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A New Bivalve from the Permian of the Western United States

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Major L. F. Brady, of the Museum of Northern Arizona, discovered and called our attention to an unusual bivalve mollusk which occurs in some abundance in the marine Gamma Member of the Permian Kaibab Formation, south of Flagstaff, Arizona. Several specimens collected by Brady were lent to us by the Museum of Northern Arizona for study, and one of us (Newell), in company with G. Robert Adlington, of the American Museum of Natural History, collected additional specimens from Brady's locality. In the meanwhile, Ciriacks recognized a closely related species in the Phosphoria Formation of western Wyoming. Extended study of these fossils brings us to the conclusion that they are morphologically distinct from any heretofore published genus or family of bivalves.

In general shape and hinge structure, the new form somewhat recalls *Schizodus*, with which it is associated, but it differs from that genus and other members of the Trigoniacea in details of the dentition and in the possession of a conspicuous pallial sinus and a posterior myophoric buttress. The last two of these characters indicate that this bivalve was a burrower, unlike other Trigoniacea, which probably were active members of the epifauna. Remote affinity with the Myophoriidae, a family of primitive trigoniaceans, is indicated by the shell form and the form and arrangement of the hinge teeth.

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SYSTEMATIC DESCRIPTION

SUPERFAMILY TRIGONIACEA

FAMILY **SCAPHELLINIDAE** NEWELL AND CIRIACKS, NEW FAMILY

Ovoid, opisthogyrate, opisthodetic shells with obscure lunule and escutcheon; sinupalliate, with a strong myophoric buttress in front of posterior adductor; pallial line expanded posteriorly; adductor scars

FIGS. 1, 2. *Scaphellina bradyi*, new genus, new species, A.M.N.H. No. 28106. A composite cast and restoration in rubber and plaster; posterior gape probably somewhat exaggerated. × 1.

FIG. 3. *Scaphellina bradyi*, M.N.A. No. 62.6984. A rubber cast of a left valve. × 1.

FIG. 4. *Schizodus texanus* Clifton, State University of Iowa No. 1453. Rubber cast of interior of holotype, left valve below. Illustrated for comparison with *Scaphellina bradyi*. Permian of Texas. × 2.

deeply impressed, anterior adductor slightly smaller of the two, higher than wide; one well-defined pedal muscle insertion at anterior margin of posterior adductor and one just ahead of hinge teeth (fig. 5), a third pedal muscle scar lying at apex of umbones; dentition consisting of three cardinal teeth and two sockets in left valve and two teeth and three sockets in right valve, of which the posterior tooth and socket are rudi-

mentary; lateral teeth absent: $A\frac{R\ 01010}{L\ 10107}P$; median tooth, as in many Trigoniacea, broad, distally notched, and gable shaped, and floor of median socket deeply notched.

COMPARISONS: Similar to *Schizodus* in form and dentition but differing from that genus in the possession of a pallial sinus, a posterior myophoric

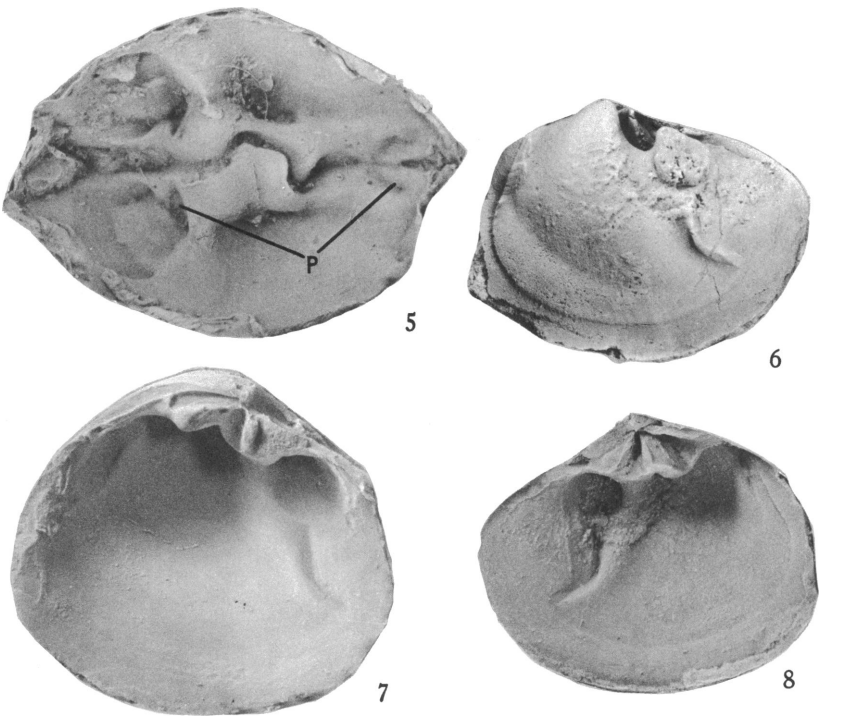

FIG. 5. *Scaphellina bradyi*, M.N.A. No. G2.322. Ventral view of hinge, left valve below; P, pedal scars. × 2.

FIGS. 6, 8. *Scaphellina bradyi*, A.M.N.H. No. 28106/1:2. Left valve. 6. Internal mold. 8. Cast. Both × 1.

FIG. 7. *Scaphellina bradyi*, M.N.A. No. 62.6850. Rubber cast of the holotype, a right valve. × 1.

buttress, and a posterior third tooth in the left valve and corresponding socket in the right. As in the Myophoriidae, the anterior cardinal tooth in these forms is in the left valve contrary to the situation in heterodonts, in which the anterior cardinal tooth characteristically is in the right valve.

GENUS **SCAPHELLINA** NEWELL AND CIRIACKS, NEW GENUS

GENOTYPE: *Scaphellina bradyi* Newell and Ciriacks, new species; Permian.

DIAGNOSIS: Shell ovoid, gibbous, heavy, about one-fourth to one-third longer than high, unornamented except for an obscure, narrow, cardinal area outside ligament; lateral profile broadly rounded anteriorly, somewhat attenuated and slightly gaping posteriorly, beaks depressed, opisthogyre, situated slightly ahead of midpoint of hinge.

RANGE: Mid-Permian (Kaibab, Park City) Arizona, Wyoming, Montana.

COMPARISONS: In *Schizodus* the dental formula is $A\frac{R\ 0101}{L\ 1010}P$. The dentition of *Scaphellina* is very similar in general arrangement and the form of the teeth except that an additional, somewhat rudimentary tooth and socket have been added at the posterior end of the sinus: $A\frac{R\ 01010}{L\ 10107}P$. Other similarities and differences are listed above under the family Scaphellinidae.

Scaphellina bradyi Newell and Ciriacks, new species

Figures 1–3, 5–8

DIAGNOSIS: Shell elongate-ovate, tapering posteriorly, length/height ratio about 4/3, bivalve convexity about three-fourths of height. Measurements of the holotype, taken from a restored cast, are: length, 46 mm.; height, 36 mm.; biconvexity, 26 mm. The largest of about a dozen fragmentary individuals is 45 mm. high, with an estimated original length of 55 or 60 mm.

This species is congeneric with *Schizodus phosphoriensis* Branson and *Schizodus concinnus* Branson from the Ervay and Grandeur Members of the Permian Park City (Phosphoria) Formation of western Wyoming. These differ from the present species in having a carinate posterior umbonal ridge. *Schizodus concinnus* is a much smaller, flatter, and more elongate form based on a poorly preserved internal mold. It may be a juvenile of the associated *S. phosphoriensis*.

DISTRIBUTION: Common in the Gamma (lower) dolomite Member of the Kaibab Limestone at Jones Crossing of East Clear Creek, Arizona, about 3½ miles east of Long Valley Store and 50 miles southeast of Flagstaff. The associated fauna consists mainly of mollusks, including several species of *Schizodus*. It has affinities with the fauna of the basal Word Limestone of the Glass Mountains, west Texas. The types are at the Museum of Northern Arizona, Flagstaff, and the American Museum of Natural History, New York.