



Explanation of Figures 10 to 17

Specimens coated with ammonium chloride. Figures 10–12. *Turritella xylina* Squires & Saul, sp. nov. Figure 10. Holotype CAS 69111.02, CAS loc. 69111, right-lateral view, $\times 2.9$. Figure 11. Paratype LACMIP 13315, LACMIP loc. 27242, abapertural view, $\times 2.5$. Figure 12. Paratype LACMIP 13316, LACMIP loc. 23470, apertural view, $\times 4$. Figures 13–17. *Turritella petersoni* Merriam, 1941. Figure 13. Holotype CAS 1291.06, CAS loc. 1291, left-lateral view, $\times 6.1$. Figure 14. Hypotype CAS 69106.02, CAS loc. 69106, apertural view of tip, $\times 8.8$. Figure 15. Hypotype CAS 69107.05, CAS loc. 69107, apertural view, $\times 2.2$. Figure 16. Hypotype CAS 69284, CAS loc. 2335, abapertural view, $\times 3.9$. Figure 17. Hypotype CAS 69285, CAS loc. 69098, right-lateral view, $\times 2.5$.

to 5 mm diameter) slightly convex, covered by spiral threads of generally uniform strength. Adult whorls (approximately 5 mm diameter and greater) concave between very broad and flattened shoulder area and broad to mod-

erately sharp abapical angulation (rib C?); medial part of concave part of whorl commonly bears moderately prominent rib B? and several threads. Suture impressed. Growth line sigmoidal, antispinal on concave part of whorl.

Dimensions of holotype: 24 mm in height, 9 mm greatest diameter (specimen incomplete).

Holotype: CAS 69111.02.

Type locality: CAS 69111, 122°33'30"W longitude, 40°27'15"N latitude.

Paratypes: LACMIP 13315 and 13316.

Geologic age: Cenomanian.

Distribution: Budden Canyon Formation, Bald Hills Member, North Fork Cottonwood Creek, Shasta County, northern California.

Discussion: This new species is based on 38 specimens, and preservation is only moderately good. The largest specimen is 34 mm in height and 13.5 mm in greatest diameter, but the specimen is incomplete.

Turritella xyлина is unlike the other species described in this present paper. It most closely resembles *Turritella chaneyi orienda* Saul (1983a:84–86, pl. 5, figs. 4–11, 16–17) from upper Maastrichtian strata in central and southern California. *Turritella xyлина* differs by having a wider pleural angle, overall weaker ribbing (especially on the concave middle part of the whorls), shoulder closer to suture with narrow interwhorl valley, and whorls sides more vertical with stronger shoulder offset, producing a slightly stepped-whorl appearance.

Rodda (1959) identified the new species as *Turritella* cf. *T. robertiana* (Anderson, 1958). Anderson (1958) had originally referred his species to *Nerinea robertiana*, but, as mentioned in Saul & Squires (1998:465), Anderson's specimens are not nerineids. Saul (1983a) mentioned that *T. robertiana* is similar to *T. chaneyi orienda*. She also mentioned that *T. robertiana* is similar to *T. chaneyi* Merriam, 1941, and tentatively included Anderson's supposed nerineid in synonymy with *T. chaneyi*.

Etymology: The species is named for its occurrence in the North Fork Cottonwood Creek area; Greek, *xylinos* meaning of wood.

Turritella petersoni Merriam, 1941
(Figures 13–17)

Turritella petersoni Merriam, 1941:64–65, pl. 1, figs. 10, 11.

Diagnosis: Adult whorls slightly convex to flattish with ribs thin, numerous, weakly noded, closely spaced, and alternating in strength.

Description: Medium shell. Pleural angle approximately 18°. Protoconch unknown. Early juvenile whorls (approximately 1 mm diameter) convex and bearing ribs r, A, B, and C; interspaces as wide as ribs. Juvenile whorls (1 to 4 mm diameter) convex and bearing ribs r, A, s, B, t, C, u, and d; r approaching strength of A, B, and C on whorls approximately 3 mm diameter); A, B, and C weakly nod-

ed. Adult whorls (approximately greater than 5 mm diameter) slightly convex to flattish (occasionally with slightly tabulate shoulder) and with numerous, thin, very closely spaced, weakly noded ribs, and alternating in strength with weaker ribs. Occasional specimens (see Figure 17) with R, s, A, B, c, u, and d distinguishable, but notation of spiral ribs usually difficult. Threads most common on anterior part of whorls. Some specimens with numerous cycles of single strong rib alternating with bands containing one to four weaker ribs; stronger ribs usually with nodes, weaker ribs unnoded. Suture at but not overlapping d. Area baseward of d with 2 to 3 fine, faintly beaded riblets; bordered by a stronger rib; followed by weak to stronger alternations of diminishing strength to whorl center. Growth line sigmoidal, maximum of antisinus near midpoint of whorl. Aperture round.

Holotype: CAS 1291.06.

Type locality: "1 mile east of Peterson's ranch house, 4 miles north of Sites, Colusa County, California" (Merriam, 1941:64).

Geologic age: Cenomanian to early Turonian.

Distribution: CENOMANIAN: Great Valley Group, Sites area, Colusa County, northern California; Budden Canyon Formation, Bald Hills Member, Ono area, Shasta County, northern California. CENOMANIAN OR TURONIAN: Valle Group, Cedros Island, Baja California, Mexico. LOWER TURONIAN: Budden Canyon Formation, Gas Point Member, lower part, Ono area, Shasta County, northern California.

Discussion: This study of Merriam's species is based on 149 specimens. Preservation is generally good. Many of the specimens are from the Gas Point Member of the Budden Canyon Formation.

Turritella petersoni has been a poorly known species prior to this study. Its geologic age was tentatively reported as Cenomanian by Saul (1978:38–39) because of inexact knowledge regarding the location of its type locality.

Three moderately well preserved specimens of *T. petersoni* were detected from LACMIP loc. 15741 in the Valle Group, Cedros Island, Baja California, Mexico. The specimens are float derived from this group, and utilizing the geologic map provided by Kilmer (1984), the specimens are from either the upper part of the lower member (i.e., the Cenomanian Vargas Formation) or the lower part of the upper member (i.e., the Turonian Pinos Formation).

Turritella petersoni is similar to *Turritella iota* but *T. petersoni* differs by having whorls sides that can be weakly convex (never concave) and in not having a moderate carina at C. *Turritella petersoni* also has more numerous and more closely spaced ribs with the nodes usually stronger, and the sculpture can also vary from ribs having

nodes to ribs without almost any nodes. The latter variation might be due to ecologic factors. The basal sculpture differs from *T. iota* in having ribs of alternating strength.

Turritella hearni Merriam, 1941
(Figures 18–21)

Turritella hearni Merriam, 1941:64, pl. 1, figs. 1–9; Saul: 1982:72 (chart).

Turritella tolenasensis Merriam, 1941:62, pl. 1, figs. 14, 15; Saul, 1983a:103.

Diagnosis: Whorls slightly convex with three prominent and equal-strength spiral ribs (nodes not strong) on juvenile whorls, increasing to four prominent spiral ribs (nodes strong and elongate) on later whorls (ribs A and B strongest) and numerous unnoded threads on all interspaces.

Description: Shell medium. Pleural angle 13°. Protoconch and earliest juvenile whorls unknown. Whorls slightly convex to flattish. Juvenile whorls (less than 4 mm diameter) with ribs A, B, and C equally prominent and unnoded; ribs r and d weak (see Figure 21). Later whorls (greater than 4 mm diameter) show ribs R, A, B, C, t, and d; ribs A and B most prominent and noded; rib C slightly less prominent and with or without nodes. Interspaces between ribs on later whorls with 3 to 8 threads; later whorls on some specimens (see Figure 20) only with R, A, B, and C, and their interspaces bearing only threads. Rib d just adapical to suture followed by very fine riblets. At suture, riblet with low elongate nodes; remainder of base with very fine, somewhat wavy riblets. Growth lines sigmoidal, maximum of antisinus somewhat posterior of midpoint of whorl. Suture impressed. Aperture round.

Holotype: CAS 61938.01.

Holotype dimensions: 27.5 mm height, 7 mm greatest diameter, specimen incomplete.

Type locality: CAS 61938.

Geologic age: Turonian, and probably early Coniacian.

Distribution: LOWER TURONIAN: Redding Formation, Bellavista Sandstone Member and Frazier Siltstone Member, Shasta County, northern California; Budden Canyon Formation, Gas Point Member, lower part, Shasta County, northern California. UPPER TURONIAN: Ladd Formation, Baker Canyon Member, Holz-Baker transition, and lower part Holz Shale Member, Santa Ana Mountains, Orange County, southern California. TURONIAN UNDIFFERENTIATED: Hornbrook Formation, Jackson County, southern Oregon. PROBABLY LOWER CONIACIAN: Hornbrook Formation, probably the Ditch Creek Siltstone Member, Siskiyou County, northern California.

Discussion: This study of Merriam's species is based on

239 specimens. Many of these are from the Hornbrook Formation, where the preservation is generally very good. A considerable number of specimens, however, are from the Redding Formation, east of Redding. Preservation of the Redding material is also generally very good.

Saul (1982:fig. 2 on p. 72) plotted the stratigraphic occurrence of this species in the Ladd Formation.

Merriam (1941) reported *Turritella tolenasensis* Merriam (1941:62, pl. 1, figs. 14, 15) from Cenomanian or Turonian strata in northern California. Saul (1983a:103), however, reported that Merriam's species is probably conspecific with *Turritella hearni* and that Merriam's type material of *T. tolenasensis* is definitely of Turonian and not Cenomanian age. In this present report, we put *T. tolenasensis* into synonymy with *T. hearni*.

Merriam (1941) reported *Turritella tolenasensis* subsp. Merriam (1941:62–63, pl. 1, fig. 12) from Tuscan Springs, Tehama County, northern California. Saul (1983a:102–104), however, tentatively put this subspecies into synonymy with *Turritella packardi* Merriam, 1941, an early to possibly middle Campanian gastropod.

Turritella iota Popenoe, 1937
(Figures 22–23)

Turritella iota Popenoe, 1937:401, pl. 49, fig. 8; Saul, 1982: 72 (chart).

Diagnosis: Adult whorls slightly concave to flattish with C rib strongest, forming narrow and projecting, weakly noded carina; posterior to carina sculpture consisting of three to four, weak spiral ribs alternating with weaker ones.

Description: Medium shell, slender. Pleural angle approximately 16°. Protoconch and earliest juvenile whorls unknown. Teleoconch whorls very shallowly concave to flattish. Suture impressed. Juvenile and early adult whorls (2 to 4.5 mm in diameter) with R, A, s, B, T, and C, with d appearing at approximately 2 mm diameter; R, A, B, and d weak and thin, C forming narrow and projecting carina. Adult whorls (greater than 5 mm diameter) similar to earlier whorls but with nodes on R, A, B, and C. Interspaces with threads, especially immediately posterior to carina. Carina of adult individuals rounded on slightly convex base. Base with noded rib adjacent to and paralleling d, another riblet toward mid base, and otherwise with fine striations. Basal ribs weakening toward aperture. Growth line sigmoidal, antisinus at midpoint of whorl and deepest at s.

Holotype: LACMIP 4186.

Holotype dimensions: 35.5 mm height, 9.6 mm greatest diameter, specimen incomplete.

Type locality: LACMIP 8178.

Geologic age: Late Turonian.