhabits below the efflux of the tide near Sta. Diego and Sta. Barbara."—Kobelt, Syst. Conchyl.-Cab., Bd. 7, Abt. 2, *Spondylus* und *Pecten*, 1887, p. 203, Taf. 54, figs. 7, 8. West Coast of North America, especially California.

Pecten (Chlamys) latiauritus Conrad, Arnold, U. S. Geol. Survey, Prof. Paper 47, 1906, p. 115, pl. 46, figs. 2, 2a, 3, 3a. Monterey to San Diego, California. Also Pliocene and Pleistocene.—I. S. Oldroyd, Stanford Univ. Publ., Univ. Ser. Geol. Sci., vol. 1, no. 1, 1924, p. 57, pl. 22, fig. 2 (under subgenus *Chlamys*, section *Leptopecten*). (Reproduction of Conrad's type figure). Monterey, California, to the Gulf of California. See also remarks by Grant & Gale, Mem. San Diego Soc. Nat. Hist., vol. 1, 1931, pp. 203-204.

Range: Monterey, California to Gulf of California (I. S. Oldroyd); ?San Francisco Bay, California (Packard). Pliocene to Recent.

One specimen of this species with both valves was dredged by the Templeton Crocker Expedition at Loc. 27600 (C. A. S.), in 25 fathoms off San Martin Island, Lower California. The exact locality is given as "above long spit."

An inspection of Conrad's original figures of *latiauratus* and *monotimeris*, indicates that *latiauratus* has more squarely shaped ribs, a longer hinge line, and acutely pointed ears. The longer hinge line and prominently lamellated interspaces distinguish the subspecies *latiauratus delosi* (Plate 19, figure 10) from Conrad's species. *P. latiauratus cerritensis* Arnold in the Pleistocene has fewer ribs. *P. andersoni* Arnold in the Miocene of western North America is a related species.

Pecten (Leptopecten) tumbezensis d'Orbigny

Plate 19, figures 11, 12

Pecten aspersus Sowerby, Proc. Zool. Soc. London, 1835, p. 110. "Hab. ad Tumbez, Peruviae."

Not *Pecten aspersus* Lamarck, Anim. s. Vert., vol. 6, 1819, p. 167. "Habite . . . Mon cabinet."

Pecten tumbezensis d'Orbigny, Voy. Amér. Mérid.,³⁷ vol. 5, 1846, p. 663. Tumbez, Peru (Cuming). New name for *P. aspersus* Sowerby, not *P. aspersus* Lamarck.—Peile in Bosworth, Geol. N. W. Peru, 1922, p. 178, pl. 25, fig. 8. "Talara Tablazo" and "Lobitos Tablazo." Quaternary, Peru.—Olsson, Nautilus, vol. 37, no. 4, 1924, p. 127. "Paíta, Negritos, Lobitos, Jorritos," Peru. "Salinas," Ecuador.

Pecten sowerbyi Reeve, Conch. Icon., vol. 8, 1852, *Pecten*, sp. 4, pl. 1, fig. 4. "Tumbez, Peru." New name for *P. aspersus* Sowerby, not *P. aspersus* Lamarck.—Kobelt, Syst. Conchyl.-Cab., Bd. 7, Abt. 2, *Spondylus* und *Pecten*, 1888, p. 229, Taf. 61, fig. 3. Peru.

³⁷ For a collation of this work see Sherborn, C. D., and F. J. Griffin, Ann. & Mag. Nat. Hist., ser. 10, vol. 13, no. 73, 1934, pp. 130-134.

Pecten paucicostatus Carpenter, Rept. Brit. Assoc. Adv. Sci. for 1863 [issued 1864.], p. 645. Neighborhood of Santa Barbara (Jewett).—Kobelt, Syst. Conchyl.-Cab., Bd. 7, Abt. 2, *Spondylus* und *Pecten*, 1888, p. 281. Original record cited.

Pecten (*Plagiectenium*) *paucicostatus* Carpenter, Arnold, U. S. Geol. Survey, Prof. Paper 47, 1906, p. 137, pl. 39, figs. 3, 3a, 4. Gulf of California.—I. S. Oldroyd, Stanford Univ. Publ., Univ. Ser. Geol. Sci., vol. 1, no. 1, 1924, p. 56, pl. 41, figs. 4, 5. "Santa Barbara, California, to the Gulf of California."

Pecten cf. *latiauritus fucicolus* Dall, Li, Bull. Geol. Soc. China, vol. 9, no. 3, 1930, p. 255, pl. 2, fig. 11. Mouth of the Rio Grande near La Boca about one mile from the mainland in Panama Bay. Recent. [Not *P. latiauritus fucicolus* Dall. See Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, vol. 83, 1931, p. 429.]

Pecten latiauritus Conrad *indentus* Li, Bull. Geol. Soc. China, vol. 9, no. 3, 1930, p. 256, pl. 2, fig. 13. Mouth of Rio Grande near La Boca about one mile from mainland in Panama Bay. [= *P. tumbezensis* d'Orbigny, according to Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, vol. 83, 1931, p. 429].

Pecten latiauritus Conrad *splendens* Li, Bull. Geol. Soc. China, vol. 9, no. 3, 1930, p. 256, pl. 2, fig. 12. Mouth of Rio Grande near La Boca, about one mile from the mainland in Panama Bay. Recent. [= *P. tumbezensis* d'Orbigny, according to Pilsbry, Proc. Acad. Nat. Soc. Philadelphia, vol. 83, 1931, p. 429].

Pecten (*Aequipekten*) *tumbezensis* d'Orbigny, Grant & Gale, Mem. San Diego Soc. Nat. Hist., vol. 1, 1931, p. 206. Earlier records cited. [Not *P. palmeri* Dall in the synonymy.]

Range: Gulf of California to Tumbez and Paita, Peru. Also Quaternary of Peru.

This interesting species was secured at a number of localities by the Templeton Crocker Expedition.

Loc. 27527 (C. A. S.), dredged in Acapulco Bay, Mexico.

Loc. 27558 (C. A. S.), dredged in 50 fathoms between Punta Arenas and Bat Island, about five to six miles off Delas, Costa Rica.

Loc. 27569 (C. A. S.), dredged in 28 fathoms, Lat. 15° 40' N., Long. 93° 49' W.

Loc. 27571 (C. A. S.), dredged off Mexico in 20-45 fathoms, Lat. 16° 38' to 16° 39' N., Long. 99° 24' 30" to 99° 27' 30" W.

Loc. 27580 (C. A. S.), dredged one-half mile east of Isabel Island, between Isabel Island and Mazatlan, Mexico.

Loc. 27583 (C. A. S.), dredged in 10-17 fathoms. Lat. 22° 44' N., Long. 105° 59' W.

Loc. 27584 (C. A. S.), dredged in 20-220 fathoms off Mexico, Lat. 23° 03' to 23° 06' N., Long. 109° 31' to 109° 36' W.

Loc. 27584A (C. A. S.), dredged about five miles west of Mazatlan, Sinaloa, Mexico, Lat. 23° 12' N., Long. 106° 29' W.

Pecten tumbezensis d'Orbigny is known to range from the Gulf of California to Peru. It has been recorded from Santa Barbara,

California, but this is a very doubtful record. Arnold in referring to *P. paucicostatus* Carpenter, which can be regarded as a synonym of *tumbezensis*, stated that it undoubtedly came from the Gulf of California, and that no species with its characteristics is known outside the tropics.

P. tumbezensis possesses a rather small but fairly heavy shell. The largest specimen in the collection has an altitude of 30.4 mm. The shell is usually ornamented by about 14 ribs. The left valve usually shows a sprinkling of light bluish dots on a slate-colored or brownish background.

Olsson has mentioned a similarity between *P. tumbezensis* and *P. woodringi* Spieker,³⁸ from the Miocene of Peru.

Rutten's record (Leid. Geol. Mededeel., Deel 5, 1931, p. 661) of "*Pecten sowerbyi* Reeve" in the Quaternary of Surinam, South America, can apparently be referred to some other species.

***Pecten (Leptopecten) velero* Hertlein, new species**

Plate 19, figures 13, 14

The type is a left valve with 16 strong ribs, of which every third rib is higher than the intervening ones; the two ribs on the margins are a little stronger than those on the middle; strong imbricating lamellae cross the ribs and interspaces and are especially prominent on the stronger ribs. The anterior ear is ornamented by about six to seven imbricated riblets and the posterior ear shows about five such riblets. The exterior of the shell is colored pink with whitish and brownish spots. The hinge line has transverse striations; and the ribs are shown on the interior of the shell by strong ridges and hollows. Other specimens sometimes have pairs of raised ribs instead of only one. Type, altitude approximately 6.4 mm.; length of hinge line approximately 6.2 mm.

Range: Bahia Honda, Veragua, Panama; Mazatlan, Mexico; and Maria Madre Island, Tres Marias Group, Mexico.

Holotype: Left valve No. 6857 (Mus. Calif. Acad. Sci. Paleo.); paratype, left valve No. 6886, and plesiotype, right valve No. 6887 (Mus. Calif. Acad. Sci. Paleo. type coll.), **Bahia Honda, Veragua, Panama**, in three to nine fathoms, G. Allan Hancock Expedition; L. G. Hertlein, collector.

P. velero is not present in the collection made by the Templeton Crocker Expedition, but is recorded here as a new species.

The new species differs from *P. latiauratus delosi* Arnold, in the character of the ribs, of which every third one is raised and occasionally a pair is raised. Another left valve and a right valve, slightly worn, occurred with the type at Bahia Honda, Panama. The right valve has about 16 ribs, every third one is slightly raised, and

³⁸ *Pecten woodringi* Spieker, Johns Hopkins Univ. Studies in Geol., no. 3, 1922, p. 125, pl. 7, figs. 4, 5. "Upper Zorritos. Quebradas Pantheon, del Toro, de las Alturas and del Grillo."—Olsson, Bull. Amer. Paleo., vol. 19, Bull. no. 68, 1932, p. 81, pl. 5, figs. 2, 5 (as *Pecten (Plagiocentrum) woodringi*). "Tumbez formation, probably Que. Tucillal, Zorritos (Nelson)."

it is presumably the right valve of the new species. Its general appearance is considerably like *P. latiauratus* Conrad, Recent west American species, and *P. ischnon* Pilsbry & Johnson ³⁹ from the Miocene of Santo Domingo.

Several specimens of *P. velero* were collected by the author at Loc. 27,223 (C. A. S.), Mazatlan, Mexico. One left valve was collected by G. D. Hanna & E. K. Jordan at Loc. 23,779 (C. A. S.), Maria Madre Island, Tres Marias Group, Mexico, in ten fathoms.

This new species is named for Captain G. Allan Hancock's yacht, *Velero III*.

***Pecten (Lyropecten) subnodosus* Sowerby**

Plate 19, figure 15

Pecten subnodosus Sowerby, Proc. Zool. Soc. London, 1835, p. 109. Var. brownish red with white striae, "ad Sinum Californiae." Var. variegated with brown and white patches, "ad Insulam Platae Columbiae Occidentalis." Var. A more depressed shell of a bright orange color, "ad Sinum Tehuantepec, Mexicanorum." "in sandy mud and coral sand in from ten to seventeen fathoms."—Sowerby, Thes. Conch., vol. 1, 1842, p. 65, pl. 15, figs. 97 and 112. Earlier records cited.—Küster, Syst. Conchyl.-Cab., Bd. 7, Abt. 2, *Spondylus* und *Pecten*, 1859, p. 112, Taf. 32, fig. 3. "Mexico und Westcolumbien."—Dall. Proc. U. S. Nat. Mus., vol. 37, 1909, p. 256. "Gulf of California to Guayaquil and the Galapagos Islands."—Olsson, Nautilus, vol. 37, no. 4, 1924, p. 127. "Negritos, Mancora," Peru. "Salinas," Ecuador.

Lyropecten intermedius Conrad, Amer. Jour. Conch., vol. 3, 1867, p. 7. "Cape St. Lucas, California."

Pecten (Nodipecten) subnodosus Sowerby, Arnold, U. S. Geol. Survey, Prof. Paper 47, 1906, p. 128, pl. 52, fig. 1; pl. 53, figs. 1, 1a. Recent from Coast of Lower California to Ecuador. Also Pliocene and Pleistocene.

Pecten (Lyropecten) nodosus (Linnaeus) variety subnodosus Sowerby, Grant & Gale, Mem. San Diego Soc. Nat. Hist., vol. 1, 1931, p. 180. "Panama and West Columbia."

Pecten (Lyropecten) nodosus (Linnaeus) variety intermedius (Conrad), Grant & Gale, Mem. San Diego Soc. Nat. Hist., vol. 1, 1931, p. 181. Earlier records cited from Pliocene to Recent.

Range: Scammon Lagoon, Lower California, and the Gulf of California, to Guayaquil, Ecuador (Dall and others). Also Pliocene and Pleistocene of Lower California and Pliocene of Imperial County, California.

This well known species was collected at four localities by the Templeton Crocker Expedition.

Loc. 27559 (C. A. S.), Braxilito Bay, Costa Rica.

³⁹ *Pecten ischnon* Pilsbry & Johnson, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, 1917, p. 194. Santo Domingo. Miocene.—Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, vol. 73, pt. 2, January 18, 1922, p. 413, pl. 44, figs. 7, 8, (type) 9. Santo Domingo. Miocene.

Loc. 27562 (C. A. S.), Port Parker, Costa Rica.

Loc. 27577 (C. A. S.), on south shore of Maria Madre Island, Mexico.

Loc. 27578 (C. A. S.), San Juanito Island, Tres Marias Group, Mexico.

Pecten subnodosus is quite variable in color. It may be red, variegated with red and brown or white, or orange in color. An excellent specimen from San Juanito Island has eleven ribs on the right valve and ten on the left. This, as well as specimens from the Gulf of California, does not substantiate Grant & Gale's⁴⁰ conclusion that the more northern forms described as *intermedius* by Conrad, can be recognized as a separate subspecies possessing one less rib than the Panama shells.

P. nodosus Linnaeus,⁴¹ from the Caribbean region is a closely related species as is *P. veatchii* Gabb from the Pliocene of Cedros Island, Lower California. Related species such as *P. peedeensis* Tuomey & Holmes,⁴² *P. pernodosus* Heilprin,⁴³ *P. pittieri* Dall,⁴⁴ *P. pittieri collierensis* Mansfield⁴⁵ and *P. colinensis* F. & H. Hodson,⁴⁶ occur in the Miocene and Pliocene of the Caribbean region.

***Pecten* (*Decadopecten*) *fasciculatus* Hinds**

Plate 18, figures 1, 2

Pecten fasciculatus Hinds, Zool. Voy. Sulphur, Moll., pt. 3, 1844 [date on cover January, 1845], p. 61, pl. 17, fig. 4 "West coast of Veragua. In seventeen fathoms, among sandy mud."—Reeve, Conch. Icon., vol. 8, 1853, *Pecten*, sp. 171, pl. 35, fig. 171. Hinds' record cited.

Pecten (*Pallium*) *miser* Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 401, pl. 8, fig. 6. Gulf of Panama, in 182 fathoms, mud, bottom temperature 54.1° F.

?*Pecten panamensis* Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, 1898, p. 696.

⁴⁰ Mem. San Diego Soc. Nat. Hist., vol. 1, 1931, p. 181.

⁴¹ *Ostrea nodosa* Linnaeus, Syst. Nat., Ed. 10, 1758, p. 697. "Habitat in O. Africano E Indico."

Pecten corallinus Chemnitz, Neues Syst. Conch.-Cab., Bd. 7, 1784, p. 306, pl. 64, figs. 609, 610, 611. St. Croix, St. Thomas and St. Jean, Danish West Indies.

Pecten nodosus Linnaeus, Reeve, Conch. Icon., vol. 8, *Pecten*, 1852, sp. 15, pl. 3, fig. 15. "Hab. Gulf of Mexico."

⁴² *Pecten peedeensis* Tuomey & Holmes, Pleiocene Fossils of South Carolina, 1857, p. 30, pl. 12, figs. 1, 2, 3, 4, 5. "Darlington District."

⁴³ *Pecten pernodosus* Heilprin, Trans. Wagner Free Inst. Sci., vol. 1, 1887, p. 131, pl. 16b, figs. 69, 69a. Caloosahatchie, Florida. Pliocene.

⁴⁴ *Pecten* (*Lyropecten*) *pittieri* Dall, Smithsonian, Misc. Coll., vol. 59, no. 2, March 2, 1912, p. 10. "Moin Hill, near Port Limon, Costa Rica, niveau a. H. Pittier. 1899."—Dall, Proc. U. S. Nat. Mus., vol. 66, 1925, p. 23, pl. 17, fig. 6.

⁴⁵ *Pecten* (*Nodipecten*) *pittieri collierensis* Mansfield, U. S. Geol. Surv., Prof. Paper 170-D, 1932, p. 47, pl. 16, figs. 3, 5. "Tamiami trail, about 11 miles east by north of Marco, Collier County, Fla." Pliocene.

⁴⁶ *Pecten* (aff. *Nodipecten*) *colinensis* F. & H. Hodson, Bull. Amer. Paleol., vol. 13, Bull. 49, October 7, 1927, p. 33, pl. 18, figs. 3, 6; pl. 19, fig. 4. "District of Colina, State of Falcón," Venezuela. "Miocene-Pliocene."

Range: Panama.

This species is not present in the Templeton Crocker Collection. Hinds illustrated only a left valve, and Dall a right valve, of species occurring off Panama. The number of ribs in each, is about the same, and the descriptions seem to indicate that Dall's species will need to be placed in the synonymy of *P. fasciculatus* Hinds. This species appears to be the only representative of the subgenus *Decadopecten*, to be reported Recent or fossil from western North America. Recent and fossil forms of *Decadopecten* are represented in the Asiatic and Mediterranean regions.

Dall in 1898 gave a brief description of a species cited as *Pecten panamensis* Dall. According to the description the species differs from *P. plica* Linnaeus, "by having the cardinal laminae obsolete and in the presence of a byssal sinus and ctenolium." No locality is given for the species but the name suggests that it came from or occurs near Panama. Possibly this is the species later described by Dall as *P. miser* which in the present paper is referred to *P. fasciculatus* Hinds.

P. parmeleei Dall and related forms in the Pliocene belongs to the subgenus *Swiftopecten* Hertlein, the type of which is *P. swiftii* Bernardi.

***Pecten (Cyclopecten) cocosensis* Dall**

Plate 18, figures 7, 8

Pecten (Cyclopecten) cocosensis Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 405, pl. 6, figs. 1, 3. "near Cocos Island Gulf of Panama, in 52 fathoms, rocky bottom, temperature 62°.2 F."—Zetek, Los Mol. Republ. Panama. Revista Nueva, nos. 1 & 2, 1918, p. 39.

Range: San José Island, Gulf of California to Acapulco Bay, Mexico, and near Cocos Island, Costa Rica.

This species was dredged at several localities by the Templeton Crocker Expedition. At some localities the species was represented only by small juvenile specimens.

Loc. 27527 (C. A. S.), in Acapulco Bay, Mexico.

Loc. 27581 (C. A. S.), between Isabel Island and Mazatlan, Mexico.

Loc. 27584 (C. A. S.), dredged about 10 miles due east of San Jose del Cabo, Lower California, in Lat. 23° 03' to 23° 06' N., Long. 109° 31' to 109° 36' W., in 20 to 220 fathoms.

Loc. 27587 (C. A. S.), off Cape San Lucas, Lower California, in 20 to 25 fathoms.

It is also present in the collections of the California Academy of Sciences from the following localities:

Loc. 23779 (C. A. S.), in five to ten fathoms off Maria Madre Island, Tres Marias group, Mexico; G. D. Hanna & E. K. Jordan, colls.

Loc. 23804 (C. A. S.), Amortajada Bay, San José Island, Gulf of California. F. Baker coll.

The shell of this species has a subangular posterior margin, and a broad shallow sulcus occurs on the posterior fourth of the shell. The color of the exterior of the shell consists of white, red, and brown, occurring in lines, zigzags, or in clouded patches.

P. catalinensis Willett,⁴⁷ has more nearly equal ears and a different color pattern and lacks the sulcus on the posterior portion of the valves.

Dall's figures of *P. guppyi* Dall,⁴⁸ from the late Tertiary of the Caribbean region, show a resemblance to *P. cocosensis*. The Caribbean shell apparently has a broad shallow sulcus on the posterior portion of the shell, and traces of coloration in blotches, is said to be present. *P. subminutus* Aldrich,⁴⁹ from the Tertiary of Mississippi is said to resemble *P. guppyi* but is smaller.

Pecten aotus Olsson⁵⁰ from the Miocene of Costa Rica, has, on the left valve, fine radial lines, which according to the description, occur in irregular streaks or blotches.

Pecten (Cyclopecten) oligolepis Brown & Pilsbry⁵¹ bears some resemblance to *P. cocosensis*.

***Pecten (Cyclopecten) pernomus* Hertlein, new name**

Plate 18, figures 11, 12, 13

Pecten (Cyclopecten) rotundus Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 404. "Panama Bay, in 29½ fathoms; also at station 2784, in 194 fathoms, mud bottom temperature 51°.9 F." "A single valve from near the Straits of Magellan, apparently the same species."—Zetek, Los Mol. Republ. Panama. Revista Nueva, nos. 1 and 2, 1918, p. 39. Panama.

⁴⁷ *Pecten (Cyclopecten) catalinensis* Willett, Nautilus, vol. 45, no. 2, 1931, p. 65, pl. 4, figs. 1, 2. . . . "in 100 fathoms off White's Landing, north side of Catalina Island, California."

⁴⁸ *Pecten (Pseudamusium) guppyi* Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, 1898, p. 718, pl. 34, figs. 12, 13. "Oligocene of the Bowden marl, Jamaica, and of the Alum Bluff sand at Oak Grove, Santa Rosa County, Florida, Burns; and in the Pliocene Marl of Port Limon, Costa Rica, Hill."

Chlamys (Palliolium?) guppyi (Dall), Woodring, Carnegie Inst. Washington, Publ. 366, 1925, p. 72, pl. 8, figs. 13, 14, 15, 16. "Bowden, Jamaica."

⁴⁹ *Pecten (Pseudamusium) subminutus* Aldrich, Nautilus, vol. 16, no. 9, January, 1903, p. 100, pl. 4, figs. 16, 17. "Red Bluff, Miss., Jackson, Miss."

⁵⁰ *Pecten aotus* Olsson, Bull. Amer. Paleo., vol. 9, Bull. 39, 1922, p. 376 (204), pl. 21 (18), figs. 17, 18. "Gatun Stage: Port Limon." "Coll. 5, Red Cliff Creek," Costa Rica. Miocene.

⁵¹ *Pecten (Cyclopecten) oligolepis* Brown & Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, vol. 64, 1912, p. 512, text fig. 5. "From the excavation of the lower locks at Gatun." Miocene.

Not *Pecten rotundus* v. Hagenow, Neues Jahrb. f. Min., 1842, p. 554. "Rügen, schen Kreide."

Range: Panama Bay (Dall). (?) Straits of Magellan (Dall).

This species is not present in the Templeton Crocker Expedition collection. The name *Pecten rotundus* was used by von Hagenow much earlier than by Dall, and the name *pernomus* is here proposed for the West American species.

According to Townsend,⁵² No. 2799 U. S. B. F. Sta., is given as Lat. 8° 44' 00" N., Long. 79° 09' 00" W., at a depth of 29.5 fathoms, green mud, surface temperatures 75° F., March 6, 1888, and Dall in his original record of *P. rotundus* gave the locality as . . . "in Panama Bay, in 29½ fathoms."

The specimens illustrated on plate 18, figures 11, 12, 13, are considered in the present paper to be syntypes of *Pecten rotundus* Dall, due to the fact that the altitude given in the original description is 3 mm., and the altitude of the specimens illustrated in figures 11 and 13 are both 3 mm. From the present information it is not clear which specimen, if any, was selected as holotype by Dall. The photographs of the "types" of *P. rotundus*, were received from the U. S. National Museum, through the kindness of Dr. A. Wetmore.

Additional collections may show that this is the young of *P. cocosensis* Dall, but for the present it is regarded as a separate species.

***Pecten (Delectopecten) zacae* Hertlein, new name**

Plate 18, figures 3, 4, 5, 6, 9, 10

Pecten (Pseudamusium) panamensis Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 404, pl. 6, figs. 8 and 10. "Gulf of Panama, in 322 fathoms, mud, bottom temperature 56°F."

Not *Pecten panamensis* Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, 1898, p. 696. No locality cited [? = *P. fasciculatus* Hinds].

Range: Cape San Lucas, Lower California to Panama.

Holotype: No. 6880 (C. A. S. Paleo. type collection), from Loc. 27587 (C. A. S.), off Cape San Lucas, Lower California; paratypes: Nos. 6881, 6882 (C. A. S. Paleo. type collection), from Loc. 27584 (C. A. S.), dredged in 20 to 220 fathoms from Lat. 23° 03' to 23° 06' N., Long. 109° 31' to 109° 36' W.; Templeton Crocker collector.

This species was dredged by the Templeton Crocker Expedition at two localities. Loc. 27584 (C. A. S.), about 10 miles due east of San Jose del Cabo, Lower California, in 20 to 220 fathoms, Lat.

⁵² Townsend, C. H., Dredging and other records of the United States Fish Commission Steamer *Albatross* with bibliography relative to the work of the vessel, in Rept. U. S. Commission of Fish and Fisheries, pt. 26. 1900 [issued 1901], p. 404.

23° 03' to 23° 06' N., Long. 109° 31' to 109° 36' W.; and Loc. 27587 (C. A. S.), off Cape San Lucas, Lower California, in 20 to 25 fathoms.

The thin, delicate forms of this species, collected by the Templeton Crocker Expedition, possess the shell characters of the species described by Dall as *P. panamensis* in 1908 (not *P. panamensis* Dall, 1898). Due to the fact that Dall has used the name *panamensis* for a species in 1898, the name *zaca* is here proposed for the present species. It is named for Mr. Templeton Crocker's yacht, *Zaca*.

Some specimens are nearly smooth, while others have 40 to 65 fine radial, minutely scaly threads. The whole surface externally, is covered by fine camptonectes striations.

The more elongate form, fewer and more widely spaced ribs, the broader anterior ear of the right valve, and the squarer posterior margin of the posterior ears of both valves, separate the species from *P. randolphi* Dall and *P. randolphi tillamookensis* Arnold.

Pecten lillisi Hertlein⁵³ from the Kreyenhagen Shale (upper Eocene or lower Oligocene), appears to be a related species.

⁵³ *Pecten* (*Pseudamusium*) *lillisi* Hertlein, Bull. South Calif. Acad. Sci., vol. 33, pt. 1, January-April (issued February 28), 1934, p. 5, pl. 1, fig. 1, pl. 2, figs. 2, 3. "diatomite, Kreyenhagen shale, from S. E. corner of Sec. 35, T. 6 S., R. 7 E., M. D. M., Stanislaus County, California; on the north side of Crow Creek road."

PLATE 18

Fig. 1. *Pecten* (*Decadopecten*) *fasciculatus* Hinds. A reproduction of the original figure of *Pecten* (*Pallium*) *miser* Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, pl. 8, fig. 6 "Gulf of Panama, in 182 fathoms." P. 318.

Fig. 2. *Pecten* (*Decadopecten*) *fasciculatus* Hinds. A reproduction of the original figure of *Pecten fasciculatus* Hinds, Zool. Voy. *Sulphur*, Moll., pt. 3, 1844 [date on cover given as January, 1845], pl. 17, fig. 4. "West coast of Veragua." P. 318.

Fig. 3. *Pecten* (*Delectopecten*) *zaca*e Hertlein, new species. Altitude 12 mm.; longitude approximately 10 mm. Paratype, right valve, No. 6881 (C. A. S. Paleo. type coll.) from Loc. 27584 (C. A. S.), Lat. 23° 03' to 23° 06' N., Long. 109° 31' to 109° 36' W., in 20 to 220 fathoms. P. 321.

Fig. 4. *Pecten* (*Delectopecten*) *zaca*e Hertlein, new species. Altitude 11 mm.; longitude 10.8 mm. Holotype, right valve, No. 6880 (C. A. S. Paleo. type coll.), from Loc. 27587 (C. A. S.), off Cape San Lucas, Lower California, in 20 to 220 fathoms. P. 321.

Fig. 5. *Pecten* (*Delectopecten*) *zaca*e Hertlein, new species. Altitude approximately 13.8 mm.; longitude approximately 13.8 mm. Paratype, left valve, No. 6882 (C. A. S. Paleo. type coll.), from same locality as specimen shown in figure 3. This valve shows stronger ribbing than that on the left valve of the holotype. P. 321.

Fig. 6. *Pecten* (*Delectopecten*) *zaca*e Hertlein, new species. Holotype, left valve of specimen shown in figure 4. P. 321.

Fig. 7. *Pecten* (*Cyclopecten*) *cocosensis* Dall. A reproduction of the original figure of the right valve given by Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, pl. 6, fig. 3. . . . "near Cocos Island, Gulf of Panama, in 52 fathoms." P. 319.

Fig. 8. *Pecten* (*Cyclopecten*) *cocosensis* Dall. A reproduction of the original figure of the left valve given by Dall, 1908, pl. 6, fig. 1. From same locality as specimen shown in figure 7. P. 319.

Fig. 9. *Pecten* (*Delectopecten*) *zaca*e Hertlein, new species. A reproduction of the original figure of the right valve of *Pecten* (*Pseudamusium*) *panamensis* Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, pl. 6, fig. 10. "Gulf of Panama, in 322 fathoms." P. 321.

Fig. 10. *Pecten* (*Delectopecten*) *zaca*e Hertlein, new species. A reproduction of the original figure of the left valve of *Pecten* (*Pseudamusium*) *panamensis* Dall, 1908, pl. 6, fig. 8. Same locality as specimen shown in figure 9. P. 321.

Fig. 11. *Pecten* (*Cyclopecten*) *pernomus* Hertlein, new name. Altitude 3 mm. Paratype, left valve Cat. No. 110708 (U. S. Nat. Mus.), from U. S. B. F. Sta. 2799, Lat. 8° 44' 00" N., Long. 79° 09' 00" W., at a depth of 29.5 fathoms. Figures 11, 12, 13 are photographs of *Pecten* (*Cyclopecten*) *rotundus* Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 404. [Not *Pecten rotundus* von Hagenow.] P. 320.

Fig. 12. *Pecten* (*Cyclopecten*) *pernomus* Hertlein, new name. Altitude 3.5 mm. Holotype, right valve, Cat. No. 110708 (U. S. N. M.), from same locality as specimen shown in figure 11. P. 320.

Fig. 13. *Pecten* (*Cyclopecten*) *pernomus* Hertlein, new name. Altitude 3 mm. Paratype, left valve (Cat. No. 110708 U. S. N. M.), from same locality as specimen shown in figure 11. P. 320.

(Plate 18 continued on next page)

PLATE 18—Continued

Fig. 14. *Pecten (Pecten) sericeus* Hinds. A reproduction of one of the original figures of *Pecten sericeus* Hinds, Zool. Voy. *Sulphur*, Moll., pt. 3, 1844, pl. 17, fig. 1a. "Bay of Panama. In fifty fathoms." P. 303.

Fig. 15. *Pecten (Pecten) sericeus* Dall. A reproduction of the original figure of the left valve given by Hinds, 1844, pl. 17, fig. 1. Same locality as specimen shown in figure 14. P. 303.

Fig. 16. *Pecten (Delectopecten) liriopae* Dall. Altitude 7.5 mm.; longitude 8 mm.; length of hinge line 4.5 mm. Holotype, right valve of *Pecten (Pseudamusium) liriopae* Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 402. Cat. no. 122,869 (U. S. Nat. Mus.), from "U. S. S. 'Albatross', station 3392, Gulf of Panama, in 1270 fathoms, hard bottom, temperature, 36° 4 F., U. S. N. Mus. 122,869." This photograph was furnished through the kindness of Dr. A. Wetmore, Assistant Secretary Smithsonian Institution.

PLATE 19

Fig. 1. *Pecten (Chlamys) lowei* Hertlein, new species. Altitude 13.8 mm.; longitude 11.5 mm. Holotype, right valve, No. 6878 (C. A. S. Paleo. type coll.), from Carmen Island, Gulf of California, from a depth of 20 fathoms; H. N. Lowe, collector. P. 308.

Fig. 2. *Pecten (Chlamys) lowei* Hertlein, new species. Holotype, left valve. P. 308.

Fig. 3. *Pecten (Pecten) sericeus* Hinds. Altitude approximately 17 mm.; longitude approximately 17.5 mm. Plesiotype, right valve of a juvenile specimen, No. 6876 (C. A. S. Paleo. type coll.), from Loc. 27584 (C. A. S.), dredged in 20 to 220 fathoms, Lat. $23^{\circ} 03'$ to $23^{\circ} 06'$ N., Long. $109^{\circ} 31'$ to $109^{\circ} 36'$ W. P. 303.

Fig. 4. *Pecten (Pecten) sericeus* Hinds. Left valve of specimen shown in figure 3. P. 303.

Fig. 5. *Pecten (Pecten) diegensis* Dall. Altitude approximately 25 mm.; longitude approximately 26 mm. Plesiotype, right valve of a juvenile specimen, No. 6875 (C. A. S. Paleo. type coll.), from Loc. 27824 (C. A. S.), Isthmus Cove, Santa Catalina Island, California, in 30-50 fathoms. P. 302.

Fig. 6. *Pecten (Pecten) diegensis* Dall. Left valve of specimen shown in figure 5. P. 302.

Fig. 7. *Pecten (Chlamys) lowei* Hertlein, new species. A much less enlarged view of specimen shown in figure 1. P. 308.

Fig. 8. *Pecten (Chlamys) lowei* Hertlein, new species. A much less enlarged view of specimen shown in figure 2. P. 308.

Fig. 9. *Pecten (Chlamys) zeteki* Hertlein, new name. A reproduction of the original figure of *Pecten digitatus* Hinds (not *P. digitatus* Perry), Zool. Voy. *Sulphur*, Moll., pt. 3, 1844, pl. 17, fig. 2. "Bay of Guayaquil." P. 306.

Fig. 10. *Pecten (Leptopecten) latiauratus delosi* Arnold. Altitude approximately 7.5 mm.; longitude approximately 7.8 mm. Plesiotype, left valve No. 6885 (C. A. S. Paleo. type coll.), from San Benito Island, Lower California, in ten fathoms; H. N. Lowe, collector. P. 314.

Fig. 11. *Pecten (Leptopecten) tumbezensis* d'Orbigny. Altitude approximately 18.4 mm.; longitude approximately 20 mm.; diameter (both valves) approximately 8.2 mm. Plesiotype, right valve No. 6883 (C. A. S. Paleo. type coll.) from Loc. 27584 (C. A. S.), Lat. $23^{\circ} 03'$ to $23^{\circ} 06'$ N., Long. $109^{\circ} 31'$ to $109^{\circ} 36'$ W., in 20 to 220 fathoms. P. 314.

Fig. 12. *Pecten (Leptopecten) tumbezensis* d'Orbigny. Left valve of specimen shown in figure 11. The left valve shown in this figure has more white marking than the other specimens in the collection. Usually they are ornamented by smaller white patches, or in some specimens only by light bluish dots on a brownish or slate colored background. P. 314.

Fig. 13. *Pecten (Leptopecten) velero* Hertlein, new species. Altitude approximately 6.1 mm.; length of hinge line approximately 5.9 mm. Plesiotype, right valve, No. 6887 (C. A. S. Paleo. type coll.), from Loc. 27229 (C. A. S.), Bahia Honda, Veragua, Panama, in three to nine fathoms. P. 316.

(Plate 19 continued on next page)

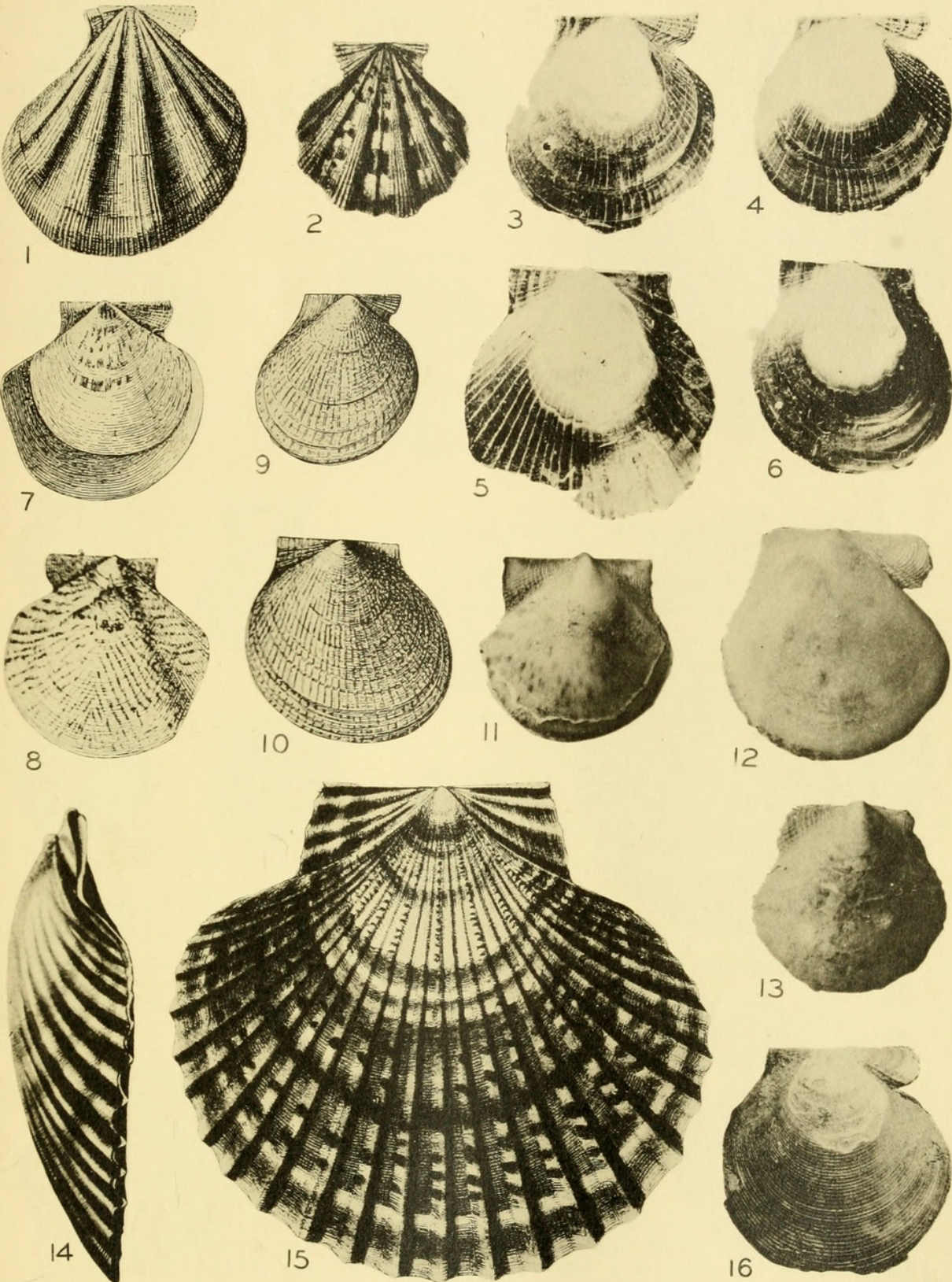
PLATE 19—Continued

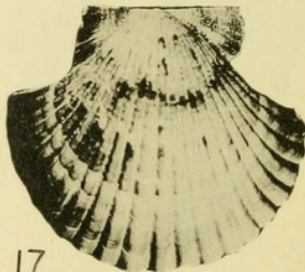
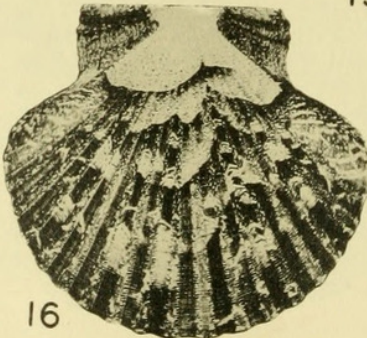
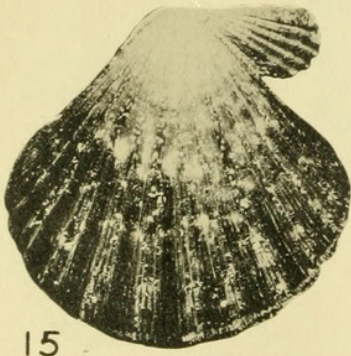
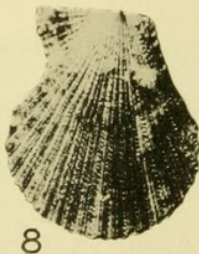
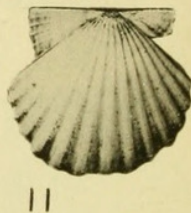
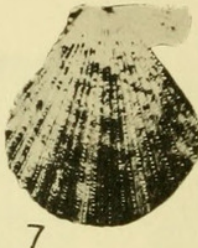
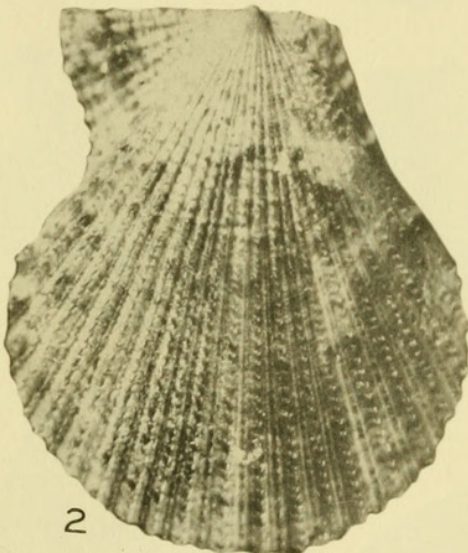
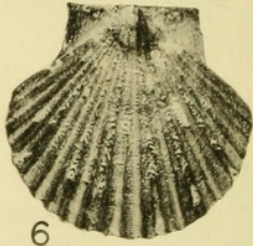
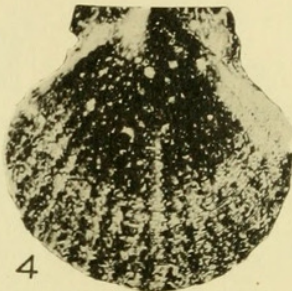
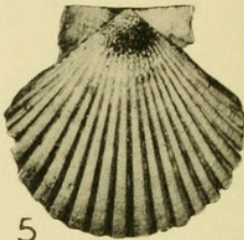
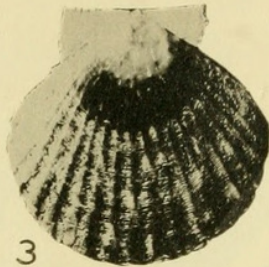
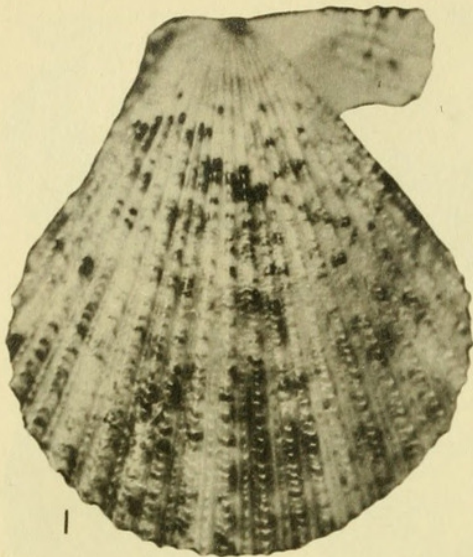
Fig. 14. *Pecten* (*Leptopecten*) *velero* Hertlein, new species. Altitude approximately 6.4 mm.; length of hinge line approximately 6.2 mm. Holotype, left valve, No. 6857 (C. A. S. Paleo. type coll.), from Loc. 27229 (C. A. S.), Bahia Honda, Veragua, Panama, in three to nine fathoms. P. 316.

Fig. 15. *Pecten* (*Lyropecten*) *subnodosus* Sowerby. Altitude 37.2 mm.; longitude 36.5 mm. Plesiotype, right valve (left ear imperfect), No. 6884 (C. A. S. Paleo. type coll.), from Loc. 27577 (C. A. S.), Maria Madre Island, Tres Marias Islands, Mexico. P. 317.

Fig. 16. *Pecten* (*Pecten*) *vogdesi* Arnold. Altitude approximately 37.4 mm.; longitude approximately 41 mm. Plesiotype, left valve No. 6877 (C. A. S. Paleo. type coll.), from Loc. 27584 (C. A. S.). Lat. $23^{\circ} 03'$ to $23^{\circ} 06'$ N., Long. $109^{\circ} 31'$ to $109^{\circ} 36'$ W., in 20 to 220 fathoms. P. 304.

Fig. 17. *Pecten* (*Pecten*) *vogdesi* Arnold. Right valve of specimen shown in figure 16. Convexity of valve approximately 13.1 mm. P. 304.







Hertlein, Leo George. 1935. "The Templeton Crocker Expedition of the California Academy of Sciences, 1932. No. 25. The recent Pectinidae." *Proceedings of the California Academy of Sciences, 4th series* 21, 301–328.

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