AMERICAN MUSEUM
Novitates

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, NY 10024
Number 3263, 5 pp., 4 figures May 4, 1999

A New Lower Triassic *Permophorus* from the Central Rocky Mountains

NORMAN D. NEWELL[1] AND DONALD W. BOYD[2]

ABSTRACT

A new species, *Permophorus triassicus,* is described. It is the first citation known to us of a valid Lower Triassic example of the genus.

INTRODUCTION

The character of *Permophorus* and its family, Permophoridae, presents some problems. The generic diagnosis given in the Treatise on Invertebrate Paleontology (Chavan, in Moore, 1969) exemplifies a long-standing disagreement concerning hinge interpretation. Although Logan (1964) reviewed that history, restudied critical British specimens, and found only two cardinal teeth (2 and 3b) in the type species, Chavan's diagnosis in the Treatise adds teeth 3a and 4b. The interpretive problem is underscored by the fact that the Treatise figures (p. N545, figs. 3a,b) illustrating Chavan's diagnosis represent latex casts of specimens figured by Logan (1964: pl. 47, figs. 8, 9) in support of his simpler interpretation. It should be noted, however, that Logan later modified his conservative interpretation. After studying American specimens of *P. albequus* (Beede), he concluded (Logan, 1967: 52) that additional rudimentary cardinal and posterolateral teeth may sometimes be developed.

Many of the generic names assigned in the Treatise to the Permophoridae were not well established. Ronchetti and Allasinaz (1965) have cited differences among several genera. Their work is useful, but a review of all permophorids is needed, since the hinges are unknown in many genera.

About the authors: for more than 40 years, Boyd and Newell have collaborated in re-

[1] Curator Emeritus, American Museum of Natural History; Professor Emeritus, Columbia University, New York, NY.
[2] Research Associate, American Museum of Natural History; Professor Emeritus, University of Wyoming, Laramie, WY 82071.

 ISSN 0003-0082 / Price $1.30

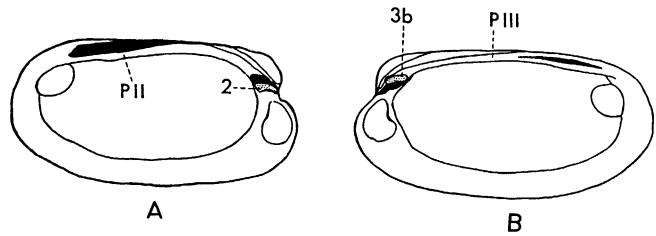

Fig. 1. *Permophorus costatus* (Brown), type species of *Permophorus* ×3. Diagram after Logan (1964), showing his interpretation of teeth (stippled) and sockets (black).

search—probably a record between paleontologists. As in all their projects, the authors have supported each other; in this one, sharing the exploration and sampling of the Lower Triassic Thaynes Formation from southern Nevada to Montana. Acid preparation was done by Boyd in Laramie, Wyoming, while preliminary organization and illustrations were contributed by Newell in New York, with frequent telephone discussions between Laramie and New York.

SYSTEMATICS

SUBCLASS HETERODONTA NEUMAYR, 1883
FAMILY PERMOPHORIDAE VAN DE POEL, 1959 (1895)

Genus *Permophorus* Chavan, 1954

TYPE SPECIES: *Arca costata* Brown, 1841.

DIAGNOSIS: Elongate-rectangular, with prosogyral beaks near anterior end; escutcheon well defined, lunule small; ligament external and amphidetic. One prominent cardinal tooth below beak on each valve, no. 3b dorsal, and no. 2 ventral, and a posterolateral tooth, PIII, in right valve, with corresponding socket in left vavle, the socket bounded ventrally by a narrow posterolateral tooth, PII (figs. 1–3). A few species have obscure supplemental cardinal and posterolateral teeth. Anterior adductor scar small and deep, bordered behind by a strong buttress; small retractor pit above buttress; posterior adductor scar large and indistinct; ornamentation: growth lamellae with or without a few radial costae.

DISTRIBUTION: Lower Carboniferous-Permian, cosmopolitan; Lower Triassic (Spathian), western U.S.

DISCUSSION: We are using the designation *Permophorus* for shells with hinges closely resembling those of the type species (fig. 1) as interpreted by Logan (1964), while allowing for the minor variability noted in his 1967 paper.

Permophorus triassicus Newell and Boyd, new species
Figures 2, 3, and 4

DIAGNOSIS: Shape variable, with dorsal margin nearly straight in elongate valves but strongly arcuate in ovoid ones. Valves equiconvex, with maximum convexity above mid-height. Lunule short but deep; shallow escutcheon extends past mid-length of valve. Nymph bladelike, commonly terminating near valve mid-length. Tooth 2 bulbous, with long axis inclined posteroventrally; tooth 3b a ridge with axis subparallel to valve length. Tooth PII a short ridge behind mid-length of valve, forming ventral wall of the PIII socket; tooth PIII inconspicuous, a slightly elevated and sharpened part of posterodorsal margin. Radial ornament absent.

DISTRIBUTION: Upper Thaynes Fm. (upper Lower Triassic) at localities in northeastern Utah (B6956; B873), western Wyoming (B7850; B7854), southeastern Idaho (B8251; B8828), and southwestern Montana (B8537). (See Newell and Boyd, 1995: 85–86, for information pertinent to the cited locality numbers.)

ETYMOLOGY: *triassicus* is named for the Triassic Period.

DISCUSSION: Our study collection consists of approximately 200 silicified valves. Most are incomplete, and many specimens include welded matrix. Roughly equal numbers of left and right valves are present. The variation in proportions, based on material from

Fig. 2. *Permophorus triassicus* Newell and Boyd, new species. A. Internal view; B. External view. Holotype, right valve, ×1, AMNH cat. 44088. From the Lower Triassic, upper Thaynes Fm., AMNH loc. B7850, Commissary Ridge, southwestern Wyoming.

two localities, is indicated in figure 4. The shape depicted in figure 1 matches that of our most elongated specimens, whereas a nearly circular outline characterizes rare valves at the other end of the spectrum of L/H variation. Intermediates similar to figures 2 and 3 comprise the majority of the collection.

Another variable feature is the linear extension of the valve ahead of the beak. The beak ranges in location from nearly above the valve's anterior extremity to well behind it.

The anterior pedal retractor scar is a deep pit near, but separated from, the posterodorsal corner of the anterior adductor scar. Posterior muscle scars are very faint. Where they are visible, a small pedal retractor scar is in contact with the dorsal margin of the subjacent adductor scar.

Although topographic details of the hinge plate vary from specimen to specimen, our best material shows no evidence of teeth 3a and 4b. On poorly preserved right valves, the surface between the anterior retractor scar and the socket for tooth 2 might be mistaken for tooth 3a. On some right valves the narrow shelf between anterior adductor and inner edge of the lunule is concave, forming a socket-like groove opposite the convex counterpart of the left valve.

Fig. 3. *Permophorus triassicus* Newell and Boyd, new species. Left valve, ×1, AMNH cat. 44089, AMNH loc. B7850.

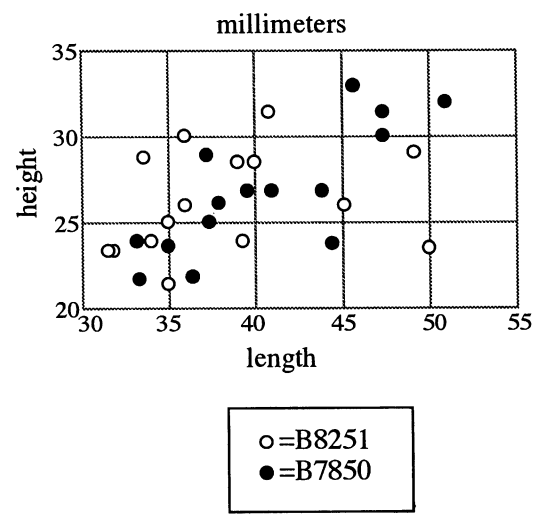

Fig. 4. *Permophorus triassicus* Newell and Boyd, new species. Scattergram showing form variation in samples from AMNH locations B7850 and B8251. Both left and right valves are included.

COMPARISONS: Our new species is very similar to Permian permophorids of Europe and North America. *Permophorus triassicus* differs from the type species of the genus, *P. costatus* (Brown), in lacking radial ornamentation and in details of the hinge. Logan's (1964) restoration of *P. costatus,* reproduced here as figure 1, could easily be modified to represent *P. triassicus.* In so doing, we would make the socket above PII shorter and narrower, and tooth 2 more bulbous, with a posteriorly sloping axis. Furthermore, the diagram's designation for tooth III would be moved posteriorly and the faint lateral socket now shown in that area would be deleted.

The new species is more ovoid than *P. albequus* (Beede), and lacks its sulcus, ventral sinus, and radial costellae.

Although Girty (1927) described three species of *Pleurophorus* (now *Permophorus*), from Lower Triassic strata of Idaho, Newell and Kummel (1942) and Ciriacks (1963) noted that the lack of evidence concerning internal features made the generic identification uncertain. Considering their stratigraphic association and the lack of discrete differences between them, Ciriacks (1963) placed the three taxa in synonymy as *Permophorus bregeri*? (Girty). Ciriacks (1963) discovered a single internal mold of *P.*? *bregeri* from another Idaho locality. Although it exhibits the imprint of a myophorus buttress, the lack of hinge evidence leaves the generic assignment in doubt. Illustrated specimens referred to *P.*? *bregeri* (Girty), 1927 (see plate 30, also Newell and Kummel, 1942; Ciriacks, 1963) are all from the Dinwoody Formation, an older (Griesbachian) Triassic unit than the Thaynes specimens described here. *P.*? *bregeri* differs from *P. triassicus* in possessing an umbonal ridge and a less arcuate dorsal margin.

PRESERVATION: *Permophorus triassicus* is a common constituent of shell beds in limestones of the upper Thaynes Formation. In these concentrations, articulated valves are rare but left and right valves commonly occur in roughly equal numbers. Valves are diversely oriented in the matrix, although the convex-up position dominates. Very few of our silicified specimens were broken before burial, and encrusting organisms are rare. However, abundant borings of several shapes and sizes attest to the activity of a diverse endolithic biota.

In our Thaynes specimens, a very thin surface layer of microquartz crystals preserves the original external morphology. At most localities, this rind encloses coarse macroquartz lacking evidence of original microstructure. Such a diagenetic fabric indicates that an open mold, created by dissolution of skeletal aragonite, preceded precipitation of void-filling silica (e.g., Boyd and Newell, 1972; Schmitt and Boyd, 1981). At one locality (B8251), some envelopes were not filled by macroquartz and underwent cracking and partial collapse during sediment compaction.

ACKNOWLEDGMENTS

We are grateful for help throughout this project from: Gillian W. Newell who worked closely on all aspects in field and office; Dr. Walter L. Elvers for computer work, drafting, library research, and organization of specimens; Portia Rollings for the photography.

Drs. Xunhong Chen and James Schmitt, then graduate students at the University of Wyoming, provided valuable assistance in both field and laboratory. Many of the specimens were collected during fieldwork supported by National Science Foundation grants EMS 74-12372, DEB 77-01558, and BSR 88-06186.

We thank Drs. Douglas Erwin and Christopher McRoberts for their helpful reviews.

REFERENCES

Beede, J. W.
1907. Invertebrate paleontology of the Upper Permian Red Beds of Oklahoma and the Panhandle of Texas. Univ. Kansas Sci. Bull. 4(3): 115–171.

Boyd, D. W., and N. D. Newell
1972. Taphonomy and diagenesis of a Permian fossil assemblage from Wyoming. J. Paleontol. 46: 1–14.

Brown, T.
1837–1849. Illustrations of the fossil conchology of Great Britain and Ireland: viii and 273.

Chavan, A.
1954. Les *Pleurophorus* et genres voisins. Cah. Geol. 22: 200.
1969. Permophoridae. *In* R. C. Moore (ed.),

Treatise on invertebrate paleontology N(2), Mollusca 6: 543–547. Lawrence: Kansas Univ.

Ciriacks, K. W.
1963. Permian and Eotriassic bivalves of the Middle Rockies. Bull. Am. Mus. Nat. Hist. 125(1): 1–100.

Girty, G. H.
1927. Descriptions of Carboniferous and Triassic fossils. *In* G. R. Mansfield, Geography, geology, and mineral resources of part of southeastern Idaho. U.S. Geol. Surv. Prof. Pap. 152: 453 pp.

Logan, A.
1964. The dentition of the Durham Permian pelecypod *Permophorus costatus* (Brown). Palaeontology. 7(2): 281–285.
1967. The Permian Bivalvia of Northern England. Palaeontogr. Soc. Pub. London 518: 72 pp.

Neumayr, M.
1883. Zur morphologie des bivalvenschlosses. Akad. Wiss., Sitzungsber. 88(1): 1–35.

Newell, N. D., and D. W. Boyd
1995. Pectinoid bivalves of the Permian-Triassic crisis. Bull. Am. Mus. Nat. Hist. 227: 95 pp.

Newell, N. D., and B. Kummel
1942. Lower Eotriassic stratigraphy, western Wyoming and southeastern Idaho. Geol. Soc. Am. Bull. 53: 937–995.

Poel, L. van de
1959. Faune malacologique du Harview. Bull. Inst. Roy. Sci. Nat. Belg. 35(15 & 16): 1–26, 1–28.

Ronchetti, C. R., and A. Allasinaz
1965. Trias in Lombardia, *Curionia,* nuovo genere di lamellibranco heterodonte Triassico. Riv. Ital. Paleontol. 71(2): 351–412.

Schmitt, J. G., and D. W. Boyd
1981. Patterns of silicification in Permian pelecypods and brachiopods from Wyoming. J. Sediment. Petrol. 51: 1297–1308.

Recent issues of the *Novitates* may be purchased from the Museum. Lists of back issues of the *Novitates* and *Bulletin* published during the last five years are available at World Wide Web site http://nimidi.amnh.org. Or address mail orders to: American Museum of Natural History Library, Central Park West at 79th St., New York, NY 10024. TEL: (212) 769-5545. FAX: (212) 769-5009. E-MAIL: scipubs@amnh.org

♾ This paper meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).