



Figures 9–30. All whitened with ammonium chloride. **9–10.** *Perissoptera robinaldina* (d'Orbigny, 1842), hypotype LACMIP 11536, from Atherfield, Isle of Wight, Great Britain, $\times 2$, **9**, back view, **10**, apertural view showing wing edge. **11–13, 19.** *Latialia* sp., all $\times 2$, latex pulls from LACMIP loc. 24670, **11**, LACMIP 7969, back view, **12**, LACMIP 7968, apertural view, **13**, LACMIP 7966, back view, **19**, two specimens, arrow points to LACMIP 7967. **14–18, 20–21.** *Latialia heliaca* n. sp., **14**, holotype LACMIP 11378 from LACMIP loc. 28788, $\times 1$, back view, **15**, paratype LACMIP 11379 from LACMIP loc. 28788, $\times 3$, back view, **16**, paratype LACMIP 11380 from LACMIP loc. 28788, $\times 4$, protoconch and first juvenile whorl, **17**, paratype LACMIP 11382 from LACMIP loc. 16838, $\times 2$, back view, **18**, paratype LACMIP 11383 from LACMIP loc. 16838, $\times 2$, left side, **20**, paratype 11381 from LACMIP loc. 16838, $\times 2$, back view, **21**, paratype 11384 from LACMIP loc. 16838, $\times 2$, wing in rock containing abundant *L. heliaca*. **22–30.** *Latialia californica* (Gabb), **22**, lectotype ANSP 4772 from the Siskiyou Mountains?, $\times 2$, photo by T. Susuki, **23**, paralectotype ANSP 4772 from the Siskiyou Mountains?, $\times 2$, photo by T. Susuki, **24**, hypotype LACMIP 11390 from LACMIP loc. 10901, $\times 2$, back view, **25–26**, hypotype LACMIP 11388 from LACMIP loc. 10901, $\times 2$, **25**, apertural view, **26**, back view, **27**, hypotype LACMIP 11385 from UCLA loc. 4365, $\times 2$, back view, **28**, hypotype LACMIP 11387 from UCLA loc. 4365, $\times 3$, apertural view, **29**, hypotype LACMIP 11386 from UCLA loc. 4365, $\times 2$, apertural view, **30**, hypotype LACMIP 11389, from LACMIP loc. 10901, $\times 1.5$, back view.

Table 4. Measurements in mm of specimens of *Latiala* sp.

	H	Hp	D	Dp	Dp/Hp	S	A	R	Rj	Rp	WB	WH	WD	Whorls
LACMIP 7966	18.2	3.3	—	—	—	9.1	—	—	18 [?]	15 [?]	7.9	7.8	13.3	4
LACMIP 7628	19.0	3.0	—	—	—	10.0	30°	—	20 [?]	21 [?]	6.5	—	—	5
LACMIP 7967	15.4	3.9	8.0	5.8	1.5	8.0	31°	8	21	24*	—	—	—	4
LACMIP 7969	20.5	3.8	—	6.8	1.8	11.0	28°	—	—	—	7.8	6.9	9+	6

A = pleural angle; D = diameter last whorl; Dp = diameter of penultimate whorl; H = height; Hp = height of penultimate whorl; R = axial ribs on body whorl; Rj = axial ribs on juvenile whorl; Rp = axial ribs on penultimate or other late teleoconch whorl; S = height of spire; WB = wing breadth measured from last rib to distal edge; WD = length distal margin of wing; WH = wing height except posterior and anterior spurs; † = broken, crushed; * = axial ribs counted on one side of whorl and doubled.

specimens of Cenomanian age from Clear Creek, Shasta County, and Sunflower Valley, Fresno County, that he had labeled *Arrhoges* (*Latiala*) new species. Specimens of *Latiala* of Turonian age from the Santa Ana Mountains reveal differences in the sculpture of the early whorls and in onset of sculpture changes on the spire, as compared to specimens of *L. californica* from the Siskiyou Mountains of the Oregon California border. On the basis of these differences, *L. californica* is discriminated from *L. nodosa* and considered not to be found in southern California.

Latiala sp.

Figures 11–13, 19; Table 4.

Diagnosis: A fusiform *Latiala* with about 18–24 axial ribs on spire whorls, reduced to about eight on body whorl; body whorl with ribs not confined to back of whorl.

Description: Shell of medium size, spindle shaped, except for expanded outer lip; whorls about twice as wide as high, numbering about seven or eight whorls, last whorl approximately half of shell height; pleural angle about 30°; whorl profile on spire roundly convex; profile of last whorl roundly convex except at axial nodes; outer lip expanded, broad, subquadrate, with short anterior and longer more pointed posterior projection. Protoconch unknown. Sculpture of 18–24 arched, round-topped, axial ribs, crossed by much weaker, fine spiral cordlets, strongest adjacent to posterior suture, two cordlets commonly strongest; sculpture on body whorl of eight to nine, short sharp, strong axial ribs crossed by fine spiral cordlets; ribs on back of body whorl shorter, stronger, more nodular. Aperture elongate; inner lip thickly callused with well defined edge; rostrum narrow, of moderate length.

Material examined: LACMIP 7628, 7966–7969 from LACMIP loc. 24670 on Grave Creek, Jackson County, Oregon.

Dimensions: See Table 4.

Age: Late early to middle Albian.

Geographic distribution: Studied specimens are all from the Hornbrook ? Formation on Grave Creek, Jackson County, Oregon

Remarks: This undescribed species is left unnamed because the specimens studied are all rock molds, and the figures are from latex pulls. The protoconch was present on some of these specimens, but the sandstone is too coarse-grained to yield a latex pull that replicates the original surface. Sculpture of the spire is similar to that of *Latiala hayamii* (Kase, 1984), but *Latiala* sp. has a broader pleural angle. *Latiala* sp. differs from *L. heliaca* in having more axial ribs on the body whorl, some of which are on the apertural side of the whorl. *Latiala* sp. has a proportionately higher wing than *Latiala heliaca*, *L. californica*, or *L. sigma*.

Table 5. Measurements in mm of specimens of *Laticosta heliaca* n. sp.

	H	Hp	D	Dp	Dp/Hp	S	A	R	Rj	Rp	WB	WH	WD	Whorls
LACMIP 11378	34.1	4.6	—	8.9	1.9	16.0	35°	—	19	14	—	—	—	8
LACMIP 11379	9.7	1.9	5.0	4.2	2.2	—	34°	—	26*	—	—	—	—	7
LACMIP 11380	5.5	0.8	2.7	2.0	2.5	2.5	43°	—	38	—	—	—	—	5
UCLA 28625 = LACMIP 9824	20.5	3.3	9.6	7.0	2.1	11.6	32°	3	—	—	10.4	9	10	7
UCLA 28626 = LACMIP 9825	13.7	3.4	7.0	5.4	1.6	13.7	36°	—	30	17	—	—	—	9
LACMIP 11381	19.2	3.3	8.4	6.0	1.8	9.8	35°	3	—	—	—	—	—	5
LACMIP 11382	14.5	2.4	6.8	4.9	2.0	6.0	35°	2	—	14	6.6	5.5	7.0	6
LACMIP 11383	17.0	2.7	6.8	5.2	1.9	8.6	34°	—	28*	—	—	—	—	8
LACMIP 11384	—	—	—	—	—	—	—	—	—	—	7.8	7.3	14.8	—

A = pleural angle; D = diameter last whorl; Dp = diameter of penultimate whorl; H = height; Hp = height of penultimate whorl; R = axial ribs on body whorl; Rj = axial ribs on juvenile whorl; Rp = axial ribs on penultimate or other late teleoconch whorl; S = height of spire; WB = wing breadth measured from last rib to distal edge; WD = length distal margin of wing; WH = wing height except posterior and anterior spurs; * = axial ribs counted on one side of whorl and doubled.

Laticosta heliaca n. sp.

Figures 14–18, 20–21; Table 5.

Arrhoges californicus (Gabb)—Murphy and Rodda, 1960, p. 841, pl. 102, fig. 6–7.

Diagnosis: A slender fusiform *Laticosta* with about 16 axial ribs on spire whorls, greatly reduced on final whorl to two or three on dorsal side of body whorl.

Description: Shell of medium size, spindle shaped, except for expanded outer lip, of about nine whorls; whorls about twice as wide as high; last whorl approximately half of shell height; pleural angle about 36°; whorl profile on spire roundly convex; profile of last whorl roundly convex except at axial nodes and with broad axial bulge on apertural face; outer lip expanded, broad, subquadrate, slightly thickened at distal edge, with short anterior and longer posterior projections. Protoconch of four or five rapidly enlarging, rounded, glossy whorls; transition to juvenile sculpture gradual, marked by spaced faint, arched, axial ribs and spiral striae; ribs rapidly strengthened, becoming crowded. Sculpture on first juvenile whorl of 26–36 arched axial ribs crossed by much weaker fine spiral cordlets; sculpture of next through penultimate whorls of about 16 arcuate axial ribs crossed by fine spiral cordlets, strongest adjacent to posterior suture, three cordlets commonly strongest; sculpture on body whorl of three to four short, sharp, strong axial ribs crossed by fine spiral cordlets. Aperture elongate; inner lip broadly callused, callus angling from posterior of aperture across mid-whorl on apertural face and wrapping halfway around anterior rostrum; rostrum narrow, straight, relatively short.

Type specimens: Holotype, LACMIP 11378. Paratypes LACMIP 11379–11380 from LACMIP loc. 28788; UCLA 28625 = LACMIP 9825, UCLA 28626 = LACMIP 9824 from UCLA loc. 3465, and LACMIP 11381–11384 from LACMIP loc. 16838, Ono area, Shasta County, California.

Type locality: LACMIP 28788, north end of Sunflower Valley (= McLure Valley), Fresno County, California. Panoche Formation.

Dimensions: See Table 5.

Age: ?Late Albian-Cenomanian.

Geographic distribution: Budden Canyon Formation, Bald Hills Member, Ono area, Shasta County (UCLA loc. 3465; Great Valley Series, Elder Creek, Tehama County (LACMIP loc. 24370); Panoche Formation, Sunflower Valley, Fresno County (LACMIP loc. 28788), California.

Remarks: No varices were recognized on the early whorls of *L. heliaca*. LACMIP 11380 consists of a protoconch of 4 polished, rounded whorls and the first teleoconch whorl. The earliest axial ribs are irregular, low, and difficult to count, but on the second quarter of the first teleoconch whorl the ribs become stronger, more distant and more regular. Rib strength varies between

Table 6. Measurements in mm of specimens of *Latiala californica* (Gabb).

	H	Hp	D	Dp	Dp/Hp	S	A	R	Rj	Rp	WB	WH	WD	Whorls
ANSP 4272	15.0	2.0	5.0	3.9	1.95	7.0	?	—	40	—	4.7	3.8	7.0	7
CASG 61950.01	10.65		6.15											
CASG 61950.02	22.26													
LACMIP 11385	14.8	2.0	6.0	4.7	2.35	7.0	42°	3	30+	—	7.0	5.0	6.5	7
LACMIP 11386	19.7	3.8	8.5	6.5	1.76	11.0	30°	4	—	20	—	—	—	6
LACMIP 11387	8.9	1.8	4.3	3.3	1.83	—	33°	—	§	—	—	—	—	6
LACMIP 11388	18.3	3.4	7.9	6.0	1.76	10.0	35°	3	—	14?	8.8	6.9	9.0	8
LACMIP 11389	22.3	3.4	9.6	6.9	2.03	10.5	34°	4	60?	—	—	—	—	5
LACMIP 11390	14.0	3.4	7.0	5.7	1.7	8.0	34°	3	—	22	—	—	—	4

A = pleural angle; D = diameter last whorl; Dp = diameter of penultimate whorl; H = height; Hp = height penultimate whorl; R = axial ribs on body whorl; Rj = axial ribs on juvenile whorl; Rp = axial ribs on penultimate or other late teleoconch whorl; S = height of spire; WB = wing breadth measured from last rib to distal edge; WD = length distal margin of wing; WH = wing height except posterior and anterior spurs; § = ribs too fine to count.

individuals, and on some whorls the axial ribs may be indiscernible.

Specimens from Elder Creek (LACMIP loc. 24370) are from a boulder containing species suggestive of late Albian age in a conglomerate that is of Turonian age (Jones and Bailey, 1973).

Latiala heliaca is larger and more slender than *L. californica* and has fewer axial ribs. Whereas *L. californica* retains the fine axial ribbing of the juvenile whorl throughout most of the spire whorls, in *L. heliaca* the intermediate whorls have fewer, coarser ribs, and the body whorl is not angulate at the shoulder, although the nodose axial ribs can create the impression of a shoulder angulation. *Latiala helica* has more axial ribs on the spire and fewer on the body whorl, is more slender with a more fusiform shape, and has a slightly broader shorter wing than *L. nodosa*. *Latiala helica* is more slender, has less of a shoulder, fewer axial ribs, and a shorter wing than *L. sigma*.

Latiala heliaca is most similar in shape to *Latiala hayamii* (Kase, 1984) from the Aptian-Albian of northeast Japan, but differs in having fewer axial ribs on the body whorl.

Etymology: The species name, derived from Greek, *helios*, sun, refers to the type locality at the northwest end of Sunflower Valley.

Latiala californica (Gabb, 1864)

Figures 22–30; Table 6.

Aporrhais californica Gabb, 1864, p. 128, pl. 29, figs. 230a, b.
Arrhoges californicus (Gabb)—Stewart, 1927, p. 363, pl. 21, fig. 15.

Arrhoges (Latiala) californicus (Gabb). Popenoe, 1983, p. 761 (in part; not fig. 6F, I. See *L. nodosa* Packard).

Not *Arrhoges californicus* (Gabb)—Murphy and Rodda, 1960, p. 841, pl. 102, fig. 6–7. See *L. heliaca* n. sp.

Not *Arrhoges californicus* (Gabb)—Jones, Sliter and Popenoe, 1978, p. xxii.9, pl. 1, fig. 10. See *L. nodosa* Packard).

Diagnosis: A small *Latiala* in which axial sculpture of spire consists of fine, closely spaced, almost sigmoid ribs. Sculpture of body whorl of three to four strong, short ribs, present only on dorsal side, nodular at the shoulder.

Description: Shell, thin, of small to medium size, spindle shaped except for expanded outer lip; whorls nearly twice as wide as high, numbering about seven; last whorl approximately two-thirds to three-quarters of shell height; pleural angle about 35°; whorl profile on spire rounded; profile of last whorl angulate at shoulder and with broad axial bulge on apertural face; varices rare (?one juvenile varix per specimen), forming broad axial swellings; outer lip expanded, broad and moderately tall, with very short anterior and much longer posterior projections. Protoconch multispiral of five or six smooth, rounded whorls. Sculpture on body whorl of about four short, nodular axial ribs on dorsal side, a broad axial bulge on the apertural side and fine spiral striae, stronger spiral cordlets on shoulder and on collar; sculpture

on penultimate whorl of about 20 fine nearly sigmoid axial ribs and fine (about four per mm), regularly spaced spiral cordlets, strongest near posterior suture; sculpture on earlier whorls finer than on penultimate whorl. Aperture elongate, outer lip thickened internally; distal edge of outer lip relatively long; rostrum short.

Type specimens: Lectotype ANSP 4272 (designated by Murphy and Rodda, 1960). Paralectotypes (2) ANSP 79470; CASG 61950.01 (one loose specimen + a rock fragment containing several, two largely exposed).

Hypotypes: LACMIP 11385–11387 from UCLA loc. 4365, Redding area, Shasta County; and LACMIP 11388–11390 from LACMIP loc. 10901, Rancheria Gulch, Siskiyou County, California.

Type locality: Siskiyou Mountains?, Jackson County, Oregon or Siskiyou County, California. Gabb (1864, p. 129) listed this species from "Orestimba Cañon; Martínez; Puerto Cañon, Stanislaus County; Siskiyou Mountains." None of these was precise as to geographic or stratigraphic position. Stewart (1927) said that the label with Gabb's ANSP specimens read Siskiyou Mts. and Martinez, but that all of the specimens were in a similar black limestone matrix with small pebbles which he considered more likely to have come from the Siskiyou Mountains than from Martinez. Natural History Museum of Los Angeles County specimens resembling Gabb's material are from the Osburger Gulch Sandstone Member of the Hornbrook Formation in the Siskiyou Mountains, but are not identical in preservation to Gabb's Siskiyou Mountains specimens.

Dimensions: See Table 6.

Age: Turonian.

Geographic distribution: Hornbrook Formation, Osburger Gulch Sandstone Member (LACMIP loc. 10901, LACMIP loc. 10876, LACMIP loc. 25422), Jackson County, Oregon and Siskiyou County, California; Redding Formation, ?Frazier Siltstone Member (UCLA 4365) near Redding, Shasta County, California.

Remarks: The CASG "syntypes" have a label that lists SUT 266, Calif. Geol. Surv. 2144, and UCB 14907, indicating that the specimens were originally at University of California, Berkeley, Museum of Paleontology before they were moved to Stanford and from there to the California Academy of Sciences.

The lectotype is 15 mm high, nearly complete, and has an adult aperture, but is missing shell on the last two whorls. The absence of parts of the shell interferes with describing the sculpture. The ANSP and CASG type specimens are small, but some collections (e.g., LACMIP loc. 10901) contain a few larger individuals (Figure 30). The above description depends in part on additional specimens from the rather generalized type locality of Siskiyou Mountains. Specimens are commonly found locally in abundance as in the blocks of paratype material, but the very thin shell of this species has made

difficult the recovery of specimens with shell adhering. This species exhibits juvenile sculpture onto the penultimate whorl on small adults and up to the penultimate whorl on large adults.

Gabb's illustration (fig. 230a) has an outline more like that of *Latiala heliaca* than of *L. californica* and may have been based on a specimen of that species. If so, the specimen appears to have been lost.

Latiala californica differs from *L. heliaca* in having an angulate shoulder and more axial ribs on most whorls. It differs from *L. nodosa* in having a very thin shell, retaining the fine axial ribbing onto or up to the penultimate whorl. *Latiala californica* is smaller, has weaker spiral sculpture, and fewer axial ribs on the body whorl than *L. sigma*. Of the five species described in this paper, *L. californica* has the relatively shortest wing.

Latiala sigma n. sp.
Figures 31–43; Table 7.

Diagnosis: A relatively large *Latiala* with relatively strong spiral sculpture, numerous fine axial ribs on early whorls, and about seven ribs on body whorl.

Description: Shell of medium size, stoutly spindle shaped, except for expanded outer lip; whorls about twice as wide as high, nine in large mature individuals, seven in small mature individuals; last whorl approximately two-thirds of shell height; pleural angle about 36°; whorl profile on spire nearly flat sided with narrow rounded shoulder; whorl profile of last two whorls rather evenly rounded; varices poorly developed on early whorls; outer lip expanded, tall and broad, subquadrate with very short, blunt anterior and narrow posterior projections; angle of distal edge of outer lip to that of shell axis about 33°. Protoconch of four rounded, glossy whorls. Sculpture on winged body whorl of five to seven short axial ribs on dorsal side, on penultimate whorl of about 20 to 30 curved axial ribs and three narrow spiral cordlets at the suture; sculpture on first quarter of first teleoconch whorl of fine axial lines, at least eight per 1 mm, axial lines double in size and by third teleoconch whorl are four to 1 mm; second teleoconch whorl with about 40–50 fine axial ribs crossing about 20 spiral cordlets; cordlets weakest mid whorl and strongest posteriorly. Aperture elongate, outer lip not much thickened; inner lip somewhat thickened; rostrum relatively long.

Type specimens: Holotype LACMIP 11391. Paratypes LACMIP 11392–11398 from UCLA loc. 5421, LACMIP 11399–11401 from CIT 1346, and LACMIP 11402 from CIT 1266, all on Little Cow Creek, Redding area, Shasta County, California.

Type locality: UCLA loc. 5421, Little Cow Creek, south line sec. 9, T32N, R3W, Millville quad., Shasta County, California. Redding Formation, Melton Sandstone.

Dimensions: See Table 7.

Age: Turonian.