

Marine and brackish water Cretaceous Ostracoda from wells in central and southern Florida

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ABSTRACT—A small fauna represented by 17 species of ostracods, belonging to 13 genera, has been obtained from white oolitic limestones of probable Washitan (late Albian-early Cenomanian) age in 11 deep wells in Collier, Lee, Monroe, Pinellas, Palm Beach, Hendry, and Highlands Counties, central and southern Florida. Both marine and presumed brackish-water and/or fresh-water species are represented in the fauna. Five of the species are new; *Clithrocytheridea? medioreticulata*, *C.? paucipunctata*, *C.? holoreticulata*, *Eocytheropteron highlandsensis* and *Cytheropteron? pinellensis*.

INTRODUCTION

The ostracod fauna discussed in this paper was obtained from the wells listed in Table 1. The locations of the wells are shown in Fig. 1. The ostracods are of interest because they appear to be mainly undescribed and include both marine and fresh-water or brackish-water species in an oolitic limestone matrix. Most of the specimens are closed valves filled with opaque matrix and with the shell material corroded or recrystallized, which has made observation of internal shell structures difficult. The specimens that yielded information on internal shell structures were immersed in oil and examined by reflected and transmitted light in oil.

ENVIRONMENTAL ASPECTS OF THE FAUNA

Although most of the ostracods described herein are marine forms, several suggest brackish-water or fresh-water conditions. The presumed brackish-water types are: *Fossocytheridea* sp. and *Timiriasevia?* sp., and the supposed fresh-water forms are *Limnocythere?* sp. 1 and *L.?* sp. 2; the latter two may also possibly represent seasonally-variable fresh and brackish-water conditions. All the ostracods collected occur in white, chalky, oolitic limestone. The fresh and brackish-water ostracods may have: (1) lived in the same area of the more definitely marine types, but at seasonally different salinity periods; (2) become adapted to higher salinity or the marine forms may have adapted to lower salinity conditions; or (3) been washed into the marine environment from inland lakes and ponds or brackish lagoons. It is not possible to decide at present which one or more of these alternatives is correct. It does seem clear that the facies containing the ostracods represent very nearshore conditions. A sabkha environment may be represented by the evaporite deposits associated with the oolitic limestone.

STRATIGRAPHY

Rocks of Washitan age occur in the subsurface under the entire state of Florida except for an area in the north central part of the state where they are absent. This area is located on the central part of the Peninsular Arch, a NW–SE trending positive structural feature against which Washitan and older Comanchean rocks pinch out in on-lap relationship. From a feathered edge at their updip limit, Washitan strata thicken to the southwest and south. Proximal to the Peninsular Arch and southwestward from it, these strata are composed of nonmarine coarse sands and white to yellow shales. South, on the Florida platform area, they are represented by a carbonate-evaporite facies.

In central and southern Florida, Washitan strata range in thickness from 825 feet in well 10, Pinellas County, to 2169 feet in well 6, Monroe County (Fig. 1). They overlie microcrystalline tan to grey mottled Fredericksburgian limestone, and are overlain by calcareous grey to black shale, fine-grained sand, and chalky to fine crystalline dolomitic limestone of Woodbinian and Eaglefordian age. The general stratigraphic relationships of these units across south-central Florida are shown in Fig. 2.

No definite assignment of age of the containing deposits can be made on the basis of the Ostracoda alone. The fauna contains several forms suggesting a late Lower Cretaceous age; these include *Pontocyprrella* sp. aff. *P. roundyi*, *Paracypris* sp. cf. *P. alta*, *Fossocytheridea* sp., and *Eocytheropteron* sp. aff. *E. tumidum*.

The best available evidence for Washitan age of the deposits is the presence of the miliolid foraminifer *Nummuloculina heimi* Bonet, 1956. This form was described from the El Abra Limestone (late Albian-early Cenomanian) of San Luis Potosi, Mexico (Bonet, 1956), and is also recorded from the upper part of the Devils River Limestone of late Albian age, Val Verde

	Col-OT-5	Col-OT-6	Mon-OT-2	Mon-OT-5	Pitt-OT-2	Lee-OT-2	PB-OT-1	PB-OT-3	Hen-OT-5	Hi-OT-1
<i>Pontocyprilla</i> sp. aff. <i>P.?</i> <i>roundyi</i> (Alexander)	8,802-03									
<i>Paracypris</i> sp. cf. <i>P.</i> <i>alta</i> Alexander	8,803-04									
<i>Clithrocytheridea?</i> <i>medioreticulata</i> sp.nov.	8,802-03 8,908-09		8,300-10			8,930-40 8,950-60	7,700-10			
<i>Clithrocytheridea?</i> <i>paucipunctata</i> sp.nov.	8,802-03	8,590-00			7,515-20	9,470-80	7,690-00			
<i>Clithrocytheridea?</i> <i>holoreticulata</i> sp.nov.									8,620-50	
<i>Fossocytheridea</i> sp.								7,371-72		
<i>Asciocythere</i> cf. <i>A.</i> <i>elongata</i> Swain & Brown	8,802-03									
<i>Asciocythere?</i> sp.					7,250-60			7,371-72		
<i>Fabanella tumidosa</i> (Swain)	11,916-17									
<i>Ovocytheridea?</i> sp.	8,802-03				7,650-75					
<i>Eucythere?</i> sp.	9,232-33								8,620-30	
<i>Limnocythere?</i> sp. 1					7,570-75					
<i>Limnocythere</i> & sp. 2							7,691-96			
<i>Timiriasevia?</i> cf. <i>T. polymorpha</i> Mandelstam			9,430-40							
<i>Eocytheropteron</i> <i>highlandsensis</i> sp.nov.				8,300-10						8,010-20
<i>Eocytheropteron</i> sp. aff. <i>E. tumidus</i> (Alexander)	8,802-03				7,840-45	8,950-60				
<i>Eucytherura</i> <i>pinellensis</i> sp.nov.	8,802-03				7,570-75	9,470-80				8,010-20
<i>Taxodiella?</i> sp.						8,950-60				

Table 1. Distribution of Ostracod species; depths in feet below land surface.

County, Texas (Conkin & Conkin, 1956). It is considered a fairly reliable index fossil for middle Albian to Cenomanian calcareous reef facies in the southern United States and Mexico.

The occurrence of the ostracod fauna with *N. heimi* provides a possible future means of age determination of the containing strata on the basis of the ostracods alone. The underlying Lower Cretaceous rocks of peninsular Florida have yielded a different ostracod assemblage (Swain & Miller, 1978). In that assemblage, species of *Fabanella* Martin are indicative of brackish-water conditions at various levels (see also Swain &

Brown, 1972), whereas in the present collection from the Washitan, *Fossocytheridea* sp. and *Limnocythere?* spp. represent such conditions. As was noted previously (Swain, 1981), *Fabanella* appears not to range above the Aptian or early Albian in the western Atlantic region. A species of *Fabanella* from the Trinitian (early Albian-late Aptian) of one of the wells studied here is included for comparison with the Washitan deposits.

Washitan strata in the area of study consist predominantly of dolomite which commonly shows highly developed vuggy porosity as a result of the dolomite replacing oolitic and foraminiferal limestone. Tan to

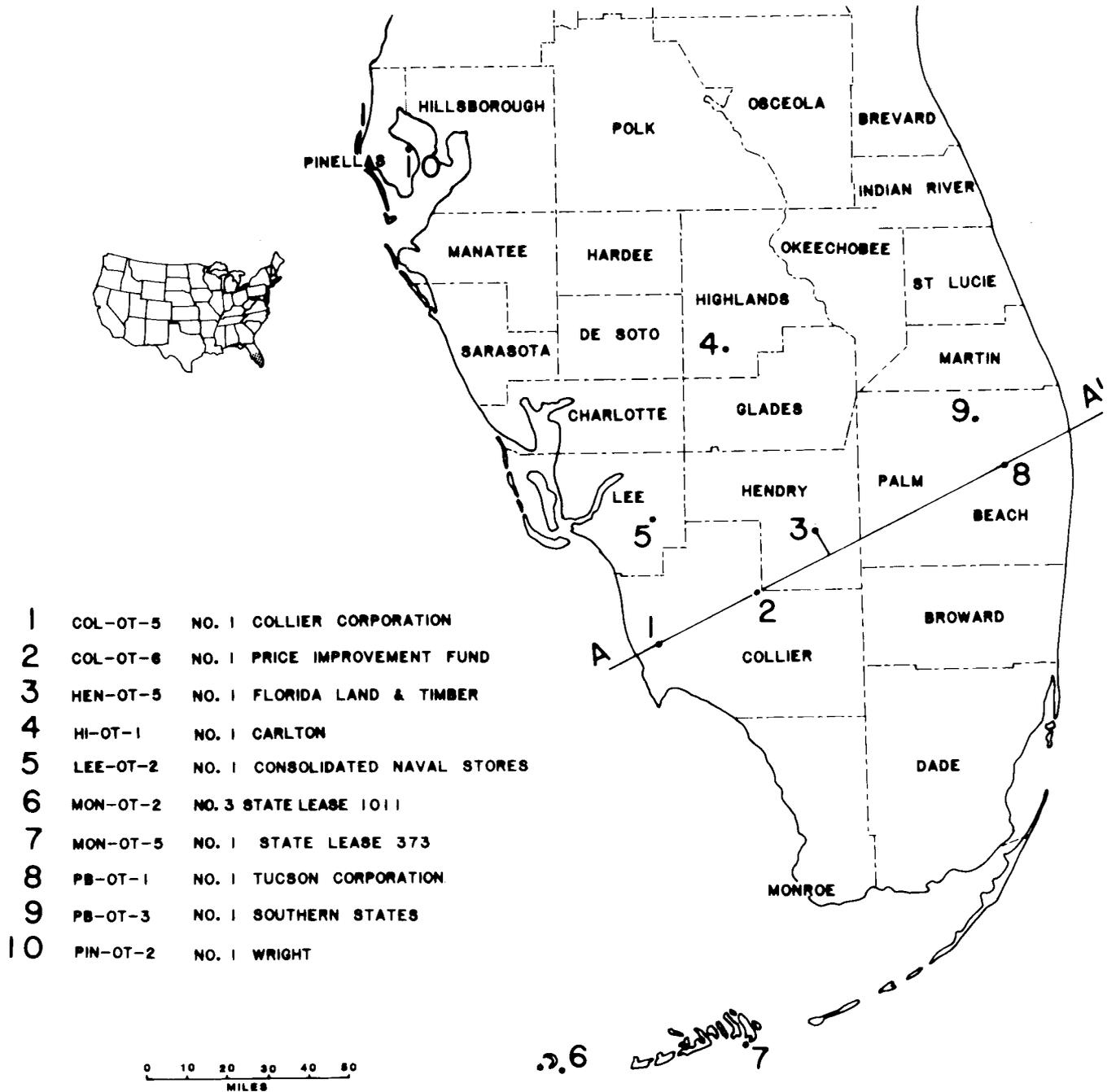


Fig. 1. Map of Florida showing location of wells.

white thin-bedded to massive anhydrite, and cream to white oolitic limestone with a chalky matrix are commonly interbedded with the dolomite. These oolitic limestone beds contain the ostracod fauna described herein, along with abundant specimens of the foraminifer *N. heimi* and occasional small shells of gastropods and pelecypods. The Ostracoda occur both as discrete grains in the chalky matrix and as the nuclei of oolites.

Oolitic limestone occurs predominantly in the upper

third of the Washitan unit, and is also found near its base, 50 to 200 feet above Fredericksburgian rocks. At both levels, it is interbedded with vuggy dolomite. Anhydrite and dolomite comprise the lower two-thirds of the Washitan unit. A thin green "pencil" shale which carries *Fossocytheridea* sp. marks the top of Washitan strata in many wells, particularly those in Palm Beach County.

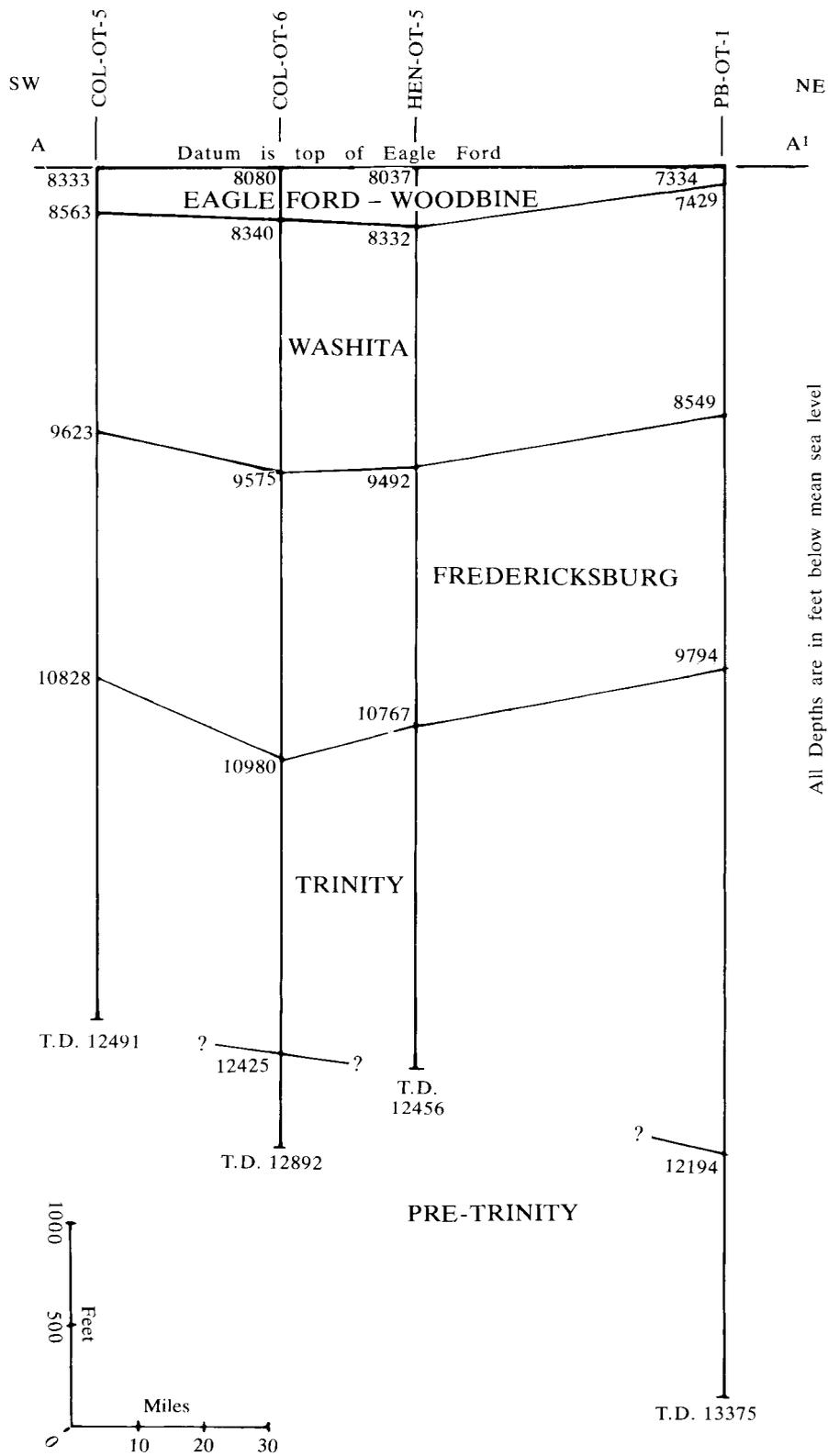


Fig. 2. Geological cross section A-A¹.

The following ostracods are present in the collection:

- Pontocyprella* sp. aff. *P. roundyi* (Alexander, 1929)
Paracypris cf. *P. alta* Alexander, 1929
Clithrocytheridea? *medioreticulata*, sp. nov.
Clithrocytheridea? *paucipunctata*, sp. nov.
Clithrocytheridea? *holoreticulata*, sp. nov.
Fossocytheridea sp.
Asciocythere cf. *A. elongata* Swain & Brown, 1972
Asciocythere? sp.
Fabanella tumidosa (Swain, 1952), a pre-Washitan brackish-water species, introduced for comparison
Ovocytheridea? sp.
Eucythere? sp.
Limnocythere? sp. 1
Limnocythere? sp. 2
Timiriasevia? cf. *T. polymorpha* Mandelstam, 1955 in Galeeva, 1955
Eocytheropteron highlandsensis, sp. nov.
Eocytheropteron sp. aff. *E. tumidum* (Alexander, 1933)
Cytheropteron? *pinellensis*, sp. nov.
Taxodiella? sp.

For economy of space, systematic descriptions are not given for all the above in the following section.

Systematic descriptions

- Suborder Podocopina Sars, 1866
Superfamily Cypridacea Baird, 1845
Family Paracyprididae Sars, 1923
Genus *Pontocyprella* Lyubimova, 1955
Pontocyprella? sp. aff. *P.?* *roundyi* (Alexander, 1929)
(Pl. 1, figs. 1–3)

Material. Four carapaces.

Remarks. This form is similar to the type species *P. harrisiana* (Jones, 1849) (Howe & Laurencich, 1958) in general shape and relationships, but is more convex dorsally than is characteristic of that species, and less concave ventrally. It is similar to *P.?* *roundyi* (Alexander) from the Kiamichi and Duck Creek Formations of Texas, but is less pointed posteriorly than that species (Alexander, 1929).

Variation in relative elongation of shells may represent sexual dimorphism.

Occurrence. The species is frequent in beds of Washitan age, Fla-Col-OT-5 well, 8,802–8,803 feet, Collier County, Florida.

Genus *Paracypris* Sars, 1866

Paracypris sp. cf. *P. alta* Alexander, 1929
(Pl. 1, fig. 4)

1929 *Paracypris alta* Alexander: 66, pl. 3, figs. 9, 12; Lozo, 1951, p. 82. not Zálányi, 1929, p. 44, figs. 14, 15, 16.

Material. One carapace.

Remarks. The outline and overlap relationships of this form are closely similar to Alexander's species, and the two are probably conspecific.

Distribution. The species occurs in beds of Washitan age (late Albian to early Cenomanian), Fla-Col-OT-5 well, 8,803–8,804 feet, Collier County, Florida. It was recorded previously from the Denton, Grayson and Woodbine Formations of Texas (Alexander, 1929; Lozo, 1951).

Superfamily Cytheracea Baird, 1850
Family Cytherideidae Sars, 1925
Subfamily Cytherideinae Sars, 1925
Genus *Clithrocytheridea* Stephenson, 1936
Clithrocytheridea? *medioreticulata*, sp. nov.
(Pl. 1, figs. 5–9)

Derivation of name. After the reticulate nature of the shell surface mediolaterally.

Diagnosis. Outline subovate to subelliptical, dimorphic, posterior much narrower than anterior, shell tumid, left valve strongly overlaps right ventrally; surface irregularly reticulate medially.

Holotype. Male carapace, UMPC 13231.

Material. 50+ specimens.

Type locality and horizon. Fla-Lee-OT-2 well, depth 8,930–8,940 feet (2722–2725m), beds of Washitan age.

Description. Shell subovate in lateral view in presumed male, more elongate and subelliptical in presumed female; highest about three-fifths of length from anterior end; dorsal margin strongly convex with median to posteromedian slope straightened; ventral margin of left valve slightly convex, that of right valve sinuous; anterior margin broadly rounded, most extended slightly ventral of midheight, subtruncate above; posterior margin narrowly rounded in presumed male, less narrowly rounded in presumed female. Left valve larger than right, overlapping and extending beyond edge of right valve strongly in midventral two-thirds, less strongly elsewhere. Valves strongly convex, greatest convexity submedian.

Median to posteromedian half of shell reticulate; the reticulating ridges are broad and low with rounded crests and are irregular in pattern and distribution; remainder of shell surface smooth or weakly pitted.

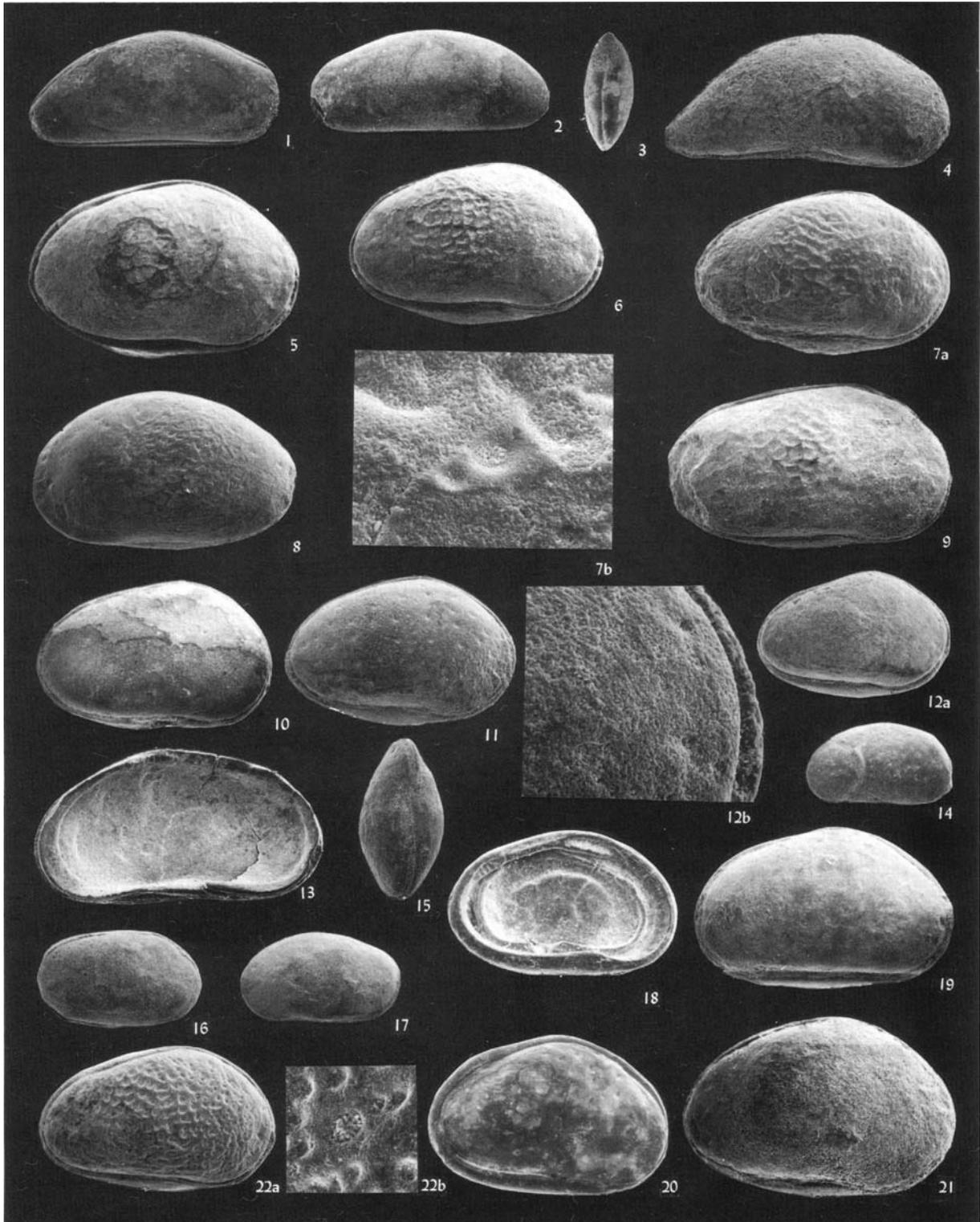
Hinge not clearly observed but appears to be anti-merodont; infolds (inner lamellae) narrow; vestibules present terminally; radial canals few? and widely spaced; normal pores widely spaced and in part are accompanied by sieve plates (Pl. 1, fig. 7B). Adductor muscle scars consist of an anteromedian vertical row of four spots, with two frontal scars.

Remarks. The medially reticulate surface of this species distinguishes it from other species of *Clithrocytheridea?*

Explanation of Plate 1

All specimens are of Washitan (Albian-Cenomanian) age, housed in the Paleontological Collections of the University of Minnesota. Numbers in parentheses refer to length, height and width of specimens in mm.

- Fig. 1. *Pontocyprrella* sp. aff. *P.?* *roundyi* (Alexander). Car. R side, UMPC 13226, x 49, (0.87, 0.44, 0.34). Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 2. *Pontocyprrella* sp. aff. *P.?* *roundyi* (Alexander). Car. L side, UMPC 13227, x 49. Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 3. *Pontocyprrella* sp. aff. *P.?* *roundyi* (Alexander). Car. dors., UMPC 13228, x 25, Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 4. *Paracypris* sp. cf. *P. alta* Alexander. Car. R side, UMPC 13229, x 51 (0.87, 0.40, 0.33). Fla-Col-OT-5 well, 8,803–8,804 feet.
- Fig. 5. *Clithrocytheridea?* *medioreticulata* sp.nov. ♂ car. R side, UMPC 13230, x 51, Fla-Lee-OT-2 well, 8,950–8,960 feet.
- Fig. 6. *Clithrocytheridea?* *medioreticulata* sp.nov. Holotype ♂ car. R side, UMPC 13231, x 51 (0.77, 0.53, 0.50). Fla-Lee-OT-2 well, 8,930–8,940 feet.
- Fig. 7a, b. *Clithrocytheridea?* *medioreticulata* sp.nov. ♂ car. R side, UMPC 13232, x 49, and enlargement of median shell surface, x 485, showing sieve plate structure; Fla-Mon-OT-2 well, 8,300–8,310 feet.
- Fig. 8. *Clithrocytheridea?* *medioreticulata* sp.nov. ♂ car. L side, UMPC 13233, x 50, Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 9. *Clithrocytheridea?* *medioreticulata* sp.nov. ♂ car. R side, UMPC 13234, x 51, Fla-Col-OT-5 well, 8,908–8,909 feet.
- Fig. 10. *Clithrocytheridea?* *paucipunctata* sp.nov. Holotype ♀ car. R side, UMPC 13235, x 51, Fla-Pin-OT-2 well, 7,515–7,520 feet.
- Fig. 11. *Clithrocytheridea?* *paucipunctata* sp.nov. ♂ car. R side, UMPC 13236, x 51, Fla-Lee-OT-2 well, 9,470–9,480 feet.
- Fig. 12. *Clithrocytheridea?* *paucipunctata* sp.nov. ♂ car. R side, UMPC 13237, x 49, and enlargement of mid-anterior region, x 288, Fla-Col-OT-6 well, 8,590–8,600 feet.
- Fig. 13. *Fossocytheridea* sp. Interior of broken RV, UMPC 13238, x 48 (0.93, 0.53, 0.23). Fla-PB-OT-3 well, 7,371–7,372 feet.
- Fig. 14. *Fossocytheridea* sp. Exterior of broken LV, UMPC 13239, x 25, Fla-PB-OT-3 well, 7,371–7,372 feet.
- Fig. 15. *Asciocythere* sp. cf. *A. elongata* Swain & Brown. Car. oblique vent., UMPC 13240, x 25 (1.06, 0.62, 0.59). Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 16. *Asciocythere* sp. cf. *A. elongata* Swain & Brown. Car. oblique R side, UMPC 13241, x 26, Fla-Col-OT-5 well, 8,802–8,803 feet. Sinuous form of ventral margin obscured by tilting of shell.
- Fig. 17. *Asciocythere* sp. cf. *A. elongata* Swain & Brown. Car. L side, UMPC 13242, x 26, Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 18. *Asciocythere?* sp. Interior of LV, UMPC 13243, x 50, in which a smaller RV and perhaps a smaller molt shell are nested, Fla-PB-OT-3 well, 7,371–7,372 feet.
- Fig. 19. *Asciocythere?* sp. Car. R side, UMPC 13244, x 49, Fla-Pin-OT-2 well, 7,250–7,260 feet.
- Fig. 20. *Asciocythere?* sp. Car. R side, UMPC 13245, x 50 (0.73, 0.50, 0.30), Fla-PB-OT-3 well, 7,371–7,372 feet.
- Fig. 21. *Clithrocytheridea?* *paucipunctata* sp.nov. Car. R side, UMPC 13246, x 49, Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 22a, b. *Clithrocytheridea?* *holoreticulata* sp.nov. Holotype? ♂ R side, UMPC 13247, x 49 (0.74, 0.47, 0.49), and enlargement of median surface, x 257, showing a poorly preserved sieve plate structure, Fla-Hen-OT-5 well, 8,620–8,650 feet.



in the present collection. The shape and overlap relationships of this and the following forms tentatively assigned to the genus appear to resemble *Clithrocytheridea* Stephenson more than other described genera.

The species is abundant in beds of Washitan age in the following wells in Florida: Fla-Col-OT-5, depths 8,802–8,803 and 8,908–8,909 feet, Collier County; Fla-Lee-OT-2 well, depths 8,930–8,940 and 8,950–8,960 feet, Lee County; Fla-PB-OT-1 well, depths 7,700–7,710 feet, Palm Beach County; and Fla-Mon-OT-2 well, depths 8,300–8,310 feet, Monroe County.

Clithrocytheridea? paucipunctata, sp. nov.
(Pl. 1, figs. 10–12, 21)

Derivation of name. Latin meaning poorly pitted, referring to the relatively smooth (for the genus) shell surface.

Diagnosis. Shell subtriangular to subovate in lateral outline, dorsum strongly convex, truncate posterior to position of greatest height, dimorphic, males? more triangular than females?; surface of shell nearly smooth, but in well-preserved specimens bears densely spaced small pits and scattered larger normal pore canal pits.

Holotype. Female carapace, UMPC 13235.

Material. Five specimens.

Type locality and horizon. Fla-Pin-OT-2 well, depth 7,515–7,520 feet (2291–2293m), beds of Washitan age.

Description. Shell subovate in lateral view in presumed female dimorphs, and subtriangular in presumed male dimorphs, highest anterior to midlength; dorsal margin strongly convex subumbonate, truncate posterior to umbo in male? shells, subtruncate in females?; ventral margin in male? dimorphs gently convex (left valve), sinuous in female? dimorphs. Anterior margin broadly rounded, slightly extended below; posterior margin more narrowly rounded, strongly extended below. Left valve larger than right, overlapping and extending strongly beyond right mid-ventrally, less strongly elsewhere. Valves strongly convex, greatest convexity sub-medial.

Surfaces of valves in well-preserved specimens bear densely spaced small pits but are typically smooth except for scattered large pore pits.

Internal shell structures not observed because of recrystallization of shell.

Dimensions. (mm)

	l	h	w
Holotype ♀ car., UMPC 13235	0.73	0.50	0.46
Paratype ♂ car., UMPC 13236	0.70	0.47	0.42

Remarks. The species differs from other *Clithrocytheridea?* of the collection in its relatively smooth surface and in the more ovate outline of the female? shells.

Distribution. The species occurs in beds of Washitan age in the following wells in southern Florida: Fla-Pin-OT-2 well, depth 7,515–7,520 feet, Pinellas County; Fla-Lee-OT-2 well, depth 9,470–9,480 feet, Lee County; Fla-Col-OT-6 well, depth 8,590–8,600 feet, Fla-Col-OT-5 well, depth 8,802–8,803 feet, Collier County; and Fla-PB-OT-1 well, depth 7,690–7,700 feet, Palm Beach County.

Clithrocytheridea? holoreticulata sp. nov.
(Pl. 1, figs. 22a, b)

Derivation of name. After the uniformly reticulate nature of the surface ornamentation.

Diagnosis. Shell medium-sized, subovate, highest anteromedially; left valve overlaps right, surface of valves more or less completely ornamented by reticulating low ridges.

Holotype. Carapace, UMPC 13247.

Material. Two specimens.

Type locality and horizon. Fla-Hen-OT-5 well, depth 8,620–8,650 feet (2628–2637m), beds of Washitan age.

Description. Shell subovate in lateral view, highest about three-eighths from anterior end, dorsal margin strongly convex; ventral margin slightly convex; anterior margin broadly rounded, slightly extended below; posterior margin more narrowly rounded, extended below. Valves strongly convex, greatest convexity slightly posteromedian. Left valve larger than right, overlapping and extending beyond edge of right valve around entire periphery; greatest overlap mid-ventrally.

Surfaces of valves covered by a coarse pattern of low reticulating ridges having irregular distribution rather than occurring in distinct alignment; widths of ridges equal to or less than pits between ridges. Internal features obscured by recrystallization of shell.

Remarks. The species is more completely reticulate on the shell surface than are others of the genus in the present fauna. The figured shell is believed to be a male specimen but females have not yet been found.

Distribution. Rare in beds of Washitan age (late Albian-early Cenomanian), occurring only in the Fla-Hen-OT-5 well, depth 8,620–8,650 feet, Hendry County, Florida.

Genus *Fossocytheridea* Swain & Brown, 1964
Fossocytheridea sp.
(Pl. 1, figs. 13, 14)

Material. Two broken valves.

Remarks. The outline, anteromedian sulcus and internal shell structures relate this form to *Fossocytheridea*. The sulcus is weaker than in *F. lenoiresis*

Swain & Brown, 1964, the type species from Washitan beds of North Carolina.

Distribution. The form occurs rarely in beds of Washitan age in the Fla-PB-OT-3 well, depth 7,371–7,372 feet, Palm Beach County, Florida.

Genus *Asciocythere* Swain, 1952

Asciocythere sp. cf. *A. elongata* Swain & Brown
(Pl. 1, figs. 15–17)

1952 *Asciocythere?* cf. *A.?* *amygdaloides* (Cornuel)
Swain: 76, pl. 8, figs. 37–39.

1972 *Asciocythere elongata* Swain & Brown: 22,
pl. 5, figs. 3, 5–7.

Material. 25+ specimens.

Distribution. In the present collection the species was found in beds of Washitan age, Fla-Col-OT-5 well, depth 8,802–8,803 feet, Collier County, Florida. It was described from beds of Trinitian to Washitan age from the subsurface of North Carolina (Swain & Brown, 1972).

Asciocythere? sp.
(Pl. 1, figs. 18–20)

Material. Three specimens.

Remarks. This form is more triangular than either *A. rotunda* (Vanderpool, 1928) or *A. macropunctata* Swain, 1952, from the Lower Cretaceous of Arkansas, Louisiana, Texas, and the southwestern states. It is less convex than the species here assigned to *Clithrocytheridea?*

Distribution. This form is rare in beds of Washitan age, Fla-PB-OT-3 well, depth 7,371–7,372 feet, Palm Beach County; and Fla-Pin-OT-2 well, depth 7,250–7,260 feet, Pinellas County, Florida.

Genus *Fabanella* Martin, 1961
Fabanella tumidosa (Swain)
(Pl. 2, figs. 1–4)

1952 *Apatocythere?* *tumidosa* Swain: 73, pl. 9, fig. 44.
1972 *Fabanella tumidosa* (Swain); Swain & Brown: 32,
pl. 7, figs. 5–7, 9.

Material. Four specimens.

Remarks. This species was first described from beds of Trinity? and pre-Trinity? age, undifferentiated, in wells in North Carolina (Swain, 1952) and has further been recorded from beds of Trinitian (late Aptian-early Albian), Nuevo Leonian (late Neocomian-early and middle Aptian) and Durangoan (early and middle Neocomian) ages (Swain & Brown, 1972). It is recorded here from beds of Trinitian age in the Fla-Col-OT-5 well, depth 11,916–11,917 feet, Collier County, Florida, to illustrate the kind of brackish-water ostracods that

occur in the pre-Washitan beds of the area. No *Fabanella* species were found in the Washitan beds in the present collection.

Genus *Ovocytheridea* Grekoff, 1951
Ovocytheridea? sp.
(Pl. 2, figs. 5a, b, 6, 7)

Material. Three specimens.

Remarks. The subelliptical-subreniform elongate outline, strong left valve overlap, and posterior position of greatest convexity suggest a relationship to *Ovocytheridea*. Lack of knowledge of internal shell structures, however, prevents a more definite identification.

Distribution. This form is rare in beds of Washitan age, Fla-Pin-OT-2 well, depth 7,650–7,675 feet, Pinellas County, Florida, and Fla-Col-OT-5 well, depth 8,802–8,803 feet, Collier County, Florida.

Subfamily Eucytherinae Puri, 1954
Genus *Eucythere* Brady, 1868
Eucythere? sp.
(Pl. 2, fig. 9)

Material. One carapace.

Remarks. This form is larger than many other described species of *Eucythere* and atypically has the greatest convexity slightly anterior to middle. It is only hesitantly assigned to this genus.

Distribution. Very rare in beds of Washitan age, Fla-Col-OT-5 well, depth 9,232–9,233 feet, Collier County, Florida.

Family Limnocytheridae Klie, 1938
Subfamily Limnocytherinae Klie, 1938
Genus *Limnocythere* Brady, 1868
Limnocythere? sp. 1
(Pl. 2, figs. 11–13)

Material. Five specimens.

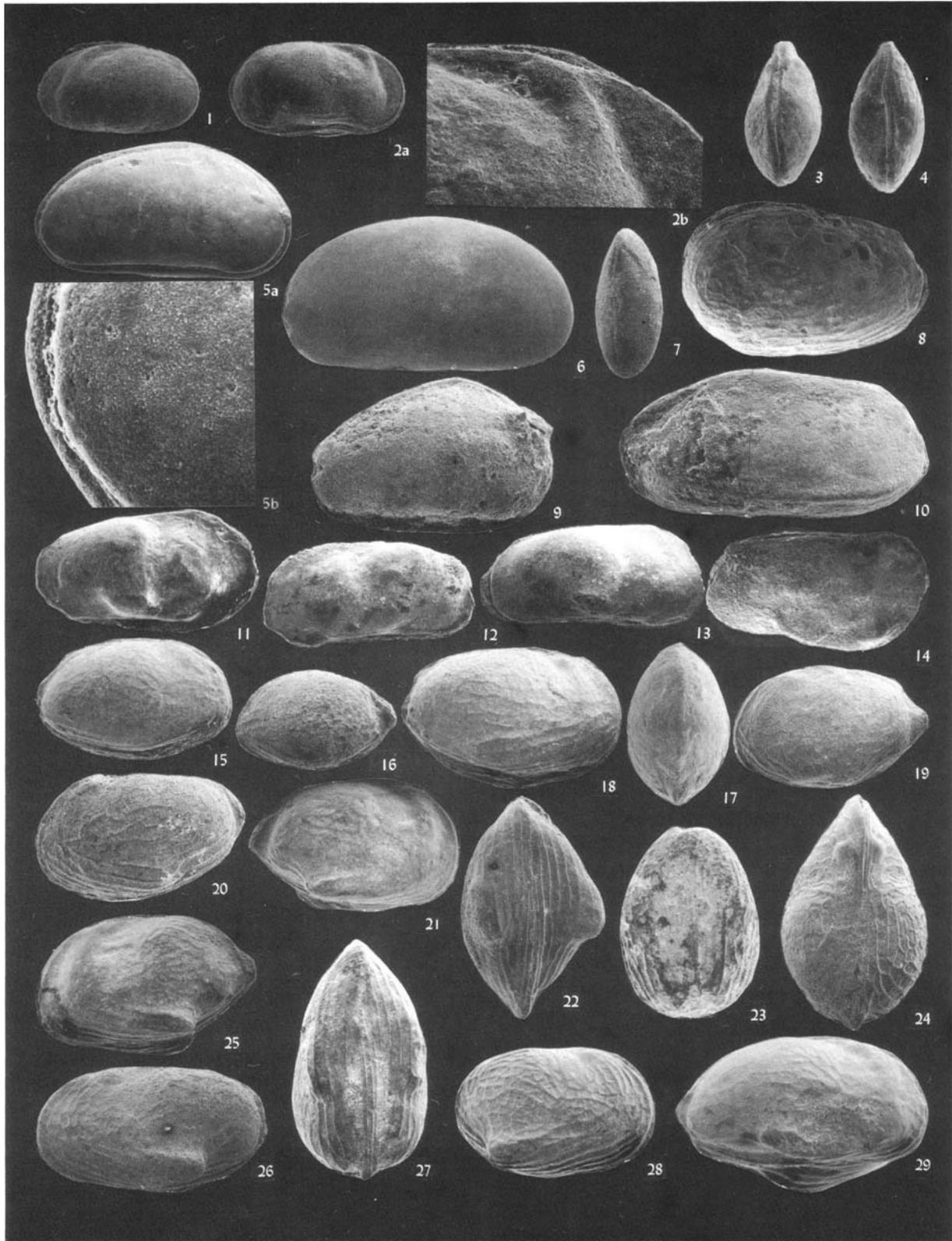
Description. Shell subquadrate (presumed female) to elongate-subelliptical (presumed male) in side view, highest one-fourth to one-fifth from anterior end, dorsal margin slightly convex to nearly straight, with poorly defined, broadly obtuse cardinal angles, the anterior larger than the posterior; ventral margin sinuous to slightly concave; anterior margin broadly curved, generally incompletely preserved in present specimens, slightly extended below, subtruncate above; posterior margin narrower, extended medially to ventro-medially, but poorly preserved in present specimens.

Anteromedian and posteromedian surface of each valve swollen, posterior more elevated than anterior swelling; in presumed male the swollen areas are not connected ventrally and are separated by a narrow anteromedian sulcus that reaches four-fifths of distance

Explanation of Plate 2

All specimens are of Washitan (Albian-Cenomanian) age, unless otherwise stated, housed in the Paleontological Collections of the University of Minnesota. Numbers in parentheses refer to length, height and width of specimens in mm.

- Fig. 1. *Fabanella tumidosa* (Swain). ♂ car. L side, UMPC 13248, x 26, Fla-Col-OT-5 well, 11,916–11,917 feet. Beds of early Trinitian (Neocomian?) age.
- Fig. 2a, b. *Fabanella tumidosa* (Swain). ♀ car. R side, UMPC 13249, x 26 (1.10, 0.63, 0.53), and enlargement of anterodorsal area, x 121, Fla-Col-OT-5 well, 11,916–11,917 feet. Beds of early Trinitian (Neocomian?) age.
- Fig. 3. *Fabanella tumidosa* (Swain). ♂ car. dors., UMPC 13250, x 26, Fla-Col-OT-5 well, 11,916–11,917 feet. Beds of early Trinitian (Neocomian?) age.
- Fig. 4. *Fabanella tumidosa* (Swain). Car. vent., UMPC 13251, x 24, Fla-Col-OT-5 well, 11,916–11,917 feet. Beds of early Trinitian (Neocomian?) age.
- Figs. 5a, b. *Ovocytheridea?* sp. Car. R side, UMPC 13252, x 51 (0.80, 0.47, 0.40), and enlargement of part of anterior margin showing scattered normal pores, x 251, Fla-Pin-OT-2 well, 7,650–7,675 feet.
- Fig. 6. *Ovocytheridea?* sp. Car. L side, UMPC 13253, x 50, Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 7. *Ovocytheridea?* sp. Car. vent., UMPC 13254, x 25, Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 8. *Timiriasevia?* sp. cf. *T. polymorpha* Mandelstam. Car. R side (poorly preserved), UMPC 13255, x 51 (0.76, 0.50, 0.63), Fla-Mon-OT-5 well, 9,430–9,440 feet.
- Fig. 9. *Eucythere?* sp. Car. R side (poorly preserved), UMPC 13256, x 51 (0.77, 0.50, 0.40), Fla-Col-OT-5 well, 9,232–9,233 feet.
- Fig. 10. *Taxodiella?* sp. Car. L side (matrix adhering anteriorly), UMPC 13257, x 103 (0.47, 0.23, 0.30), Fla-Lee-OT-2 well, 8,930–8,940 feet.
- Fig. 11. *Limnocythere?* sp. 1. ?♂ LV, UMPC 13258, x 51 (0.67, 0.40, 0.38), Fla-Hen-OT-5 well, 8,620–8,630 feet.
- Fig. 12. *Limnocythere?* sp. 1. LV, UMPC 13259, x 51, Fla-Pin-OT-2 well, 7,570–7,575 feet.
- Fig. 13. *Limnocythere?* sp. 1. RV, UMPC 13260, x 51, Fla-Pin-OT-2 well, 7,570–7,575 feet.
- Fig. 14. *Limnocythere?* sp. 2. ?♂ car. R side, UMPC 13261, x 50 (0.70, 0.40, 0.37), Fla-PB-OT-1 well, 7,691–7,696 feet.
- Fig. 15. *Eocytheropteron highlandsensis* sp.nov. Holotype ?♂ car. R side, UMPC 13262, x 50 (0.63, 0.42, 0.45), Fla-Hi-OT-1 well, 8,010–8,020 well.
- Fig. 16. *Eocytheropteron* sp. aff. *E. tumidum* (Alexander). Car. L side, UMPC 13263, x 51, Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 17. *Eocytheropteron* sp. aff. *E. tumidum* (Alexander). Car. dors., UMPC 13264, x 50, Fla-Pin-OT-2 well, 7,840–7,845 feet.
- Fig. 18. *Eocytheropteron highlandsensis* sp.nov. Car. R side, UMPC 13265, x 50, Fla-Mon-OT-5 well, 8,300–8,310 feet.
- Fig. 19. *Eocytheropteron* sp. aff. *E. tumidum* (Alexander). Car. L side, UMPC 13266, x 49 (0.62, 0.43, 0.42), Fla-Lee-OT-2 well, 8,950–8,960 feet.
- Fig. 20. *Eocytheropteron highlandsensis* sp.nov. Car. L side, UMPC 13267, x 49, in which dorsum is tilted slightly toward observer, Fla-Mon-OT-5 well, 8,300–8,310 feet.
- Fig. 21. *Cytheropteron? pinellensis* sp.nov. ♀ car. R side, UMPC 13268, x 60, Fla-Pin-OT-2 well, 7,570–7,575 feet.
- Fig. 22. *Cytheropteron? pinellensis* sp.nov. ♀ car. slightly oblique vent., UMPC 13269, x 49, Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 23. *Eocytheropteron highlandsensis* sp.nov. Car. vent., UMPC 13270, x 50, Fla-Mon-OT-5 well, 8,300–8,310 feet.
- Fig. 24. *Cytheropteron? pinellensis* sp.nov. ♀ car. dors., UMPC 13271, x 60, Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 25. *Cytheropteron? pinellensis* sp.nov. Holotype ♀ car. L side, UMPC 13272, x 50, Fla-Pin-OT-2 well, 7,570–7,575 feet.
- Fig. 26. *Cytheropteron? pinellensis* sp.nov. Car. L side, UMPC 13273, x 60, Fla-Col-OT-5 well, 8,802–8,803 feet.
- Fig. 27. *Cytheropteron? pinellensis* sp.nov. ♂ car. vent., UMPC 13274, x 50, Fla-Pin-OT-2 well, 7,570–7,575 feet.
- Fig. 28. *Cytheropteron? pinellensis* sp.nov. ♀ car. R side, UMPC 13275 (caudal process abraded), x 51, Fla-Hi-OT-1 well, 8,010–8,020 feet.
- Fig. 29. *Cytheropteron? pinellensis* sp.nov. Car. R side, UMPC 13276, x 60, Fla-Lee-OT-2 well, 9,470–9,480 feet.



to ventral margin, and broadens toward dorsum; in presumed female, sulcus reaches very slightly ventrally of midheight and swollen areas are connected ventrally; ventral part of posteromedian swelling forms a low subalate expansion; valve surfaces in terminal areas of shell compressed. Internal shell structure not seen.

Remarks. The tentative assignment of this species to *Limnocythere* is based on the shape, general surface ornamentation and dimorphism shown by the shells. No described species appears to be similar to these forms.

Forms referred to *Eucytherura ansata* Weingeist, 1949, and *E. strumosa* Weingeist from the Weno and Grayson formations of Texas are similar to the *Limnocythere* sp. of the present paper in general outline and surface ornamentation, but differ in details of shell features. The present writer does not believe that the Texas species belong in *Eucytherura*.

Distribution. This species is rare in beds of Washitan age, occurring in the Fla-Hen-OT-2 well, depth 8,620–8,630 feet, Hendry County, Florida, and Fla-Pin-OT-2 well, depth 7,570–7,575 feet, Pinellas County, Florida.

Limnocythere? sp. 2
(Pl. 2, fig. 14)

Material. One carapace.

Description. Lateral outline subquadrate, highest about one-fourth from posterior end, dorsum straight, venter sinuate with anteromedian concavity; anterior margin rounded, slightly extended below, truncate above; posterior margin more broadly rounded, extended above, subtruncate below (some of the outline features may be due to imperfect preservation or distortion). Left valve slightly larger than right valve.

Surfaces of valves with an anteromedian ventral narrow sulcus and nodelike and ridgelike elevations; two low nodes lie anterior to sulcus; the node posterior to sulcus is the highest elevation, the ridge midventrally forms a low ala; terminal fifth of valves compressed. Internal shell structures not observed.

Remarks. This form differs from the preceding one in features of surface ornamentation; it has more strongly elevated nodes and a better defined midventral alaform ridge than *L.* sp. 1.

Distribution. The species is very rare in beds of Washitan age; Fla-PB-OT-1 well, depth 7,691–7,696 feet, Palm Beach County, Florida.

Subfamily Timiriaseviinae Mandelstam, 1960

Genus *Timiriasevia* Mandelstam, 1947

Timiriasevia? sp. cf. *T. polymorpha* Mandelstam, 1955
(Pl. 2, fig. 8)

1955 *Timiriasevia polymorpha* Mandelstam in Galeeva, 1955: 61, pl. 15, figs. 4a-b; Lyubimova, 1956, p. 121, pl. 23, figs. 7, 8.

Material. One carapace.

Description. Outline ovate in side view; highest posteromedially, dorsal margin gently convex; ventral margin moderately convex; anterior margin narrowly rounded, posterior margin broadly rounded, extended medially. Valves subequal, very strongly convex; greatest convexity posteromedian. Valve surfaces in marginal half of shell bear 5-6 low concentric ridges; median valve surfaces weakly ornamented with an irregular pattern of ridges.

Internal shell structures not seen.

Remarks. The outline, very strong posterior convexity of shell, and concentric surface ornamentation ally this form to *Timiriasevia*. Among described species, it resembles *T. polymorpha* Mandelstam from the Lower Cretaceous of Mongolia in convexity, outline, and surface ornamentation.

Distribution. Very rare in beds of Washitan age, in the Fla-Mon-OT-5 well, depth 9,430–9,440 feet, Monroe County, Florida.

Family Cytheruridae Müller, 1894
Genus *Eocytheropteron* Alexander, 1933
Eocytheropteron highlandsensis sp. nov.
(Pl. 2, figs. 15, 18, 20, 23)

Derivation of name. After the type locality in Highlands County, Florida.

Diagnosis. An *Eocytheropteron* with subovate to subquadrate lateral outline, low ventral alaform expansion of shell surface; shallow anterodorsal oblique sulcus; and coarsely but weakly reticulate surface.

Holotype. ?Male carapace, UMPC 13262.

Material. Six specimens.

Type locality and horizon. Fla-Hi-OT-1 well, depth 8,010–8,020 feet (2441–2445m), beds of Washitan age.

Description. Shell subovate to subquadrate in lateral view; dimorphic?, the females? more elongate than males?; highest medially to submedially; dorsum nearly straight to slightly convex; venter moderately convex; anterior margin broadly rounded, slightly extended below; posterior margin narrowly rounded, with weakly developed caudal extension medially to dorsomedially. Left valve slightly larger than right; valves strongly convex, greatest convexity ventomedian.

Surfaces of valves coarsely, weakly, and irregularly reticulate, interspaces equal to four or five times widths of ridges. A broad shallow oblique sulcus defines a low eye tubercle? anterodorsally. Ventral surface with low alaform expansions of surface that overhang margin.

Adductor muscle scars a submedian vertical row of four longitudinally elongate spots, with one frontal spot anterior of middle of adductor group. Normal pores widely spaced, surrounded by subcircular sieve

plates which, in most cases, bear elevated rims. Hinge margin not clearly observed, but appears to be feebly antimerodont.

Remarks. This form is less caudate posteriorly than the following species, but has a similar pattern of surface ridges and minute pits; the two forms may be dimorphs or variants. As compared to *E. acaudatum* (Swain, 1952) from the subsurface Washitan beds of North Carolina the present species is less turned inward ventrally and has lesser overhang of the ventral margin by the ventral surface.

Distribution. This form occurs frequently in beds of Washitan age; Fla-Hi-OT-1 well, depth 8,010–8,020 feet, Highlands County, Florida; and Fla-Mon-OT-5 well, depth 8,300–8,310 feet, Monroe County, Florida.

Eocytheropteron sp. aff. *E. tumidum* (Alexander, 1933)
(Pl. 2, figs. 16, 17, 19)

Material. Six specimens.

Remarks. This form is more strongly caudate and lacks the anterodorsal sulcus and eye? node of the preceding form. Whether or not those differences are intraspecific variations cannot be determined, but they appear to be sufficient for recognition of the two forms. The species resembles *E. tumidum* (Alexander) from the Goodland and Kiamichi Formations (Albian) of Texas.

Distribution. This form occurs frequently in beds of Washitan age; Fla-Col-OT-5 well, depth 8,802–8,803 feet, Collier County, Florida; Fla-Pin-OT-2 well, depth 7,840–7,845 feet, Pinellas County, Florida; and Fla-Lee-OT-2 well, depth 8,950–8,960 feet, Lee County, Florida.

Genus *Cytheropteron* Sars, 1866
Cytheropteron? *pinellensis* sp. nov.
(Pl. 2, figs. 21, 22, 24–29)

Diagnosis. Dimorphic shells of questionable *Cytheropteron* having shorter, higher, more convex, more strongly alate, and posteriorly more pointed female than male shells; with weakly and variably reticulate surfaces, blunt alate posteromidventral processes, anterodorsal broad oblique sulci that define low eye tubercles.

Holotype. Female carapace, UMPC 13272.

Material. 25+ specimens.

Type locality and horizon. Fla-Pin-OT-2 well, depth 7,570–7,575 feet (2307–2309m), beds of Washitan age.

Description. Shell subelliptical to subovate in lateral view, highest posteromedially; dorsal margin nearly straight to gently convex, ventral margin gently convex to sinuous depending on degree to which alae are developed and extend beyond ventral margin; anterior

margin in male shells broadly and nearly uniformly rounded, in females broadly rounded and somewhat extended below; posterior margin in males somewhat less broadly rounded than anterior margin; in females posterior margin bears pointed caudate extension dorso-medially. Left valve slightly larger than right valve. Valves strongly convex in male, greatest convexity posteromedian, strongly inflated in female, greatest convexity also posteromedian; in dorsal view female is more tapered and less blunt at posterior end than male.

Surfaces of valves variably ornamented with narrow reticulating ridges; many shells incompletely reticulate, due to abrasion or recrystallization of shell surface; widths of interspaces are two to three times widths of ridges; ventral surface has four or five longitudinal ridges on each valve; anterodorsal oblique broad sulcus defines a low rounded eye tubercle on each valve; posteroventrally blunt alae rise from surface; these are more elevated in female than in male; terminal borders compressed, and anterior margin bears a narrow rim.

Adductor muscle scars an anteromedian vertical row of four longitudinally elongate spots; with two frontal spots anterior of top and bottom of adductor group. Hinge, as viewed by reflected light in oil, appears to be weakly merodont.

Dimensions (mm)

	l	h	w
Holotype ♀ car., UMPC 13272	.72	.43	.42
Paratype ♂ car., UMPC 13274	.80	.42	.45

Remarks. The quadrate outline, sulcation, ventral alae, and reticulate surface of this species provide a relationship to *Cytheropteron* Sars. *C.?* *abundans* Donze, 1964 from the Berriasian of southern France, is closely similar to the present species in shape and dimorphic characteristics, but is more weakly reticulated, and is also less elongated than *C.?* *pinellensis*. *Eocytheropteron acaudatum* (Swain, 1952) from Washitan? beds of North Carolina, lacks the posteroventral alate expansions of the present species, has different surface ornamentation, and is not known to be dimorphic.

Distribution. The species is common in beds of Washitan age; Fla-Pin-OT-2 well, depth 7,570–7,575 feet, Pinellas County, Florida; Fla-Col-OT-5 well, depth 8,802–8,803 feet, Collier County, Florida; Fla-Hi-OT-1 well, depth 8,010–8,020 feet, Highlands County, Florida; and Fla-Lee-OT-2 well, depth 9,470–9,480 feet, Lee County, Florida.

Family Uncertain
Genus *Taxodiella* Kuznetsova, 1957
Taxodiella? sp.
(Pl. 2, fig. 10)

Material. One carapace.

Remarks. The shape and longitudinal ventral ridge of

this form are similar to features of *Taxodiella*. It is more elongate the *T.* sp. from the Neocomian of North Carolina (Swain & Brown, 1972) and lacks the reticulate surface ornamentation of that form. It is very much like the illustrated male specimens of *Klieana alata* Martin, 1940 (Neale, 1978, p. 831, pl. 6, figs. 1, 2) from the Lower Purbeck beds, Late Jurassic, of England, but lacks the partially reticulated surface of that species.

The adductor muscle scar in this form consists of an antero-submedian vertical row of four elongate spots; one rounded frontal spot lies opposite the middle of the main group. Hinge not seen.

Distribution. This species is very rare in beds of Washitan age in the Fla-Lee-OT-2 well, depth 8,950–8,960 feet, Lee County, Florida.

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