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ADDITIONS TO PACIFIC SLOPE TURONIAN GASTROPODA

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Additions to Pacific Slope Turonian Gastropoda

by

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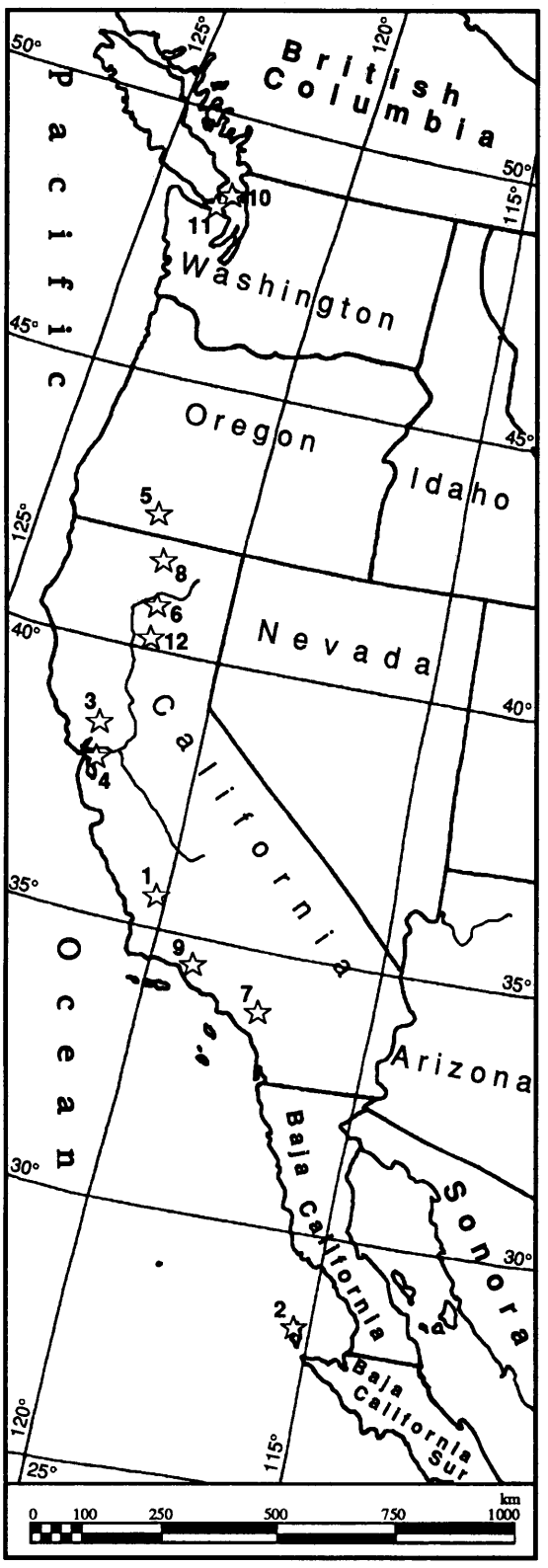
Abstract. Eighteen species of Pacific Slope Turonian (Late Cretaceous) gastropods are discussed. Nine of the species and six of the genera are new. The new genera are ***Praesargana***, ***Cydas***, ***Saturnus***, ***Skyles***, ***Varens***, and ***Konistra***. The new species are *Anchura* (*Helicaulax*) ***tricosa***, *Confusiscala*? ***juvenca***, *Confusiscala*? ***sulfurea***, *Eripachya* ***vaccina***, *Drilluta* ***sicca***, ***Skyles salsus***, *Remera* ***vacca***, ***Varens anae***, and ***Varens formosus***. The Turonian age of *Palaeatractus crassus* Gabb, 1869, and ***Saturnus*** *dubius* (Packard, 1922) is demonstrated. Supraspecific assignment, age, and geographic distribution of *Anchura* (*Helicaulax*) *condoniana* (Anderson, 1902), *Praesargana condoni* (White, 1889), *Cydas crossi* (Anderson, 1958), *Drilluta jacksonensis* (Anderson, 1958), *Carota dilleri* (White, 1889), *Carota*? *mitraeformis* (Gabb, 1869), and *Konistra biconica* (Anderson, 1958) are discussed. Recognition of Gulf Coast and Western Interior genera *Drilluta, Remera,* and *Carota* for the first time in Pacific Slope faunas adds to the probability of greater interchange than previously recognized between the Gulf Coast-Western Interior and the Pacific Slope during the Turonian.

INTRODUCTION

Pacific Slope molluscan faunas of Cretaceous age remain underdescribed. W. P. Popenoe worked on the rich Cretaceous fauna of the Redding area, Shasta County, California (Figure 1), for roughly 50 years. He was particularly interested in gastropods of Turonian age and left at his death unpublished descriptions of a number of species. This paper describes or discusses 18 species, nine of which are new, and proposes six new genera. Although these descriptions are from an uncompleted manuscript on the Redding area, not all of the specimens discussed are from there. Figure 1 is an orientation map for places of occurrence. New taxa proposed are: *Anchura* (*Helicaulax*) ***tricosa*** sp. nov., *Confusiscala*? ***juvenca*** sp. nov., *Confusiscala*? ***sulfurea*** sp. nov., ***Praesargana*** *condoni* (White, 1889) gen. nov., ***Cydas*** *crossi* (Anderson, 1958) gen. nov., *Eripachya* ***vaccinus*** sp. nov., ***Saturnus*** *dubius* (Packard, 1922) gen. nov., *Drilluta* ***sicca*** sp. nov., ***Skyles salsus*** gen. et sp. nov., *Remera* ***vacca*** sp. nov., ***Varens anae*** gen. et sp. nov., ***Varens formosus*** gen. et sp. nov., and ***Konistra*** *biconica* (Anderson, 1958) gen. nov. Systematic and stratigraphic position and geographic distribution are discussed for *Anchura* (*Helicaulax*) *condoniana* Anderson, 1902, *Palaeatractus crassus* Gabb, 1869, *Drilluta jacksonensis* (Anderson, 1958), *Carota dilleri* (White, 1889), and *Carota*? *mitraeformis* (Gabb, 1869). *Palaeatractus crassus* Gabb, 1869, "*Cordiera*" *mitraeformis* Gabb, 1869, *Acteon politus* Gabb, 1869, and *Liocium punctatum* Gabb, 1869, were originally described "From the Shasta Group, from a canyon in the foothills, a mile south of the road from Colusa to the Sulphur Springs near the eastern margin of the Coast Range, Colusa County," and considered by GABB (1869) to be of Early Cretaceous age. All four have, however, been collected from beds of Turonian age in the Redding Formation.

Pacific Slope Cretaceous gastropod faunas show, in general, little similarity to faunas of the Gulf Coast and Western Interior, but generic affinities of the Pacific Slope Senonian gastropods to those of Japan have commonly been

[1] Deceased.



recognized. However, among the 13 Turonian genera discussed in this paper, four are also present in the Gulf Coast-Western Interior and a fifth, ***Praesargana,*** bears strong resemblance to a Gulf Coast genus. These gastropods thus suggest greater interchange with Atlantic realm faunas during the Turonian than during the Senonian. Quantitative comparisons of these faunas must await more complete description of the Pacific Slope faunas. In addition to increasing the knowledge of the paleogeographic distributions of some groups, the descriptions of these Turonian forms increase our ability to assess biodiversity of the past.

Curatorial abbreviations used are CASG = California Academy of Sciences, Geology; CIT = California Institute of Technology; CSMB = California State Mining Bureau; GSC = Geological Survey of Canada; LACM = Natural History Museum of Los Angeles County, Malacology Section; LACMIP = Natural History Museum of Los Angeles County, Invertebrate Paleontology Section; MCZ = Harvard University, Museum of Comparative Zoology; UCBMP = University of California, Berkeley, Museum of Paleontology; UCLA = University of California, Los Angeles, Department of Earth and Space Sciences; UCR = University of California, Riverside, Department of Geological Sciences; USGS = United States Geological Survey; USNM = United States National Museum; UW = University of Washington, Thomas Burke Museum.

In the following descriptions, species characterized as small are under 20 mm in height; those characterized as medium-sized range between 20 mm and 60 mm in height; and those characterized as large are 60 mm or more in height.

Features measured are listed by the following abbreviations in tables: height = H; maximum diameter = D; height of penultimate whorl = Hp; diameter of penultimate whorl = Dp; height of spire = Ha; height of shoulder on penultimate whorl = Hs; length of extended outer lip in aporrhaids = Lw; length of prong in aporrhaids = Lp;

←

Figure 1

Index map. Two sequences have provided the bulk of the studied material: the exposures of the Redding Formation, northeast of Redding, Shasta Co., and the lower part of the Ladd Formation in the northern Santa Ana Mountains, Orange Co., California. A third significant unit is the Osburger Gulch Member of the Hornbrook Formation cropping out in Jackson Co., Oregon, and Siskiyou Co., California. Place names (starred) mentioned in the text are: 1, Antelope Valley, Kern. Co., California; 2, Cedros Island, Baja California, Mexico; 3, Colusa to the Sulphur Springs, Colusa Co., California; 4, Martinez, Contra Costa Co., California; 5, Phoenix, Jackson Co., Oregon; 6, Redding, Shasta Co., California; 7, Santa Ana Mts., Orange Co., California; 8, Siskiyou Co., California; 9, Simi Hills, Los Angeles Co., California; 10, Sucia Island, San Juan Co., Washington; 11, Sydney Island, Straits of Georgia, British Columbia; 12, Tuscan Springs, Tehama Co., California.

length of aperture = La; length of rostrum = Lr; pleural angle = A; number of axial ribs per whorl = R.

SYSTEMATIC PALEONTOLOGY

Phylum Mollusca Linnaeus, 1758

Class Gastropoda Cuvier, 1797

Order Mesogastropoda Wenz, 1938

Superfamily Strombacea Rafinesque, 1815

Family APORRHAIDAE Gray, 1850

Aporrhaids have an aperture with at least three large sinus areas that are independent of the lip extensions. One is posterior and adjacent to the whorl, the second bends the outer lip next to the rostrum, and the third is a hollow across the base of the columella and whorl base that exits on the body side of the anterior rostrum. When the animal is in living position, these sinuses accommodate the head and foot of the animal beneath the shell (Figure 2). The depth of the basal sinus (Figure 2C) is accentuated in some aporrhaids by the buildup of callus on the apertural face of the last whorl. In Campanian and Maastrichtian *Anchura* spp. these calluses are commonly very thick, but in the Turonian *Helicaulax* spp. the inner lip is thin to thick and not expanded onto the face of the last whorl.

Genus *Anchura* Conrad, 1860

Type species: *Anchura abrupta* Conrad, 1860, by monotypy, from the Gulf Coast Maastrichtian.

Diagnosis: Medium- to large-sized aporrhaids with high, evenly tapering spires; sculpture ornate, with both axial and spiral elements, commonly noded at intersections; aperture sublenticular; anterior rostrum long and narrow; outer lip elongate, extended into a falcate digitation, bent posteriorly.

Subgenus *Anchura* Conrad, 1860

Diagnosis: *Anchura* with the long narrow anterior rostrum deflected to the left in apertural view; lateral arm of the outer lip without flanges.

Discussion: Time and geographic ranges of the subgenus *Anchura* are difficult to determine in the absence of more complete studies of various species that have been assigned to it (SOHL, 1960). The subgenus is well represented in beds ranging in age from Cenomanian through Maastrichtian of North America and Europe. It appears to have a longer range and be more prolific in the Western Interior and the Gulf Coast than elsewhere. On the Pacific Slope it has not yet been found earlier than Turonian. Two Pacific Slope species have been described, *Anchura* (*Anchura*) *falciformis* (Gabb, 1864) of early Campanian age and *A.* (*A.*) *gibbera* Webster, 1983, of early Maastrichtian age. Although "*Anchura*" *angulata* (Gabb, 1864) of ?Albian–Cenomanian age resembles *Anchura* in overall shape, it has a wing more like that of *Drepanochilus* Meek, 1864, or *Dimorphosoma* Gardner, 1875, and very fine sculpture on the spire that is distinctly different than the ornate sculpture of typical *Anchura.*

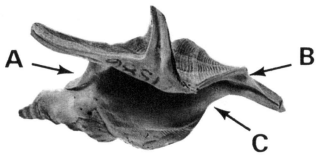


Figure 2

Three large sinus areas of the aporrhaid aperture. A. Posterior sinus to accommodate the posterior part of the foot. B. Anterior outer lip sinus to accommodate the snout. C. Basal sinus to accommodate the anterior part of the foot. (Example is modern *Aporrhais pespelecani* (Linnaeus, 1758) from the Mediterranean Sea, LACM 149737x (= UCLA cat. no. 41586).

Subgenus *Helicaulax* Gabb, 1868

Type species: *Rostellaria ornata* d'Orbigny, 1843, by subsequent designation (COSSMANN, 1904), from the Turonian of France.

Diagnosis: Medium-sized, high-spired aporrhaids with whorls ornately sculptured by both axial and spiral elements and usually noded at the intersections; last whorl uniangulate; anterior rostrum elongate, narrow, straight; aperture subquadrate; posterior digitation reflexed, elongate, and adnate to spire at its base; outer lip extended, falcate, tapering posteriorly to a spike; inner lip thin to thick.

Discussion: *Helicaulax* resembles *Anchura* Conrad, 1860, in spire, sculpture, rostrum, and expansion of the outer lip, but it differs from *Anchura* in having, in addition to its expanded outer lip, an elongate, reflexed posterior digitation that is adnate to the spire (SOHL, 1960:103). In typical *Anchura* the anterior rostrum is deflected to the left in apertural view, but in *Helicaulax* it is straight. *Helicaulax* tends to develop flanges along the lateral segment of the outer lip. Although GABB (1868), when proposing the subgenus, placed two California species, in addition to the type species, in *Helicaulax,* neither of these California species can be retained in it (SOHL, 1960). *Helicaulax bicarinata* Gabb, 1864, of ?Albian age, is a *Tessarolax* Gabb, 1864, and *H. costata* Gabb, 1864, of Paleocene age is, according to STEWART (1927), an *Araeodactylus* Harris & Burrows, 1891. The chronologic range of *Helicaulax* is Cenomanian to Maastrichtian (SOHL, 1960). *Anchura* (*Helicaulax*) *condoniana* and *A.* (*H.*) ***tricosa*** are the only known Pacific Slope representatives of this subgenus, which is better known from the Western Interior and Gulf Coast of North America and from Europe. Whereas *Anchura* (*Anchura*) is more common in North American Upper Cretaceous deposits, *A.* (*Helicaulax*) is better represented in Europe.

Both *A. (H.) condoniana* and *A. (H.)* ***tricosa*** differ from the typical European forms in having the posterior digitation that sprouts adjacent to the whorl, thereafter unattached rather than adnate for part of its length. Additionally, the inner lip of these West Coast species is thick whereas that of *A. (H.) ornata* is very thin (COSSMANN, 1904:64). *Helicaulax* has been considered a subgenus of *Aporrhais* da Costa, 1778, by COSSMANN (1904) and WENZ (1940), but it differs from *Aporrhais* in having a laterally extended falcate outer lip that tapers to a spike rather than the broadly palmate digitated wing of *Aporrhais*. In *Aporrhais* the ornamentation tends to have a bicarinate orientation, but on *Helicaulax* and *Anchura* the complex sculpture has axial and spiral elements that commonly form nodes at intersections. On the last whorl, one or two of the spirals increase in strength to give the body whorl an unicarinate profile. Although *Helicaulax* differs from *Anchura* in having (1) a posterior digitation, (2) flanges along the lateral extension of the wing, (3) a straight anterior rostrum, *Helicaulax* is so similar to *Anchura* Conrad, 1860, that the two must be closely related. Of the two Pacific Slope species, *Anchura (Helicaulax) condoniana* has more poorly developed flanges along the wing and a shorter posterior prong that is late to develop and then callused over. It appears, thus, to be more similar to *Anchura* than is *A. (H.)* ***tricosa***. Except for its posterior digitation and straight anterior rostrum, *A. (H.) condoniana* is similar to *Anchura*. SOHL (1960:106) gives the range of *Anchura* as Cenomanian through Maastrichtian, and includes *Anchura turricula* Stephenson, 1952, from the Cenomanian age Woodbine of Texas despite its slight flanges on the lateral extension of the wing. The morphologies of both *A. (H.) condoniana* and *A. turricula* appear transitional between *A. (Helicaulax)* and *A. (Anchura)*.

The two Pacific Slope Turonian species of *Anchura (Helicaulax)* have different known geographic and sediment distributions. *Anchura (H.) condoniana* has a more northern distribution in sandstone; *A. (H.)* ***tricosa*** has a more southern distribution in siltstone. Some of the morphological features of *A. (H.)* ***tricosa***, especially the long posterior prong and the expanded flanges on the lateral extension of the wing, seem appropriate to a quiet-water habitat on a fine-grained substrate, and the retrieval of these two species from different sediment types is probably related to their ecologic preferences. At present, the significance of the north–south distributions of these two species cannot be determined.

Anchura (Helicaulax) condoniana (Anderson, 1902)
(Figures 3–18)

Anchura condoniana ANDERSON, 1902:76, pl. 8, fig. 179; JONES, SLITER & POPENOE, 1978:xxii.9, pl. 1, fig. 15. Not *Anchura condoniana* Anderson of STADUM, 1973, cover photo = *A. (H.)* ***tricosa*** sp. nov.

Drepanochilus condoniana (Anderson): ANDERSON, 1958:166.

Diagnosis: A *Helicaulax* having a short posterior digitation roughly parallel to the shell axis, adjacent to the spire at its base, but not otherwise adnate; sculpture dominantly axial; fifth and sixth abapical spiral cords forming the angulation and continuing onto extended outer lip; outer lip falcate but only slightly flanged posteriorly and anteriorly along its lateral portion.

Description: Shell medium sized, high spired, turriculate, drawn out anteriorly into a moderately long, nearly straight anterior rostrum; whorls about eight in number, barely convex; suture appressed; protoconch unknown; growth line antispirally concave on the spire. Sculpture ornate, consisting of axial and spiral elements, the axial dominant on whorl sides; surface of spire ornamented by about 20 slightly arcuate axial ribs crossed by six spiral ribs forming nodes at axial-spiral intersections; the first four abapical ribs separated by interspaces of nearly equal width, the fifth, sixth, and seventh closer together, the fifth and sixth forming the peripheral angulation on the last whorl and continuing onto the extended outer lip. Aperture subquadrate, deeply broadly sinused between posterior spur and falcate digitation; outer lip with two extensions, a short straight, spurlike process adjacent to the spire and a long and falcate digitation, slightly flanged both posteriorly and anteriorly along its lateral portion, and grooved internally

→

Explanation of Figures 3 to 18

All figures ×1; all specimens, except LACMIP cat. no. 11537, coated with ammonium chloride.

Figures 3–10. *Anchura (Helicaulax) condoniana* Anderson, 1902. Figure 3: LACMIP cat. no. 10832 from UCLA loc. 4214, holotype, apertural view. Figure 4: CAS cat. no. 445.30 from CAS loc. 445, holotype, back view. Figures 5–8: LACMIP cat. no. 11540 from LACMIP loc. 10735, hypotype; Figure 5, right side; Figure 6, back; Figure 8, aperture. Figure 7: LACMIP cat. no. 11539 (latex pull) from LACMIP loc. 10735, hypotype, aperture. Figure 9: LACMIP cat. no. 11537 (latex pull) from LACMIP loc. 10726, hypotype, back, apparent bend in rostrum results from imperfection in rock mold. Figure 10: LACMIP cat. no. 11538 from UCLA loc. 4214, hypotype, back.

Figures 11–18. *Anchura (Helicaulax)* ***tricosa*** sp. nov. Figure 11: USNM cat. no. 465514 from USGS loc. 2759, holotype, aperture. Figure 12: USNM cat. no. 465515 from USGS loc. 2759, paratype, back. Figure 13: Paratype, USNM cat. no. 465518 from USGS loc. 2757, back. Figures 14, 15: USNM cat. no. 465517 from USGS loc. 2757, paratype; Figure 14, aperture; Figure 15, back. Figure 16: UCR cat. no. 7787/101 from UCR loc. 7787, paratype, aperture. Figure 17: LACMIP cat. no. 11541 from UCLA loc. 4235, paratype, back. Figure 18: Chapman College specimen figured by STADUM (1973) from Ladd Formation, upper Holz Shale Member, Santa Ana Mts., California, paratype, collected and prepared by Frank and Mabel Grouard. Photographs 3, 9, 10, 18 by Susuki; 4–8, 11–17 by De Leon.

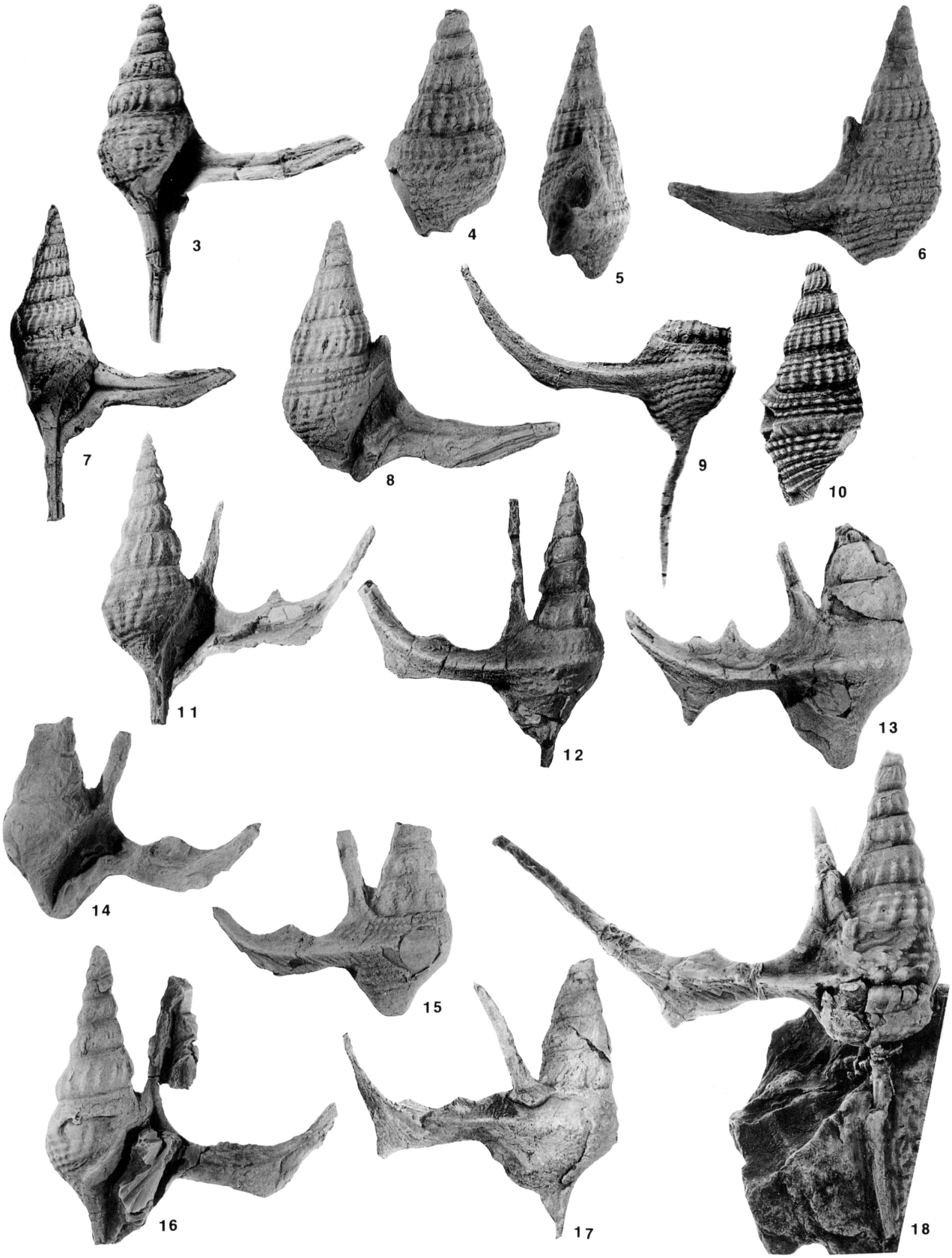

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Table 1

Measurements (mm) of *Anchura* (*Helicaulax*) *condoniana* Anderson, 1902.

	H	D	Hp	Dp	Ha	Lw	Lp	A	Lr	Dp/Hp
CAS 445.30	45.0*	23.0	9.0	16.4	25.0	—	—	34°	—	1.8
UCLA 58437	58.7*	17.0†	6.4	14.6†	18.0*	30.0*	—	39°	24.0	2.3
LACMIP 11537●	42.8*	17.4†	7.8	14.8†	23.0*	—	—	35°	—	1.9
LACMIP 11538	41.5*	19.0†	7.0	15.0†	22.8*	—	—	36°	—	2.1
LACMIP 11539●	46.0*	—	—	—	29.0	31.0	11.0	30°	—	
LACMIP 11540	60.0	—	7.0	—	25.5	26.0			19.0	

* Specimen incomplete; † specimen crushed; ● latex pull. Abbreviations decrypted in Introduction.

opposite the external ridge; groove filled by thick callus deposit within aperture; inner lip very thick.

Holotype: CASG cat. no. 445.30.

Hypotypes: LACMIP cat. nos. 10837 (= UCLA 58437), 11538 from LACMIP loc. 24214 (= UCLA loc. 4214), Little Cow Creek; 11537 from LACMIP loc. 10726 (= CIT loc. 1032), Dry Creek; 11539–11540 from LACMIP loc. 10735 (= CIT loc. 1212), Little Cow Creek, Shasta Co., California.

Dimensions: See Table 1.

Type locality: CASG loc. 445, Forty-nine mine, near Phoenix, Jackson Co., Oregon (Anderson, 1902).

Distribution: Unnamed formation on Sidney Island (coll.: Peter Ward, 3 September 1992), British Columbia; Hornbrook Formation, Jackson Co., Oregon; Hornbrook Formation, Osburger Gulch Member, Siskiyou Co., California; Redding Formation, Bellavista Sandstone Member, rare, Frazier Silt Member, locally abundant, Melton Sandstone Member, rare, northeast of Redding, Shasta Co., California.

Geologic age: Middle to late Turonian, at LACMIP loc. 10876 (= CIT loc. 1042) associated with *Subprionocyclus neptuni* (Geinitz, 1849) (MATSUMOTO, 1960:102).

Remarks: The holotype was rescued from the ashes after the 1906 San Francisco earthquake. It now lacks the expanded wing and the rostrum of ANDERSON's (1902) figure (figure 179).

The extended wing of *Anchura* (*H.*) *condoniana* apparently formed before the posterior prong. Several specimens that have an extended falcate outer lip have no posterior spur (*e.g.,* the specimen figured by JONES *et al.,* 1978:pl. 1, fig. 15) and no indication that one has broken off. Apertures of specimens that have a spur have thicker callus deposits within the aperture, suggesting that these are more mature specimens.

Anchura (*Helicaulax*) *condoniana* differs from the similar *A.* (*H.*) ***tricosa*** in having the prong shorter and at less of an angle to the shell axis, only suggestions of flanges along the lateral extension of the outer lip, and a sturdier shell. The more strongly noded sculpture of *A.* (*H.*) *condoniana* is more similar to that of typical *Helicaulax* than is that of *A.* (*H.*) ***tricosa***.

PACKARD (1916:148) reported both *Alaria condoniana* and *Alaria falciformis* (Gabb, 1864) from the "*Actaeonella oviformis*" Zone of the Santa Ana Mountains. "*Actaeonella oviformis*" in the Santa Ana Mountains is *Trochactaeon* (*T.*) *packardi* (Anderson, 1958) and of Turonian age (SOHL & KOLLMANN, 1985). *Anchura* (*Helicaulax*) *condoniana* is also from the Turonian, but specimens so identified from the Santa Ana Mountains thus far examined are *Anchura* (*Helicaulax*) ***tricosa*** sp. nov. POPENOE (1942:fig. 4) recorded *Anchura* cf. *A. falciformis* (Gabb, 1864) from nine localities in the Santa Ana Mountains. The specimens from his localities in the Baker Canyon Sandstone and "Holz-Baker Transition" are also *A.* (*H.*) ***tricosa*** sp. nov. with the exception of those from LACMIP loc. 10100 (= CIT loc. 92) which are an undescribed new species of *Anchura* (*Anchura*). Popenoe's specimens of *A.* cf. *A. falciformis* from the upper Holz Shale belong to another undescribed species of *Anchura* (*Anchura*). The *Anchura* (*Helicaulax*) *condoniana* of STADUM (1973) from the Santa Ana Mountains Turonian is an unusually complete specimen of *Anchura* (*Helicaulax*) ***tricosa*** sp. nov. *Anchura* (*Helicaulax*) *condoniana* is locally abundant in the Redding region, but few specimens have the rostrum and extended outer lip preserved.

Anchura (*Helicaulax*) Saul & Popenoe, ***tricosa*** sp. nov.

(Figures 11–18)

Anchura condoniana Anderson: STADUM, 1973, cover photo. Not *Anchura condoniana* Anderson, 1902.

Diagnosis: A large-sized *Helicaulax* with a long, posterior prong that is at an angle to the shell axis and a falcate outer lip broadened both anteriorly and posteriorly by angulate flanges.

Description: Shell large, high spired, drawn out anteriorly into a long, straight anterior rostrum; whorls about nine

Table 2

Measurements (mm) of *Anchura* (*Helicaulax*) ***tricosa*** sp. nov.

	H	D	Hp	Dp	Ha	Lw	Lp	A	Lr	Dp/Hp
LACMIP 11541	53.0*	19.7	7.7	14.3	25.0*	31.0	22.0	30°	13.8*	1.8
LACMIP 11542	43.7*	19.5	8.8	15.8	26.0*	32.5*	10.0*	25°	—	1.8
UCR 7787/101	52.1*	17.0†	7.5	14.7†	25.7	33.3*	19.0	28°	—	2.0
USNM 465514	42.0*	16.5	6.8	13.5	24.0*	33.0*	14.0	26°	—	2.0
USNM 465515	50.0*	18.0	6.7	12.0	31.0	45.5*	22.0	22°	8.0*	1.8
USNM 465517	37.0*	16.0	8.0	12.6	15.0*	29.6*	16.0	27°	—	1.6
USNM 465518	45.0*	21.0	9.0	15.8	19.0*	35.7*	14.5*	—	10.0*	1.8

* Specimen incomplete; † specimen crushed. Abbreviations decrypted in Introduction.

in number, wider than high, barely convex; suture impressed; body whorl angulate; anterior rostrum longer than the last whorl, slender, straight; early whorls with arcuate axial ribs; penultimate whorl ornamented by about 16 axial ribs crossed by straplike spiral ribs, about five on the spire and eight or nine on the body whorl; ribs forming nodes at intersections; first three abapical ribs separated by slightly wider interspaces, fourth and fifth closer together, forming the angulation of the body whorl that extends onto the outer lip digitation. Aperture subtriangular, deeply broadly sinused between posterior spur and falcate digitation; outer lip with two extensions, a relatively long, straight, spurlike posterior process basally adjacent to the spire and a long, and falcate digitation flanged both posteriorly and anteriorly along its lateral extension; posterior prong at an angle of 20°–30° to the shell axis.

Holotype: USNM cat. no. 465514.

Paratypes: LACMIP cat. nos. 11541 from UCLA loc. 4235, Holz Ranch, and 11542 from LACMIP loc. 15295, Silverado Canyon, Santa Ana Mts., Orange Co., California; UCR cat. nos. 7787/101, from UCR loc. 7787, Silverado Canyon, and 7788/20, from UCR loc. 7788, Silverado Canyon, Santa Ana Mts., Orange Co., California; USNM cat. nos. 465517–465518 from USGS loc. 2757, Silverado Canyon; USNM cat. nos. 465515–465516 from USGS loc. 2759, Ladd Canyon, Santa Ana Mts., Orange Co., California; Stadum specimen.

Type locality: USGS loc. 2759, lower Ladd Canyon, near Silverado Canyon, Santa Ana Mts., Orange Co., California.

Dimensions: See Table 2.

Distribution: Ladd Formation, upper Baker Canyon Sandstone and lower Holz Shale members, uncommon, Santa Ana Mts., Orange Co., California.

Geologic age: Turonian.

Remarks: *Anchura* (*Helicaulax*) ***tricosa*** differs from *A.* (*H.*) *condoniana* in having a broader falcate outer lip with angulately developed flanges, a longer posterior spur that extends at a greater angle to the shell axis, fewer axial ribs on the spire, a narrower pleural angle, and a slightly taller spire. On most available specimens, both axial and spiral sculpture appear more subdued than on *A.* (*H.*) *condoniana,* but this is at least partly due to preservation. A few specimens (*e.g.,* the holotype and paratypes UCR 7788/101–102) have the sculpture fairly well preserved. On these *A.* (*H.*) ***tricosa,*** the spirals are narrower and the interspirals wider, the axials fewer, and the nodes at the intersection stronger, especially on the angulation, than on *A.* (*H.*) *condoniana. Anchura* (*H.*) ***tricosa*** is from fine-grained muddy sandstone and siltstone, but *A.* (*H.*) *condoniana* is common in beds of coarser grain. A fragmentary specimen (USNM cat. no. 465516) of *A.* (*H.*) ***tricosa*** has a body whorl diameter of about 20 mm, suggesting a height of at least 72 mm, a size close to twice that of any *A.* (*H.*) *condoniana.* As discussed under *A.* (*H.*) *condoniana,* PACKARD's (1916) *Alaria condoniana* from the Santa Ana Mountains is *Anchura* (*H.*) ***tricosa*** as is POPENOE's (1942) *Anchura* cf. *A. falciformis* from the upper Baker Canyon Sandstone and lower Holz Shale members of the Ladd Formation. POPENOE's (1942) specimens of *A.* cf. *A. falciformis* from the upper Holz Shale differ from *A.* (*H.*) ***tricosa*** in lacking the posterior prong, in having a shorter lateral extension to the wing that lacks flanges, and in being more coarsely sculptured. USNM 465515 was encrusted with calcareous tubes (probably annelid) on both apertural and abapertural sides of the wing and on the base of the body whorl adjacent to the lip. These encrustations were probably subsequent to the death of the gastropod.

Etymology: The species name is from the Latin *tricosus,* meaning full of tricks or wiles.

Superfamily ?JANTHINACEA, Lamarck, 1812

Family EPITONIIDAE Berry, 1910

SOHL (1964) placed the Epitoniidae in the order Cephalaspidea, but PONDER & WARÉN (1988) have included it in