

following features: thinner shell, stronger spiral ribbing, and an aperture with denticles.

Haplocochlias previously was known with certainty only as a Recent genus in the eastern Pacific and western Atlantic (Hickman & McLean, 1990). The fossil record of the family Skeneidae had been reported as early Miocene to Recent, with some of the Eocene species assigned to *Collonia* Gray, 1850 by Cossmann (1918:pl. 1, figs. 42-47; pl. 2, figs. 1-3) possibly included in the family (Hickman & McLean, 1990). The new species has a much higher spire and a much narrower umbilicus than these Eocene species, which are from the Paris Basin, France.

Cossmann & Pissarro (1910-1913:pl. 4, figs. 33-1 to 33-4, 33-7 to 33-13; pl. 5, figs. 33-14 to 33-28) illustrated additional Eocene species of *Collonia* from the Paris Basin, France. Of these, the new species is most like *Collonia* (*Cirsochilus*) *grignonensis* (Deshayes, 1864-1866:pl. 60, figs. 22-24 [= *Turbo grignonensis*]; Cossmann & Pissarro, 1910-1913:pl. 4, fig. 33-13) from middle Eocene (Lutetian Stage) strata. The new species differs in the following features: finer spiral ribbing on body whorl angulation, an aperture with denticles, and no beaded umbilical cord.

The new species is the first positively known fossil species of *Haplocochlias* and the earliest known representative of family Skeneidae.

Etymology: The species name is from the Latin *montis*, mountain, and refers to the position of the type locality of this species.

Occurrence: "Capay Stage" (middle lower Eocene). Crescent Formation, Larch Mountain, Washington (CSUN loc. 1563).

Order Neritoida Golikov & Starobogatov, 1975

Family NERITIDAE Rafinesque, 1815

Genus *Nerita* Linné, 1758

Type species: *Nerita peloronta* Linné, 1758, by subsequent designation (Montfort, 1810), Recent, Caribbean Sea.

Subgenus *Theliostyla* Mörch, 1852

Type species: *Nerita albicilla* Linné, 1758, by subsequent designation (Kobelt, 1879), Recent, Indo-Pacific.

Nerita (*Theliostyla*) *olympia*

Squires & Goedert, sp. nov.

(Figures 12-17)

Diagnosis: A *Theliostyla* with a body whorl having seven to eight noded carinae separated by interspaces as wide as the carinae.

Description: Shell small, up to 7 mm in height, broader than high, with rapidly expanding body whorl. Spire flattened, apex barely elevated above nearly flat dorsal surface. Dorsal surface with three to four noded spiral ribs (excluding carina on shoulder) that become coarser and more elevated toward outer lip. Body whorl with seven to eight, evenly spaced and usually equal-strength nodose carinae becoming, in some specimens, increasingly coarse toward base of body whorl. Interspaces approximately as wide as carinae and with or without a single, beaded spiral rib. Axial riblets fine, crossing spiral carinae and interspaces. Aperture large, quadrate. Outer lip flared, grooved at body-

Explanation of Figures 2 to 29

All specimens coated with ammonium chloride. Pictures taken by the senior author. All from CSUN loc. 1563.

Figures 2-5. *Emarginula washingtoniana* Squires & Goedert, sp. nov., holotype LACMIP 12279. Figure 2. Dorsal view, $\times 9.2$. Figure 3. Anterior view, $\times 10$. Figure 4. Left-lateral view, $\times 8.7$. Figure 5. Right-lateral view, $\times 7.6$. Figures 6-8. *Callovarica pacifica* Squires & Goedert, sp. nov., holotype LACMIP 12281. Figure 6. Apertural view, $\times 2.4$. Figure 7. Umbilical view, $\times 2.5$. Figure 8. Abapertural view, $\times 2.8$. Figures 9-11. *Haplocochlias montis* Squires & Goedert, sp. nov., holotype LACMIP 12283. Figure 9. Apertural view, $\times 14.4$. Figure 10. Umbilical view, $\times 13$. Figure 11. Abapertural view, $\times 13$. Figures 12-17. *Nerita* (*Theliostyla*) *olympia* Squires & Goedert, sp. nov. Figure 12. Holotype LACMIP 12285, apertural view, $\times 16$. Figure 13. Paratype LACMIP 12286, deck area, $\times 9.5$. Figure 14. Paratype LACMIP 12287, abapertural view, $\times 4.6$. Figure 15. Holotype LACMIP 12285, abapertural view, $\times 11$. Figures 16-17. Para-

type LACMIP 12288, operculum, $\times 11$. 16. Exterior view. 17. Interior view. Figures 18-20. *Lapsigyrys crescentensis* Squires & Goedert, sp. nov., holotype LACMIP 12289, $\times 8$. Figure 18. Apertural view. Figure 19. Lateral view showing outer lip. Figure 20. Abapertural view. Figures 21-23. *Mitrella* (*Mitrella*) *blackhillsensis* Squires & Goedert, sp. nov., holotype LACMIP 12291. Figure 21. Apertural view, $\times 7.8$. Figure 22. Lateral view showing outer lip, $\times 7.5$. Figure 23. Abapertural view, $\times 7.5$. Figures 24-26. *Ovatella* (*Myosotella*) *coneyi* Squires & Goedert, sp. nov., holotype LACMIP 12292, $\times 14$. Figure 24. Apertural view. Figure 25. Apertural view, rotated so as to reveal parietal plica. Figure 26. Abapertural view. Figures 27-29. *Linearia* (*Linearia*) *louellasaulae* Squires & Goedert, sp. nov. Figure 27. Holotype LACMIP 12294, right valve, $\times 10.3$. Figure 28. Paratype LACMIP 12295, right-valve hinge, $\times 14.6$. Figure 29. Paratype LACMIP 12296, left valve, $\times 12.3$.

whorl carinae. Inner lip with seven teeth. Two posterior-most teeth stronger than rest, with tooth next to posterior-most tooth strongest. Five small, subequal teeth medially. Deck with numerous small tubercles, round to elongate, arranged loosely in rows. Operculum calcareous with peg-like projection anteriorly and two small protuberances on inner lip side; exteriorly with numerous small tubercles medially and posteriorly arranged loosely in rows; interiorly smooth.

Dimensions of holotype: Height 2 mm, width 3 mm.

Holotype: LACMIP 12285.

Type locality: CSUN loc. 1563, Larch Mountain, Washington, 47°59'03"N, 123°8'12"W.

Paratypes: LACMIP 12286 to 12288, all from CSUN loc. 1563.

Discussion: Thirty specimens of *Nerita olympia* were found, and all are from CSUN loc. 1563. Most of the shells are chalky due to weathering and/or diagenesis and fall apart when removed from the brittle, silty mudstone that encloses them. Ten specimens of the operculum were found, and they are also all from CSUN loc. 1563.

The new species is similar to *Nerita (T.) héberti* Szöts (1953:30, 141–142, pl. 2, figs. 3–5) from the Eocene of Hungary. The new species differs by having fewer carinae on the dorsal surface and on the body whorl and stronger carinae on the body whorl. Szöts (1953) did not assign his species to the subgenus *Theliostyla*, but *N. héberti* has a dentate outer lip, a granulate deck area, and a finely dentate inner lip. These features are listed by Keen & Cox (1960) as being diagnostic of *Theliostyla*, hence Szöts' species belongs in *Theliostyla*.

There are only two other known species of *Nerita (Theliostyla)* from the Pacific coast of North America. One is *N. (T.) triangulata* Gabb (1869:170, pl. 28, figs. 52, 52a) from middle lower Eocene ("Capay Stage") to upper Eocene ("Tejon Stage") deposits from southern California to southwestern Oregon. Squires (1992b) reviewed the considerable range of morphologic variation of this species. The new species differs by having more carinae on the body whorl, more widely spaced carinae, and fewer or no ribs in the interspaces. The other known species is *N. (T.)* n. sp. (?) Woods & Saul (1986:649, figs. 6.13, 6.16, 6.17) from the upper Paleocene? or lower Eocene? ("Capay Stage") Sepultura Formation, Baja California Sur, Mexico. The new species differs by having many fewer carinae on the body whorl and more widely spaced carinae.

There are three known species of *Nerita* s.l. from Eocene rocks along the Pacific coast of North America. Two, *N. washingtoniana* Weaver & Palmer (1922:28–29, pl. 11, fig. 4) from the upper middle Eocene Cowlitz Formation, southwest Washington, and *N. vokesi* Durham (1944:156, pl. 17, figs. 11, 12) from the upper Eocene of northwest Washington (Squires, 1992b), are quite different from the new species because they possess smooth body whorls. The

third, *N. cowlitzensis* Dickerson (1915:58–59, pl. 5, fig. 7a, b) from the Cowlitz Formation in southwest Washington also differs significantly from the new species by possessing a body whorl with only minute sculpture.

Theliostyla probably originated in the Old World Tethyan paleobiotic province and immigrated to the Pacific coast of North America during the early Eocene (Squires, 1992b).

Etymology: The species is named for the city of Olympia, Washington, which is near the type locality of the new species.

Occurrence: "Capay Stage" (middle lower Eocene). Crescent Formation, Larch Mountain, Washington (CSUN loc. 1563).

Order Caenogastropoda Cox, 1960

Family RISSOIDAE Gray, 1847

Genus *Lapsigyryrus* Berry, 1958

Type species: *Alvania contrerasi* Jordan, 1936 (= *Alba mutans* Carpenter, 1857), by original designation, Pleistocene to Recent, west Mexico.

Lapsigyryrus crescentensis Squires & Goedert, sp. nov.

(Figures 18–20)

Diagnosis: A *Lapsigyryrus* having an elongate shell with 16 to 17 spiral threads on the body whorl.

Description: Shell minute, up to 5.5 mm in height, elongate, ovately conic, having approximately six convex whorls; spire high. Nucleus of 2½ whorls, smooth and conical. Spiral sculpture of thin ribs with 10 to 11 on penultimate whorl and 16 to 17 on body whorl; five terminal ribs on base are about twice as strong as preceding ribs; channels between spiral ribs filled with innumerable minute axial threads producing finely netted appearance within channels only. Suture indistinct. Body whorl strongly descending, exposing anteriormost part of preceding whorl. Aperture large, D-shaped. Outer lip slightly opisthoclinal, with narrow varix.

Dimensions of holotype: Height 5.5 mm, width 2.3 mm.

Holotype: LACMIP 12289.

Type locality: CSUN loc. 1563, Larch Mountain, Washington, 47°59'03"N, 123°8'12"W.

Paratype: LACMIP 12290, CSUN loc. 1563.

Discussion: Three specimens were found, and they are all from CSUN loc. 1563. The holotype is the largest specimen. The new species is remarkably similar to the living *Lapsigyryrus myrioshirissa* Shasky (1970:189, fig. 3) from west Mexico. The new species differs by having a more elongate shell with thicker and more widely spaced spiral ribs.

Previously, the geologic range of genus *Lapsigyris* was Pleistocene to Recent, with a single Pleistocene species and a few living species (Shasky, 1970; Keen, 1971). The geographic range of the genus was from Magdalena Bay, Baja California Sur, Mexico, to Costa Rica (Keen, 1971; Ponder, 1985). The new species extends the geologic range to the early Eocene and the geographic range to Washington.

Etymology: The species is named for the Crescent Formation.

Occurrence: "Capay Stage" (middle lower Eocene). Crescent Formation, Larch Mountain, Washington (CSUN loc. 1563).

Family COLUMBELLIDAE Swainson, 1840

Genus *Mitrella* Risso, 1826

Type species: *Mitrella flaminea* Risso, 1826, by subsequent designation (Cox, 1927), Recent, Mediterranean Sea.

Subgenus *Mitrella* s.s.

Mitrella (*Mitrella*) *blackhillsensis*

Squires & Goedert, sp. nov.

(Figures 21–23)

Diagnosis: A small *Mitrella* having a broad body whorl and no teeth on inner lip.

Description: Shell small, up to 5.5 mm in height, oval-fusiform. Suture distinct and impressed. Spire high with flat-sided, smooth whorls. Body whorl somewhat broad, smooth. Neck and siphonal fasciole areas with many fine spiral ribs. Aperture ovate. Outer lip varicose with 13 denticles on interior. Inner lip smooth. Anterior notch narrow.

Dimensions of holotype: Height 5.5 mm (incomplete); width 3 mm.

Holotype: LACMIP 12291.

Type locality: CSUN loc. 1563, Larch Mountain, Washington, 47°59'03"N, 123°8'12"W.

Discussion: Only two specimens were found. The new species is most similar to *Mitrella richthofeni* (Gabb, 1869: 10, pl. 2, fig. 16) from Pliocene beds in northern California (Keen & Bentson, 1944) and tentatively from lower Miocene beds in southern California (Loel & Corey, 1932). The new species differs in the following features: smaller size, broader body whorl, and no teeth on inner lip.

Wenz (1941) reported the geologic range of *Mitrella* s.s. to be Miocene to Recent. Several late Cenozoic species are known from the Pacific coast of North America. *Mitrella tenuilineata* (Clark, 1918:173, pl. 22, figs. 2, 3) has been reported from Oligocene beds in northern California, but

does not belong to *Mitrella* s.s. because it has spiral ribbing over the entire teleoconch.

The new species is the earliest record of *Mitrella* s.s.

Etymology: The species is named for the Black Hills, Washington.

Occurrence: "Capay Stage" (middle lower Eocene). Crescent Formation, Larch Mountain, Washington (CSUN loc. 1563).

Subclass Pulmonata Milne-Edwards, 1848

Order Basommataophora Schmidt, 1855

Family ELLOBIIDAE H. & A. Adams, 1855

Genus *Ovatella* Bivona, 1832

Type species: *Ovatella punctata* Bivona, 1832 [= *Auricula firminii* (Payraudeau, 1826)], by original designation, Recent, Mediterranean Sea.

Subgenus *Myosotella* Monterosato, 1906

Type species: *Auricula myosotis* Draparnaud, 1801, by original designation, Recent, Europe and both east and west coasts of the United States.

Ovatella (*Myosotella*) *coneyi*

Squires & Goedert, sp. nov.

(Figures 24–26)

Diagnosis: A narrow shelled *Ovatella* having subtabulate whorls, inner lip with two plicae, and anterior end of aperture pointed.

Description: Shell minute, up to about 3 mm in height, narrowly ovate-fusiform, with approximately five convex whorls; spire elevated (approximately 36 percent of shell height). Suture distinct and impressed. Whorls smooth and subtabulate near suture; middle of body whorl with very faint shoulder. Aperture ovate, anterior end pointed and flattened. Inner lip with two plicae continuing deep inside of aperture, anteriormost plica formed by turning of lip within the aperture and twice as strong as the posteriormost plica; posteriormost plica in parietal area. Outer lip broken off.

Dimensions of holotype: Height 2.75 mm, width 1.5 mm.

Holotype: LACMIP 12292.

Type locality: CSUN loc. 1563, Larch Mountain, Washington, 47°59'03"N, 123°8'12"W.

Paratype: LACMIP 12293, CSUN loc. 1563.

Discussion: Only two specimens were found and both are from CSUN loc. 1563. The new species resembles some variants of the living species *O. (M.) myosotis* (Draparnaud, 1801), a Mediterranean and eastern Atlantic species

dispersed by man to the east and west coasts of North America, the West Indies, South Africa, Australasia, and New Zealand (Climo, 1982). *Ovatella* (*M.*) *myosotis* shows considerable variation in the number of teeth on the inner and outer lips. The inner lip can have two to four teeth, and the outer lip can have one tooth or none (Climo, 1982). The new species resembles those specimens of *O.* (*M.*) *myosotis* that have two teeth on the inner lip and are without teeth on the outer lip (e.g., Climo, 1982:fig. 1A; and a few specimens in LACM lot 46780 from Purfleet, Essex, England). When compared to these particular examples, the new species differs in the following features: smaller size, spire whorls less convex, suture more impressed, subtabulate rather than non-tabulate whorls, base of body whorl more constricted, and aperture more elongate anteriorly.

Climo (1982) discussed the nomenclatural history of the family name that *Ovatella* should be assigned to, and Paulson (1957) reviewed the complex history of the genus name *Ovatella*. Zilch (1959–1960) discussed synonyms.

Zilch (1959–1960) reported the geologic range of *Ovatella* to be Paleocene to Recent. The early Tertiary species are from the Paris Basin, France, and the new species somewhat resembles *Ovatella* (*Myosotella*) *depressa* (Dehayes, 1864–1866:pl. 58, figs. 19–21; Cossmann & Pissarro, 1910–1913:pl. 58, fig. 256-8) from lower Eocene (Cuisian Stage) strata of the Paris Basin. The new species differs in the following features: smaller size, body whorl much less inflated near the suture, no spiral band anterior to suture, anterior end of aperture more pointed, no parietal callus, and no tendency to have more than one parietal plica.

Ovatella (*Myosotella*) *coneyi* is the first record of a marine pulmonate in the lower Tertiary of the Pacific coast of North America.

Etymology: The new species is named in memory of Charles Clifton Coney, who made valuable contributions to the study of Recent freshwater bivalves and terrestrial pulmonates.

Occurrence: "Capay Stage" (middle lower Eocene). Crescent Formation, Larch Mountain, Washington (CSUN loc. 1563).

Class Bivalvia Linné, 1758

Order Veneroida H. & A. Adams, 1856

Family TELLINIDAE de Blainville, 1814

Genus *Linearia* Conrad, 1860

Type species: *Linearia metastriata* Conrad, 1860, by monotypy, Late Cretaceous, Alabama.

Subgenus *Linearia* s.s.

Linearia (*Linearia*) *louellasaulae*
Squires & Goedert, sp. nov.

(Figures 27–29)

Diagnosis: A minute, circular-ovate *Linearia* having beaks located posteriorly, radial ribbing weak on center of valves, and posterior slope with different curvature than rest of valve.

Description: Valves minute, up to 3 mm high, thin and fragile, circular-ovate in plan: beaks small, slightly anterior of center; anterior end rounded, posterior end truncate. Sculpture of closely spaced, thin concentric ribs crossed by numerous fine radial ribs, except on umbonal area. Radial ribbing weak on center of valves. Intersections of concentric and radial ribs beaded, strongest anteriorly and posteriorly. Posterodorsal slope with different curvature than rest of valve and with approximately seven serrated ribs; rib on umbonal ridge coarsest. Right-valve hinge with two cardinals separated from each other by deep and narrow socket, anterior cardinal slender and obliquely directed downward; posterior cardinal shorter, thicker, and directed nearly vertically downward. Dorsal margin of right valve beveled to serve as laterals. Left-valve hinge not observable.

Dimensions of holotype: Height 3 mm, length 4 mm.

Holotype: LACMIP 12294.

Type locality: CSUN loc. 1563, Larch Mountain, Washington, 47°59'03"N, 123°8'12"W.

Paratypes: LACMIP 12295, 12296, both from CSUN loc. 1563.

Discussion: Eight specimens were found. Four are right valves, two are left valves, and two are fragments. The very delicate left valves are embedded in well-indurated matrix, and the hinges could not be exposed.

The new species is remarkably similar to *L.* (*L.*) *metastriata* Conrad (1860:279, pl. 46, fig. 7; Stephenson, 1923:329, pl. 84, figs. 1–5; Afshar, 1969:58, pl. 24, figs. 12–15; Keen, 1969, figs. E109-11a, 11b) from Upper Cretaceous strata of New Jersey, Maryland, North Carolina, Tennessee, and Mississippi. The new species differs in the following features: much smaller size, less elongate shell, beaks posteriorly located, posterior slope with a different curvature than rest of valve, and right-valve posterior cardinal thicker and not oblique.

Keen (1969) reported that the geologic range of *Linearia* s.s. is Early through Late Cretaceous, with species in Europe, North America, and Africa, but Stoliczka (1871:pl. 5, figs. 6, 7) reported *Linearia* from the Cretaceous of southern India. The North American species are primarily from the Upper Cretaceous of the east coast of the United States from New Jersey to Texas (Stephenson, 1923, 1941; Wade, 1926).

Only a few species of *Linearia* are known from the Pacific coast of North America. *Linearia suciensis* Whiteaves (1879:146–147, pl. 17, fig. 12) has the external features of *Linearia*, but the hinge characters are unknown and the only known specimen has been lost. This species

was found in Cretaceous rocks of Sucia Island in the Strait of Georgia, northwest Washington. These rocks are the Cedar District Formation, and the highest fossiliferous beds on the island have ammonites indicative of middle Campanian age (L. R. Saul, personal communication). The new species differs from *L. suciensis* in the following features: beaks more posteriorly located, posterior more truncate, radial ribs on ventral margin, coarser radial ribs on dorsal areas, and a distinct postero-dorsal umbonal ridge.

Whiteaves (1903:377) placed *L. suciensis* in synonymy with *Asapis multicosata* Gabb (1869:181, pl. 29, fig. 70) from Crooked Creek, central Oregon. The type locality of *A. multicosata* is somewhat vague. There are Cenomanian strata along the Crooked River (Jones, 1960:438), however, and Gabb's (1869:181) associated fossils suggest Gabb's material is from the same horizon as *A. multicosata*. Stewart (1930:284-285, pl. 4, figs. 8,9) also considered *L. suciensis* and *A. multicosata* to be the same and called them *Linearia multicosata* (Gabb). These two taxa are morphologically quite different, and it seems likely that they are not the same species. *Asaphis multicosata* lacks the fine, crowded concentric striae of *L. suciensis*, and *A. multicosata* is geologically older than *L. suciensis*.

Whiteaves (1879:147) assigned *Tellina meekiana* Whiteaves (1874:268, unnumbered plate, fig. 6) to *Linearia (Leiothyris) meekana* (Whiteaves). This species was found in Cretaceous rocks of Gabriola Island, just west of Vancouver, British Columbia, Canada. Examination of the LACMIP-collection plaster cast of the holotype of *Tellina meekiana* revealed that this species is quite unlike a *Linearia*. Saul (1993) studied Cretaceous venerids from the Pacific coast of North America, and she put *T. meekiana* in synonymy with *Paraesa (?) lens* (Gabb, 1864:23, fig. 143). She also reported that *P. (?) lens* [= *Flaventia lens* (Gabb, 1864)] is a common species in deposits of Campanian age from southern British Columbia to southern California.

Dailey & Popenoe (1966) described the tellinid *Palaeo-moera dyskritos* Dailey & Popenoe (1966:18-19, pl. 5, figs. 1, 2, 5) from the Upper Cretaceous Jalama Formation, Santa Barbara County, southern California. They mentioned that they thought that this species belonged to *Linearia* until they found a specimen that showed the hinge of the left valve. It contained only one oblique cardinal; hence, it could not be assigned to *Linearia*.

The new species is the youngest record of genus *Linearia* anywhere in the world.

Etymology: The species is named for LouElla Saul, in recognition of her many valuable contributions to the study of Cretaceous mollusks from the Pacific coast of North America.

Occurrence: "Capay Stage" (middle lower Eocene). Crescent Formation, Larch Mountain, Washington (CSUN loc. 1563).

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- CSUN 1564. At elevation of 1738 feet (530 m), on N side of logging road, 800 m N and 50 m W of SE corner of section 25, T18N, R3W, and 950 m N25°W of Rock Candy Mountain, Summit Lake U.S. Geological Survey quadrangle, 7.5-minute, 1981, Thurston County, Washington. Crescent Formation. Age: Middle early Eocene ("Capay Stage"). Collectors: J. L. & G. H. Goedert, August, 1992.

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