

SOME OSTRACODA FROM THE LOWER CRETACEOUS OF NORTHERN AND EASTERN SPAIN

Frederick M. SWAIN

Department of Geology and Geophysics,
University of Minnesota, Minneapolis.
Minnesota 55455 USA

ABSTRACT

Ostracodes from 8 localities in the Lower Cretaceous of northern and eastern Spain are described and illustrated. Two charophyte species are also recorded.

A fauna of 11 species of both marine and non-marine or brackish water ostracodes and two species of charophytes was obtained from predominantly Wealden-facies deposits in northern Valencia Province. In this area the Wealden facies is probably Barremian in age. A nearby locality in southern Tarragona Province yielded 20 species of marine Ostracoda of which five are recorded here and 15 were dealt with previously in beds of Barremian/Aptian age. The non-marine ostracodes are endemic in nature while the marine ostracodes are related to western European and North American species.

Nineteen species of probable Aptian age were obtained from carbonate localities in Tarragona Province and in southern Valencia Province. These species also show relationships to western European and North American Gulf and Atlantic coast species.

A small fauna of three species was found in probable Albian carbonate and shale deposits in northern Spain near Santander.

Keywords: Ostracoda, Cretaceous, Spain, Barremian, Aptian, Albian.

RESUMEN

En este trabajo se describen e ilustran ostracodos del Cretácico Inferior procedentes de 8 localidades del Norte y Este de España. También se incluyen dos especies de carófitas. En el norte de la provincia de Valencia, en depósitos de facies mayoritariamente wealdieneses, se encontró una fauna con 11 especies de ostracodos, tanto marinos como no marinos o salobres y dos especies de carófitas. En ese área las facies Weald son probablemente de edad Barremiense. En una localidad cercana, en el sur de la provincia de Tarragona, se han encontrado 20 especies de ostracodos marinos en capas de edad Barremiense-Aptiense. De ellas, describimos en este artículo 5, ya que las 15 restantes han sido tratadas en trabajos previos. Mientras que los ostracodos no marinos son endémicos, los marinos guardan relación con especies de Europa occidental y América del Norte.

En varias localidades de la provincia de Tarragona y del sur de la provincia de Valencia, las facies carbonatadas de edad probable Aptiense contienen diecinueve especies, también relacionadas con especies de Europa occidental y de las costas del Golfo de México y del Atlántico.

En el norte de España, cerca de Santander, se encontró una reducida fauna con tres especies en depósitos de carbonatos y lutitas de probable edad Albiense.

Palabras clave: Ostracodos, Cretácico, España, Barremiense, Aptiense, Albiense.

INTRODUCTION

This paper describes and illustrates 40 species of Ostracoda and two species of charophytes from the Lower Cretaceous of northeastern Spain. The work is part of a study undertaken by the writer to compare Lower Cretaceous ostracode faunas in southern and eastern United States with those of southwestern Europe. The collections were obtained by the writer during the period 1975-1978 from 8 localities listed below. Samples from 51 other Lower Cretaceous localities in northern, eastern and southeastern Spain did not yield Ostracoda.

Relatively few studies have been published on Lower Cretaceous ostracodes from Spain. Ramírez del Pozo (1969, 1973) gave summaries of the Aptian and Albian

Ostracoda of areas in northern Spain. Kneuper-Haack (1966) reported on non-marine Wealden facies in the Sierra de los Cameros. Brenner (1976) published a comprehensive study of Ostracoda and charophytes in Wealden facies of northeastern Spain. He found 68 species of Ostracoda and 16 of charophytes in a Purbeck-Wealden non-marine to brackish-marine sequence ranging from the Kimmeridgian to the Aptian. Andreu (1985) examined Albian and Cenomanian ostracodes from the Sierra d'Aulet southern Pyrenees, Spain. Swain, Xie and von Hillebrandt (1991) described a Barremian-Aptian ostracode fauna from Tarragona Province, northeastern Spain. Discussions of Lower Cretaceous rocks north of the study area in the southern Pyrenees have been provided by Grekoff *et al.* (1961) and by Peybernes and Oertli (1972).



Figure 1. Localities from which Lower Cretaceous Ostracoda were obtained (see text for localities).

The faunas recorded in the present paper came from localities: (1) near Santander in north-central Spain, (2) the vicinity of Tortosa northeastern Spain, and (3) an area between Alicante and Valencia, east-central Spain (Fig. 1, Tb. 1).

STRATIGRAPHIC SUMMARY

1. North-central Spain. The Lower Cretaceous stratigraphy of north-central Spain was summarized by Ramírez del Pozo (1971), Brenner (1976), and Fernández-Mendiola and García-Mondéjar (1991). The Neocomian of this area occurs principally in a Wealden (non-marine to brackish-water) facies and comprises about 400 m of varicolored sandstone and shale containing charophytes and non-marine ostracodes. Berriasian and wedge-like intercalations of Valanginian occur beneath younger Neocomian Wealden (Hauterivian, Barremian) beds in the Vascogeticum region (Brenner, 1976). The Berriasian rests unconformably on the Jurassic Kimmeridgian in the area. Both the Aptian (up to 800 m or more) and the locally very thick Albian (up to 3,500 m near Vitoria) comprise gray and black sandstones and shales,

sandstones, thin limestones, intercalated red beds and reefal limestones in the lower Albian and Aptian (Fernández-Mendiola and García-Mondéjar, 1991).

The Neocomian of the area contains a wide variety of both non-marine ostracodes and charophytes and marine ostracodes (Brenner, 1976). The upper Barremian and Aptian contain a relatively large proportion of marine ostracodes. Several species of marine ostracodes were recorded from the Aptian and Albian of the area by Ramírez del Pozo (1971).

In the present paper only deposits presumed to be of Albian age yielded ostracodes in north-central Spain (locality 1). The following species were recorded: *Bairdia* cf. *comanchensis* Alexander, *Paracypris* sp., and *Rehacythereis?* sp. gr. *ilhaensis* Damotte and Rey. The small assemblage differs in detail from that recorded by Ramírez del Pozo but in both instances a shallow marine shelf fauna is indicated by the ostracodes and associated fossils (oysters, foraminifera). The fauna recorded in the present paper shows a limited relationship to United States Gulf Coast Albian ostracodes and a somewhat lesser relationship to Portuguese Barremian.

2. Northeastern Spain. The Lower Cretaceous of northeastern Spain is much thinner than in north-central Spain, discussed above. The Lower Cretaceous of the

Species	N	B	Ap	Al
<i>Fabanella</i> Cf. <i>boloniensis</i>	-----			
<i>Cypridea soriana</i>	?-----			
<i>Cypridea bullata</i>	?-----			
<i>Cypridea ventriosa</i>	?-----			
<i>Mantelliana</i> sp.	?-----			
<i>Asciocythere cinctorensis</i>	?-----			
<i>Fabanella nana</i>	?-----			
<i>Dictyocythere gibbera</i>	?-----			
<i>Atopochara</i> cf. <i>trivolvus</i>	?-----			
<i>Flabellochara</i> cf. <i>harrisi</i>	?-----			
<i>Timiriasevia?</i> sp.	---			
<i>Rehacythereis</i> cf. <i>glabrella</i>		-----		
<i>Rehacythereis?</i> sp.		-----		
<i>Cythereis praeornata</i>		-----		
<i>Cythereis</i> aff. <i>robustus</i>		-----		
<i>Veeniacythereis?</i> sp.		-----		
<i>Cytherella</i> aff. <i>symmetrica</i>			---	
<i>Cytherella</i> aff. <i>beyrichoidea</i>			---	
<i>Pontocyprilla</i> cf. <i>alexanderi</i>			---	
<i>Dolococytheridea</i> aff. <i>intermedia</i>			---	
<i>Dolococytheridea</i> aff. <i>bosquetiana</i>			---	
<i>Asciocythere?</i> sp.			---	
<i>Asciocythere rotunda</i>			---	
<i>Haplocytheridea</i> aff. <i>rodewaldensis</i>			---	
<i>Schuleridea</i> aff. <i>jonesiana</i>			---	
<i>Neocythere</i> aff. <i>mertensi</i>			---	
<i>Neocythere denticulata</i>			---	
<i>Hechtycythere</i> aff. <i>pumila</i>			---	
<i>Rehacythereis</i> aff. <i>senckenbergi</i>			---	
<i>Rehacythereis</i> aff. <i>nuda</i>			---	
<i>Rehacythereis?</i> aff. <i>dentonesis</i>			---	
<i>Cytherura?</i> sp.			---	
<i>Protocythere derooi</i>			---	
<i>Cytherella frederickburgensis</i>			---	
<i>Bairdia</i> cf. <i>comanchensis</i>			---	
<i>Paracypris</i> sp.				---
<i>Rehacythereis?</i> <i>ilhaensis</i>				---

Table 1. Ranges of species of Ostracoda and Charophytes studied here. N=Neocomian; B=Barremian; Ap=Aptian; Al=Albian

Montalban-Morella area, Teruel Province which lies about 80 km west of localities 6-8 of the present paper was discussed by Canerot (1969) in one of a series of papers on this region and by Brenner (1976). The non-marine Wealden, fluvio-deltaic-lacustrine facies in this area occupies the Hauterivian, Barremian, and some of the lower Aptian, overlying marine Valanginian, Berriasian and Portlandian. As in the Barremian at locality 7 the Morella beds comprise sandstone, red shale, sandy limestone and conglomerate, overlying 100 m of Valanginian. Near La Cenia which lies just south of locality 7, Bulard and Canerot (1969) obtained Berriasian and Valanginian charophytes from a brackish sequence, showing that the Wealden facies expands stratigraphically downward toward the east in this region. The marine strata at locality 6 of the present paper are designated Barremian or Aptian based on the Ostracoda. The species identified from this locality in the present paper (5 species) are given in List of Localities and in a previous paper (15 species) (Swain, Xie and von Hillebrandt, 1991). Important species in the fauna are *Paraschuleridea curta* Swain and Brown, *Cythereis praeornata* Swain and Brown, *Neocythere gottisi* (Damotte and Grosdidier) which suggest an Aptian and/or Barremian age.

At locality 7, Reserva Nacional de Caza, the Lower Cretaceous is in a non-marine or brackish water facies and contains the species listed in List of Localities. These species suggest a Barremian age for the contained strata. The deposits at locality 8 are of uncertain age but on the basis of the few contained ostracode species are possibly Aptian. Albian beds in this area occur primarily in a Utrillas, thin clastic, facies, in marked contrast to the Albian of north-central Spain in which this stage may attain several thousand meters in thickness.

3. Southeastern Spain. Localities 2-5 represent samples from an area in southeastern Spain near Alcoy, Valencia Province. The Lower Cretaceous rocks in the area were discussed by García-Rosell (1972). In this area the Wealden beds are shale and sandstone about 100 m thick and are overlain by Neocomian-Aptian limestones and marls 250 m thick. A thin Utrillas sequence (Albian) is overlain by 250 m of Cenomanian and Turonian beds. At the localities sampled in this study the ostracode species listed for Localities 2-5 occur. Notable among these are *Asciocythere cinctorensis* Brenner, *A. cf. rotunda* (Vanderpool), and, *Protocythere? cf. derooi* Oertli all of which suggest, but do not prove an Aptian age for the containing strata.

REGIONAL AND INTER-REGIONAL RELATIONSHIPS OF FAUNAS

Northeastern Spain. The Ostracoda from the Wealden facies of probable Barremian age at Locality 7, Reserva Nacional de Caza, are represented by nine species of which eight were recorded by Brenner (1976) and Kneuper-Haack (1966) from similar deposits in this part of Spain. Only *Fabanella* cf. *boloniensis* (Jones) has been found in other areas in western Europe. Thus, the Barremian Wealden non-marine fauna of this area appears

to be mainly endemic, probably developing in a lake system that was not connected directly to those in Germany and Great Britain. The associated charophytes, identified with North American species by Brenner, suggest a Barremian or Aptian age.

The shallow water marine ostracode fauna suggested to be Barremian or Aptian, at Locality 6, Mas de Barberans, consists of 20 species described herein and previously (Swain, Xie and von Hillebrandt, 1991). Five of the species have been assigned to forms that occur in the Lower Cretaceous of eastern and southern North America, ranging from Barremian to Cenomanian. Two other species occur in the Barremian and Aptian of both Europe and North America. Only three of the Mas de Barberans species resemble typical western European forms, while nine additional species left in open nomenclature could not be compared with species elsewhere. Thus the Mas de Barberans fauna, although in large part endemic, appears to show closer relationships to North American than to European species.

Two of three species from Locality 8, near Perello, suggested to be Aptian, are closely related to European forms and the third species was left in open nomenclature.

Southeastern Spain. The shallow water marine ostracodes from Localities 2-5, near Confrides and Castell de Castells, Valencia Province include 17 species that are mostly given affinitive assignments or were left in open nomenclature. Six forms assigned to described species include four western European and three American species. The fauna appears to be largely indigenous, with only a few migrants from both sides of the Proto-Atlantic Ocean.

North-central Spain. Three species of ostracodes were obtained from the localities in north-central Spain suggested to be of Albian age. One of the species is identified with a form from the southern United States, and a second is compared with a Barremian species from Portugal. The latter identification is tentative owing to poor preservation of my specimens. One other species is left in open nomenclature. No regional affinity for North American ostracodes can be recognized on the basis of this limited fauna.

It should be emphasized that, although samples from nearly 60 localities in the Lower Cretaceous of northern and eastern Spain were examined for Ostracoda, the present study represents only an introduction to knowledge of these faunas. This paper may serve as a guide to future work on these interesting and stratigraphically useful fossils.

SYSTEMATIC PALEONTOLOGY

The illustrated specimens are stored in the University of Minnesota Paleontological Collection. Abundance designations in the Systematic Paleontology section are as follows: Rare 1-4, frequent 5-9, common 10-24, abundant 25-49, very abundant 50 or more specimens.

Orden PODOCOPIDA Müller, 1894
Sub-order PLATYCOPINA Sars, 1866
Family *Cytherellidae* Sars, 1866
Genus *Cytherella* Jones, 1849

Cytherella fredericksburgensis Alexander, 1932 Pl. I, Figs. 1-3

1932 *Cytherella fredericksburgensis* Alexander, 308, Pl. 28, Figs. 7, 8.

Summary of shell characters: Subovate in side view, highest medially; dorsum convex, subumbonate with long anterodorsal slope, venter gently convex, ends nearly equally rounded; right valve extends beyond edge of left valve prominently along dorsum and venter, less so terminally. Valves moderately convex, greatest width posteromedian; surface smooth.

Length of figured specimen (Pl. I, Figs. 2, 3) 0.77 mm, height 0.54 mm, width 0.34 mm.

Remarks: The present specimens conform in shell characters especially the long anterodorsal slope, to those assigned to *C. fredericksburgensis* from the Goodland Formation, Abian, of Texas.

Occurrence: The species was found to be rare at Locality 4, Confrides area, eastern Spain, in beds of Aptian? age, marine.

Cytherella sp. aff. *C. symmetrica* Jones, 1884 Pl. I, Figs., 1, 8, 9

Summary of shell characters: Shell sub-elliptical in side view, highest medially; dorsum and venter slightly convex; terminal margins broadly rounded, the anterior slightly narrower than the posterior. Right valve much larger than left valve, overlapping and extending beyond edge of left around entire periphery, less posteriorly than elsewhere; valves moderately convex, greatest width in posterior third of shell. Dorsomedian surface bears a rounded pit; general surface smooth.

Length of figured shell (Pl. I, Fig. 8) 0.71 mm, height 0.37 mm, width 0.32 mm.

Remarks: This form closely resembles *C. symmetrica* Jones 1884 from the Lower Cretaceous, Neocomian? of England in form, length to height ratio, and median pit, but that species is pitted rather than smooth.

Occurrence: Rare in beds of Aptian? age, Confrides area, Locality 4, marine.

Cytherella sp. aff. *C. beyrichoides* Swain and Brown, 1964 Pl. I, Figs. 4, 7

Summary of shell characters: Subovate to subelliptical, dimorphic, the presumed males less elongate and less convex in edge view, than presumed females, highest submedially; dorsum moderately convex, venter slightly convex to nearly straight; anterior end broadly rounded, posterior end more narrowly rounded, extended below; right valve larger than left valve, extending beyond edge of left most strongly along dorsum and venter; male valves moderately convex, female valves more strongly convex, greatest width posteromedian. Surface smooth; dorsomedian surface slightly depressd.

Length of figured specimen (Pl. I, Fig. 4) 0.64 mm, height 0.44 mm, width 0.37 mm; length of female shell (Pl. I, Fig. 6) 0.73 mm, height 0.43 mm, width 0.41 mm.

Remarks: The present forms resemble the species (Swain and Brown, 1964) from the lower Atkinson Formation, late Lower Cretaceous or early Upper Cretaceous of Georgia in outline, and overlap relationships, but is smooth rather than minutely punctate as in *C. beyrichoides*.

Occurrence: Frequent in beds of Aptian? age, Confrides area, Locality 4, marine.

Sub-order PODOCOPINA Sars, 1866
 Superfamily BAIRDIACEA Sars, 1888
 Family Bairdiidae Sars, 1888
 Genus *Bairdia* McCoy, 1844

Bairdia cf. *comanchensis* Alexander, 1929
 Pl. I, Figs. 10-12

1929 *Bairdia comanchensis* Alexander, 63, Pl. 2, Fig. 15;
 Pl. 3, Fig. 4.

Summary of shell characters: Shell subtriangular-trapezoidal in side view, highest medially to anteromedially, dorsum strongly convex, slightly truncate anterior to position of greatest height; venter gently convex; anterior narrowly rounded, extended below, truncated to slightly concave above; posterior bluntly pointed, strongly extended below. Left valve larger than right valve, overlapping and extending beyond edge of right most noticeably dorsally and ventrally; valves moderately convex, greatest width median to slightly anteromedian in position. Surface of valves smooth.

Length of figured specimen (P. I, Figs. 10, 11) 1.00 mm, height 0.58 mm, width 0.44 mm.

Remarks: This form resembles *B. comanchensis* Alexander from the late Albian Washita group of Texas in outline. It differs from his illustrations of the species in having less strong overlap of the right valve by the left, and in having a less convex venter than that species. *B. sp.* 302 Oertli (1958) from the lower Albian beds in the Apt district, France is similar in outline to the present species but the dorsum in Oertli's species is more strongly umbonate.

Occurrence: Frequent in beds of Albian? age, San Vicente, Locality 1, marine.

Superfamily CYPRIDACEA Baird, 1845
 Family Paracyprididae Sars, 1923
 Genus *Paracypris* Sars, 1866

Paracypris sp.
 Pl. I, Fig. 14

Summary of shell characters: elongate - sub lanceolate - subreniform in side view, highest anteromedially; dorsum moderately convex, venter concave; anterior margin rounded, extended below; posterior margin broken but appears narrowly rounded to acuminate, strongly extended below. Left valve larger than right valve; valves compressed. Surface smooth.

Length of figured shell, incomplete posteriorly 0.50 mm, height 0.25 mm, width 0.15 mm.

Remarks: This form resembles *P. arcuata* Zalanyi 1959 from the Lower Cretaceous (Aptian) of Hungary but is less elongate with respect to height than that species. It is also less elongate than *P. arcuatilis* Donze 1964 from the Lower Cretaceous (Berriasian) of France.

Occurrence: Rare in beds of Albian? age, San Vicente, Locality 1, marine.

Genus *Pontocyprrella* Lyubimova, 1955

Pontocyprrella cf. *alexanderi* Howe and Laurencich,
 1958
 Pl. I, Figs. 15, 16

1958 *Pontocyprrella alexanderi* Howe and Laurencich, 462,
 unnumbered text fig.

Summary of shell characters: Shell elongate-sublanceolate in side view, highest slightly anterior to middle; dorsum gently convex, venter nearly straight to slightly convex; anterior rounded, extended above; posterior narrowly rounded to subacuminate; left valve larger than right valve, overlapping and extending beyond edge of right most strongly along antero-dorsal and posteroventral margins, valves relatively compressed, greatest width slightly posteromedian. Surface smooth.

Length of figured specimen 0.60 mm, height 0.29 mm, width 0.21 mm.

Remarks: In outline this form resembles *P. alexanderi* from the Albian of Texas, but has less uniform overlap of the right valve than the left than figured for that species.

Occurrence: Rare in beds of Aptian? age, Confrides area, Locality 2, marine.

Family Ilyocyprididae Kaufmann, 1900
 Subfamily Cyprideinae Martin, 1940
 Genus *Cypridea* Bosquet, 1852

Subgenus *Cypridea (Uwellingia)* Anderson, 1939

Cypridea (Uwellingia) cf. *soriana* Kneuper-Haack, 1966
 Pl. I, Figs. 13, 17-20

1966 *Cypridea (Cypridea) soriana* Kneuper-Haack, 181, Pl. 44,
 Fig. 6.

1976 *Cypridea soriana* Kneuper-Haack; Brenner, 130, Pl. 7,
 Fig. 3.

Summary of shell characters: Subquadrate in side view, highest about one-third of length from anterior end; dorsum nearly straight, about half of shell length; anterior cardinal marginal angle broader than that at posterior marginal bend; venter slightly convex, interrupted anteroventrally by notch; anterior margin broadly rounded; posterior margin more narrowly rounded. Right valve larger than left valve, overlapping and extending beyond edge of left most strongly along dorsum and venter; valves moderately convex, greatest width median to posteromedian. Valve surfaces densely punctate; anteroventrally is a well defined cyprideid hood and furrow, the former projecting ventrally as a short beak.

Length of figured specimen (Pl. I, Figs. 18, 19) 0.89 mm, height 0.60 mm, width 0.42 mm.

Remarks: The overlap relationships, outline, surface ornamentations and beak, hood, and furrow of this species ally it with *C. soriana* Brenner from the Upper Hauterivian and Barremian of northeastern Spain.

Occurrence: The species is very abundant in beds of Barremian age, in the Reserva Nacional de Caza, Locality 7, non-marine or brackish water. It was previously recorded by Brenner (1976) at Enciso, Logroño Province, about 250 km northwest of Reserva Nacional de Caza. The presence of the later Hauterivian and Barremian species together with *C. ventriosa* Brenner and *C. bullata* Brenner of the Barremian and early Aptian is used here to designate a Barremian age for the Reserva Nacional de Caza exposures.

Subgenus *Cypridea (Cypridea)* Bosquet, 1852

Cypridea (Cypridea) cf. *bullata* Brenner, 1976
 Pl. I, Figs. 21-23

1976 *Cypridea bullata* Brenner, 125, Pl. 5, Figs. 1-6.

Summary of shell characters: Subquadrate to subovate in side view, highest slightly anterior to middle; dorsum gently convex, without well-defined cardinal angles; venter sinuous, slightly convex, with prominent anteroventral notch; anterior margin rounded, extended below; posterior margin more narrowly rounded, slightly extended above; left valve larger than right valve; valves moderately convex, greatest width posteromedian; anterior marginal zone compressed. General surface densely pitted; anteroventrally cyprideid hood and groove are well developed, and hood projects, ventrally as a short beak.

Length of figured specimen (Pl. I, Figs. 22, 23) 0.91 mm, height 0.62 mm, width 0.39 mm.

Remarks: This form, besides reversal in overlap, is more ovate, shorter and higher, than *C. (Ullwellia) sorianna* Brenner and is more unequal-ended than *C. (Cypridea) ventriosa* Brenner with which it is associated.

Occurrence: Common in beds of Barremian? age, Reserva Nacional de Caza, Locality 7, non-marine or brackish water. Previously this species was recorded by Brenner (1976) from Barremian to early Aptian deposits at Uña, Cuenca Province northeastern Spain, about 250 km southwest of Reserva Nacional de Caza.

Cypridea (Cypridea) ventriosa Brenner, 1976
Pl. I, Figs. 24-26

1976 *Cypridea ventriosa* Brenner, 127, Pl. 6, Figs. 1-4.

Summary of shell characters: Shell subquadrate to subovate in side view, highest anteromedially; dorsum nearly straight to gently convex, with broadly obtuse cardinal marginal bends; venter gently convex to nearly straight, with prominent anteroventral notch; anterior margin broadly rounded, posterior margin a little more narrowly rounded; left valve larger than right valve; valves moderately convex, greatest width posteromedian; shell surface densely pitted; anteroventrally, cyprideid hood and groove are well developed, but beak projects only slightly beyond margin.

Length of figured right valve (Pl. I, Figs. 25, 26) 0.90 mm, height 0.59 mm, width 0.22 mm.

Remarks: This species is more equal-ended than *C. bullata* with which it is associated.

Occurrence: Common in beds of Barremian? age, Reserva Nacional de Caza, Locality 7, non-marine or brackish water. Previously the species was recorded at Uña, Cuenca Province, about 250 km southwest of Reserva Nacional de Caza.

Family **Cyprididae** Baird, 1845
Subfamily **Cypridinae** Baird, 1845
Genus *Mantelliana* Anderson, 1966

Mantelliana sp.

Pl. II, Figs. 1-5, 25-26; Pl. III, Fig. 1

1976 *Mantelliana* sp. 2, Brenner, 135, Pl. 10, Figs. 5-7.

Summary of shell characters: Shell subelliptical to subreniform in lateral view, highest posteromedially; dorsum moderately convex, straightened medially; venter sinuous, concave anteromedially; anterior narrowly rounded, extended below; posterior more broadly rounded; valves subequal; convexity moderate, greatest width submedian. Surface of valves poorly

preserved in present specimens but coarsely pitted medially in some specimens.

Length of figured right valve (Pl. II, Figs. 1, 2) 0.72 mm, height 0.38 mm, width of valve 0.25 mm.

Remarks: The status of this form is uncertain but in lateral outline and surface ornamentation it resembles *Mantelliana* sp. 2 of Brenner (1976) from the late Hauterivian and Barremian of Montoria, Alava Province, northeastern Spain (Brenner, 1976).

Occurrence: Common in beds of Barremian? age, Reserva Nacional de Caza, Locality 7, non-marine or brackish water.

Superfamily **CYTHERACEA** Baird, 1852

Family **Brachycytheridae** Puri, 1954

Genus *Dictyocythere* Sylvester-Bradley, 1956

Dictyocythere? cf. *D. gibbera* Brenner, 1976
Pl. III, Fig. 17

1976 *Dictyocythere gibbera* Brenner, 152, Pl. 14, Figs. 1-10.

Summary of poorly preserved right? valve characters: Valve subrectangular-subtrapezoidal in side view, highest submedially; dorsum nearly straight, about half of shell length, with broadly obtuse cardinal marginal bends; venter nearly straight; terminal margins rounded, extended below, truncate above; valve compressed, perhaps due to compaction. Valve surface coarsely and densely pitted in a reticulate pattern; width of interspaces equal to about half of width of pits. Hinge of right valve consists of terminal small cusp-like teeth and interterminal furrow; inner lamellae of moderate width but not well exposed in specimen at hand.

Length of figured right valve? specimen 0.70 mm, height 0.37 mm, width of valve 0.13 mm.

Remarks: The outline and reticulate surface of this form suggest a relationship to *Dictyocythere* but the hingement is poorly preserved and identification is uncertain. *D. gibbera* Brenner from the Lower Cretaceous of northeastern Spain has similar reticulation but is more unequal-ended than the present form.

Occurrence: Rare in beds of Barremian age, Reserva Nacional de Caza, Locality 7, non-marine or brackish water.

Family **Cytherideidae** Sars, 1925

Subfamily **Cytherideinae** Sars, 1925

Genus *Dolococytheridea* Triebel, 1938

Dolococytheridea sp. aff. *D. wolburgi* Bartenstein
and Brand, 1959
Pl. II, Fig. 6

Summary of shell characters: Subovate in side view, highest anteromedially; dorsum gently convex; venter slightly convex to nearly straight; ends nearly equal; anterior broadly rounded, posterior slightly more narrowly rounded and slightly extended below; left valve slightly larger than right valve; valves moderately convex. Surface weakly and densely pitted at least medially.

Length of figured specimen 0.68 mm, height 0.41 mm.

Remarks: This form is more equal-ended than *D. wolburgi* Bartenstein and Brand, 1959 from the Valanginian (Lower Cretaceous) of northern Europe. It is less elongate and more densely pitted than *D. intermedia* Oertli, 1958 from the Hauterivian through Early Albian of Europe (Neale, 1978).

Occurrence: Rare in beds of Aptian? age, Castell de Castells area, Locality 5, marine.

Dolocytheridea cf. *bosquetiana* (Jones and Hinde, 1890)
Pl. II, Figs. 7, 8

1890 *Pontocypris bosquetiana* Jones and Hinde, 4, Pl. 2, Fig. 5; Pl. 4, Fig. 3.

1938 *Cytheridea (Dolocytheridea) bosquetiana* (Jones and Hinde); Triebel, 498, Pl. 5, Figs. 80-83; Pl. 6, Fig. 9).

1958 *Dolocytheridea bosquetiana* (Jones and Hinde); Oertli, 1505.

Summary of shell characters: Elongate sublanceolate in side view, highest about one-third of length from anterior end; dorsum slightly convex, venter concave medially to nearly straight; anterior broadly rounded; posterior narrowly rounded, strongly extended below. Left valve slightly larger than right valve (see Pl. II, Fig. 8) (illustrated specimen is tilted so that right valve appears to be larger ventrally); valves moderately convex, more or less parallel-sided in edge view and sloping abruptly toward ends; surface smooth.

Length of figured specimen (Pl. II, Figs. 7, 8) 0.82 mm, height 0.41 mm, width 0.38 mm.

Remarks: The outline, convexity, and overlap relationships of this form relate it to *D. bosquetiana* from the Albian of Europe. According to Neale (1978) the species forms a subzone in the middle Albian of Britain, although he also states that it is long-ranging. Triebel (1938) recorded it from the Albian of Germany.

Occurrence: Rare in beds of Aptian? age, Locality 4, Confrides area, marine.

Dolocytheridea? sp. aff. *D. intermedia* Oertli, 1958
Pl. II, Figs. 9, 10

Summary of shell characters: Elongate-oval in side view, highest about one-fourth of length from anterior end; dorsum nearly straight to slightly convex, with broadly obtuse cardinal angles; venter gently convex; anterior broadly rounded, posterior narrowly rounded; left valve larger than right valve; valves moderately convex, greatest width submedian; surface very poorly preserved in material at hand, no fine ornamentation observed.

Length of figured specimen (Pl. II, Figs. 9, 10) 0.73 mm, height 0.42 mm, width 0.34 mm.

Remarks: The outline, especially the straightened dorsal margin, of this form allies it with some specimens of female *D. intermedia* figured by Oertli (1958, Pl. 3, Figs. 69, 70), but poor preservation of my material prevents definite comparison.

Occurrence: Common in beds of Aptian? age, Perello area, Locality 8, marine.

Genus *Asciocythere* Swain, 1952

Asciocythere cinctorensis Brenner, 1976
Pl. II, Figs. 11, 13, 14, 17, 18

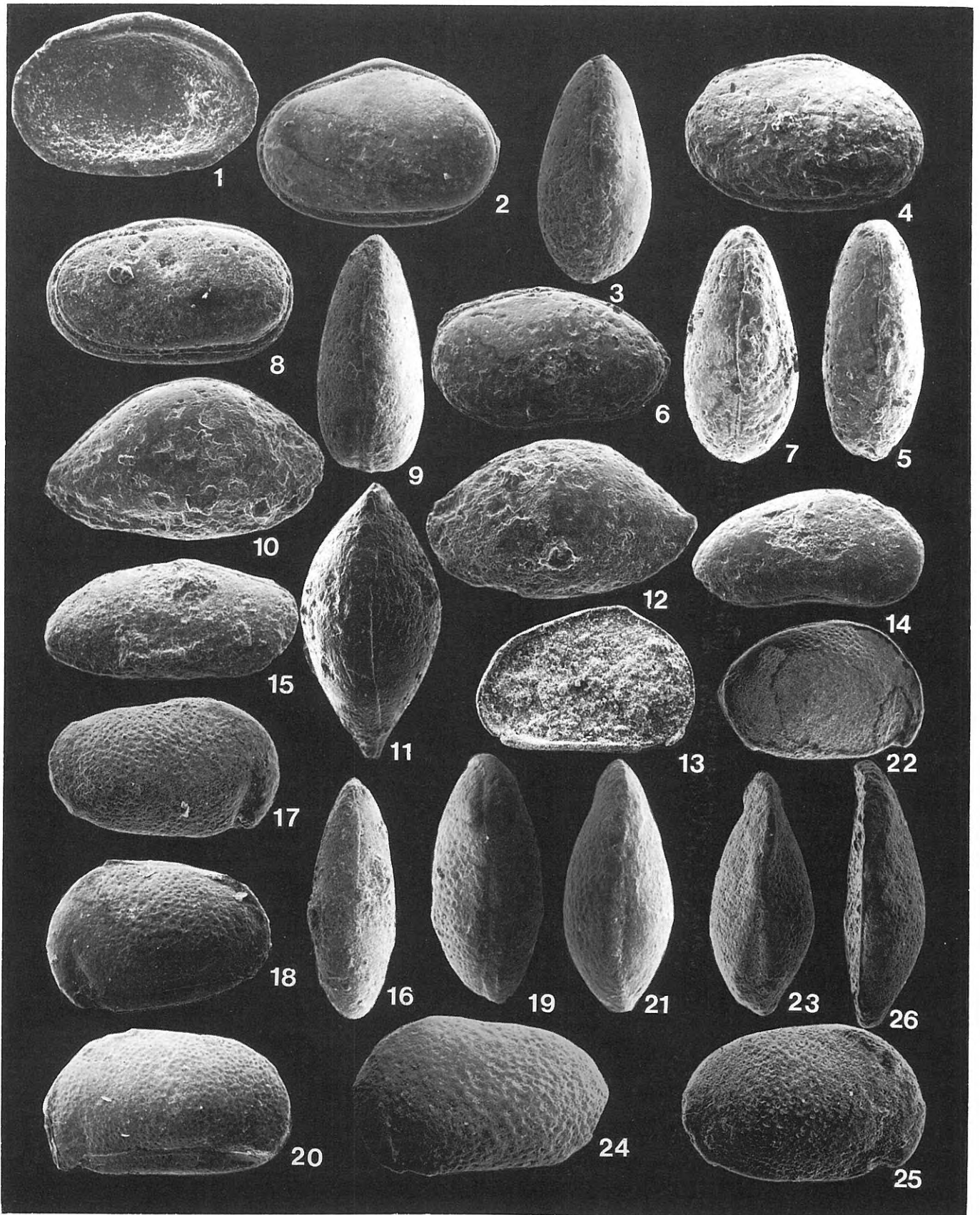
1976 *Asciocythere cinctorensis* Brenner, 147, Pl. 12, Figs. 7-14.

Summary of shell characters: Subovate-subtriangular in side view, highest submedially; dorsum strongly convex; venter gently convex; anterior broadly rounded, extended below; posterior more narrowly rounded than anterior, extended below; left valve larger than right valve, overlapping and extending beyond edge of right most prominently dorsally and ventrally; valves moderately to strongly convex, greatest width slightly posterior to middle; surface smooth.

Hinge of left valve consists of terminal elongate crenulate teeth and an interterminal non-crenulate furrow; a prominent accommodation groove lies dorsal to median furrow; inner lamellae narrow.

Plate I

- 1 *Cytherella* sp. aff. *C. symmetrica* Jones. Interior of right valve X 84. Confrides area, locality 2. Beds of Aptian? age.
- 2,3 *Cytherella fredericksburgensis* Alexander. 2. Left side X 66 and 3. dorsal view, X 72 of two shells. Confrides area, locality 4. Beds of Aptian? age.
- 4,5 *Cytherella* sp. aff. *C. beyrichoidea* Swain and Brown. 6. Left side, X 78, and 5. dorsal view, X 57 of two shells. Confrides area, locality 4. Beds of Aptian? age.
- 6,7 *Cytherella* sp. aff. *C. beyrichoidea* Swain and Brown. 6. Left side X 69 and 7. dorsal view, X 60 of two female shells. Confrides area, locality 4. Beds of Aptian? age.
- 8,9 *Cytherella* sp. aff. *C. symmetrica* Jones. 8. Left side X 84 and 9. dorsal view, X 72, of two shells. Confrides area, locality 2. Beds of Aptian? age.
- 10,11 *Bairdia* cf. *comanchensis* Alexander. 10. Right side X 60 and 11. dorsal view, X 68 of shell. San Vicente area, locality 1. Beds of Albian? age.
- 12 *Bairdia* cf. *comanchensis* Alexander. Left side of shell, X 60. San Vicente, locality 1. Beds of Albian? age.
- 13 *Cypridea (Uhwellia)* cf. *soriana* Kneuper-Haack. Interior of left valve X 54, filled with matrix. Perello area, locality 8. Beds of Aptian? age.
- 14 *Paracypris* sp. Right side of shell, incomplete posteriorly, X 84. San Vicente, locality 1. Beds of Albian? age.
- 15,16 *Pontocyprilla* cf. *alexanderi* Howe and Laurencich. 15. Right side and 16 dorsal views of shell, X 90. Confrides area, locality 2. Beds of Aptian? age.
- 17 *Cypridea (Uhwellia)* cf. *soriana* Kneuper-Haack. Left side of shell, X 59. Reserva Nacional de Caza area, locality 7. Beds of Barremian age.
- 18,19 *Cypridea (Uhwellia)* cf. *soriana* Kneuper-Haack. 18. Left side of shell, X 54 and 19. ventral view of shell, X 57. Reserva Nacional de Caza area, locality 7. Beds of Barremian age.
- 20 *Cypridea (Uhwellia)* cf. *soriana* Kneuper-Haack. Left side of shell, X 30. Reserva Nacional de Caza area, locality 7. Beds of Barremian age.
- 21 *Cypridea* cf. *bullata* Brenner. Dorsal view of shell, X 68. Reserva Nacional de Caza area, locality 7. Beds of Barremian age.
- 22,23 *Cypridea* cf. *bullata* Brenner. 22. Right side of shell, X 48, and 23. dorsal view of shell, X 58. Reserva Nacional de Caza area, locality 7. Beds of Barremian age.
- 24 *Cypridea* cf. *ventriosa* Brenner. Left side of shell, X 59. Reserva Nacional de Caza area, locality 7. Beds of Barremian age.
- 25,26 *Cypridea* cf. *ventriosa* Brenner. 25. Exterior of right valve, X 57, and 26. dorsal view of right valve, X 62. Reserva Nacional de Caza area, locality 7. Beds of Barremian age.



Length of figured specimen (Pl. II, Figs. 17, 18) 0.45 mm, height 0.29 mm, width 0.25 mm.

Remarks: This form is more strongly arched dorsally than *A. rotunda* (Vanderpool) from the Albian and Upper Aptian of the eastern United States.

Occurrence: Common in beds of Aptian? and Barremian?, Confrides area, Localities 2 and 3, marine and Reserva Nacional de Caza, Locality 7, brackish water? The species was recorded by Brenner (1976) from Cincorres, Castellon Province, about 20 km west of Locality 7.

Asciocythere? sp.

Pl. II, Fig. 12

Summary of shell characters: Ovate-elliptical in side view, highest anteromedially; dorsum moderately convex; venter gently convex; anterior narrowly rounded; posterior more broadly rounded; left valve slightly larger than right valve; valves moderately convex, greatest width submedian; surface poorly preserved in present specimens, but apparently smooth.

Length of figured specimen 0.68 mm, height 0.43 mm, width 0.36 mm.

Remarks: This form is only doubtfully referred to *Asciocythere* because of its lateral outline and overlap relationships. It is more elongate than *A. rotunda* (Vanderpool) but, as compared to *A. elongata* Swain and Brown the anterior end is more narrowly rounded than the posterior, rather than the reverse in *A. elongata*. Both these named species occur in the Albian and Upper Aptian, eastern North America (Swain and Brown, 1972).

Occurrence: Rare in beds of Aptian? age, Perello area, Locality 8, marine.

Asciocythere cf. *A. rotunda* (Vanderpool, 1928)

Pl. II, Figs. 15, 16

1928 *Bythocypris rotundus* Vanderpool, 102, Pl. 13, Figs. 5, 6.

1929 *Cytheridea amygdaloides brevis* (Cornell); Alexander, 70, Pl. 4, Fig. 13.

1933 *Cytheridea rotundus* (Vanderpool); Vanderpool, 411.

1952 *Asciocythere rotunda* (Vanderpool); Swain, 76, Pl. 8, Figs. 22-23.

Summary of shell characters: Subovate in side view, highest medially to anteromedially; dorsum moderately convex, venter slightly convex; anterior rounded, slightly extended below, subtruncate above; posterior more narrowly rounded than anterior; left valve larger than right valve, overlapping and extending beyond edge of left strongly along dorsum and venter; valves moderately convex, greatest width slightly posteromedian; surface smooth, although poorly preserved in present specimens.

Length of figured specimen 0.49 mm, height 0.32 mm, width 0.27 mm.

Occurrence: Frequent in beds of Aptian? age, Confrides area, Locality 3, marine.

Genus *Haplocytheridea* Stephenson, 1936

Haplocytheridea? sp. aff. *H. rodewaldensis* (Triebel, 1938)

Pl. II, Figs. 19, 20

Summary of shell characters: Shell of poorly preserved specimen elongate, subelliptical in side view, highest posteromedially; dorsum nearly straight, with broadly obtuse cardinal marginal bends; venter nearly straight to slightly sinuous; anterior broadly rounded, subtruncate above; posterior margin also broadly rounded, subtruncate below. Left valve larger than right valve; valves relatively compressed in edge view, greatest width posteromedian; tapering more gradually toward anterior than toward posterior end. Shell surface not well preserved but apparently smooth. Internal shell structures not observed.

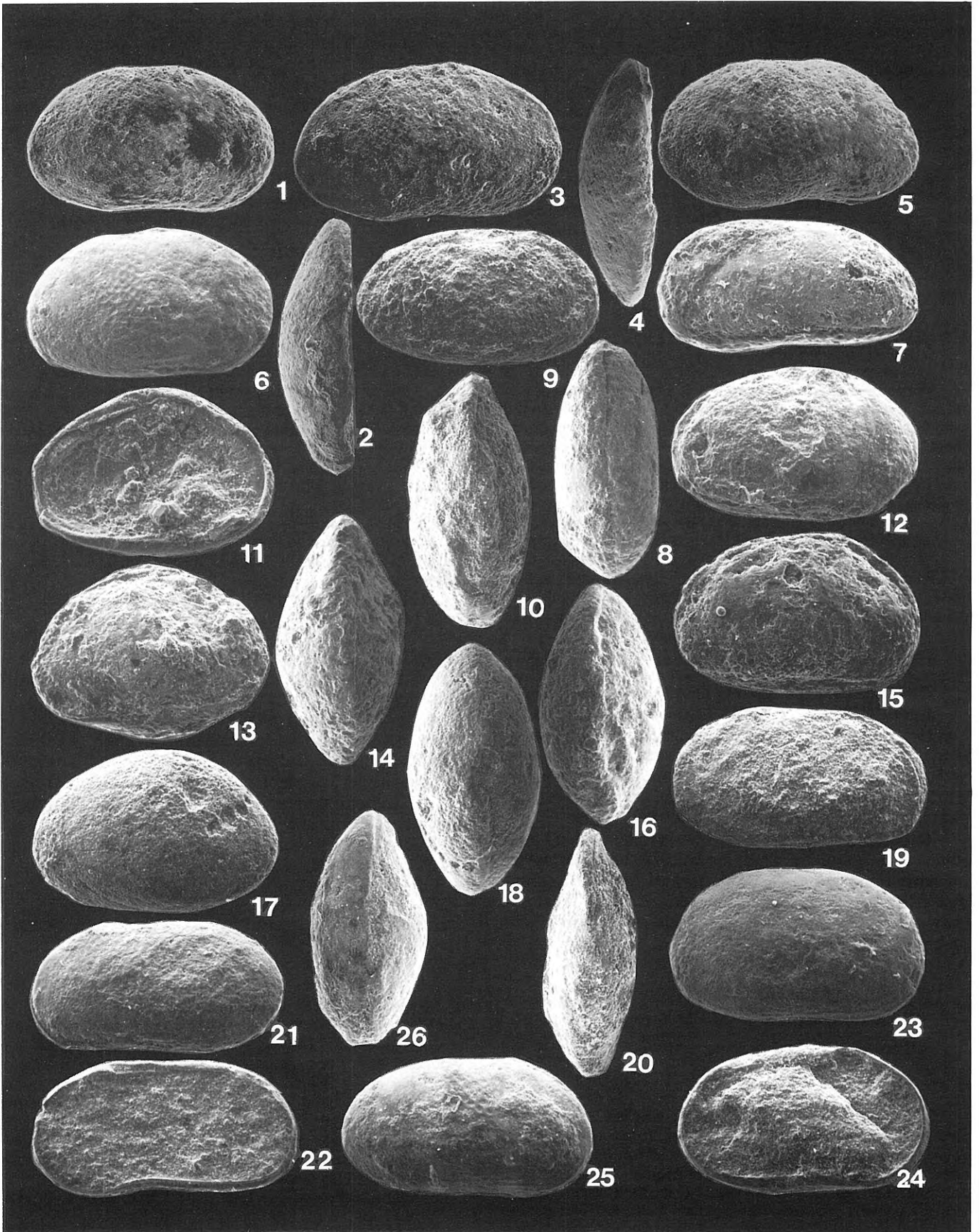
Length of figured specimen 0.84 mm, height 0.47 mm, width 0.25 mm.

Remarks: In outline and smooth surface this form resembles the male of *Haplocytheridea rodewaldensis* Trie-

Plate II

- 1,2 *Mantelliana* cf. sp. 2 of Brenner, 1976. 1. Exterior of right valve, X 72 and 2. ventral view of right valve, X 75. Reserva Nacional de Caza area, locality 9. Beds of Barremian age.
- 3,4 *Mantelliana* cf. sp. 2 of Brenner, 1976. 3. Exterior of right valve, X 83 and 4. dorsal view of right valve, X 79. Reserva Nacional de Caza area, locality 7. Beds of Barremian age.
- 5 *Mantelliana* cf. sp. 2 of Brenner, 1976. Exterior of left valve, X 58. Reserva Nacional de Caza area, locality 7. Beds of Barremian age.
- 6 *Dolocytheridea* sp. aff. *D. wolburgi* Bartenstein. Exterior of right valve, X 75. Castell de Castells area locality 5. Beds of Aptian? age.
- 7,8 *Dolocytheridea* cf. *bosquetiana* (Jones and Hinde). 7. Right side X 66, and 8 dorsal view, X 57 of shell. Confrides area, locality 4. Beds of Aptian? age.
- 9,10 *Dolocytheridea?* sp. aff. *D. intermedia* Oertli. 9. Right side of shell X 69, and 10. Dorsal view, X 75. Perello area locality 8. Beds of Aptian? age.
- 11 *Asciocythere cinctorensis* Brenner. Interior of left valve, X 96. Confrides area, locality 2. Beds of Aptian? age.
- 12 *Asciocythere?* sp. Right side of shell, X 72. Perello area, locality 8. Beds of Aptian? age.

- 13,14 *Asciocythere cinctorensis* Brenner. 13. Right side and 14. dorsal views of shell, X 75. Confrides area, locality 3. Beds of Aptian? age.
- 15,16 *Asciocythere* cf. *A. rotunda* (Vanderpool) 15. Right side X 165 and 16. dorsal view, X 98 of shell. Confrides area, locality 3. Beds of Aptian? age.
- 17,18 *Asciocythere cinctorensis* Brenner. 17. Left side X 115 and 18. dorsal view, X 112, of shell. Reserva Nacional de Caza, locality 7. Beds of Barremian age.
- 19,20 *Haplocytheridea?* sp. aff. *H. rodewaldensis* (Triebel). 19. Right side X 63, and 20. dorsal view, X 75, of shell. Perello area, locality 8. Beds of Aptian? age.
- 21,22 *Fabanella* cf. *boloniensis* (Jones). 21. Left side and 22. right valve interior, X 66, the latter nearly filled with matrix. Reserva Nacional de Caza, locality 7. Beds of Barremian age.
- 23,24 *Fabanella* cf. *boloniensis* (Jones). 23. Right side, X 78 and 24. Left valve interior, X 72, the latter nearly filled with matrix. Reserva Nacional de Caza, locality 7. Beds of Barremian age.
- 25,26 *Mantelliana* cf. sp. 2 of Brenner, 1976. 25. Right side, X 72 and 26. dorsal view X 57 of two shells. Reserva Nacional de Caza, locality 7. Beds of Barremian age.



bel, 1938 from the Hauterivian (Lower Cretaceous) of Germany, but in that species the male shells are more pointed posteriorly and are more truncated anterodorsally than the present form.

Occurrence: Rare in beds of Aptian? age, Perello area, Locality 8, marine.

Genus *Fabanella* Martin, 1940

Fabanella cf. *boloniensis* (Jones, 1882)

Pl. II, Figs. 21-24; Pl. III, Figs. 2-6

- 1882 *Cythere boloniensis* Jones, 616, Fig. B.
 1885 *Candona boloniensis* (Jones); Jones, 348, Pl. 9, Figs. 7, 8.
 1940 *Cyprideis polita* Martin, 352, Pl. 7, Figs. 110-113; Pl. 9, Figs. 149-151.
 1961 *Fabanella polita polita* (Martin); Martin, 186, Pl. 1, Figs. 1-4, 10-12.
 1962 *Neocytheridea boloniensis boloniensis* (Jones); Arbeitskreis, 218, Pl. 33b, Figs. 1, 2.

Summary of shell characters: Shell elongate, subquadrate-subelliptical in side view, highest about one-third of length from anterior end; dorsum nearly straight to slightly sinuous, about half of shell length, with broadly obtuse cardinal marginal bends; venter nearly straight weakly, concave medially; anterior broadly rounded, slightly extended below, subtruncate above; posterior slightly less broadly rounded than anterior. Left valve slightly larger than right valve; valves moderately convex, greatest width near middle. Surface of valves in present material poorly preserved, but apparently smooth.

Hinge or right valve consists of terminal elevated ridges and an interterminal furrow, these fit into corresponding terminal elongate sockets and interterminal bar on left valve, other internal shell structures not observed.

Length of figured specimen (Pl. III, Figs. 4, 5) 0.69 mm, height 0.41 mm, width 0.33 mm.

Remarks: The species was known as *Fabanella polita* Martin 1961 for many years but was placed in *F. boloniensis* (Jones 1882) by Brenner (1976) without comment. That author has had better access to the German and other European collections than has the present writer and his assignment has been accepted in this paper.

Occurrence: Abundant in beds of Barremian? age, Reserva Nacional de Caza, Locality 7, non-marine or brackish water. Elsewhere the species has been recorded from the Purbeck (Upper Jurassic) and Wealden (Lower Cretaceous) non-marine beds of western Europe and Great Britain.

Family **Limnocytheridae** Sars, 1925

Genus *Timiriasevia* Mandelstam, 1947

Timiriasevia? sp.

Pl. III, Figs. 7, 8

Summary of shell characters: Shell elongate subovate in side view, highest anteromedially; dorsum and venter gently convex, the former with broadly obtuse cardinal marginal bends; anterior broadly rounded, posterior more narrowly rounded. Left valve slightly larger than right valve; valves strongly convex, greatest width median. Valve surfaces poorly preserved in present material, exhibiting closely spaced concentric ridges ventrally and weakly reticulate? surface medially. Internal shell structures not observed.

Length of figured specimen 0.67 mm, height 0.40 mm, width 0.38 mm.

Remarks: The shape, strongly convex shell, and weakly reticulate and striate surface of this form suggest *Timiriasevia* Mandelstam but definite identification is not possible on the basis of present material.

Occurrence: Rare in beds of Barremian? age, Reserva Nacional de Caza, Locality 7, non-marine or brackish water.

Family **Schulerideidae** Mandelstam, 1958

Subfamily **Schulerideinae** Mandelstam, 1958

Genus *Schuleridea* Swartz and Swain, 1946

Schuleridea sp. aff. *S. jonesiana* (Bosquet, 1852)

Pl. III, Figs. 9-14

Summary of shell characters: Shell elongate-subtriangular in side view, highest submedially; dorsum strongly convex, broadly angulated medially; venter gently convex; anterior broadly rounded slightly extended below, truncate above. Left valve larger than right valve, overlapping and extending beyond edge of right around entire periphery, most strongly along dorsum and venter; valves moderately convex, greatest thickness posteromedian.

A narrow, oblique eye lobe lies anterodorsally, adjacent to valve margin; a broad shallow sulcus lies subjacent to lobe; anterior border of right valve bears a narrow elevated rim; a small protuberance occurs at posterior end of right valve; ventral to protuberance on right valve is a short marginal ridge; general surface smooth. Internal shell structures not observed.

Length of figured specimen (Pl. III, Fig. 11) 0.40 mm, height 0.27 mm, width 0.23 mm.

Remarks: This form resembles *S. jonesiana* (Bosquet) from the Albian and Cenomanian of northwestern Europe, in shape and small oblique eye-lobe but is smooth rather than pitted and has a small nodelike posterior termination of the right valve, unlike *S. jonesiana*. *S. bilobata* (Triebel, 1938) from the Hauterivian and Barremian of Germany and England has a posteroventral "lappet" resembling the ridge and posterior node of the present species but *S. bilobata* has a stronger eye-tubercle and a pitted surface.

Occurrence: Frequent in beds of Aptian? age, Confrides area, Locality 4, and beds of Aptian? age, Confrides area, Locality 3, marine.

Schuleridea sp. 2

Pl. III, Figs. 15, 16

Summary of shell characters: Shell elongate-subovate in lateral view, highest anteromedially; dorsum moderately convex, venter slightly convex; anterior broadly rounded, slightly extended below; posterior narrowly rounded, extended below; left valve larger than right valve, overlapping and extending beyond right around entire periphery, most strongly along dorsum and venter. An oblique eye-ridge lies anterodorsally, next to margin and is subjoined by a shallow broad oblique, sulcus-like depression; general valve surface smooth. Internal shell structure not observed.

Length of figured specimen 0.67 mm, height 0.42 mm, width 0.27 mm.

Remarks: This form has a more rounded posterior margin than the previous species. *S.* aff. *jonesiana*, but otherwise resembles it in the dorsal area of the shell.

Additional, better-preserved specimens of this and the preceding species may demonstrate that they form a distinct taxonomic group.

Occurrence: Rare in beds of Aptian? age, Confrides area, Locality 2, marine.

Family **Cytheruridae** Müller, 1894

Genus *Cytherura* Sars, 1866

Cytherura? sp.

Pl. IV, Figs. 7, 8

Summary of shell characters: Shell subpyriform in side view, highest about one third of length from anterior end; dorsum gently convex; truncate anteriorly; venter nearly straight; anterior rounded; posterior bluntly pointed, concave below. Valves subequal, the left slightly larger than right; broad shallow oblique sulci occur anterodorsally in each valve; general surface smooth. Internal shell structures not observed.

Length of figured specimen 0.65 mm, height 0.34 mm, width 0.25 mm.

Remarks: The shape of this species, particularly the lateral outline, is reminiscent of *Cytherura* but the hingement was not observed. The genus has only rarely been recorded from the Lower Cretaceous. Swain, Xie and von Hildebrandt (1991) cited as *Cytherura* sp. from beds of Aptian or Barremian age, northeastern Spain, specimens which are strongly ornamented with parallel ridges, unlike the smooth surface of the present species.

Occurrence: Rare in beds of Aptian? age, Confrides area, Locality 4, marine.

Family **Progonocytheridae** Silvester-Bradley, 1948

Subfamily **Progonocytherinae** Silvester-Bradley, 1948

Genus *Neocythere* Mertens, 1956

Neocythere sp. aff. *N. mertensi* Oertli, 1958

Pl. III, Figs. 18-22

Summary of shell characters: Shell subpyriform in side view, highest about two-fifths of length from anterior end; dorsum strongly convex, venter gently convex, anterior margin broadly rounded, posterior margin narrowly rounded. Left valve larger than right valve, but not overlapping it strongly except along dorsum; valves strongly convex, greatest width submedian. Terminal marginal zones and dorsal border of shell compressed; general surface of shell bears concentric rows of nodes that may represent concentric ridges on well preserved surfaces; anterodorsally is an elongate eye tubercle; ventrally, swollen valve surface overhangs ventral margin. Internal shell structures not observed.

Length of figured specimen (Pl. III, Figs. 18, 19), 0.53 mm, height 0.35 mm, width 0.34 mm.

Remarks: In outline, overlap, and convexity this species resembles *N. mertensi* Oertli, 1958 from the late Aptian of France, but that species has strongly elevated concentric ridges ventrally and terminally and reticulations medially and dorsally, unlike the relatively smooth surface of the present form.

Occurrence: Frequent in beds of Aptian? age, Confrides area, Locality 2, marine.

Genus *Hechticythere* Gründel, 1973

Hechticythere sp. aff. *H. pumila* (Grosdidier, 1964)

Pl. III, Figs. 22, 23

Summary of shell characters: Shell elongate, sublanceolate in side view, highest about one-fourth of length from anterior end; dorsum and venter nearly straight, converging toward posterior; anterior rounded, slightly extended below; posterior pointed, strongly extended medially. Left valve larger than right valve, extending beyond edge of right in cardinal areas. Surface of each valve ornamented by three longitudinal narrow, elevated ridges; the first extends along dorsum from elongated anterior eye tubercle to posterior end of hinge; the second and third branch from a short ventro-median anterior ridge and extend posteriorly to about one-fifth of length from posterior end; the more dorsal of these two ridges trends obliquely toward post-dorsal area then bends ventrally; the more ventral ridge curves slightly toward venter at its midpoint and nearly connects with its neighboring ridge posteriorly; posteroventral area of shell compressed; free marginal zones bear low ridges; general surface between ridges weakly and finely pitted, and coarsely but faintly reticulate. Internal shell structures not observed.

Length of figured specimen 0.44 mm, height 0.22 mm, width 0.18 mm.

Remarks: This form resembles *H. pumila* (Grosdidier, 1964) from the Hauterivian beds of France and Switzerland in outline, especially of the female, and general ornamentation, but is more sharply pointed posteriorly, and has narrower longitudinal ridges than *H. pumila*.

Occurrence: Rare in beds of Aptian? age, Confrides area, Locality 2, marine.

Genus *Protocythere* Triebel, 1938

Protocythere? cf. *derooi* Oertli, 1958

Pl. IV, Figs. 5, 6

1958 *Protocythere derooi* Oertli, 1509, Pl. 6, Figs. 129-143.

Summary of shell characters: Shell subpyriform in side view, highest near anterior end; dorsum sinuous with concavities near cardinal areas both of which are elevated; venter slightly convex; anterior broadly rounded; posterior pointed, subtruncate both below and above; left valve larger than right valve; projecting beyond edge of right most noticeably along venter and anterodorsally. Dorsal and ventral submarginal zones in middle five-eighths of shell bear broad longitudinal ridges; a median longitudinal ridge occupies middle half of each valve; terminal margins also bear narrow ridges; general valve surfaces smooth. Internal shell structures not observed.

Length of figured specimen 0.61 mm, height 0.33 mm, width 0.29 mm.

Remarks: In general shape and pattern of longitudinal ridges this form resembles *P. derooi* Oertli from the Albian and Aptian of the Apt area, southeastern France. It is more pointed posteriorly than most of Oertli's original figures and has the posterior cardinal area more strongly elevated. Lack of information about the hinge structure prevents definite generic assignment.

Occurrence: Rare in beds of Aptian? age, Confrides area, Locality 2, marine.

Family **Trachyleberididae** Silvester-Bradley, 1948

Genus *Rehacythereis* Gründel, 1973

Rehacythereis? sp. gr. *ilhaensis* Damotte and Rey, 1980

Pl. III, Fig. 24

1980 *Cythereis (Rehacythereis) ilhaensis* Damotte and Rey, 32, Pl. 2, Figs. 43-45.

Summary of shell characters: The poorly preserved shell at hand is elongate-subtrapezoidal in side view, highest one-third of length from anterior end; dorsum nearly straight, slightly sinuous, about half of shell length, with broadly obtuse cardinal angles; venter slightly concave; anterior broadly curved, extended medially, subtruncate above and below; posterior narrower, bluntly angulate medially, truncate above. Valves subequal, the left slightly the larger, valves relatively compressed, greatest width posteromedian. Dorsal and ventral margins bear narrow submarginal ridges; medially in posterior two thirds of shell, except posterior compressed portion, is a sinuous narrow longitudinal ridge; general shell surface very poorly preserved, but appears to be minutely and densely punctate.

Length of figured specimen 0.69 mm, height 0.39 mm.

Remarks: Although very poorly preserved, this form is similar to *Rehacythereis ilhaensis* Damotte and Rey (1980) from the Barremian, Ribeira d'Ilhas, southwestern Portugal, in outline, longitudinal ridges and minute surface pitting.

Occurrence: Rare in beds of Albian? age, San Vicente area, Locality 1, marine.

Rehacythereis? sp. aff. *R.?* *nuda* Alexander, 1929)
(not Jones and Hinde, 1849)
Pl. III, Figs. 25, 26

Summary of shell characters: Shell subquadrate in side view, highest about one fifth of length from anterior end; dorsal margin nearly straight, about three-fourths of shell length; the anterior cardinal angle less obtuse than posterior cardinal angle; ventral margin nearly straight to slightly concave, converging posteriorly with respect to dorsum; left valve slightly larger than right valve, extending beyond right most noticeably in cardinal areas. Posterior fourth of shell compressed and with narrow marginal ridges; narrow marginal ridges also lie along the dorsal, anterior and ventral borders; antero-

dorsally in each valve is an eye tubercle; posterior ends of dorsal and ventral ridges are formed into enlarged, pointed elevations; anteromedially is a rounded median node; posterior to node and separate from it is a short longitudinal ridge; general shell surface coarsely but weakly reticulate and finely pitted. Internal shell structures not observed.

Length of figured specimen 0.73 mm, height 0.40 mm, width 0.31 mm.

Remarks: This form resembles *Rehacythereis?* "*nuda*" (Alexander, 1929) (not Jones and Hinde, 1849) from the Cenomanian and late Albian of Texas but is less elongate and has reticulate meshwork not present in the Texas species.

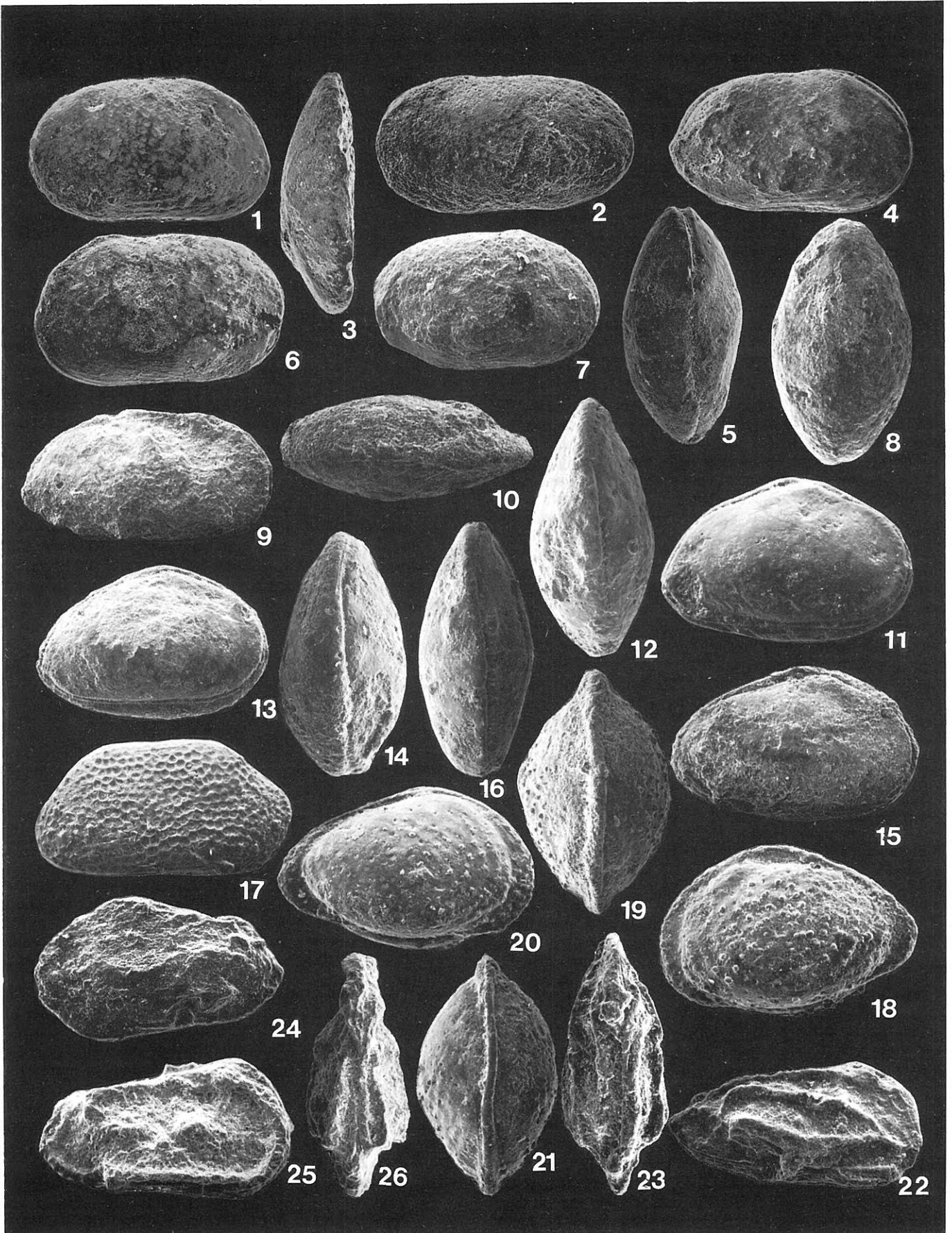
Occurrence: Rare in beds of Aptian? age, Castell de Castells area, Locality 5, marine.

Rehacythereis? sp. ff. *R. dentonensis* (Alexander, 1929)
Pl. IV, Figs. 1, 2

Summary of shell characters: Shell elongate subquadrate in side view, highest about one-fifth of shell length from anterior end; dorsal margin nearly straight, the anterior cardinal angle less obtuse than posterior cardinal angle; ventral margin gently convex, converging slightly toward posterior with respect to dorsum; anterior margin broadly rounded; posterior margin bluntly pointed, extended medially, concave above. Valves subequal, the left slightly larger than right; valves moderately convex, greatest width posteromedian; in edge view, both anterior and posterior fourth of shell compressed; at anterior end of hinge, left valve sends a cardine projection into right valve as viewed dorsally. Dorsal submargin in each valve bears a narrow sharp-crested ridge that extends from a point about one-third of length from anterior end to one-fourth from posterior end where it terminates in a triangular point; a narrow ridge rises close to dorsal margin, near midlength, en-echelon to preceding ridge, extends anteriorly through an anterodorsal eye tubercle, along anterior margin and terminates a little behind anteroventral marginal bend; midventrally a submarginal longitudinal ridge extends from

Plate III

- 1⁻ *Mantelliana* cf. sp. 2 of Brenner, 1976. Exterior of right valve, X 63. Reserva Nacional de Caza, locality 7. Beds of Barremian age.
- 2,3 *Fabanella* cf. *boloniensis* (Jones). 2. Exterior of left valve, X 84, and 3. dorsal view of valve, X 81. Reserva Nacional de Caza, locality 7. Beds of Barremian age.
- 4,5 *Fabanella* cf. *boloniensis* (Jones), 4. Right side, X 75, and 5. dorsal view of valve, X 76 of shell. Reserva Nacional de Caza, locality 7. Beds of Barremian age.
- 6 *Fabanella* cf. *boloniensis* (Jones). Left side of shell, X 73. Reserva Nacional de Caza, locality 7. Beds of Barremian age.
- 7,8 *Timiriasevia?* sp. 7. Right side, X 72, and 8. dorsal view, X 78, of shell. Reserva Nacional de Caza, locality 7. Beds of Barremian age.
- 9,10 *Schuleridea* sp. aff. *S. jonesiana* (Bosquet) 9. Right side X 60 and 10. dorsal view X 57.4, of a shell. Confrides area, locality 4. Beds of Aptian? age.
- 11,12 *Schuleridea* sp. aff. *S. jonesiana* (Bosquet). 11. Right side, X 198 and 12. dorsal view, X 115 of two shells. Confrides area, locality 4. Beds of Aptian? age.
- 13,14 *Schuleridea* sp. aff. *S. jonesiana* (Bosquet). 13. Right side, X 90 and 14. dorsal view, X 103, of two shells. Confrides area, locality 4. Beds of Aptian? age.
- 15,16 *Schuleridea* sp. aff. *S. jonesiana* (Bosquet). 15. Right side, X 78 and 16. dorsal view, X 90, of two shells. Confrides area, locality 4. Beds of Aptian age.
- 17 *Dictyocythere* cf. *gibbera* Brenner. Exterior of left valve, X 84. Reserva Nacional de Caza, locality 7. Beds of Barremian age.
- 18,19 *Neocythere* sp. aff. *N. mertensi* Oertli. 18. Left side, X 103 and 19. dorsal view, X 94 of exfoliated shell. Confrides area, locality 2. Beds of Aptian? age.
- 20,21 *Neocythere* sp. aff. *N. mertensi* Oertli. 20. Right side, X 121, and 21. dorsal view, X 115, of shell. Confrides area, locality 2. Beds of Aptian? age.
- 22,23 *Hechtycythere* aff. *H. pumila* (Grosdidier). 22. Right side and 23. dorsal views of shell, X 121. Confrides area, locality 2. Beds of Aptian? age.
- 24 *Rehacythereis?* sp. gr. *ilhaensis* Damotte and Rey. Left side of poorly preserved shell, X 76. San Vicente area, locality 1. Beds of Albian? age.
- 25,26 *Rehacythereis?* sp. aff. *R.?* *nuda* (Alexander) (not Jones and Hinde 1849). 25. Right side, X 74 and 26. dorsal view, X 72, of shell. Castell de Castells area, locality 5. Beds of Albian or Aptian age.



near anteroventral marginal bend to about one-fourth from posterior end where it also terminates in a elevated point; anteromedially is an elongate node posterior to which, but separate from it, is a short longitudinal ridge; posterior compressed portion of shell bears marginal rims; general surface smooth. Internal shell structures not observed.

Length of figured specimen 0.67 mm, height 0.35 mm, width 0.32 mm.

Remarks: This species resemble *R. dentonensis* (Alexander, 1929) from the Albian of Texas but is smooth rather than pitted on the shell surface. A similar form was recorded from the subsurface Barremian of Louisiana (Swain, 1985) but that species has several postero-dorsal nodes not present in the Spanish species.

Occurrence: Rare in beds of Aptian? age, Confrides area, Locality 3, marine.

Rehacythereis? sp. aff. *R. senckenbergi* (Triebel, 1940)
Pl. IV, Figs. 3, 4

Summary of shell characters: Shell subquadrate in side view, highest near anterior end; dorsum nearly straight, about five-eighths of shell length with anterior cardinal angle much less obtuse than posterior cardinal angle; venter nearly straight, converging slightly with dorsum in posterior direction; anterior margin broadly rounded, slightly extended below; posterior margin bluntly pointed, extended medially, truncate above; left valve slightly larger than right valve; valves moderately convex, greatest convexity posteromedian; anterior fourth and posterior fifth of shell compressed on each valve, dorsal longitudinal narrow ridge is about three-eighths of shell length; it bends sharply ventrally at its posterior end at inner edge of compressed area, but does not connect with median ridge; anteriorly it curves gently toward venter; anteromedian node large; posteriomedian short longitudinal ridge does not connect to node; ventral longitudinal ridge is more than half of shell length and rises posteriorly to form a short ala, terminating at posterior compressed area; it results in arrowhead-shaped outline of shell in edge views; anterior margin bears an elevated rim that has several short spurs projecting from its inner flank; posterior margin also has a marginal elevated

rim which helps define triangular posterior compressed areas; remainder of shell surface not well preserved but apparently is smooth. Internal valve structures not observed.

Length of figured specimen 0.63 mm, height 0.36 mm, width 0.33 mm.

Remarks: In general outline and surface ornamentation this species is similar to *R. senckenbergi* (Triebel, 1940) from the Lower Cretaceous Hauterivian Stage of western Europe. It is more elongate than, and lacks the terminal marginal spines of that species.

Occurrence: The species is rare in deposits of Aptian? age, Castell de Castells area, Locality 5, marine.

Rehacythereis cf. *glabrella* (Triebel, 1940)
Pl. IV, Figs. 10-12, 16, 17, 19

1940 *Cythereis glabrella* Triebel, 196, Pl. 6, Figs. 60-62.

1973 *Rehacythereis glabrella* (Triebel); Gründel, 1463.

1991 *Rehacythereis* cf. *glabrella* (Triebel); Swain, Xie, and von Hillebrandt, 106, Pl. 4, Figs. 21, 22.

Remarks: Specimens from the Spanish locality noted below were described and illustrated by Swain *et al.* (1991). The present illustrations are of additional material to show the right side of the shell, and the hinge structure of the right valve.

Occurrence: Frequent in beds of Barremian or Aptian age, Mas de Barberans, Locality 6, marine. The species is typically middle and upper Albian in northern and eastern Europe (Neale, 1978) and may not be correctly identified in the present material because of poor preservation.

Genus *Cythereis* Jones, 1849

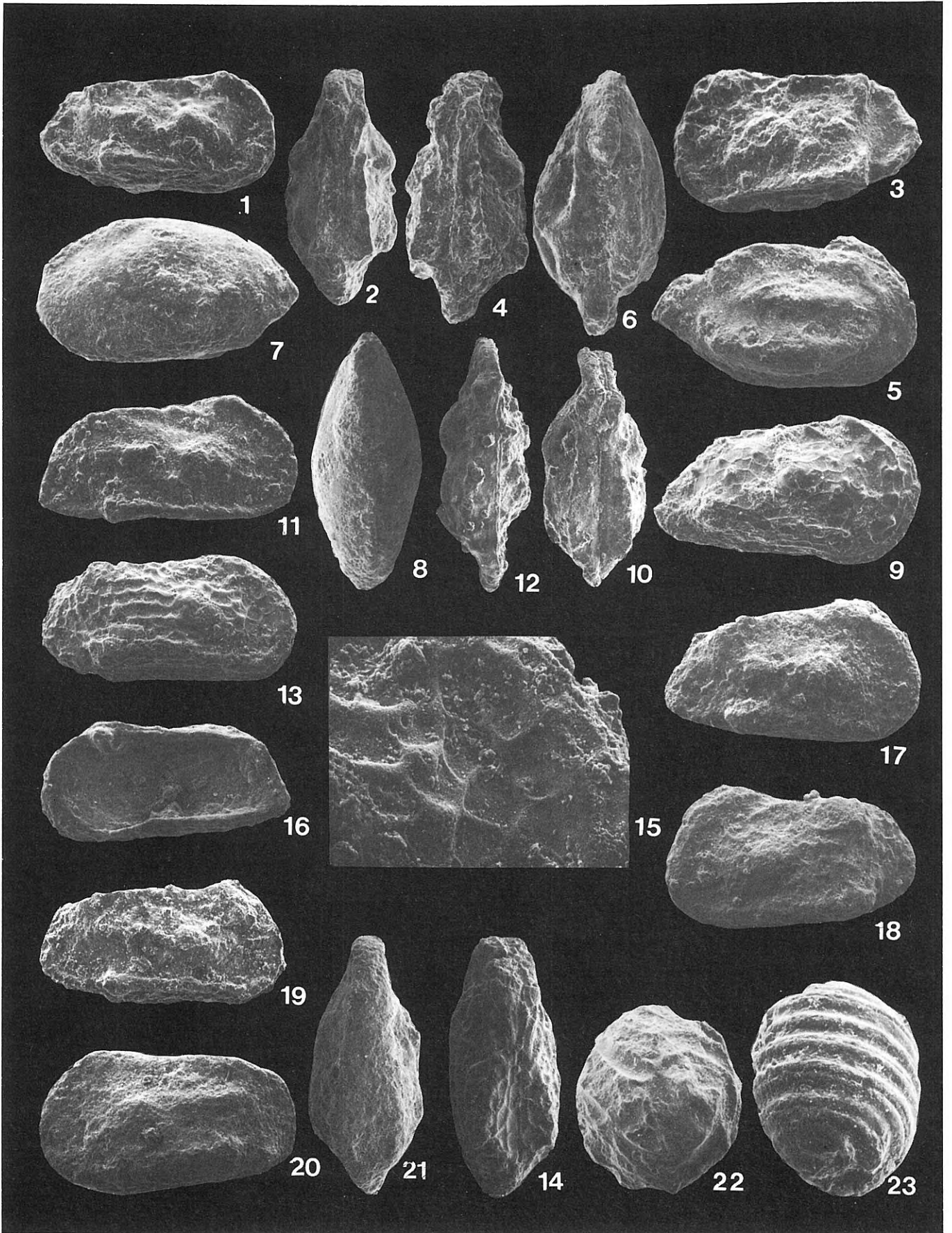
Cythereis? cf. *C. praeornata* Swain and Brown, 1964

Pl. IV, Figs. 13-15, 18?

1964 *Cythereis praeornata* Swain and Brown, 35, Pl. 5, Fig. 6.

Plate IV

- 1,2 *Rehacythereis?* sp. aff. *R. dentonensis* (Alexander) of Swain 1985. 1. Right side and 2. dorsal views of shell, X 75. Confrides area, locality 3. Beds of Aptian? age.
- 3,4 *Rehacythereis?* sp. aff. *R. senckenbergi* (Triebel) (Jones and Hinde). 3. Left side, X 84, and 4. ventral view, X 78. Castell de Castells area, locality 5. Beds of Aptian? age.
- 5,6 *Protocythere* cf. *derooi* Oertli. 5. Right side and 6. dorsal views of shell, X 96. Confrides area, locality 2. Beds of Aptian? age.
- 7,8 *Cytherura?* sp. 7. Left side and 8. dorsal views of shell, X 90. Confrides area, locality 2. Beds of Aptian? age.
- 9 *Cythereis* sp. aff. *C. robustus* Baynova. Right side of shell, X 87. 5, Mas de Barberans, locality 6. Beds of Barremian or Aptian age.
- 10-12 *Rehacythereis* cf. *R. glabrella* (Triebel). 11. Right side and 10, 12. dorsal views X 63, of two shells. Mas de Barberans, locality 6. Beds of Barremian or Aptian age.
- 13-15 *Cythereis* cf. *praeornata* Swain and Brown. 13, 15. Right side and 16. dorsal views of shell, X 60. Mas de Barberans, locality 8. Beds of Barremian or Aptian age.
- 16 *Rehacythereis* cf. *glabrella* (Triebel). Interior of right valve, X 63. Mas de Barberans, locality 6. Beds of Barremian or Aptian age.
- 17 *Rehacythereis* cf. *glabrella* (Triebel). Right side of shell, X 81. Mas de Barberans, locality 6. Beds of Barremian or Aptian age.
- 18 *Cythereis* sp. Left side of poorly preserved shell, X 68. Mas de Barberans, locality 6. Beds of Barremian or Aptian age.
- 19 *Rehacythereis* cf. *glabrella* (Triebel). Right side of shell, X 57. Mas de Barberans, locality 6. Beds of Barremian or Aptian age.
- 20,21 *Veeniacythereis?* sp. 20. Left side and 21. dorsal views of apparently abraded shell, X 57, Mas de Barberans, locality 6. Beds of Barremian or Aptian age.
- 22 *Atopochara* cf. *trivolis* Peck. Oblique view of utricle, X 48. Reserva Nacional de Caza locality 7. Beds of Barremian age.
- 23 *Flabellochara* cf. *harrisi* (Peck). Oblique view of gyrogonite, X 96. Reserva Nacional de Caza, locality 7. Beds of Barremian age.



1991 *Cythereis?* cf. *C. praeornata* Swain and Brown, Swain, Xie and von Hillebrandt 105, Pl. 4, Figs. 23, 24.

Remarks: This form was described and illustrated by Swain *et al.* (1991) and the present illustrations are presented to show additional shell details, particularly the minute pitting near the median node (Pl. IV, Figs. 13, 15).

Occurrence: Common in beds of Barremian or Aptian age, Mas de Barberans, Locality 6, marine.

Cythereis sp. aff. *C. robustus* Baynova, 1965
Pl. IV, Fig. 9

Summary of shell characters: Shell elongate-subpyriform in side view, highest about one-fourth of length from anterior end, dorsum nearly straight, slightly more than half of shell length, with broadly obtuse cardinal angles; venter nearly straight, gently concave medially, converging with dorsum toward posterior; anterior broadly rounded; posterior bluntly pointed, strongly extended below, truncate above; valves subequal, the left slightly larger than right, shell relatively compressed in edge view, greatest width submedian. A narrow knife-edge ridge occurs submarginally along anterior; at dorsal termination of ridge is a slight enlargement representing eye tubercle?; a large rounded node lies just anterior to midline; anteromid-dorsally is a short oblique narrow ridge; midventrally is a narrow ridge that terminates posteriorly in a short ala; shell surface compressed posterior to alae; general surface coarsely but weakly reticulate with narrow ridges equalling only one-fourth or less, width of interspaces; coarse nodes are scattered over valve surfaces, and anteroventrally in a row of three nodes parallel to marginal ridge. Internal valve structures not observed.

Length of figured specimen 0.98 mm, height 0.54 mm.

Remarks: In lateral outline particularly the ventrally extended pointed posterior end, this form resembles *Cythereis robustus* Baynova, 1965 from the middle and lower Albian beds of Bulgaria. In that species, the surface is more densely tuberculate, the fine reticulate network is lacking, and the shell is somewhat larger than the present species.

Occurrence: Rare in beds of Barremian or Aptian age, Mas de Barberans, Locality 6, marine.

Genus *Veeniacythereis* Gründel, 1973

Veeniacythereis? sp.
Pl. IV, Figs. 20, 21

Summary of shell characters: Shell subquadrate in side view, highest about one fourth of length from anterior end; dorsum nearly straight, slightly sinuous, the anterior cardinal angle less obtuse than that at posterior end of dorsum; venter nearly straight, converging toward posterior with respect to dorsum; anterior broadly rounded, slightly extended below; posterior subtruncate, narrower than anterior margin. Valves subequal, the left slightly the larger, convexity of valve moderate, greatest width about one-third of length from posterior end; in edge view, terminal fourths of shell compressed.

Dorsal margin bears a longitudinal narrow ridge that terminates in a slight ventral curve about one-sixth of length from posterior end; anteromedially is a rounded but indistinct node that connects by means of a saddle to a posteromedian short longitudinal ridge; midventrally is submarginal longitudinal ridge, about half of shell length, which merges with

shell surface anteriorly and forms a short ala posteriorly; general shell surface finely pitted in some areas, at least, but surface is poorly preserved. Internal shell structures not observed.

Length of figured specimen 0.96 mm, height 0.53 mm., width 0.42 mm.

Remarks: The general outline, ribbed surface, lack of connection of posterior end of dorsal and median longitudinal ridges and saddle-like connection between the median node and median longitudinal ridge are suggestive of *Veeniacythereis* Gründel. The present material is too poorly preserved to permit further characterization.

Occurrence: Rare in beds of Barremian or Aptian age, Mas de Barberans, Locality 6, marine.

Order CHARALES Mädlar, 1952

Family *Clavatoraceae* Pia, 1927

Genus *Flabellochara* Grambast, 1962

Flabellochara cf. *harrisi* (Peck, 1941) Grambast, 1959
Pl. IV, Fig. 23

1941 *Clavator harrisi* Peck, 292, Pl. 42, Figs. 25-37.

1959 *Flabellochara harrisi* (Peck); Grambast, 559.

Remarks: A gyrogonite closely similar, if not identical to those assigned to this species by Brenner (1976), from the Barremo-Aptian of northeastern Spain is shown in the figure. Elsewhere it has been found in the Aptian of the United States. Diameter: 0.74 mm.

Occurrence: Beds of Barremian age, Reserva Nacional de Caza, Locality 7, non-marine or brackish water.

Genus *Atopochara* Peck, 1938

Atopochara cf. *trivolis* Peck, 1938
Pl. IV, Fig. 22

1938 *Atopochara trivolis* Peck, 174, Pl. 28, Figs. 8-12.

Remarks: The utricle figured here is closely similar to those recorded by Brenner (1976) from the Barremo-Aptian of northeastern Spain. Elsewhere it has been recorded from the Aptian of Oklahoma (Peck, 1938) and the Barremo-Aptian of Argentina (Mussachio, 1971). Diameter, 0.36 mm.

Occurrence: Common in beds of Barremian age, Reserva Nacional de Caza, Locality 7, non-marine or brackish-water.

ACKNOWLEDGEMENTS

Laboratory facilities at the University of Delaware were used in this study. Takako Nagase prepared the SEM photographs. Luis Sánchez de Posada assisted with field work in the Oviedo area, Asturias Province, where, unfortunately, no Ostracoda were found in the Lower Cretaceous. H.J. Oertli supplied data on collecting localities in northeastern Spain. The manuscript was typed by Sue Linehan and Laura Holmstrand.

BIBLIOGRAPHY

- Andreu, B. 1983. Nouvelles species d'Ostracodes de l'Albien et du Cenomanien Sud Pyénéen (Sierra d'Aulet, Espagne). *Bulletin Centres Recherches Exploration-Production Elf-Aquitaine, Pau*, 7, 1-43.
- Brenner, P. 1976. Ostracodes und charophyten des Spanischen Wealden. *Palaeontographica A.*, 152, 113-201.
- Bulard, P. F. et Canerot, J. 1969., La transgression du Crétacé inférieur sur le substratum Jurassique dans la haute vallée du rio Matarrana (Prov. Teruel-Espagne). *Bulletin Societé Histoire Naturelle Toulouse*, 105, 365-373.
- Canerot, J. 1969. Observations géologiques dans la région de Montalban, Aliaga, et Alcorica (Prov. Teruel-Espagne). *Bulletin Societé Géologique France*, 11, 854-861.
- Damotte, R. et Rey, J. 1980. Ostracodes du Crétacé inférieur d'Estremadura. *Revue de Micropaléontologie*, 23, 16-36.
- Fernández-Mendiola, P. A. and García-Mondéjar, J. 1991. Depositional history of Aptian-Albian carbonate platforms: Aitzgorri Massif, northern Spain. *Cretaceous Research*, 12, 293-320.
- García-Rossell, L. 1972. Hoja de Alcoy, no. 64.E 1:200,000. IGME Mapa Geológico de España, Madrid.
- Grekof, N., Guerin-Desjardins, B., Latreille, M., Lys, M., Sigal, J. et Siskind, B. 1961. Présence de niveaux marin du Neocomien et probablement du Malm dans les Pyrénées de Lérida (Espagne). *Compte Rendu Academie Science*, 272, 2262-2264.
- Kneuper-Haack, F. 1966. Ostracoden aus dem Wealden der Sierra de los Cameros. *Geologische Jahrbuch*, Hannover, 44, 165-209.
- Musachio, E. A. 1971. Charophytes de la formación La Amarga (Cretácico inferior) Provincia de Neuquén, Argentina. *Revista Museo de La Plata*, 6, Paleontología, n.º 37, 18-38.
- Neale, J. W. 1978. The Cretaceous. In: *A Stratigraphical Index of British Ostracoda* (Eds. R. H. Bate and E. Robinson). Seal House Press, Liverpool, 1-331.
- Oertli, H. J. 1958. Les Ostracodes de l'Aptien-Albien d'Apt. *Revue de Institute français du Petrole*, Paris, 13, 1499-1537.
- Peck, R. E. 1938. A new family of charophytes from the Lower Cretaceous of Texas. *Journal of Paleontology*, 12, 173-176.
- Peybernes, B. et Oertli, H. 1972. La serie de passage du Jurassique au Crétacé dans le Bassin sub-Pyrénéen (Espagne). *Compte Rendu Academie Science*, Paris, 274, 3348-3351.
- Ramalho, M. 1971. Contribution à l'étude micropaléontologique et stratigraphique du Jurassique supérieur et du Crétacé inférieur des environs de Lisbonne (Portugal). *Serviços Geológicos Portugal*, Memorie 19 (n.s.) 212 pp.
- Ramírez del Pozo, J. 1969. *Síntesis estratigráfica y micropaléontológica de las facies Purbeckense y Wealdense del Norte de España*, 1, 1-68. Ed. Compañía de Investigación y Exploración de Petróleos, S.A. (CIEPSA), Madrid.
- Ramírez del Pozo, J. 1971. Biostratigrafía y Microfacies del Jurásico y Cretácico del Norte de España (región Cantábrica). Trabajos Compañía de Investigación y Exploración Petróleos, S.A. (CIEPSA), Madrid, 1-357.
- Ramírez del Pozo, J. y Giannini, G. 1973. Hoja de Gijón. E. 1:50,000 Mapa Geológico de España (IGME), Madrid, 48 pp.
- Swain, F. M. 1985. Some Ostracoda from the Rodessa, Pearsall, Sligo and upper Hosston Formations (Lower Cretaceous) of Louisiana. *Revue de Micropaléontologie*, 27, 266-294.
- Swain, F. M. and Brown, P. M. 1972. Lower Cretaceous, Jurassic? and Triassic Ostracoda from the Atlantic coastal region. *United States Geological Survey, Professional Paper*, 795, 1-55.
- Swain, F. M., Xie Chuanli and von Hillebrandt, C. 1991. Some Lower Cretaceous Ostracoda from Florida and northeastern Spain. *Revista Española de Micropaleontología*, 23, 75-118.

Manuscrito recibido: 3 de febrero, 1992

Manuscrito aceptado: 20 de julio, 1992

APPENDIX 1: List of Localities

The Ostracoda and charophytes recorded herein were obtained by the writer from the following localities:

- Locality 1 Beds of Albian? age, San Vicente, Cantabria Province, hill north of town along beach, approximately 43° 23.45' N. Lat., 4° 23.48' W. Long., about 50 km W. of Santander, Spain; light gray, dense, glauconitic chalk or chalky limestone: *Bairdia* cf. *comanchensis* Alexander, *Paracypris* sp., *Rehacythereis?* sp. gr. *ilhaensis* Damotte and Rey.
- Locality 2 Beds of Aptian? age, 1.5 km north of Confrides, approximately 38° 41.16' N. Lat., 0° 17.01' W. Long., about 18 km E of Alcoy, Valencia Province, Spain; gray silty, fossiliferous shale, strike E-W, dip 10° N; dip changes locally to 70° N at outcrop down the road: *Cytherella* sp. aff. *C. symmetrica* Jones, *Pontocyrella* sp. aff. *P. superba* Neale, *Asciocythere cinctorensis* Brenner, *Schuleridea* sp. aff. *S. jonesiana* (Bosquet), *Schuleridea* sp. 2, *Neocythere* sp. aff. *N. mertensi* Oertli, *Hechticythere* sp. aff. *H. pumila* (Grosdidier), *Protocythere* cf. *derooi* Oertli, *Cytherura?* sp.
- Locality 3 Beds of Aptian? age, 1 km north of preceding, gray shale and limestone with trace fossils, strike N 60° E. dip 84° S: *Asciocythere cinctorensis* Brenner, *Asciocythere* cf. *rotunda* (Vanderpool), *Rehacythereis?* sp. aff., *R.? dentonensis* (Alexander).
- Locality 4 Beds of Aptian? age, 0.5 km north of preceding, gray shale, strike N 40° E dip 17° NE: *Cytherella fredericksburgensis* Alexander, *Cytherella* sp. aff. *C. beyrichoidea* Swain and Brown, *Doloccytheridea* cf. *bosquetiana* (Jones and Hinde), *Schuleridea* sp. aff. *S. jonesiana* (Bosquet).
- Locality 5 Beds of Aptian? age, 3 km north of Castell de Castells, approximately 39° 45.00'; N. Lat., 0° 12.82' W. Long., about 25 km east of Alcoy, Valencia Province, Spain; gray shale, strike N. 35° E, dip 28° SE: *Doloccytheridea* sp. aff. *D. wolburgi* (Bar-

- tenstein) *Rehacythereis?* sp. aff. *R.? nuda* (Alexander, 1929, not Jones and Hinde, 1849), *Rehacythereis?* sp. aff. *R. senckenbergi* (Triebel).
- Locality 6 Beds of Barremian or Aptian age, Mas de Barberans north edge and south edge of village, approximately 40° 44.72' N. Lat., 0° 24.0' E. Long., 16 km. south of Roquetas, Tarragona Province, Spain; gray shale and argillaceous, fossiliferous limestone, strike N 15° E, dip 8° NW. In the present paper the following species are recorded: *Rehacythereis* cf. *glabella* (Triebel), *R.?* sp., *Cythereis* cf. *praeornata* Swain and Brown, *Cythereis* sp. aff. *C. robustus* Baynova, *Veeniacythereis?* sp. In a previous paper (Swain, Xie, and von Hillebrandt, 1991) 15 additional species were obtained from the Mas de Barberans locality.
- Locality 7 Beds of Barremian? age ("Wealden" facies of mainly non-marine deposits), near entrance to Reserva Nacional de Caza on west side of reservoir, 10-12 km northwest of La Cenia, approximately 40° 40.36' N. Lat., 0° 14.45' E. Long., northern Valencia Province, Spain; interbedded, impure fossiliferous limestone and gray shale, strike N. 20° E., dip 10° NW, changing northwestward to N 55° E., 30° NW in a distance of 2 km: *Cypridea (Ullwellia)* cf. *soriana* Kneuper-Haacht, *Cypridea (C.)* cf. *bullata* Brenner, *Cypridea (C.)* cf. *ventriosa* Brenner, *Mantelliana* cf. sp. 2 of Brenner 1976, *Asciocythere cinctorensis* Brenner, *Fabanella* cf. *polita* Martin, *Fabanella* cf. *boloniensis* (Jones), *Timiriasevia?* sp., *Dictocythere* cf. *gibbera* Brenner, *Atopochara* cf. *trivolvus* Peck, *Flabellochara* cf. *harrisi* (Peck).
- Locality 8 Beds of Aptian? age, about 6 km northwest of Perello, approximately 40° 56.18' N. Lat., 1° 41.92' E. Long., central Tarragona Province, Spain; interbedded marine and brackish-water dark gray shale and white-weathering fossiliferous limestone: *Doloccytheridea?* sp. aff. *D. intermedia* Oertly, *Asciocythere?* sp., *Haplocytheridea?* sp. aff. *H. rodewaldensis* (Triebel), *Cypridea (Ullwellia)* cf. *soriana* Keuper-Haack.