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LINGULID, RHYNCHONELLID AND SPIRIFERID BRACHIOPODS FROM THE SHUMWAY CYCLOTHEM, MATTOON FORMATION, PENNSYLVANIAN OF ILLINOIS

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ABSTRACT

Four species of inarticulate brachiopods occur in the black shale member of the Shumway Cyclothem. In addition one rhynchonellid species and six spiriferid species occur in the upper limestone member or Shumway Limestone Member of the Mattoon Formation. Of these, two spiriferids also occur in the lower limestone member of the Shumway Cyclothem. These eleven species are a part of a known fauna of at least one hundred and fifty taxa, occurring in the marine portion of the Shumway Cyclothem at its type locality in Effingham County, Illinois.

INTRODUCTION

This is the third of a series of papers documenting a substantial portion of the marine fauna of the Shumway Cyclothem at its type locality on the south bank of Shoal Creek in the SE 1/4, SE 1/4, SW 1/4, sec. 26, T. 9N., R. 5 E. in Effingham County, Illinois. Previous reports include a description of the mollusca and a trilobite (Scheihing and Langenheim, 1978) and of the strophomenidinid brachiopods (Scheihing and Langenheim, 1979).

The faunas of the Shumway Cyclothem are of particular interest because of their stratigraphic position, location, diversity and the general lack of knowledge regarding Pennsylvanian invertebrates in the Illinois Basin. The Shumway fauna is one of the youngest known in the Illinois sequence and, also, is located in the vicinity of the Missourian-Virgilian boundary. Thus, detailed information regarding its character is of significance to correlating the Illinois Pennsylvanian succession. The Shumway fauna is located in an outlier about half way between the well known Late Pennsylvanian faunas of Missouri, Kansas and Nebraska and the well documented faunas of the Appalachian Basin in Ohio, Pennsylvania, Maryland and West Virginia. Thus they should represent conditions intermediate between shelf sea dominated environments to the west and the tectonically affected shoreward situations to

the east. Prior to this project, Pennsylvanian fossils from Illinois have been known chiefly from the pioneer works of the second half of the nineteenth century, monographs on the Fusulinidae by Dunbar and Henbest (1942) and on the Ostracoda by Cooper (1946), a comprehensive faunal list of western Illinois Pennsylvanian fossils (Wanless, 1958) and from scattered descriptions of individual organisms and casual citations of occurrence. For these reasons systematic illustration, description and comment on some of the more than 150 taxa reported from rocks of the Shumway Cyclothem is of value.

PREVIOUS STRATIGRAPHIC AND PALEONTOLOGIC WORK

Stratigraphic accounts of the Shumway Cyclothem are brief and incomplete. The cyclothem was named by Weller and Newton (1938) and briefly described by Weller and Bell (1941). A type locality was finally designated by Kosanke et al. (1960) for the Shumway Limestone Member of the Mattoon Formation. His work includes a detailed stratigraphic column for the type area, but formally names only one of the units, the upper limestone member of this paper, in the sequence. More comprehensive accounts of these efforts are to be found in the unpublished notes of S. E. Ekblaw, made in 1931 and on file in the Illinois State Geological Survey at Urbana. These notes are more readily available, perhaps, in Scheihing's (1978) thesis which is in the Library of the University of Illinois at Urbana.

Correlation of the Shumway Cyclothem rests primarily on occurrence of Triticites turgidus and T. pauper, originally described from the lower limestone member by Dunbar and Henbest (1942). At the time, Dunbar and Henbest pointed out that, inasmuch as these taxa occur only in the Shumway Cyclothem, their value in external correlation is somewhat limited. Later, Cooper, (1946), on the basis of a more extensive collection of ostracodes, placed the Shumway in the Middle Virgilian, equivalent to the upper part of the Shawnee Group of Kansas and environs. Subsequently, Kosanke et al. (1960) and Willman et al. (1975) correlated the Shumway with the base of the Virgilian and, in addition, Sturgeon and Hoare (1968) correlate the Shumway Limestone Member with the Iatan Limestone of Kansas and the Gaysport Limestone of Ohio. In contrast, Moore (1959, Fig. 1) correlates the Shumway Limestone with the Oread Limestone, a position taken by Wanless (personal communication, Fall, 1962), who specifically compared the Shumway black, fissile shale member with the Heebner Shale of Kansas. Wanless (1975) also placed the Omega Limestone, the next limestone unit below the Shumway Limestone in Illinois, at the base of interval E in the Illinois Basin. Interval E, an informal unit utilized in the Pennsylvanian Paleotectonic Map project (McKee et al., 1975) was defined as "essentially" equivalent to the Virgilian. Our work with the strophomenidinid brachiopods (Scheihing and Langenheim, 1979) appears most compatible with the Oread Limestone correlation, but is not incompatible with either the Iatan Limestone or upper Shawnee Group allocations of Willman et al. (1975) and Cooper (1946) respectively.

Additional faunal studies of the Shumway cyclothem include Tucker's (1976a,b) account of nautiloid cephalopods and his faunal list of taxa from the Shumway Limestone Member (upper limestone member). Finally,

we (Scheihing and Langenheim, 1978) have briefly described the mollusca and one trilobite from the marine portions of the cyclothem.

We recognize the following lithologic units at the type locality of the Shumway cyclothem:

12 - Massive sandstone
11 - Claystone and shale
10 - Fossiliferous, fine-grained, gray limestone: the upper limestone member
9 - Gray, calcareous shale
8 - Black fissile shale: the black shale member
7 - Fossiliferous, argillaceous, gray limestone: the lower limestone member
6 - Fossiliferous, calcareous shale: the "clod"
5 - Coal: the Shumway Coal
4 - Underclay
3 - Underclay limestone
2 - Gray shale with plant fragments
1 - Interbedded siltstone and sandstone

Members 6 through 10 have supplied the fossils described in this report and the remaining members are considered to be of non-marine origin. All units between the coal and the upper limestone appear to have gradational contacts and, therefore, no hiatus is recognized in their depositional history.

All of the fossils described in this report were obtained from a series of measured sections and from intervening outcrops at the type locality of the Shumway Cyclothem, SE 1/4, SE 1/4, SW 1/4, sec. 26, T. 9 N., R. 5 E., Effingham County, Illinois. A complete faunal list for these localities is contained in a thesis by Scheihing (1978) that is principally devoted to consideration of paleoenvironmental succession within the Shumway Cyclothem. Catalog numbers refer to the type collection of the Department of Geology, University of Illinois, Urbana.

SYSTEMATIC PALEONTOLOGY

Class Inarticulata Huxley, 1869
Family Lingulidae Menke, 1828
Genus Lingula Bruguiere, 1792
(?) Lingula carbonaria Shumard
Plate 1, Figure 1

Lingula carbonaria Dunbar and Condra, 1932, p. 31, 32, pl. 1, figs. 1, 2; Hoare, 1961, p. 21, 22, pl. 1, figs. 1, 2; Sturgeon and Hoare, 1968, p. 21, pl. 1, figs. 1-3.

Discussion: Our single specimen is referred to L. carbonaria because of its general outline of the valve, ornamentation, and because of the affinity of the species to black and dark gray shales (Dunbar and Condra, 1932, p. 33).

Occurrence: Black shale member, unit 8. Dunbar and Condra (1932,

p. 33) report this species ranging throughout the Pennsylvanian System in the Mississippi Valley.

Material: One valve impression. Hypotype X-5655.

(?) Lingulid
Plate 1, Figure 2

Description: Shell small, subcircular in outline, precise shell convexity indeterminate because of compaction. Shell material fibrous. Immature specimens planar to slightly convex where compressed, mature specimens with corrugated anterior margin. Growth lines visible on more mature specimens.

Characteristic specimens are 6 mm long, 6 mm wide.

Discussion: The specimens are referred to Order only on the basis of shell size, shape, and presence in black shale.

Occurrence: Black shale member, unit 8.

Material: Numerous specimens from black shale, mostly crushed and fragmentary. Hypotype X-5658.

Genus Trigonoglossa Dunbar and Condra, 1932
(?) Trigonoglossa cf. T. nebrascensis Dunbar and Condra, 1932
Plate 1, Figure 3

Trigonoglossa nebrascensis Dunbar and Condra, 1932, p. 37-39, pl. 1, figs. 5, 6; Sturgeon and Hoare, 1968, p. 21, 22, pl. 1, figs. 5, 6.

Description: Valve fragment preserving straight lateral margin. Valve surface bears sharp, concentric lirae at approximately 27 lirae/cm. Interlirae flat.

Discussion: This fragmentary specimen with a straight lateral margin and sharp, widely spaced lirae is tentatively assigned to Trigonoglossa nebrascensis. A similar species, T. kentuckyensis Dunbar and Condra differs in being larger and having more closely spaced lirae.

Occurrence: Black shale member, unit 8.

According to Dunbar and Condra (1932) T. nebrascensis ranges at least from the Late Desmoinesian through the Virgilian. These authorities also place T. kentuckyensis in the Desmoinesian. Sturgeon and Hoare (1968) report T. nebrascensis in the Desmoinesian of Ohio.

Material: One fragmentary valve. Hypotype X-5656.

Family Discinadae Gray, 1840
Genus Orbiculoidea d'Orbigny, 1847
Orbiduloidea missouriensis (Shumard)
Plate 1, Figure 4

Orbiculoidea missouriensis Dunbar and Condra, 1932, p. 42-45, pl. 1, figs. 12-17; Hoare, 1961, p. 22, 23, pl. 1, figs. 3-5; Sturgeon and Hoare, 1968, p. 22, pl. 1, figs 7-11.

Description: Shell circular in outline. Some specimens retain bluish-white color of chitinophosphatic material. Brachial valve conical in side view, anterior slope slightly concave, posterior slope flat, no internal markings observed. Apex of brachial valve approximately 1/3 length from posterior margin. Pedicle valves flattened by compaction. Narrow apical foramen paralleling long axis on anterior of apex, approximately 0.7 mm long in a specimen 6 mm long. Brachial and pedicle valves bear concentric growth lines, fine concentric lirae. Growth lines, lirae crowded between posterior margin and apex of brachial valve. Mean length of Shumway specimens 3.7 mm (range 2.5 mm to 7.5 mm); mean width 3.9 mm (range 2.6 mm to 7.3 mm).

Discussion: The specimens examined agree well with the descriptions of Dunbar and Condra (1932); Hoare (1961); and Sturgeon and Hoare (1968) but differ in their small size and almost perfect circularity. In addition, the Shumway specimens apparently lack the fine radial lirae noted by Hoare (1961).

Occurrence: Black shale member, unit 8. Dunbar and Condra (1932) report O. missouriensis as ranging from the Desmoinesian into the Permian in the Mississippi Valley.

Material: Approximately 23 specimens at different stages of maturity. Hypotype X-5657.

Class Articulata Huxley, 1869
Family Wellerellidae Likharev in Rzhonsnitskaya, 1956
Genus Wellerella Dunbar and Condra, 1932
Wellerella cf. W. tetrahedra Dunbar and Condra
Plate 1, Figures 6-8

Wellerella tetrahedra Dunbar and Condra, 1932, p. 291, 292, pl. 37, figs. 11-16; Hoare, 1961, p. 31, 32, pl. 4, figs. 1-5; Sturgeon and Hoare, 1968, p. 53, 54, pl. 10, figs. 7-9.

Description: Shell small, tetrahedral in outline. Two plicae on dorsal fold, 3 plicae on either side of fold. Floor of sinus bends sharply upward to meet elevated dorsal fold. Two folds in sinus, 3 on dorsal valve. Lateral slope very steep on dorsal valve. Interior characters unobserved.

One specimen is 8 mm wide, 6 mm long, and 6 mm high.

Discussion: Wellerella spp. described by Dunbar and Condra (1932),

Sturgeon and Hoare (1968) and Hoare (1961) display considerable diversity in form and, in view of our small sample, we are unwilling to definitely assign the Shumway specimens to W. tetrahedra Dunbar and Condra. Final decisions regarding Shumway Cyclothem Wellerella specimens will require a sufficiently large collection to display the total range of morphologic diversity in the fauna and to allow sacrifice of specimens for serial sectioning.

Occurrence: Upper limestone member, unit 10.

The range of Wellerella tetrahedra Dunbar and Condra is reported as Desmoinesian to no more than Middle Missourian by Dunbar and Condra (1932). Sturgeon and Hoare (1968) restrict the species to the Desmoinesian in Ohio and Hoare (1961) cites it ranging through much of the Desmoinesian in Missouri. Thus, the species appears predominantly of Desmoinesian age. It should be noted that other species of Wellerella, such as Wellerella osagensis do occur in the upper part of the Pennsylvanian and might possibly be a more appropriate category for the Shumway specimens.

Material: Two articulated specimens. Hypotype X-5666.

Family Athyrididae McCoy, 1844
Genus Composita Brown, 1849
Composita argentea (Shepard)
Plate 3, Figures 1-5

Composita argentea Dunbar and Condra, 1932, p. 367-369, pl. 43, figs. 1-6; Sturgeon and Hoare, 1968, p. 58, pl. 18, figs. 19-24.

Description: Shell small, broadly oval to subcircular, widest at midlength, convexity greatest at midlength both on ventral and dorsal valves. Tongue of ventral sulcus moderate. Dorsal valve low, broad. Internal characters unobserved. Dimensions of two specimens: width 12 mm, length 13 mm; width 18 mm, length 20 mm.

Discussion: C. subtilita is distinguished from C. argentea by the latter's more oval outline, shorter ventral beak, later appearance of fold and sulcus and low dorsal fold and ventral sulcus. Sturgeon and Hoare (1968), however, have commented that C. argentea and C. subtilita overlap in character. The individual shown on Pl. 2, Fig. 5 is one of two poorly preserved specimens provisionally assigned to C. argentea.

Occurrence: Upper limestone member, unit 10.

Dunbar and Condra (1932) give a range of Early Desmoinesian (Middle Cherokee Shale) to Early Virgilian (Plattsmouth Limestone) for Composita argentea.

Material: Five articulated specimens. Hypotypes X-5659, X-5661.

Composita subtilita (Hall)
Plate 3, Figures 6-8

Composita subtilita Dunbar and Condra, 1932, p. 363-366, pl. 43, figs. 7-13; Hoare, 1961, p. 89, 90, pl. 11, figs. 20-25, pl. 12, figs. 1, 2; Sturgeon and Hoare, 1968, p. 57, pl. 18, figs. 5-10.

Description: Shell small to moderate size, subovate in outline. Valves subequal in convexity, no recognizable hingeline or cardinal area. Shell material distinctly fibrous, with prominent growth lines on ventral valve. Deep, elongate median sulcus on ventral valve anterior with corresponding dorsal fold. Beak curves inward against dorsal valve. No internal features observed.

One specimen 11 mm wide, 13 mm long, 8 mm thick.

Discussion: The more than 40 species of Composita described and recognized from rocks of Latest Devonian through Middle Permian age in North America are exceedingly diverse in individual external morphology and, unfortunately, criteria derived from that morphology are the basis for species distinction. Individual populations of Composita commonly contain individuals fitting the species descriptions of two or more species. Furthermore, available descriptions of species occurrences commonly do not consider variability. Grinnell and Andrews (1964) have attempted to describe the morphologic development of species in Composita through statistical analysis and more subjective examination. These authors conclude that, although most of the defined species must be considered parts of a single Mendelian population, careful consideration of "morphologic" changes through geologic time (in Composita spp.) should make many of the species more valuable guide fossils (Grinnell and Andrews, 1964, p. 245).

Composita subtilita is the most widespread and abundant Pennsylvanian species of Composita. Characters generally utilized in distinguishing it from C. argentea are discussed under that species description.

Occurrence: Upper limestone member, unit 10.

Dunbar and Condra (1932) and Grinnell and Andrews (1964) report a range for Composita subtilita from the Atokan through the Leonardian.

Material: Two articulated specimens. Hypotype X-5660.

Family Spiriferidae King, 1846
Genus Neospirifer Fredericks, 1919 (1924)
Neospirifer dunbari dunbari R. H. King
Plate 2, Figures 4-6

Neospirifer triplicatus Dunbar and Condra, 1932, p. 329-332, pl. 39, fig. 5, pl. 41, figs. 1-6; Neospirifer dunbari dunbari Spencer, 1967, p. 22-23, fig. 13-3, 14; Neospirifer dunbari Sturgeon and Hoare, 1968, p. 62-63, pl. 20, figs. 8-15.

Description: Valves medium size, widest at hingeline, valves approximately equally convex with shallow to moderate angular ventral sulcus and corresponding fold and produced cardinal extremities. Pointed beak curves inward over triangular cardinal area. Subangular costae gathered in fascicular bundles of approximately 3 costae each. About 10 costae within median sulcus at anterior margin and about 15 on each flank at anterior margin. Internal characters unobserved.

A single specimen is 36 mm wide, 21 mm long, 15 mm thick.

Discussion: The Shumway specimen has been assigned to N. dunbari dunbari on the basis of its external characters only. The subtriangular outline, angular sulcus, form of costae, and proportions closely resemble individuals illustrated by Spencer (1967), Sturgeon and Hoare (1968) and Dunbar and Condra (1932). Our specimen, however, is somewhat small for the species and appears to have somewhat fewer costae than expected.

Occurrence: Upper limestone member, unit 10.

Spencer (1967) reports N. dunbari dunbari as ranging throughout the Pennsylvanian sequence of Kansas and continuing into the Permian. Sturgeon and Hoare (1968) report a range from the Late Missourian Ames Limestone through the Virgilian Skelly Limestone of Ohio.

Material: One articulated specimen. Hypotype X-5663.

Neospirifer dunbari gibbosus Dunbar and Condra
Plate 2, Figures 1-3

Neospirifer triplicatus var. gibbosus, Dunbar and Condra, 1932, p. 333, pl. XXXVIII, figs. 14-15; Spencer, 1967, p. 24-25, fig. 13-4.

Description: Valves strongly convex, widest at straight hingeline or just anterior to hingeline. Shell material fibrous. Prominent, bluntly pointed, ventral beak curves inward over dorsal valve. Cardinal extremities slightly rounded and right-angled. Sulcus extends from umbo to anterior margin, ending in a tonguelike structure. Angular median sinus with slightly to moderately produced dorsal fold. Subangular plications mildly fasciculate, mean of 10, range of 8 to 18 plications/cm on anterior margin.

Mean width 34 mm (range 31 mm to 38 mm); mean length 20 mm (range 18 mm to 25 mm); mean thickness 2.59 (range 2.54 to 2.66).

Discussion: The Shumway Cyclothem specimens have been assigned to N. dunbari gibbosus because of the form and pattern of costae, outline and gibbosity.

Occurrence: Upper and lower limestone members, units 7 and 10. Spencer (1967) reports N. dunbari gibbosus as ranging from the Lower Missourian Winterset Limestone through the Iatan Limestone.

Material: Approximately 10 specimens, some complete and articulated. Hypotype X-5664

Family Elythidae Frederiks, 1919 (1924)
Genus Phricodothyris George, 1932
Phricodothyris perplexa (McChesney)
Plate 1, Figure 5

Squamularia perplexa Dunbar and Condra, 1932, p. 313-317, pl. 42, figs. 5-8; Condrathyris perplexa Hoare, 1961, p. 82-84, pl. 11, figs. 4-6; Phricodothyris perplexa, Sturgeon and Hoare, 1961, p. 67, 68, pl. 22, figs. 10-14.

Description: Shell oval to suboval to almost circular in outline. Ventral valve strongly convex, bears fine growth lines. Beak prominent, overarches dorsal valve. Shell material fibrous. Valve interiors not observed.

Mean width 12 mm (range 9 mm to 13 mm); mean length 13 mm (range 12 mm to 15 mm); mean length/width ratio 0.87 (range 0.75 to 1.0).

Discussion: The Shumway specimens are assigned to P. perplexa on the basis of size, convex ventral valve, overarching beak, and shell outline. The specimens, however, are slightly smaller than those described by Sturgeon and Hoare (1968). Most of the specimens in the Shumway collection are exfoliated, precluding study of fine surface ornamentation noted by the authors cited above.

Occurrence: Upper limestone member, unit 10. Dunbar and Condra (1932) report P. perplexa as ranging from the Desmoinesian Cherokee Shale to the Middle Virgilian Calhoun Shale. Sturgeon and Hoare (1968) report it ranging from the base of the Desmoinesian through the Ames Limestone near the top of the Missourian in Ohio.

Material: Eight specimens, many articulated, but with the dorsal valve buried in matrix. Hypotype X-5665.

Family Ambocoeliidae George, 1931
Genus Crurithyris George, 1931
Crurithyris planoconvexa (Shumard)
Plate 1, Figures 9-11

Ambocoelia planoconvexa Dunbar and Condra, 1932, p. 344-348, pl. 42, figs. 12-14; Crurithyris planoconvexa, Hoare, 1961, p. 81, 82, pl. 11, figs. 1-3; Sturgeon and Hoare, 1968, p. 60, 61, pl. 19, figs. 21-25.

Description: Shell small, almost circular in outline, strongly planoconvex. Shell material fibrous, bearing faint growth lines. Ventral valve convex. Beak strongly incurved over dorsal valve. Dorsal valve very slightly convex; almost flattened. Internal characters unobserved.

Mean width 6 mm (range 5 mm to 8 mm); mean length 6 mm (range 4 mm

to 7 mm); mean thickness 2 mm (range 2 mm to 3 mm); mean length/width ratio 1.0 (range 0.80 to 1.2).

Discussion: The small size, convexity of the ventral valve, flatness of dorsal valve, subcurcular outline, and strongly incurved beak are diagnostic of the species.

Occurrence: Upper and lower limestone members, units 7 to 10. Dunbar and Condra (1932) report C. planoconvexa as ranging from the Desmoines, through the Pennsylvanian and into the Wolfcampian in Kansas, Nebraska and Missouri, Sturgeon and Hoare (1968) similarly find it ranging from the Early Desmoinesian Mercer Limestone through the Virgilian Skelly Limestone in Ohio.

Material: Many specimens from both the upper and lower limestone members. Hypotype X-5662.

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Explanation of Plate 1

Figures

1 (?) Lingula carbonaria Shumard
Impression of valve. Hypotype X-5655. Black shale member, Shumway Cyclothem type locality.

2 (?) Lingulida Waagen
Valve fragment. Hypotype X-5658. Black shale member, Shumway Cyclothem type locality.

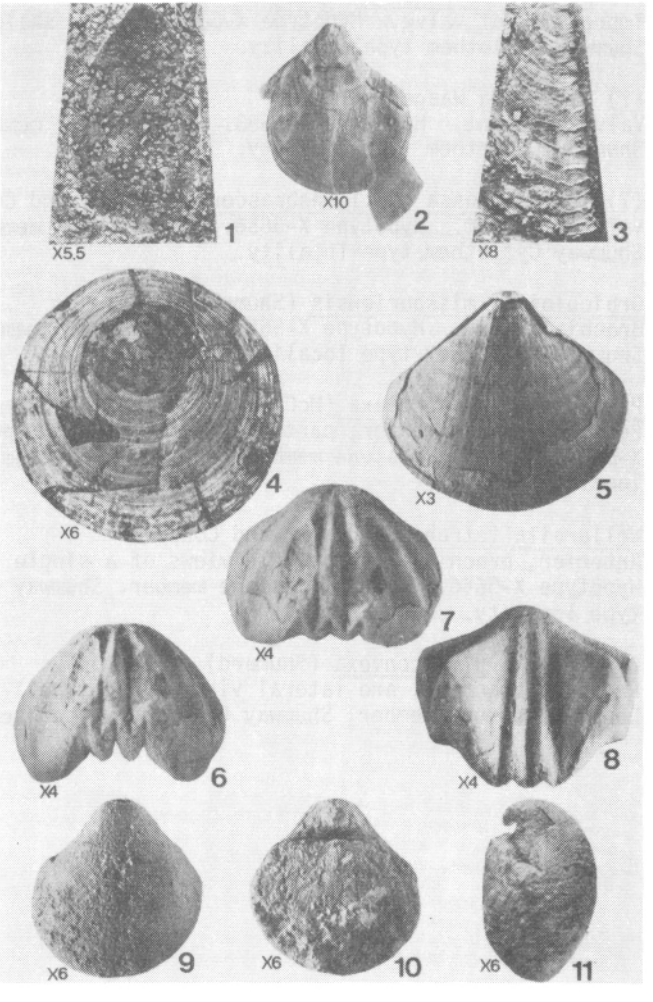
3 (?) Trigonoglossa cf. T. nebrascensis Dunbar and Condra
Valve fragment. Hypotype X-5656. Black shale member, Shumway Cyclothem type locality.

4 Orbiculoidea missouriensis (Shumard)
Brachial valve. Hypotype X-5657. Black shale member, Shumway Cyclothem type locality.

5 Phricodothyris perplexa (McChesney)
Pedicle valve exterior, partially exfoliated. Hypotype X-5665. Upper limestone member, Shumway Cyclothem type locality.

6-8 Wellerella tetrahedra Dunbar and Condra
Anterior, brachial, and pedicle views of a single specimen. Hypotype X-5666. Upper limestone member, Shumway Cyclothem type locality.

9-11 Crurithyris planoconvexa (Shumard)
Pedicle, brachial, and lateral views. Hypotype X-5662. Lower limestone member, Shumway Cyclothem type locality.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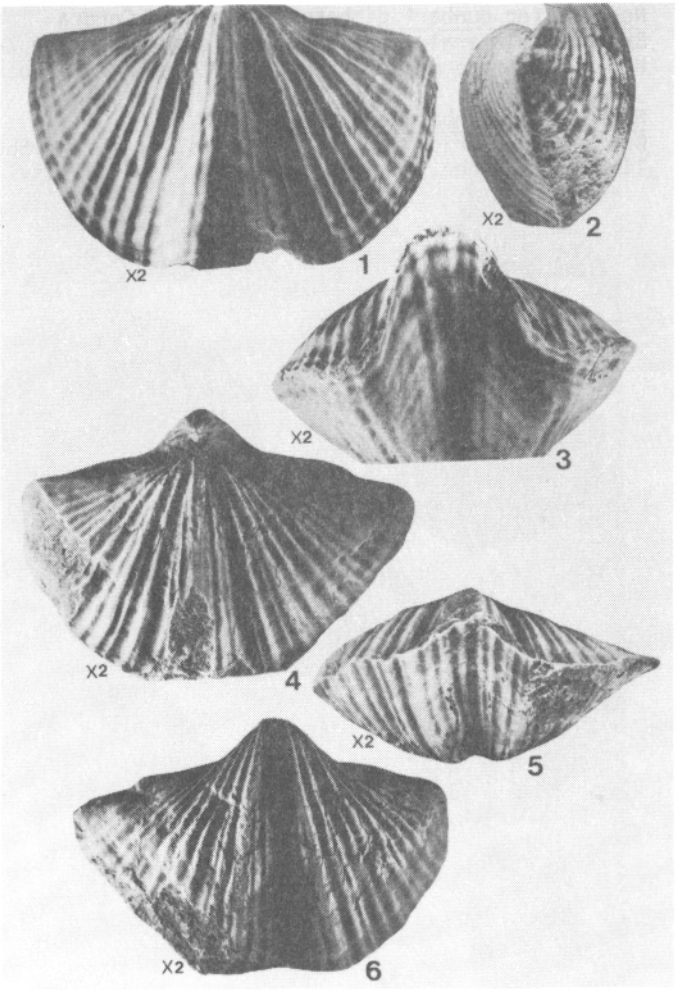
Explanation of Plate 2

Figures

1-3 Neospirifer dunbari gibbosus Dunbar and Condra
Brachial, lateral, and anterior views. Hypotype X-5664. Upper limestone member, Shumway Cyclothem type locality.

4-6 Neospirifer dunbari dunbari R. H. King
Brachial, anterior and pedicle views. Hypotype 5663. Upper limestone member, Shumway Cyclothem type locality.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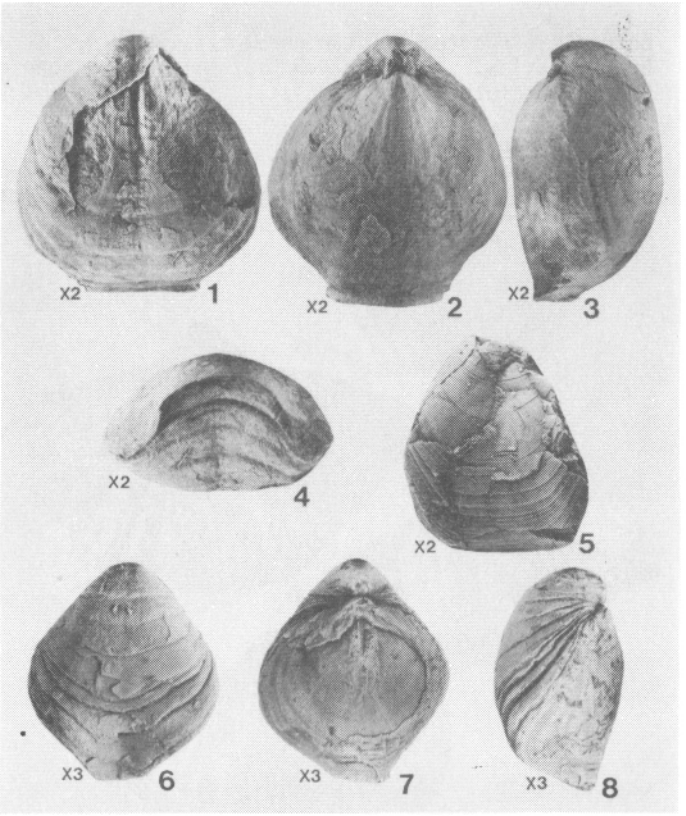
Explanation of Plate 3

Figures

1-4 Composita argentea (Shepard)
Pedicle, brachial, lateral, and anterior views of one articulated specimen. Hypotype X-5659. Upper limestone member, Shumway Cyclothem type locality.

5 Composita argentea (?) (Shepard)
Brachial view. Hypotype X-5661. Upper limestone member, Shumway Cyclothem type locality.

6-8 Composita subtilita (Hall)
Pedicle, brachial, and lateral views. Hypotype X-5660. Upper limestone member, Shumway Cyclothem type locality.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