



(Whiteaves, 1879, 1903); Chatsworth Formation, eastern Simi Hills, Los Angeles and Ventura counties, southern California. UPPER MIDDLE CAMPANIAN: Williams Formation, Pleasants Sandstone Member, Orange County, southern California. LOWER UPPER CAMPANIAN: Jalama Formation, Santa Barbara County, southern California. UPPER MIDDLE CAMPANIAN TO UPPER CAMPANIAN UNDIFFERENTIATED: Spray Formation, northwest Hornby Island, Vancouver Island area, British Columbia (Elder & Saul, 1996:392).

Discussion: Specimens are abundant at many of the localities in the Cedar District Formation, but they are usually immature ones and missing much of their shell. Only a few specimens were found in the other formations, and these specimens are usually poorly preserved mature ones.

Whiteaves (1903) assigned the Late Cretaceous epitoniid species *suciense*, *intermedium*, and *newcombii* to genus *Mesostoma* Deshayes, 1861, but the latter name is preoccupied by *Mesostoma* Ehrenberg, 1837, a turbellarian flatworm (Sohl, 1960:92), and preoccupied by *Mesostoma* Heude, 1886, a gastropod. According to Palmer (1937) and Wenz (1940), *Mesostoma* Deshayes, 1861, is also the junior synonym of *Cerithioderma* Conrad, 1860.

It is generally inadvisable to include a faunal-list reference of a species in a synonymy because the exact specimens are seldom known for purposes of documentation. In the case of the Jalama Formation, however, all the specimens listed by locality in Dailey & Popenoe (1966: fig. 3) are in the LACMIP collection and were seen by us. All are *Belliscala suciense*.

Elder & Saul (1996:392) mentioned that one of the syntypes of "*Potamides tenuis*" *nanamimoensis* Whiteaves, 1879, GSC 5763b, resembles *Belliscala suciense*. Elder & Saul (1996:fig. 5–28) also figured this syntype. Much of the sculpture is obliterated, thus the specimen can be only questionably identified as *B. suciense*. This specimen is probably from the Spray Formation on the northwest side of Hornby Island, east coast of Vancouver Island, British Columbia. According to Elder & Saul (1996), depending on which part of this formation it is

from, the specimen could be either late middle to early late Campanian or late Campanian in age.

Elder & Saul (1993) placed Whiteaves' species in genus *Bittiscala* Finlay & Marwick (1937), known from two species in lower Paleocene (Danian) rocks of New Zealand. Finlay & Marwick (1937) mentioned that their genus strongly resembles certain early members of the Epitoniidae, but they concluded that *Bittiscala* should be placed in family Cerithiidae. *Belliscala* differs from *Bittiscala* in having a conical rather than a cerithiform shape, a shorter spire, a wider pleural angle, and a sculpture where axial ribs rather than spiral ribs dominate.

Scalaria philippi Reuss (1846:114, pl. 44, figs. 14a, b; Pervinquière, 1912:61, pl. 3, figs. 19, 20) from Cenomanian strata of Tunisia strongly resembles *Belliscala suciense*, which differs from *S. philippi* by having secondary spiral ribs.

Genus *Acirsa* Mörch, 1857

Type species: *Scalaria eschrichti* Holböhl in Möller, 1842, by subsequent designation (Bouchet & Warén, 1986); Recent, northwest Atlantic.

Diagnosis: Shell acuminate, whorls joined (with only a moderately impressed suture), and not umbilicate. Sculpture much reduced, may be spiral or axial or both; incised spiral grooves usually present. Basal keel absent. Basal disk indistinct but may be defined by a subperipheral ridge (Clench & Turner, 1950; DuShane, 1974, 1979; Kilburn, 1985; Bouchet & Warén, 1986; Dockery, 1993; Neville, 2001).

Discussion: Bouchet & Warén (1986) treated *Hemiacirsa* de Boury, 1890, *Pleisoacirsa* de Boury, 1909, and *Pseudoacirsa* Kobelt, 1903, as synonyms of *Acirsa*. The protoconch of *S. eschrichti* indicates direct development (Bouchet & Warén, 1986). Today, *Acirsa* is a cold-water genus (Kilburn, 1985).

According to Kase (1984), *Acirsa (Hemiacirsa) ofunatoensis* Kase (1984:165, pl. 28, fig. 15) from Barremian (Lower Cretaceous) strata in Japan is the earliest record of *Acirsa*. He also reported *Acirsa (Hemiacirsa) miyak-*

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Figures 39–56. Specimens coated with ammonium chloride, unless otherwise stated. Figures 39–41. *Acirsa alpha* Squires & Saul, sp. nov., holotype LACMIP 13003, LACMIP loc. 23628, Chico Creek, ×4. Figure 39. Apertural view. Figure 40. Abapertural view. Figure 41. Basal view. Figures 42–44. *Acirsa beta* Squires & Saul, sp. nov., holotype LACMIP 13004, LACMIP loc. 23634, Chico Creek. Figure 42. Apertural view, ×2.9. Figure 43. Abapertural view, ×2.9. Figure 44. Basal view, ×3.3. Figures 45–47. *Acirsa obtusa* (White, 1889). Figures 45, 46. Lectotype USNM 20116a, Pentz area, specimen uncoated, ×3.1. Figure 45, apertural view. Figure 46. Abapertural view. Figure 47. Hypotype LACMIP 13005, LACMIP loc. 24340, Pentz, basal view, ×3.5. Figures 48–51. *Acirsa delta* Squires & Saul, sp. nov. LACMIP loc. 23635, Chico Creek. Figures 48–50. Holotype LACMIP 13006, ×2.2. Figure 48. Apertural view. 49. Abapertural view. 50. Basal view. Figure 51. Paratype LACMIP 13007, abapertural view, ×3.3. Figures 52–54. *Acirsa epsilon* Squires & Saul, sp. nov., holotype LACMIP 13008, LACMIP loc. 23639, Chico Creek, ×3.5. Figure 52. Apertural view. Figure 53. Abapertural view. Figure 54. Basal view. Figures 55–56. *Acirsa nexilia* (White, 1889), USNM lectotype 20119a, Pentz area, ×4.6. Figure 55. Apertural view. Figure 56. Abapertural view.

oensis (Nagao, 1934:241–242, pl. 38, figs. 11, 12; Kase, 1984:164–165, pl. 28, figs. 13, 14) from Aptian/Albian (Lower Cretaceous) strata of Japan. Both of these species have a strong basal keel, strong axial ribs, and very fine spiral ribs, and they resemble *Confusiscala* and *Opalia* more than they do the *Acirsa* described in this present report. Dockery (1993) reported the geologic range of *Acirsa* to be Late Cretaceous (Campanian) to Recent.

Acirsa is well represented in Maastrichtian strata of Mississippi and Tennessee (Sohl, 1964; Dockery, 1993), but all of these species have narrower pleural angles than those of the new species described here.

Acirsa alpha Squires & Saul, sp. nov.

(Figures 39–41)

Diagnosis: An *Acirsa* with fine, subcancellate sculpture. Axial ribs predominant. Spiral ribs somewhat wavy, closely spaced, relatively broad, and with shallow interspaces containing a distinct interrib on anterior part of mature whorls.

Description: Shell small (up to 13.9 mm high), elongate conical, with high spire. Pleural angle approximately 25°. Protoconch unknown. Teleoconch whorls approximately seven to eight (estimated), lowly rounded, somewhat flattish; suture moderately impressed. Sculpture subcancellate, axial ribs stronger than spiral ribs. Axial ribs moderately high, relatively wide, approximately as broad as interspaces, prosocline, approximately 20 on last whorl, and 21 on penultimate whorl. Spiral ribs fine, wavy, approximately six on penultimate whorl, and nine on last whorl posterior to basal part of whorl. Interspaces between spiral ribs on penultimate and last whorls shallow, narrow, and with a single distinct, wavy, very narrow interrib on anterior halves of these two whorls. No basal keel. Sculpture on basal part of last whorl consisting of approximately nine, very fine to fine spiral ribs (no interrib) crossed by growth lines; axial ribs obsolete. Aperture subcircular; inner lip with a narrow callus.

Dimensions of holotype: Incomplete specimen of 4.5 whorls, height 13.9 mm, diameter 6.5 mm.

Holotype: LACMIP 13003.

Type locality: LACMIP loc. 23628, 39°51'15"N, 121°42'35"W.

Geologic age: Late Cretaceous (latest Santonian).

Distribution: Chico Formation, Musty Buck Member, Chico Creek, Butte County, northern California.

Discussion: The above description is based on a single specimen, which is well preserved.

Acirsa alpha is most similar to *Acirsa delta*, sp. nov. and differs from it by having stronger and broader axial ribs with narrower interspaces, fewer axial ribs, wavy and

broader spiral ribs, a spiral interrib, a non-beaded look, and slightly flatter whorl sides. *Acirsa alpha* is similar to *Acirsa nexilia* (White, 1889), discussed later, and differs from it by having broader axial ribs that are more closely spaced and with non-sunken interspaces.

Etymology: The specific name *alpha* is the first letter of the Greek alphabet.

Acirsa beta Squires & Saul, sp. nov.

(Figures 42–44)

Diagnosis: An *Acirsa* with extremely fine cancellate sculpture. Intersections minutely beaded. Basal part of last whorl with extremely fine, very faintly beaded spiral ribs.

Description: Shell medium small (up to approximately 17.7 mm high), conical, with moderately high spire. Pleural angle approximately 33°. Protoconch unknown. Teleoconch whorls approximately eight (estimated), lowly rounded, somewhat flattish; suture moderately impressed. Sculpture minutely cancellate, consisting of many very fine spiral ribs crossed by approximately equal-strength growth lines with intersections minutely beaded; approximately 17 spiral ribs on penultimate whorl and on posterior part of last whorl. No basal keel. Spiral ribs on basal part of last whorl finer than elsewhere and very faintly beaded. Aperture oval.

Dimensions of holotype: Nearly complete specimen of 5.5 whorls, height 17.7 mm, diameter 8.8 mm.

Holotype: LACMIP 13004.

Type locality: LACMIP loc. 23624, 39°52'25"N, 121°42'30"W.

Geologic age: Late Cretaceous (latest Santonian to early Campanian).

Distribution: UPPERMOST SANTONIAN: Chico Formation, Musty Buck Member, Chico Creek, Butte County, northern California. LOWER CAMPANIAN: Chico Formation, Ten Mile Member, Chico Creek, Butte County, northern California.

Discussion: The above description is based on nine specimens, all of which have generally good preservation. The new species is unlike the other *Acirsa* spp. nov. in having such minute cancellate sculpture and no axial ribs (only growth lines).

Etymology: The specific name *beta* is the second letter of the Greek alphabet.

Acirsa obtusa (White, 1889)

(Figures 45–47)

Mesalia obtusa White, 1889:20:pl. 4, figs. 6, 7.

Diagnosis: An *Acirsa* with spiral ribs only. Interspaces

between ribs with prominent growth lines producing a "pitted appearance." Anteriormost part of last whorl with similar sculpture but thinner spiral ribs.

Description: Shell medium small (up to 22.5 mm high), elongate conical, with moderately high spire. Pleural angle approximately 30°. Protoconch unknown. Teleoconch whorls approximately seven to eight (estimated), very lowly rounded, flattish; suture slightly impressed. Teleoconch sculpture of fine, closely spaced, smooth spiral ribs, interspaces narrower than ribs and with prominent growth lines giving "pitted appearance" to shell; spiral ribs numerous, with approximately nine on penultimate and ante-penultimate whorls, and approximately 20 on last whorl; spiral ribs on base of last whorl thinner than elsewhere. Aperture oval; inner lip smooth on anterior part.

Dimensions of holotype: Mostly complete specimen of 5.5 whorls, height 18.4 mm, diameter 7.5 mm (slightly crushed).

Lectotype: USNM 20116a, designated here.

Type locality: Near Pentz, northern California, 39°39'08"N, 121°35'50"W.

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

Distribution: UPPER SANTONIAN: Chico Formation, Musty Buck Member, Chico Creek, Butte County, northern California. LOWER CAMPANIAN: Chico Formation, Pentz Road member (informal), Pentz area, Butte County, northern California. LOWER UPPER CAMPANIAN: Jalama Formation, Santa Barbara County, southern California.

Discussion: The above description is based on nine specimens, all of which have generally good preservation. One specimen from the Jalama Formation at LACMIP loc. 24108 shows that the spiral ribs next to the posterior suture can be wider than the other spiral ribs.

Acirsa delta Squires & Saul, sp. nov.

(Figures 48–51)

Diagnosis: An *Acirsa* with fine, subcancellate sculpture. Axial ribs very slightly stronger than spiral ribs. Intersections producing a beaded-look. Spiral ribs closely spaced, relatively broad, and separated by much narrower linear grooves. Basal part of last whorl with fine, un-beaded spiral ribs.

Description: Shell medium (up to 24 mm high), elongate conical, with high spire. Pleural angle approximately 30°. Protoconch unknown. Teleoconch whorls approximately seven to eight (estimated), lowly rounded, somewhat flattish; suture slightly impressed. Sculpture subcancellate, slight beads at intersections of ribs, and axial ribs very

slightly stronger than spiral ribs on whorls anterior to uppermost spire. Axial ribs narrow, low, closely spaced, approximately half as broad as interspaces, prosocline, approximately 36 to 39 on last whorl and penultimate whorls, and approximately 33 on ante-penultimate whorl. Spiral ribs fine, closely spaced, and approximately 10 on penultimate whorl and on last whorl posterior to basal part. Interspaces between spiral ribs moderately deep, linear-grooved, and approximately one-half as broad as ribs. No basal keel. Sculpture on basal part of last whorl consisting of approximately 10 to 12 spiral ribs, closer spaced than elsewhere on teleoconch, and crossed by growth lines; axial ribs obsolete. Aperture oval; inner lip with smooth callus.

Dimensions of holotype: Nearly complete specimen of six whorls, height 24 mm, diameter 10.2 mm.

Holotype: LACMIP 13006.

Type locality: LACMIP loc. 23635, 39°51'06"N, 121°42'40"W.

Paratype: LACMIP 13007.

Geologic age: Late Cretaceous (earliest Campanian).

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

Discussion: The above description is based on seven specimens. Although some are fragments, they have mostly good preservation.

Acirsa delta is most similar to *Acirsa epsilon*, sp. nov. but differs from it by having wider spirals, closer spaced spirals, less obvious axial ribs, and not having sunken rectangular interspaces between intersections of axial and spiral ribs. The new species is similar to *Acirsa obtusa* (White) but differs from it by having axial ribs, stronger spiral ribs, and a beaded rather than a pitted appearance.

Etymology: The specific name *delta* is the fourth letter of the Greek alphabet.

Acirsa epsilon Squires & Saul, sp. nov.

(Figures 52–54)

Diagnosis: A small *Acirsa* with cancellate sculpture. Axial ribs slightly stronger than spiral ribs. Axial ribs narrow and closely spaced, approximately 27 on penultimate whorl. Sunken rectangular interspaces between intersections of axial and spiral ribs. Basal part of last whorl with very fine and minutely beaded cancellate sculpture.

Description: Shell small (up to 15.3 mm high), elongate conical, with moderately high spire. Pleural angle approximately 28°. Protoconch unknown. Teleoconch whorls approximately seven to eight (estimated), rounded; suture very slightly impressed. Sculpture cancellate, axial ribs slightly stronger than spiral ribs, intersections