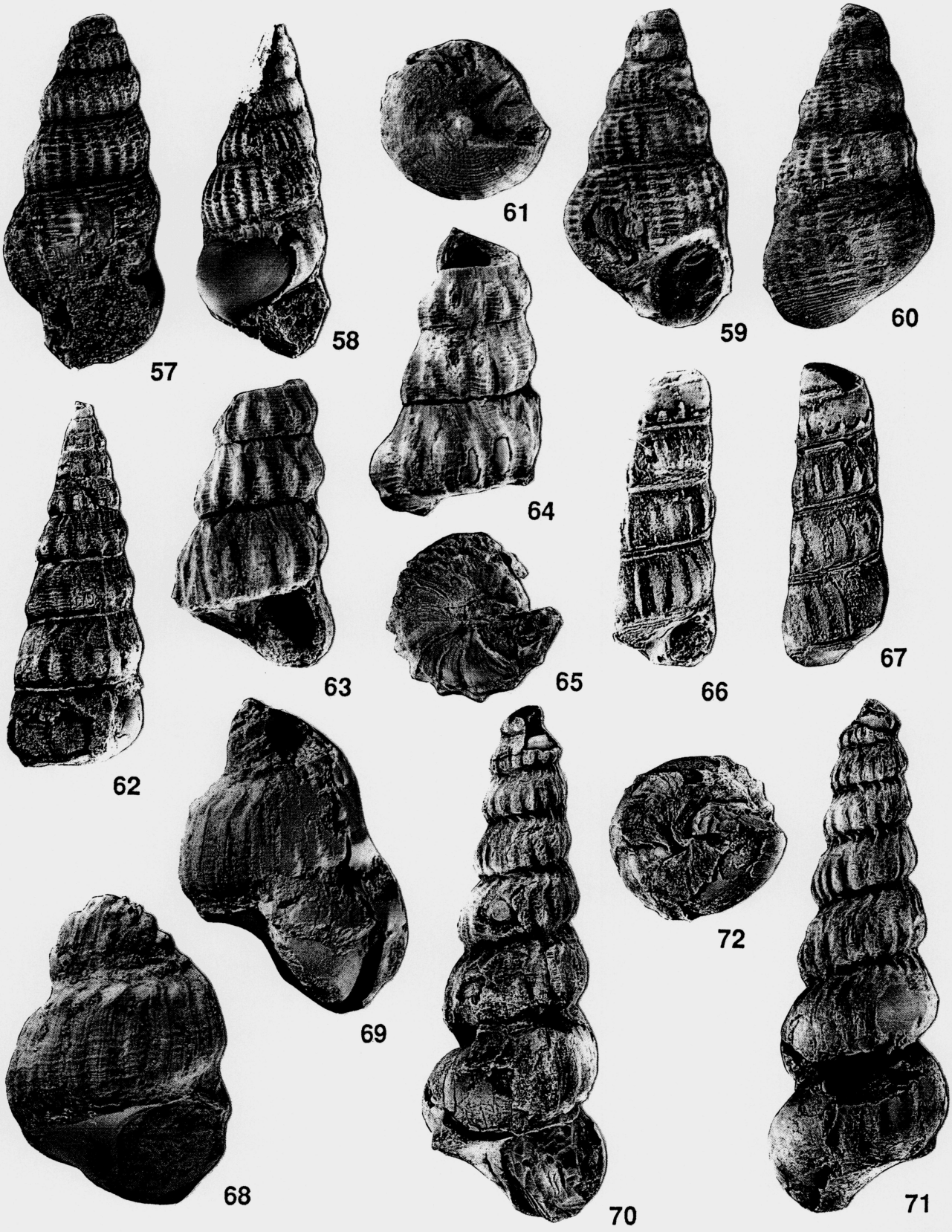
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minutely beaded, and sunken rectangular interspaces between intersections of axial and spiral ribs. Axial ribs narrow, closely spaced, approximately one-third as broad as interspaces, extending from suture to suture, aligned or not from whorl to whorl, straight, prosocline, numerous, approximately 32 on last whorl, approximately 27 on penultimate whorl, and approximately 26 on ante-penultimate whorl. Spiral ribs fine, narrow, closely spaced, approximately half as broad as interspaces, approximately 10 on penultimate whorl, and approximately 11 on last whorl posterior to basal part. No basal keel. Sculpture on base of last whorl consisting of approximately 12 spiral ribs, very fine but becoming stronger (fine) toward shell axis, very closely spaced, approximately as broad as interspaces, and very minutely beaded where crossed by growth lines (producing very fine cancellate pattern); axial ribs obsolete. Aperture ovate; inner lip smooth.

Holotype: LACMIP 13008.

Dimensions of holotype: Incomplete specimen of 4.5 whorls, height 15.3 mm, diameter 7.2 mm.

Type locality: LACMIP loc. 23639, 39°50′10″N, 121°42′55″W.

Geologic age: Early Campanian.

Distribution: Chico Formation, Ten Mile Member, Chico Creek, Butte County, northern California.

Discussion: The above description is based on 10 specimens, most of which are poorly preserved. *Acirsa* ***epsilon*** is most similar to *Acirsa nexilia* (White, 1889), discussed below, but differs from it by having smaller size; more numerous, more closely spaced, and weaker axial ribs; more closely spaced spiral ribs with no interrib; and stronger cancellate sculpture. *Acirsa* ***epsilon*** is similar to *Acirsa* ***delta***, sp. nov. but differs from it by having thinner axial and spiral ribs, more widely spaced cancellate sculpture, and sunken rectangular interspaces between intersections of axial and spiral ribs.

Etymology: The specific name *epsilon* is the fifth letter of the Greek alphabet.

Acirsa nexilia (White, 1889)

(Figures 55–61)

Ceratia nexilia White, 1889:21, pl. 3, figs. 13, 14.
Mesostoma (?) *intermedium* Whiteaves, 1903:360, pl. 43, fig. 4.

Diagnosis: A medium-sized *Acirsa* with subcancellate sculpture. Axial ribs stronger than spiral ribs. Approximately 24 axial ribs. Interspaces between spiral ribs with one secondary spiral interrib. Basal part of last whorl with very fine cancellate sculpture.

Supplementary description: Shell medium (up to 28 mm high), elongate conical, with high spire. Pleural angle approximately 31°. Protoconch unknown. Teleoconch whorls approximately 10 (estimated), rounded; suture slightly impressed and occasionally coincident with spiral rib. Sculpture cancellate on uppermost spire, subcancellate on more mature whorls, axial ribs stronger than spiral ribs, intersections with low nodes on mature whorls. Axial ribs moderately swollen, moderately spaced, and approximately half as broad as interspaces. Axial ribs extending from suture to suture, generally aligned from whorl to whorl on uppermost spire but becoming less so on more mature whorls, mostly straight, slightly prosocline, slightly reflexed leftward near posterior suture, approximately 24 on penultimate and last whorls, and 19 to 20 on penultimate and ante-penultimate whorls. Spiral ribs fine, narrow, and moderately closely spaced, approximately nine on last whorl, and seven to eight on penultimate whorl. Interspaces between spiral ribs accommodate finer but prominent spiral rib, except on uppermost spire whorls. No basal keel. Sculpture on basal part of last whorl consisting of many, very closely spaced, fine spiral ribs with narrow interspaces showing growth lines; axial ribs generally obsolete, rarely with few very weak axial ribs extending to shell axis. Aperture oval; inner lip smooth.

Dimensions of lectotype: Incomplete specimen of four whorls, height 13.5 mm, diameter 7.6 mm.

Lectotype: USNM 20119a, designated here.

←

Figures 57–72. Specimens coated with ammonium chloride. Figures 57–61. *Acirsa nexilia* (White, 1889), Sucia Island. Figure 57. Syntype GSC 5956 of *Mesostoma* (?) *intermedium* Whiteaves, 1903, apertural view, ×2.1. Figure 58. Syntype GSC 5956c of *Mesostoma* (?) *intermedium* Whiteaves, 1903, apertural view, ×2.6. Figures 59–61. Hypotype LACMIP 13009, LACMIP loc. 6965, Simi Hills, ×3.2. Figure 59. Apertural view. Figure 60. Abapertural view. Figure 61. Basal view. Figures 62–65. *Confusiscala newcombii* (Whiteaves, 1903). Figure 62. Holotype GSC 5928, Sucia Island, abapertural view, ×1. Figures 63–65. LACMIP loc. 23635, Chico Creek. Figures 63, 64. Hypotype LACMIP 13010, ×1.5. Figure 63. Apertural view. Figure 64. Abapertural view. Figure 65. Hypotype LACMIP 13011, basal view, ×1. Figures 66, 67. *Claviscala* sp., hypotype LACMIP 13012, LACMIP loc. 23637, Chico Creek, ×2.9. Figure 66. Apertural view. Figure 67. Abapertural view. Figures 68–72. ***Zebalia*** Squires & Saul, gen. nov. *suciaensis* (Packard, 1922). Figures 68, 69. Plastoholotype UCMP 12303, UCMP loc. 2209, Sucia Island, ×1. Figure 68. Apertural view. Figure 69. Right-lateral view. Figures 70–72. Hypotype LACMIP 13013, LACMIP loc. 10716, Simi Hills, ×0.6. Figure 70. Apertural view. Figure 71. Abapertural view. Figure 72. Basal view.

Type locality: Pentz area, Butte County, northern California.

Paralectotype: USNM 20119b, designated here.

Geologic age: Late Cretaceous (lower to upper middle Campanian).

Distribution: LOWER CAMPANIAN: Chico Formation, Pentz Road member (informal), Butte County, northern California. MIDDLE CAMPANIAN: Cedar District Formation, Sucia Island, Washington; Chatsworth Formation, Dayton and Bell canyons, eastern Simi Hills, Los Angeles and Ventura counties, southern California. UPPER MIDDLE CAMPANIAN: Williams Formation, Pleasants Sandstone Member, Santa Ana Mountains, Orange County, southern California.

Discussion: The above description is based on 14 specimens, which are mostly poorly preserved. The syntypes (GSC 5956, 5956a–d) of *M.* (?) *intermedium* are weathered and either in rock matrix or missing shell material on the last whorl. Photographs of *Acirsa nexilia* are shown for the first time here.

White's (1889) species *Ceratia nexilia* has the medium-shell size and subcancellate sculpture of an *Acirsa* and does not belong in genus *Ceratia* H. & A. Adams, 1852, which is characterized by minute size, fine spiral striae, and an absence of axial sculpture. Although Wenz (1939) and Fretter & Graham (1978) placed *Ceratia* in Rissoidae, Ponder (1984, 1985) showed that it can be included in the Iravadiidae, which, like the rissoids, belongs (Ponder & Warén, 1988) to the Truncatelloidea.

Genus *Confusiscala* de Boury, 1909

Type species: *Scalaria dupiniana* d'Orbigny, 1842, by original designation and monotypy; Late Cretaceous (Albian), Aube, France.

Diagnosis: Whorls joined and not umbilicate. Basal keel visible on spire supradjacent to suture. Axial ribs not crossing basal keel. Spiral sculpture fine, covering whorl sides. Basal disk with fine spiral threads, crossed by radiating slightly sinuous growth lines (Saul & Popenoe, 1993).

Discussion: *Confusiscala* was originally considered to be a subgenus of *Amaea* by de Boury (1909), and Wenz (1940) agreed. It has continued to be treated as a subgenus by several workers, including Stewart (1927), who placed it as a subgenus of *Epitonium* Röding, 1798, and Gardner (1876) and Durham (1937) who placed it as a subgenus of *Opalia.* Saul & Popenoe (1993) considered *Confusiscala* to be a genus that is closely similar to *Opalia,* and they reported that *Confusiscala* ranges from Early Cretaceous (Neocomian) through Maastrichtian. Darragh & Kendrick (1994) reported that *Confusiscala* attained a widespread, near cosmopolitan distribution during the Cretaceous (late Hauterivian to late Maastichtian).

Darragh & Kendrick (1994) placed *Opalia mathewsonii* (Gabb, 1864:321–322, pl. 32, fig. 278; Stewart, 1927: 321–322, pl. 24, fig. 20; Durham, 1937:504, pl. 56, fig. 23) in genus *Confusiscala.* As shown in our synonymy given earlier in this present paper, however, the specimen used by Durham (1937:504, pl. 56, fig. 23) is the holotype of *Confusiscala? sulfurea* Saul & Popenoe, 1993. As discussed earlier in this present paper, we have questionably placed *Opalia mathewsonii* (Gabb, 1864:321–322, pl. 32, fig. 278; Stewart, 1927:321–322, pl. 24, fig. 20) in *Opalia.*

Darragh & Kendrick (1994:42–44) reported that there is a worldwide array of very similar species of *Confusiscala* found in the following stages/substages and locales: upper Hauterivian and Aptian to Albian of Japan, Aptian of Syria, Albian of Europe, Turonian of California, Turonian to Santonian of southern India, Turonian to upper Maastrichtian of Europe, Senomanian of South Africa, and upper Maastrichtian of Australia. *Confusiscala newcombii,* from upper Santonian to middle Campanian of the Pacific slope of North America, can also be added to this list. We agree with Darragh & Kendrick (1994) that a close comparative study of all of these species is warranted.

Confusiscala newcombii (Whiteaves, 1903)

(Figures 62–65)

Mesostoma (?) *newcombii* Whiteaves, 1903:361, pl. 43, fig.
Hemiacirsa newcombii (Whiteaves). Ludvigsen & Beard, 1994:fig. 59 [in part]; 1997:fig. 70 [in part].

Supplementary description: Shell large (up to 69.5 mm high), turriculate, with high spire. Pleural angle approximately 25°. Protoconch and uppermost spire unknown. Teleoconch whorls approximately 11 (estimated), concave posterior half, convex anterior half; suture moderately impressed. Axial ribs stronger than spiral ribs. Axial ribs moderately closely spaced, strong, swollen on anterior half of whorl but with tendency to fade out on posterior half, straight, and prosocline. Growth lines confluent with axial ribs on posterior half of whorl reflexed leftward posteriorly. Axial ribs approximately 14 on last whorl, penultimate, and ante-penultimate whorls. Spiral ribs fine, closely spaced, numerous, and strongest on anterior half of whorl where single interribs also present. Basal keel strong and usually present as a subsutural rib. Basal disk covered by very faint spiral threads (weaker or approximately same strength as spiral near posterior suture) and with several sinuous, raised-growth lines confluent with primary axial ribs. Aperture subcircular.

Holotype: GSC 5928.

Dimensions of holotype: Nearly complete specimen of nine whorls, height 64.3 mm, diameter 24.9 mm.

Type locality: Sucia Island, San Juan County, Washington.

Geologic age: Late Cretaceous (Latest Santonian to middle Campanian).

Distribution: UPPERMOST SANTONIAN: Chico Formation, Musty Buck Member, Chico Creek, Butte County, northern California; Ladd Formation, middle part of Holz Shale Member, Orange County, southern California. UPPER SANTONIAN/LOWER CAMPANIAN: Haslam Formation, Vancouver Island, British Columbia (Ludvigsen & Beard, 1994, 1997). LOWER CAMPANIAN: Chico Formation, Ten Mile Member, Chico Creek, Butte County, northern California. MIDDLE CAMPANIAN: Cedar District Formation, Sucia Island, San Juan County, Washington (Whiteaves, 1903; Ludvigsen & Beard, 1994). SANTONIAN-MIDDLE CAMPANIAN UNDIFFERENTIATED: "Trent River Formation," Vancouver Island, British Columbia (Ludvigsen & Beard, 1994, 1997).

Discussion: *Confusiscala newcombii* is included in this paper because the original description is lacking in some details, no published photographs of the holotype existed before, and its stratigraphic occurrences have not been tabulated before. The original illustration of the holotype was a line drawing of the abapertural side. We include a photographic view of this side (Figure 62). The apertural side of the holotype is missing most of its shell. We also include the first photographic view of the base of this species (Figure 65).

At most localities, this species consists of small fragments, but at LACMIP loc. 23635 in the lowermost part of the Ten Mile Member of the Chico Formation, four large and well preserved specimens were collected.

The occurrence of *C. newcombii* in the middle part of Holz Shale Member of the Ladd Formation, Orange County, southern California (LACMIP loc. 10093) is a new stratigraphic record.

Ludvigsen & Beard (1994, 1997) placed Whiteaves' species in *Hemiacirsa* de Boury, 1890. Bouchet & Warén (1986) treated this genus as a synonym of *Acirsa* Mörch, 1857. Although the base of the shell may be angled in *Acirsa,* a basal keel and basal disk are not present (Bouchet & Warén, 1986; Weil et al., 1999); therefore, Whiteaves' species cannot be placed in *Acirsa* [= *Hemiacirsa*].

Genus *Claviscala* de Boury, 1909

Type species: *Scalia richardi* Dautzenberg & de Boury, 1897, by original designation; Recent, southwestern Europe, but not in the Mediterranean, usually in abyssal depths (Bouchet & Warén, 1986).

Diagnosis: Shell acuminate, whorls joined, and not umbilicate. Flat-sided whorls bearing broad axial ribs and fine spiral lines. Basal keel strong. Aperture rectangular. No pitting on surface of shell (Bouchet & Warén, 1986; Weil et al., 1999).

Discussion: Wenz (1940) reported the geologic range of *Claviscala* to be Neocomian (Early Cretaceous) to Recent, with fossil occurrences in North America and Europe and with Recent occurrences in the Atlantic Ocean. Abbass (1963), however, reported *Turriscala* (*Claviscala*) *darwishi* Abbass (1963:64, pl. 3, figs. 2, 2a) from Albian strata in Egypt. The preservation of the holotype of Abbass's species, however, is poor, and its placement in *Claviscala* seems to be somewhat tentative.

Claviscala sp.

(Figures 66, 67)

Description: Shell small (up to 17.5 mm high), cylindrical, with high spire. Pleural angle approximately 10°. Protoconch unknown. Teleoconch whorls approximately eight to nine (estimated), flattish; suture slightly impressed, with subsutural rib. Sculpture of broad axial ribs, moderately closely spaced, extending from suture to suture, not aligned from whorl to whorl, usually straight (rarely sinuous), prosocline, rarely reflexed leftward posteriorly near suture, approximately 16 on last whorl, and 14 to 15 on penultimate and ante-penultimate whorls. Fine spiral ribs near sutures. Basal keel strong. Basal disk with many very fine spiral ribs, partly obscured by a glossy callus; axial ribs obsolete on basal disk. Aperture oval, inner lip smooth.

Geologic age: Late Cretaceous (earliest Campanian to early late Campanian).

Distribution: LOWERMOST CAMPANIAN: Chico Formation, Ten Mile Member, Chico Creek, Butte County, northern California. LOWER UPPER CAMPANIAN: Jalama Formation, Santa Barbara County, southern California.

Discussion: The above description is based on two poorly preserved and apparently conspecific specimens from LACMIP locs. 23637 and 24140, from the Chico and Jalama formations, respectively. On each, the apex is missing and most of the shell is leached so that the sculpture is little more than indicated. We are, therefore, unable to name a new species based on such incomplete material. The specimens, however, do show the flat-sided whorls, strong broad axial ribs, fine spiral ribs, and strong basal keel that are diagnostic of this genus.

The name *Claviscala* has been used twice before for Cretaceous gastropods from the Pacific slope of North America. The first usage was *Nerinea dispar* Gabb (1864: 113, pl. 19, figs. 66, 66a). Stewart (1927:322) stated that the holotype of "*N.*" *dispar* is "probably related to "*Claviscala*" *clementina* d'Orbigny, 1842, from the Cretacous Albian of Europe." Saul & Squires (1998), fur-

thermore, reported that Gabb's species, although originally described as a nerineid, is definitely not one and is probably an epitoniid. Durham (1937:503, pl. 56, fig. 20) stated that *Nerinea dispar* belongs to *Claviscala*. The holotype (UCMP 11944) of this species consists of a partial external mold and the internal mold of four whorls of an individual 55 mm high. Gabb (1864:pl. 19, fig. 66a) especially emphasized a collarlike band that is the edge of the basal disk, and although Anderson (1938, 1958) reported that this feature is not seen in the holotype, it is present on the external mold, as are fine spiral ribs that cross the strong axials, which do not quite reach the basal collar or the adapical suture. The holotype is from North Fork of Cottonwood Creek, Shasta County, northern California, in strata now referred to as the Budden Canyon Formation, which ranges in age from Early Cretaceous (Hauterivian) to Late Cretaceous (Turonian) (Murphy et al., 1969). It is not known from which member the holotype of *C. dispar* was collected, but the uppermost one, the Gas Point Member, is not present on North Fork, therefore, the age range is reduced to Hauterivian to Albian. Although Anderson (1938, 1958) stated that no additional specimens had been found, CAS collections from the Budden Canyon Formation in the vicinity of the North Fork of Cottonwood Creek have specimens from at least two of the members. Anderson (1958) suggested that Gabb's species was of Late Cretaceous or even Paleocene age, but the specimens from the North Fork of Cottonwood Creek vicinity indicate a Hauterivian to Albian age. More work is needed on this Early Cretaceous epitioniid in order to determine its exact geologic age and distribution. *Claviscala* sp. from the Late Cretaceous (Campanian) Ten Mile Member of the Chico Formation differs from *Claviscala dispar* by having a smaller size, a less prominent subsutural rib, axial ribs that extend from suture to suture, fewer axial ribs, and no evidence of fine spiral ribs forming a minute-cancellate pattern where they intersect the axial ribs.

The second usage of the name *Claviscala* for Cretaceous gastropods from the Pacific slope of North America was *Opalia* (*Claviscala*) n. sp. of Durham (1937:503). He put his unnamed species into synonymy with *Nerinea dispar*? Gabb (var.), Whiteaves (1895:127, pl. 3, fig. 4a) from the Nanaimo Group on Hornby Island, east coast of Vancouver Island, British Columbia. Most likely, *Nerinea dispar*? (var.) Whiteaves is from the middle to upper Campanian Spray Formation (see "Stratigraphy") part of the Nanaimo Group, because this formation crops out extensively on Hornby Island. *Nerinea dispar*? (var.) Whiteaves is probably not a *Claviscala* at all (Saul & Squires, 1998), and it looks more like the melanopsid genus *Boggsia* Olsson, 1929, which was studied by Squires & Saul (1997).

Opalia (*Claviscala*) n. sp. of Durham, 1937, was also put by him into synonymy with *Scalaria albensis* (?) d'Orbigny of Whiteaves (1876:50, pl. 9, fig. 5) [= *Scalaria clementina* d'Orbigny of Whiteaves, 1900:287] from the Queen Charlotte Islands, British Columbia. According to Bolton (1965), *S. albensis* (?) of Whiteaves and *S. clementina* of Whiteaves are based on the same specimen, and *S. albensis* (?) is from the Haida Formation. Thompson et al. (1991) reported the Haida Formation to be Albian in age. It is possible that *Scalaria albensis* (?) d'Orbigny of Whiteaves (1876) might be the above-mentioned *Claviscala dispar* (Gabb, 1864).

In summary, although there have been previous reports of *Claviscala* from the Pacific slope of North America, these pertain to either Early Cretaceous specimens or to misidentified Late Cretaceous ones. The specimen of *Claviscala* sp. from the lower Campanian Ten Mile Member of the Chico Formation in northern California represents the first confirmed occurrence of this genus in Late Cretaceous rocks of the Pacific slope of North America.

Superorder Caenogastropoda Cox, 1959

Superfamily ZYGOPLEUROIDEA Bandel, 1991

Family ZYGOPLEURIDAE Wenz, 1938

Discussion: Opisthocline-axial ribs and their distinctive parasigmoidal pattern on the posterior part of the whorls are typical of zygopleurids. Other zygopleurid morphologic features are the elongate-conical shape, strong-axial sculpture, and subordinate spiral ornament. In addition, some zygopleurids have a rounded aperture. Family Zygopleuridae has a geologic range from Late Permian (Kasmanian) to middle Late Jurassic (Callovian) (Tracey et al., 1993). The new genus described below extends the geologic range of zygopleurids from the Late Jurassic to the Late Cretaceous. Zygopleurids are reportedly extinct, but Houbrick (1979) showed that the modern deep-sea genus *Abyssochrysos* Tomlin, 1927, is a relict gastropod whose shell closely resembles that found in Zygopleuridae.

Genus ***Zebalia*** Squires & Saul, gen. nov.

Type species: ***Zebalia*** *suciaensis* (Packard, 1922); Late Cretaceous (middle Campanian), Sucia Island, Washington and southern California.

Diagnosis: A zygopleurid with very large size, acuminate spire. Whorls joined and not umbilicate. Axial ribs strong, opisthocline, but parasigmoidal and bladelike near suture. Spiral ribs fine and wavy. Basal disk only with raised growth lines.

Discussion: In terms of the general shape of the whorls and the presence of strong axial ribs, the new genus is most similar to *Zygopleura* Koken, 1892, known from Triassic to Late Jurassic (lower Kimmeridgian) (Knight et al., 1960). The new genus differs from *Zygopleura* in having axial ribs that taper posteriorly, at least some spiral sculpture, and a circular aperture. In terms of the

shape of the aperture, the new genus is similar to the zygopleurid *Tyrsoecus* Kittl, 1892, known from Middle Triassic to Late Jurassic (Knight et al., 1960). The new genus differs from *Tyrsoecus* by having parasigmoidal-axial ribs and non-tuberculate axial ribs.

Zebalia suciensis generally resembles an epitoniid, but the parasigmoidal-axial ribs and giant size of this new gastropod are unlike any other epitoniid, fossil or modern-day. Although most workers do not provide much information on epitoniid growth-line morphology, our observations revealed that most epitoniids have prosocline growth lines, with a tendency for them to be slightly reflexed leftward near the posterior suture. A few have straight or even slightly sinuous (sigmoidal) growth lines, but no epitoniid teleoconch has parasigmoidal-growth lines like that seen on ***Z. suciensis***. The protoconchs of some species of the deep-water epitoniid *Eccliseogyra* Dall, 1892, illustrated by Bouchet & Warén (1986:figs. 1131, 1132, 1134), however, do have parasigmoidal-axial ribs. Yet, the axial ribs on the teleoconchs of these same specimens are not parasigmoidal. Bouchet & Warén (1986) also mentioned that *Eccliseogrya* was originally considered an "archaeogastropod." It was transferred to the family Epitoniidae as a subgenus of *Epitonium* by Rex & Boss (1973).

Etymology: The genus is named for P. T. & G. P. Zebal, who found and donated the largest known specimen of the type species of this genus.

Zebalia suciaensis (Packard, 1922)

(Figures 68–72)

Cerithium (?) *suciaensis* Packard, 1922:430, pl. 35, fig. 4.
Confusiscala suciense (Packard). Saul & Popenoe, 1993: 359.

Diagnosis: Same as for genus.

Description: Shell very large (up to 161 mm high), turriculate, with high spire. Pleural angle approximately 19°. Protoconch and upper spire unknown. Teleoconch whorls approximately 10 to 11 (estimated), rounded, with a concave-subsutural area; suture slightly markedly impressed. Axial ribs strong, spaced proportionally same distance apart on each whorl, extending from suture to suture, generally aligned from whorl to whorl, straight on main part of early whorls, opisthocline on later whorls, and strongly parasigmoidal (reflected rightward near posterior suture and reflected strongly leftward within subsutural area). Axial ribs approximately 20–22 on penultimate and preante-penultimate whorls. Axial ribs thin significantly on spire, becoming bladelike (lamellar). Spiral sculpture (at least on anterior part of later whorls) consisting of numerous fine wavy spiral ribs between axial ribs and crossing them, with two secondary spiral threads between primary spiral ribs. Basal keel possibly present. Basal disk with raised growth lines. Aperture circular; inner lip thickened somewhat.

Dimensions of holotype: Very incomplete specimen of 1.5 whorls, height 53 mm, diameter 41.4 mm.

Holotype: UCMP 12303.

Type locality: UCMP loc. 2209.

Geologic age: Late Cretaceous (middle Campanian).

Distribution: Cedar District Formation, Sucia Island, San Juan County, Washington; Chatsworth Formation, Dayton Canyon area, eastern Simi Hills, Los Angeles and Ventura counties, southern California.

Discussion: The above description is based on the very incomplete holotype and a very large specimen (Figures 70–72) from the Chatsworth Formation. The last whorl of the Chatsworth specimen is missing most of its shell. There appears to be a basal keel, but this might be the result of weathering of the shell.

Zebalia suciaensis is similar to *Cerithium iddingsi* Olsson (1928:68–69, pl. 15, fig. 4), known from the Pale Greda Formation of early Eocene age (Bolli, 1957) of northwestern Peru. ***Zebalia suciaensis*** differs from *C. iddingsi* by having much more rounded whorl sides, a more impressed suture, axial ribs in the subsutural area more distinct and more sharply reflected, spiral ribs more numerous on anterior part of later whorls, and an absence of spiral ribs in the subsutural area. Unfortunately, the extreme basal part of the last whorl and the apertural and columellar features of *C. iddingsi* are not preserved. The overall shell shape and growth-line pattern of *C. iddingsi* are strongly suggestive that this species is a zygopleurid. Its growth-line pattern is unlike that of *Cerithium* Bruguière, 1789.

The Cedar District Formation on Sucia Island in Washington is correlative (Muller & Jeletzky, 1970) to the ammonite zone *Hoplitoplacenticeras vancouverense*, which is of middle Campanian age. This geologic age is close to that of the very large specimen of ***Zebalia suciaensis*** from the Chatsworth Formation.

The Chatsworth Formation specimen of ***Z. suciensis*** is from a bed slightly stratigraphically higher in the formation than are the middle Campanian epitoniids (reported elsewhere in this paper) from very fossiliferous exposures of the Chatsworth Formation in Dayton and Bell canyons. Nevertheless, the geologic age of ***Z. suciaensis*** is also middle Campanian because, as reported by Saul & Popenoe (1993), it is from that part of the Chatsworth Formation yielding the ammonite *Metaplacenticeras* aff. *M. pacificum* (Smith, 1900). This particular ammonite is slightly older than zonal species *Metaplacenticeras pacificum*, which is indicative of the late middle Campanian to early late Campanian (Elder & Saul, 1996).

Except for a few localized, richly fossiliferous lenses

in the lower and upper parts of the formation, megafossils are generally scarce in the Chatsworth Formation and represent shallow-marine species displaced downslope via turbidity currents into deeper waters of bathyal depth (Squires et al., 1981). The specimen of ***Zebalia suciaensis*** is from a small pebbly conglomerate lens in massive sandstone in the middle part of the formation (LACMIP loc. 10716). Associated megafossils at this locality include such shallow-water mollusks as the gastropods *Turritella* and *Volutoderma,* the bivalves *Crassatella, Glycmyeris, Indogrammatodon, Meekia, Pterotrigonia,* and *Yaadia,* as well as the ammonite *Baculites* cf. *B. rex* Anderson, 1958. Macrofossils are generally rare in this part of the formation because of the high-sedimentation rates associated with the sand-rich, turbidite-channel deposits. It is likely that the specimen of ***Z. suciaensis*** was not transported very far, based on its nearly complete large size.

Based on the information of several labels found in the box containing ***Z. suciaensis*** from the Chatsworth Formation, the specimen has had an interesting identification history. It has been identified as various heteromorph ammonites (Early Cretaceous *Heteroceras*? sp., Late Cretaceous *Turrilites*? sp., and Late Cretaceous *Bostrychoceras*? sp.), but the ammonite expert T. Matsumoto personally studied the specimen and and wrote on a card that "he did not think it was an ammonite." We concur, as did Saul & Popenoe (1993), who identified it as the epitoniid *Confusiscala suciense* (Packard).

Acknowledgments. Lindsey T. Groves (Natural History Museum of Los Angeles County, Invertebrate Paleontology and Malacology sections) provided access to the fossil and recent collections and provided important references. Jean Dougherty (GCS) and Jean DeMouthe (CAS) arranged for the loan of type specimens. Mary Stecheson (Department of Geological Sciences, California State University, Northridge) did an inventory of all the epitoniid specimens from the Chatsworth Formation.

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APPENDIX

LOCALITIES CITED

Unless otherwise stated, localities are LACMIP.

Sucia Island

10449. West end of peninsula on S side of Fox Cove, Sucia Island, San Juan County, Washington. Cedar District Formation. Age: Middle Campanian. Collectors: R. Durbin, H. L. Popenoe & W. P. Popenoe, 1935.

UCMP 2209. ?Sucia Island (no more information known).

Yreka Area

25401. Sandstone outcrop 549 m S and 914 m E of NW corner of section 26, T. 46 N, R. 6 W, U.S. Geological Survey Yreka quadrangle (30 minute, 1939), Black Mountain area, east of Yreka, Siskiyou County, northern California. Hornbrook Formation, Osburger Gulch Sandstone Member. Age: Turonian. Collector: W. P. Popenoe, May 16, 1944.

East of Redding

U.S. Geological Survey Millville quadrangle (15 minute, 1953), Shasta County, northern California. Redding Formation.

10786. [= CIT 1005]. Near crest of S slope of divide between Basin Hollow and Clover creeks, at approximately the SE corner of the NW ¼ of section 33, T. 32 N, R. 2 W. Member V (lower part) of Popenoe (1943). Age: Early Santonian. Collectors: W. P. Popenoe & D. W. Scharf, August 8, 1931.

10794. [= CIT 1246]. Float on hillsope on E side of "1000-foot hill," SE ¼ of NE ¼ of section 13, T. 32 N, R. 2 W. Member V of Popenoe (1943). Age: Santonian. Collector: W. P. Popenoe, August 1, 1936.

24217. Hard sandstone slabs in bed of Clover Creek, 213 m N and 366 m W of SE corner of section 22, T. 32 N, R. 2 W. Member VI of Popenoe (1934). Age: Late Santonian. Collectors: W. P. Popenoe & D. Dailey, August 27, 1959.

24246. SE side of Oak Run Valley, in sandstone below thick conglomerate, 518 m E and 549 m N from SW corner of section 15, T. 32 N, R. 2 W. Member V of Popenoe (1943). Age: Early Santonian. Collector: W. P. Popenoe, August 31, 1959.

Chico Creek

U.S. Geological Survey Paradise quadrangle (7.5 minute, 1953), Butte County, northern California. Chico Formation. Unless otherwise stated, Collectors: L. R. Saul & R. B. Saul, August, 1952.

10849. Sandstone layer about approximately 30 m below Cretaceous/lava flow contact, on hillside N and a little E of Mickey's house, NW ¼ of the SW ¼ of section 1, T. 23 N, R. 2 E. Musty Buck Member. Age: Late Santonian. Collectors: W. P. Popenoe & D. W. Scharf, August 18, 1931.

23624. First ravine to S of Mickey's house on W side of Chico Creek, 395 m N and 274 m E of SW corner of section 1, T. 23N, R. 2 E. Musty Buck Member. Age: Santonian.

23628. Fossils in brown and gray-blue sandstone on E bank of Chico Creek, 244 m S and 305 m E of NW corner of section 13, T. 23 N, R. 2E. Musty Buck Member. Age: Late Santonian.

23634. On E bank of Chico Creek, 518 m S and 160 m E of NW corner of section 13, T. 23 N, R. 2 E. Musty Buck Member/Ten Mile Member boundary. Age: Earliest Campanian.

23635. On E bank of Chico Creek, 549 m S and 122 m E of NW corner of section 13, T. 23 N, R. 2 E. Ten Mile Member. Age: Earliest Campanian.

23637. On E bank of Chico Creek, 381 m N of SE corner of and just barely inside E line of section 14, T. 23 N, R. 2 E. Ten Mile Member. Age: Early Campanian.

23639. In concretions in massive, greenish-gray sandstone, 373 m S and 293 m W of NE corner of section 23, T. 23 N, R. 2 E. Ten Mile Member. Age: Early Campanian.

23648. Sandstone bluff on W side of Chico Creek, 533 m S and 549 m E of NW corner of section 35, T. 23 N, R. 2 E. Ten Mile Member. Age: Early Campanian.

Pentz Area

24340. Conglomerate beds cropping out just below a drainage canal, SE side of Oroville Highway, about 1.2 km NE of intersection of the highway and Pentz-Magalia-Oroville Road, and 427 m S and 183 m W of the NE corner of section 36, T. 21 N, R. 3 E, U.S. Geological Survey Cherokee quadrangle (7.5 minute, 1949), Butte County, northern California. Chico Formation, Pentz Road member (informal). Age: Early Campanian. Collector: W. P. Popenoe, May 13, 1960.

Pigeon Point

USGS Mesozoic M8610 [= loc. 10 of Elder & Saul, 1993]. About 1 km E of Pigeon Point, U.S. Geological Survey Pigeon Point quadrangle (7.5 minute, 1955), San Mateo County, northern California. Pigeon Point Formation, southern sequence. Age: Probably early middle Campanian. Collector: Unknown.

Jalama Creek

U.S. Geological Survey Lompoc Hills quadrangle (7.5 minute, 1947), western Santa Ynez Mountains, Santa Barbara County, southern California. Jalama Formation. Age: Early late Campanian.

24108. Elevation 168 m, thin bed of hard, fine-grained, gray quartz sandstone in gully bottom and 9 m above on brush-covered sandstone face, 610 m N of Jalama Creek, 3.3 km S of the Jalama Ranch Headquarters, 4.2 km W and 1.3 km N of the SE corner of topographic quadrangle. Collector: D. Dailey, August, 1958.

24140. Elevation 152 m, fine-grained, dark-gray sandstone, 274 m N of Jalama Creek, 3 km E and 0.6 km S of the Jalama Ranch Headquarters, 4.7 km W and 1.2 km N of the SE corner of topographic quadrangle. Collector: W. P. Popenoe, September, 1938.

Simi Hills

U.S. Geological Survey Calabasas quadrangle (7.5 minute, 1952), Ventura County (unless otherwise stated), Simi Hills, southern California. Chatsworth Formation, unless otherwise stated, lower part of formation and of middle Campanian age.

6965. Same as 10715 (see below). Collector: J. Alderson, 1974.

10715. [= CIT 1159]. Prominent fossil bed on crest of spur between forks of Dayton Canyon 122 m E of Los Angeles-Ventura County Line, and 1829 m N23°W of SE corner of section 33, T. 2 N, R. 17 W, Los Angeles County. Collectors: R. Durbin, H. L. Popenoe & W. P. Popenoe, June 21, 1935.

10716. [= 26464 and CIT 1538]. Small pebbly conglomerate lens in massive Cretaceous sandstone near crest of Simi Hills, about 1.3 km west of Los Angeles-Ventura County line and 2.5 km N60°W of SE corner of section 33, T. 2 N, R. 17 W, and 320 m N and 1128 m W of SW corner of County line, section 28. Middle Campanian. Collectors: P. T. & G. P. Zebal, October 25, 1942.

26020. [= CIT 1158]. Fine-grained sandstone cropping out on high bare cliff, N bank of Bell Canyon, just E of mouth of large gully, 2743 m W and 152 m S of the NE corner of section 4, T. 1 N, R. 17 W. Collector: W. P. Popenoe, February 11, 1972.

Santa Ana Mountains

10093. Pebbly lens near top of shale series just below crest of ridge, first prominent NE-SW spur N of Santiago Creek near its junction with Harding Creek, about 914 m straight W of the dam in Harding Canyon, U.S.

Geological Survey El Toro quadrangle (7.5 minute, 1949), Orange County, southern California. Unless otherwise stated, Williams Formation, Pleasants Sandstone Member. Age: Late middle Campanian. Collector: W. P. Popenoe, 1933–1934.

Arroyo Santa Catarina

2853. Broken concretion with numerous fossils, just S of Arroyo Tiburon (a tributary on W side of Arroyo Santa Catarina). Near mouth of and along W side of Arroyo Santa Catarina, SE side of Mesa San Carlos, northern Baja California, Mexico (see Webster, 1983:fig. 1, for detailed locality map). Rosario Formation. Age: Late Campanian to early Maastrichitian. Collector: M. Webster, 1966.