



FIGURE 4—All specimens coated with ammonium chloride. All specimens from CSUN loc. 1580, unless otherwise noted. 1–4, *Epilucina washingtoniana* (Clark, 1925); 1–2, hypotype LACMIP 12354, height 52.5 mm, $\times 0.8$. Figure 1, left valve; 2, right valve; 3, hypotype LACMIP 12355, hinge-line (anterior to the left), thickness 20.2 mm, $\times 1.5$; 4, hypotype LACMIP 12356, cast of interior of right valve, height 37.5 mm, $\times 1.1$; 5–8, *Conchocele bisecta* (Conrad, 1849); 5, hypotype LACMIP 12357, cast of left valve, height 58.4 mm, $\times 0.8$; 6, hypotype LACMIP 12358, cast of right valve, height 51 mm, $\times 0.8$; 7, hypotype LACMIP 12357, posterior view, thickness 36.8 mm, $\times 0.7$; 8, hypotype LACMIP 12359, CSUN loc. 1581, cast of right valve of a juvenile, height 17.5 mm, $\times 2$; 9–12, *Vesicomya* (*Vesicomya*) aff. *V. (V.) tschudi* Olsson, 1931; 9, hypotype LACMIP 12360, left valve, height 18.4 mm, $\times 1.7$; 10, hypotype LACMIP 12361, right valve, height 18.3 mm, $\times 1.5$; 11–12, hypotype LACMIP 12362; 11, hinge-line (anterior to the left), thickness 16.1 mm, $\times 1.7$; 12, anterior view, $\times 2$.

imens, due to adherence of extremely hard rock matrix, the lunule is well preserved on a few specimens. It is situated entirely in the right valve and fits into a corresponding depression in the left valve. This type of asymmetric lunule is a diagnostic

feature of *Epilucina*. The dentition is very hard to observe because of the high number of articulated specimens, but on one specimen (LACMIP 12356), a part of the dentition is observable between the articulated valves. Alteration on the left valve of

this specimen has partially exposed two cardinal teeth, but they cannot be photographed because the right valve interferes with lighting. On one other specimen, which is a cast of a right? valve, a large lateral tooth is present. *Epilucina washingtoniana* has an internal radial structure that is observable only on rare internal molds with surfaces that are unaffected by dissolution or extensive weathering (Figure 4). These specimens show evidence of radial ribs on the medial part of the valves and along the ventral edge. The presence of radial ribs is not a characteristic that is usually listed by workers as a feature of *Epilucina*. Examination of two lots (LACM 151265 and 151266) of modern specimens of *Epilucina californica* (Conrad, 1837) from southern California, however, revealed the presence of weak but distinct internal radial ribs on many specimens, especially along their ventral edges.

Epilucina washingtoniana has been found at only two other places besides at Wagonwheel Mountain. One place is the type locality of the species in the upper Eocene Marrowstone Shale, Olympic Peninsula, Jefferson County, Washington (Clark, 1925; Durham, 1944; Squires, 1990). At this locality, Clark (1925) reported *E. washingtoniana* in sandy shale and associated with *Conchocele bisecta*, mytilid bivalves, and an epitoniid gastropod. The second place is a single locality (UCMP loc. B-7027) in the upper part of the Gaviota Sandstone, southwestern Santa Ynez Mountains, Santa Barbara County, southern California (Weaver and Kleinpell, 1963). At this locality, Weaver and Kleinpell (1963) reported *E. washingtoniana* to be the only megafossil present. This locality, which is in a gray concretionary siltstone when plotted onto the geologic map of Dibblee (1988), is most likely associated with a cold seep.

Epilucina washingtoniana superficially resembles *Anodontia*? (*Anodontia*?) *inflata* (Wagner and Schilling, 1923, page 254, plate 45, figures 3, 4) from the "black shale" of the San Emigdio Formation, San Emigdio Mountains, Kern County, California. DeLise (1967) assigned this "black shale" to the upper Eocene Refugian Stage. Examination of the holotype of this species revealed it to have an apparently symmetric lunule and coarser commarginal ribbing than *E. washingtoniana*.

Epilucina washingtoniana is very closely related to *Phacoides* (*Lucinoma*) *zapotalensis* Olsson (1931, page 49, plate 5, figures 2-5) from the middle Oligocene Mambri shales near Zapotal, Ecuador, South America. *Epilucina washingtoniana* is larger and has coarser concentric ribs than does Olsson's species. Although poor preservation of the lunule area prevents determination of whether or not Olsson's species has an asymmetric lunule, we also assign his species to genus *Epilucina* because of the remarkable similarity to *Epilucina washingtoniana*.

According to Bretsky (1976, figure 7), *Epilucina* probably evolved from *Myrtucina* during the Eocene. *Epilucina washingtoniana* is one of the earliest species of the genus. Clark (1946, page 60, plate 12, figure 6) described *Epilucina gabrielensis* from an upper Eocene shallow-marine [non-chemosynthetic] molluscan assemblage in Colombia, South America. *Epilucina washingtoniana* has much coarser and more widely spaced concentric ribbing. In addition to *E. washingtoniana*, the only other known Cenozoic species of *Epilucina* from the Pacific coast of North America is the type species, *E. californica* (Conrad, 1837, page 255, plate 20, figure 1), the geologic range of which is late Miocene to Recent and with a geographic range from Crescent City, northern California to Rocas Alijos, Baja California Sur, Mexico (Coan et al., in press). *Epilucina washingtoniana* is larger, has coarser concentric ribs, and has a more truncated posterior end than *E. californica*.

Material.—Specimens very abundant at both localities (CSUN loc. 1580 and 1581). Holotype SU 35, UW loc. 705, upper Eocene, Olympic Peninsula, Washington.

Occurrence.—Upper Eocene: Olympic Peninsula, Washington; Wagonwheel Mountain, central California; and southwestern Santa Ynez Mountains, southern California.

Family THYASIRIDAE Dall, 1901

Genus CONCHOCELE Gabb, 1866

Type species.—*Conchocele disjuncta* Gabb, 1866, by monotypy, Miocene, California.

Conchocele bisecta (Conrad, 1849)

Figure 4.5-4.8

Venus bisecta CONRAD, 1849, p. 724, pl. 17, figs. 10, 10a.

Conchocele disjuncta GABB, 1866, p. 28; 1869, p. 99, pl. 7, figs. 48, 48a, 48b.

Thyasira bisecta var. *nipponica* YABE AND NOMURA, 1925, p. 84, pl. 23, fig. 3, pl. 24, figs. 2-4.

Thyasira quadrata YABE AND NOMURA, 1925, p. 92-93, pl. 23, figs. 1a, 1b.

Thyasira (*Conchocele*) *bisectoides* KURODA, 1931, p. 50, pl. 12, figs. 95, 96.

Thyasira bisecta var. *humila* KRISHTOFOVICH, 1936, p. 24-28, pl. 2, figs. 1, 1a.

Thyasira bisecta var. *alta* KRISHTOFOVICH, 1936, p. 29-32, pl. 1, figs. 3, 4.

Thyasira disjuncta var. *ochotica* KRISHTOFOVICH, 1936, p. 35-38, pl. 3, fig. 2, pl. 4, figs. 1, 2, pl. 5, figs. 1-3.

Thyasira clarki KRISHTOFOVICH, 1936, p. 39-40, pl. 2, fig. 2.

Thyasira folgeri Wagner and Schilling. VAN COUVERING AND ALLEN, 1943, fig. 211 [misidentified].

Thyasira cf. *T. disjuncta* (Gabb). SMITH, 1956, p. 77.

Discussion.—At locality CSUN 1580, nearly all of the specimens are articulated and range from 1.8 to 5.9 cm in height and 1.85 to 6.2 cm in length. The largest specimen is shown in Figure 4.5. At locality 1581, all of the specimens are articulated juveniles about 2 cm in height. Juvenile specimens do not elongate posteriorly in the ventral region until they reach a height of about 2.4 cm. A juvenile specimen 1.65 cm in height is shown in Figure 4.8.

There has been much confusion concerning whether or not *Conchocele bisecta* is conspecific with *Conchocele disjuncta*. Some authors regarded them as a single species (e.g., Dall, 1895; Arnold, 1903; Reagan, 1909; Yokoyama, 1924; Yabe and Nomura, 1925; Grant and Gale, 1931; Makiyama, 1934; Kanno, 1971a; Abbott, 1974; Coan et al., in press), but others regarded them as two distinct species (e.g., Tegland, 1928; Stewart, 1930; Clark, 1932; Krishtofovich, 1936; Kamada, 1962; Bernard, 1972; Yoon, 1976; Moore, 1984, 1988; Honda, 1989).

The main morphological basis used for separating the two species has been the shape of the anterior surface. Tegland (1928), Bernard (1972), and Moore (1984) reported that *C. bisecta* has a concave outline of the anterior surface and *C. disjuncta* has a straight outline. Kanno (1971a), however, reported that the specimens of *C. bisecta* are extremely variable in shape, with the greatest amount of variation in the apical angle. Based on this observation, as well as on the observations by Makiyama (1934) that the varietal forms of *C. bisecta* and their intermediates commonly occur in the same outcrop, Kanno (1971a) concluded that *C. disjuncta* is a synonym of *C. bisecta*. Most subsequent workers would have most likely accepted Kanno's conclusion, except Bernard (1972), who reported *C. bisecta* and *C. disjuncta* to be anatomically distinct. Recently, however, Coan et al. (in press) reported that the "anatomical differences do not seem of great significance and cannot be confirmed in any available material, including the specimens Bernard evidently examined."

Based on the preceding discussion, we consider *C. bisecta* and *C. disjuncta* to be the same species. We list all the junior syn-