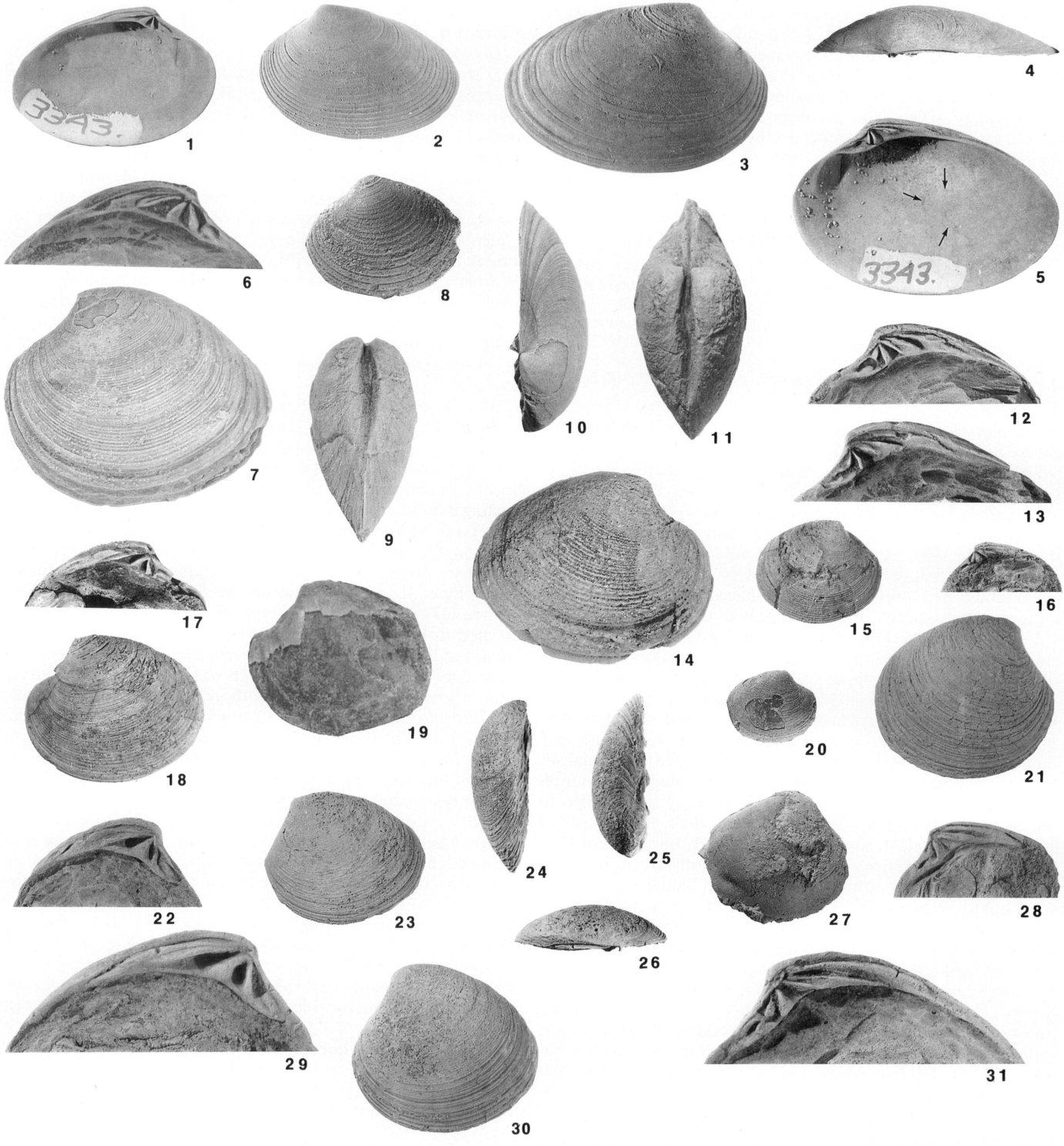


FIGURE 3—*Callista* (*Microcallista*) *proxima* (Deshayes) and *Callistalox* spp. All except *8, 19,* and *20* coated with ammonium chloride, all photos by De Leon except as otherwise indicated. *1–5, C.* (*M.*) *proxima* (Deshayes, 1860). *1, 2,* LACMIP 11299, hypotype, ×2, Eocene, Ypresian, Sables de Cuise, Cuise, Oise, France, left valve; *1,* hinge; *2,* exterior; *3–5,* LACMIP 11298, hypotype, ×2, Eocene, Ypresian, Sables de Cuise, Cuise, Oise, France, right valve; *3,* exterior; *4,* dorsal view; *5,* hinge. *6–19, Callistalox arata* (Gabb, 1864). *6, 7,* LACMIP 8236, hypotype, ×2, Turonian, from LACMIP loc. 10079, left valve; *6,* hinge; *7,* exterior; *8,* ANSP 4388, lectotype, ×2, Turonian, from "Orestimba Cañon," left valve, exterior, photo by Susuki; *9, 11,* LACMIP 8186, hypotype, ×2, Turonian, from UCLA loc. 2323; *9,* posterior view; *11,* dorsal view; *10, 13,* LACMIP 8191, hypotype, ×2, Turonian, from LACMIP loc. 8195, right valve; *10,* anterior view; *13,* hinge; *12, 14,* LACMIP 8237, hypotype, ×2, Turonian, from UCLA loc. 4208, right valve; *12,* hinge; *14,* exterior; *15, 16,* LACMIP 8189, hypotype, ×2, Turonian, from LACMIP loc. 10766, right valve; *15,* exterior; *16,* hinge; *17, 18,* LACMIP 8175, hypotype, ×2, Turonian, from LACMIP loc. 10766, left valve; *17,* hinge; *18,* exterior; *19,* LACMIP 8190, hypotype, ×2, Turonian, from LACMIP loc. 8198, left valve, pallial line. *20–31, Callistalox fragilis* (Gabb, 1869). *20,* ANSP 4385, lectotype, ×1, late Maastrichtian, from Martinez, right valve, exterior, photo by Susuki; *21, 31,* LACMIP 8264,

TABLE 3—Measurements (in mm) of *Callistalox arata.*

| Museum no. | H | L | I | B | LL | LW | L/H | H/I | L/B | LL/LW |
|---|---|---|---|---|---|---|---|---|---|---|
| ANSP 4388 | 10.0 | 12.8 | 3.4 | 5.5 | — | — | 1.3 | 2.9 | 2.3 | — |
| LACMIP 8175 | 13.2 | 16.6 | 5.6 | 6.4 | 4.2 | 1.6 | 1.2 | 2.4 | 2.6 | 2.6 |
| LACMIP 8189 | 9.5 | 11.4 | 3.5 | 4.5 | 3.6 | 1.0 | 1.2 | 2.7 | 2.5 | 3.6 |
| LACMIP 8191 | 19.3 | — | 7.7 | 8.0 | 4.8 | 1.9 | — | 2.5 | — | 2.5 |
| LACMIP 8236 | 19.0 | 23.5 | 5.2 | 11.5 | 6.0 | 1.4 | 1.2 | 3.6 | 2.0 | 4.3 |
| LACMIP 8237 | 16.7 | 21.0 | 6.2 | 9.4 | 4.0 | 1.5 | 1.3 | 2.7 | 2.2 | 2.7 |
| UCLA 40662 | 17.0 | 21.7 | 6.0 | 8.8 | 4.2 | 1.8 | 1.3 | 2.8 | 2.5 | 2.3 |
| UCLA 49501 | 20.4 | 25.4 | 6.8 | 11.7 | 4.6 | 2.0 | 1.2 | 3.0 | 2.2 | 2.3 |

*Rhaiphiale pharota* and its sculpture consists of impressed concentric lines rather than fine to moderately wide ribs, as in *R. pharota. Callistalox arata* is smaller and more elongate than *Callistalox fragilis* (Gabb, 1869).

Specimens of *Callistalox arata* have been confused with *Calva* (*Microcalva*) *haggarti,* but *C. arata* lacks posterior laterals, has a more widely bifid cardinal 3b and a longitudinally grooved cardinal 4b, and is sculptured by concentric grooves rather than round-topped ribs.

Nagao (1932, p. 39, Pl. 6, fig. 6, 6a) figured a specimen from the Upper Ammonite bed (=Coniacian–Santonian, upper Yezu Group) of Hokkaido as *Callista* (?) cf. *arata* (Gabb), but its hinge is unknown, and it appears too inflated to be *Callistalox arata* (Gabb). Although Nagao indicated that its sculpture was similar to Whiteaves' description of the Sucia Island specimens, which are *Calva* (*Microcalva*) *haggarti,* it cannot be assigned to *Microcalva* on the basis of sculpture alone.

*Callistalox arata* is rare in the Redding area [5], Shasta County, but common in the Santa Ana Mts. [13], Orange County, California. Collections from the Diablo Range [9 and 10], including Orestimba Canyon, are too few, too sparse, and of insufficient volume to indicate abundance of the species.

### CALLISTALOX FRAGILIS (Gabb, 1869)
Figure 3.20–3.31

?*Meretrix fragilis* GABB, 1869, p. 185, Pl. 30, fig. 77.
"?*Meretrix*" *fragilis* Gabb, 1869. STEWART, 1930, p. 246, Pl. 4, fig. 4.

*Diagnosis.*—A relatively short, subtrigonal *Callistalox* ornamented with closely spaced concentric grooves.

*Description.*—Shell small, rounded subtrigonal, roundly moderately inflated medially; beaks prominent, at anterior third-length of shell, prosogyrous; lunular margin slightly concave; anterior end well rounded; ventral border arched; posterior end rounded; posterior dorsal slope long, barely arched; lunule lanceolate, moderately depressed, circumscribed by a line; shell surface ornamented by closely and evenly spaced concentric grooves and irregularly spaced impressed growth checks.

Ligament groove long and arched, behind long, narrow, smooth nymphae. Hinge of right valve with cardinals 3a and 1 anteriorly directed, divergent, beneath beak, 1 longer than 3a; cardinal 3b twice as long as 1, bifid; anterior laterals obscure enclosing moderately deep socket for AII; no posterior lateral but posterior valve margin grooved. Hinge of left valve with cardinals 2a and 2b sturdy, nearly equal, divergent; cardinal 4b longer, slender, separated from nymph by shallow groove; anterior lateral AII short, at an angle to lunular and hinge plate margin. Pallial line distant from shell margin; pallial sinus broad, angulate, extending nearly one-third of shell length across valve; dorsal arm convex, slightly ascending; ventral arm steeply ascending at nearly 70° to pallial line. Muscle scars lightly impressed.

*Lectotype.*—ANSP 4385.

*Paralectotypes.*—ANSP 76909. Stewart (1930) indicated that the syntype lot consisted of three specimens. The two (incomplete) paralectotypes have been newly catalogued (Elana Benamy, personal commun.).

*Hypotypes.*—LACMIP 8261, 8262 from CIT loc. 1573, Los Baños Creek [10], Merced County; 8264 from CIT loc. 1572, canyon south of Laguna Seca [10], Merced County, California. UCBMP 38657, from UCBMP loc. A-3371, north side Lake Nacimiento [11], San Luis Obispo County, California.

*Type locality.*—Martinez [8], Contra Costa County, California.

*Geologic age.*—Late Maastrichtian.

*Distribution.*—Great Valley Series near Martinez [8], Contra Costa County; Moreno Formation, Tierra Loma Shale Member, east side Diablo Range [10], Merced County; El Piojo Formation near Lake Nacimiento [11], San Luis Obispo County; San Francisquito Formation, Warm Springs Mountain [12], Los Angeles County, California.

*Measured specimens.*—See Table 4.

*Remarks.*—Gabb's figure shows an ascending, linguiform si-

TABLE 4—Measurements (in mm) of *Callistalox fragilis.*

| Museum no. | H | L | I | B | LL | LW | L/H | H/I | L/B | LL/LW |
|---|---|---|---|---|---|---|---|---|---|---|
| ANSP 4385† | 11.0 | 13.8 | 4.4 | 6.2 | — | — | 1.2 | 2.5 | 2.2 | — |
| LACMIP 7549 | 27.2 | 31.2 | 9.5 | 12.3 | 7.0 | 1.8 | 1.1 | 2.9 | 2.5 | 3.9 |
| LACMIP 8261 | 21.0 | — | 8.0 | 11.5 | 5.1 | 1.7 | — | 2.6 | — | 3.0 |
| LACMIP 8262 | 23.4 | 28.3 | 8.5 | 13.2 | — | — | 1.2 | 2.8 | 2.1 | — |
| LACMIP 8264 | 27.4 | 31.0 | 9.0 | 13.0 | 6.7 | 1.8 | 1.1 | 3.0 | 2.4 | 3.7 |
| UCBMP 38657 | 28.7 | 32.5 | 10.8 | 15.0 | 7.0 | 1.8 | 1.1 | 2.7 | 2.2 | 3.9 |

† Measured on UCLA plaster cast 28772.

←

hypotype, late Maastrichtian, from LACMIP loc. 10663, right valve; *21,* ×1, exterior; *31,* ×2, hinge; *22, 24, 25, 30,* UCBMP 38657, hypotype, ×1, late Maastrichtian, from UCB loc. A-3371, left valve; *22,* hinge; *24,* posterior view; *25,* anterior view; *30,* exterior; *23, 26, 29,* LACMIP 8262, hypotype, late Maastrichtian, from LACMIP loc. 10685, left valve; *23,* ×1, exterior; *26,* ×1, dorsal view; *29,* ×2, hinge; *27,* LACMIP 8184, hypotype, ×1, late Maastrichtian, from UCLA loc. 2661, right valve, pallial sinus; *28,* LACMIP 8261, hypotype, ×1, late Maastrichtian, from LACMIP loc. 10685, left valve, hinge.

nus. The lectotype is small and its hinge is not exposed. In its shape and sculpture it resembles the above hypotypes. The species was referred to as *Loxo fragilis* (Gabb, 1869) by Saul (1983), and its oblique anterior lateral is suggestive of *Loxo,* but the absence of posterior lateral teeth excludes it from *Loxo. Callistalox fragilis* has a linguiform pallial sinus suggestive of *Microcalva,* but the absence of posterior lateral teeth excludes it from *Microcalva. Callistalox arata* is more coarsely sculptured, more elongate, and smaller than *C. fragilis.* In both *C. arata* and *C. fragilis* the posterior margin of the right valve is grooved and the posterior margin of the left valve fits into this groove.

## Genus EGRONA n. gen.

*Type species.*—*Egrona fallax* n. sp., Turonian, Orange County, California.

*Diagnosis.*—Veneriform bivalves having smooth exterior except for growth lines; lunule depressed, set off by incised line; escutcheon of left valve obscurely delimited by angulation; three cardinals in each valve; right posterior cardinal bifid; an elongate, smooth sided anterior lateral tooth in left valve; shell margin of right valve grooved parallel to margin posterior to ligament; nymphs smooth; pallial sinus moderately deep and angular.

*Discussion.*—*Egrona* is a pitarine venerid externally similar enough in shape to *Calva* Popenoe, 1937, to have long been confounded with it, but *Egrona* lacks posterior laterals, has a better defined escutcheon, and has weak growth checks. *Egrona* has a better developed escutcheon than *Callistina* Jukes-Brown, 1908, and smooth rather than rugose laterals. Stewart (1930), Cox (1952), and Keen (1969, p. N676) synonymized *Aphrodina* Conrad, 1869, and *Callistina* Jukes-Brown, 1908. Although the type species of *Callistina, Venus plana* J. Sowerby, 1812 (late Albian, Upper Greensand, Blackdown, Devon, England), was reported to have cardinal 2a not bifid, David Jablonsky and Noel Morris have just shown, on the basis of hinges of type specimens cleaned by Morris, that *Callistina plana* has a slightly grooved 2a; and *Aphrodina* and *Callistina* cannot be separated on that basis. Apparently, Stephenson (1952) considered a bifid 2a to be of only specific importance as he included in *Callistina* two species having weakly bifid 2a, *C. lamarensis* (Shumard, 1860) and *C.* (*L.*) *munda* Stephenson, 1952, as well as *C.* (*L.*) *taffi* (Cragin, 1893) and *C.* (*L.*) *alta* Stephenson, 1952, in neither of which is 2a bifid. He differentiated the two genera on the basis of the alignment of cardinal and lateral teeth and the submergence of *Callistina* in *Aphrodina* is perhaps premature.

*Egrona* resembles three supraspecific taxa that have the left anterior cardinal 2a bifid: *Aphrodina* Conrad, 1869 (type species *Meretrix tippana* Conrad, 1858, from the Gulf and Atlantic Coast Maastrichtian), *Larma* Stephenson, 1952 (type species *Callistina* (*Larma*) *munda* Stephenson, 1952, Cenomanian, Woodbine Formation, Lamar County, Texas), and *Mesocallista* Cox, 1952 (type species, *Meretrix andersoni* Newton, 1909, ?Albian or Campanian of South Africa). In addition to having an entire 2a, *Egrona* lacks the striate anterior lateral AII of *Aphrodina.* Compared to *Larma,* it has a longer 4b that is more distant from 2b, a more linguiform pallial sinus, and a smooth rather than ribbed exterior. Keen (1969) placed *Larma* as a subgenus of *Mesocallista* presumably because both have smooth laterals and because the type species of *Larma, Callistina* (*Larma*) *munda,* has a weakly bifid 2a, although Stephenson (1952) had included two species with entire cardinals 2a in *Larma. Mesocallista* was described as a relatively small, ovate *Aphrodina* by Cox (1952), who ranked it as a subgenus of *Aphrodina. Egrona* is relatively large compared to both *Aphrodina tippana* and *Mesocallista andersoni.*

The hinge of *Microcallista* Stewart, 1930, is similar to that of *Egrona,* but *Microcallista* is concentrically ribbed, does not have as distinct an escutcheon, and is of small size.

*Etymology.*—The generic name *Egrona* is by anagram from orange, for Orange County, California, and is feminine in gender.

### EGRONA FALLAX n. sp.
Figure 4.1–4.12

*Diagnosis.*—As given for the genus.

*Description.*—Shell thick, of moderate size, subtrigonal, nearly as high as long, evenly inflated; beaks prominent, anterior to mid-length of shell, prosogyrous; anterior dorsal border strongly concave; anterior end sharply rounded; ventral border broadly arched; posterior end roundly truncate; posterior dorsal border moderately long, slightly arched; lunule heart-shaped, moderately large, depressed, delimited by inscribed line; escutcheon moderately wide, smooth, demarked by angulation in left valve.

Ligament groove arched behind moderate nymphs. Hinge of right valve with anterior tooth 3a and median cardinal tooth 1 short, narrowly triangular, diverging ventrally, situated directly beneath beaks; posterior cardinal 3b elongate, straight, shallowly bifid subparallel to nymph; socket for lateral AII elongate, narrow, moderately deep, smooth sided, parallel to lunular border of the shell. Hinge of left valve with anterior cardinal 2a prominent, very slender, aligned almost vertically beneath beak; cardinal 2b thicker than 2a, trigonal, directed posteriorly; posterior cardinal 4b slightly longer than anterior teeth, slender, very close to nymph and separated from it only by shallow groove; anterior lateral AII elongate, parallel to lunular valve margin, smooth sided. Pallial sinus sharply angulate, of moderate depth; dorsal arm nearly straight, horizontal; ventral arm arcuate, ascending.

*Holotype.*—LACMIP 8193.

*Paratypes.*—LACMIP 8194, 8195, 11273, 11274 from UCLA loc. 3449, Mabey Canyon, Santa Ana Mts. [13], Riverside County; 8265–8268 from LACMIP loc. 8167 (=CIT loc. 1305), east side Santa Ana Mts. [13], Orange County, California. USNM 456076 from USGS loc. 2184, Santa Ana Mts. [13], Orange County, California.

*Type locality.*—UCLA loc. 3449, Mabey Canyon, Santa Ana Mts. [13], Riverside County, California.

*Geologic age.*—Turonian.

*Distribution.*—Ladd Formation, upper Baker Canyon Conglomerate Member and lower Holz Shale Member, Santa Ana Mountains [13], Orange County, California.

*Measured specimens.*—See Table 5.

*Remarks.*—Specimens of *Egrona fallax* have long been confounded with *Calva* (*Calva*) *regina* Popenoe, 1937. They are more flatly inflated, have a more angulate escutcheonal margin, and are not as abruptly truncated posteriorly as those of *C. regina. Egrona fallax* usually has obscure growth checks. Internally, *E. fallax* has no posterior laterals, but the right valve does have a long shallow groove in the dorsal shell margin posterior to the ligament. Anterior lateral AII is relatively shorter in *E. fallax* than in *C.* (*C.*) *regina.* The portion of the hinge plate that supports the anterior lateral or its socket widens dorsally, unlike that of *C.* (*C.*) *regina,* which remains of nearly the same width for the length of the tooth or socket.

*Egrona fallax* differs from *Callistina plana* (J. Sowerby, 1812) (Woods, 1908, Pl. 30, figs. 1–6) in having a smaller lunule, narrower nymphs, 3b narrowly rather than widely bifid, and smooth laterals. Of the three species assigned by Stephenson (1952) to the subgenus *Larma* from the Woodbine, *Egrona fallax* is most similar in shape to *C.* (*L.*) *munda* Stephenson, 1952, which has 2a weakly bifid, but *E. fallax* has a stronger