

THE LATE PALEOZOIC GASTROPOD *WARTHIA* IN BRAZIL¹

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Reed (1930, p. 42, figs. 5,5a) described a Carboniferous-Permian faunule from Taió, State of Santa Catarina, Brazil, that included two internal molds identified as *Bellerophon?* cf. *micromphalus* (Morris), 1845. Other faunal elements were 14 species of pelecypods and 1 of brachiopods. Although in discussion Reed emphasized the similarity of the Taió fossils to those from New South Wales, Australia, the bellerophonacean is one of but two taxa he tentatively referred to species described originally from Australia. Rocha-Campos recently collected nearly two dozen additional gastropod specimens which permit reconsideration of Reed's identification.

In 1930, considerable uncertainty surrounded biologic placement of *Bellerophon micromphalus*. Several authors considered the species a cephalopod, though subsequently it was placed in *Warthia* Waagen, an assignment now generally accepted (Teichert & Fletcher, 1943, p. 156-158). *Warthia micromphala* is widespread in Australia (Branson, 1948, p. 751) and has been reported from the Agglomeratic Slate of Kashmir (Reed, 1932, p. 69, pl. 12, figs. 12-13, ?14). Although Reed (1932, p. 69) indicated that Kashmir specimens were compared with the type of *W. micromphala* (Morris), neither illustrated specimen shows the wide sinus characteristic of that species. The Kashmir specimens should be critically reexamined to see if they are, in fact, conspecific with *W. micromphala*.

Permian gastropods of New South Wales have been carefully studied by Fletcher (1958) who noted that *Bellerophon undulatus* Dana (1847; figured, 1849, pl. 10, figs. 4a,b), was a junior subjective synonym of *Warthia micromphala* (Morris). We concur in this observation. Dana's specimen has never been illustrated photographically; it is presented here (text-figs. 1a,1b) both for its intrinsic utility and for comparison with Brazilian specimens.

The Brazilian specimens are anomphalous (text-fig. 3) like other *Warthia* species; steinkerns show narrow umbilical cavities (text-fig. 4b). The dorsum is well rounded and follows a relatively narrow arc. The whorl sides are long and nearly vertical in profile, so that the ratio of

height to width is nearly 2 to 1. No growth lines are preserved. One specimen (text-fig. 2) shows an apparently gentle prosocline curve of the outer lip toward the dorsum, though this may be an artifact produced by subsequent iron staining. Another steinkern shows a U-shaped elevation, occupying about half the dorsum, which could have formed if an interruption during growth resulted in shell thickening. The "U" is suggestive of a short slit within a shallowly sinuate aperture, though the evidence is far from conclusive.

The matrix at the Taió outcrops is a fine-grained sandstone. In spite of the relative coarseness of the matrix, fairly fine detail is preserved on associated pelecypods. However, neither external molds nor steinkerns of the gastropods show any indication of spiral ornament, the absence of which distinguishes *Warthia* from the closely related *Euphemiles*. If such ornament were originally present on the gastropods it probably would have been preserved. Comparison of external molds with steinkerns indicates that the shell of the Brazilian *Warthia* was quite thin.

These specimens of *Warthia* have a more rounded dorsum but longer and steeper sides than *W. micromphala*. If the supposed slit in the Brazilian material is as interpreted, it differs markedly from the wide shallow sinus of *W. micromphala*. Of the other two Australian Permian species, *W. perspecta* Fletcher is wider, and *W. stricta* (Dana) as figured by Fletcher, though of similar shape, has a broad shallow sinus. The holotype of the latter species (USNM 3623) does not preserve the growth lines; there is a dorsal flattening that appears to be lacking in the Brazilian form, but the large size difference between the two lots makes comparison of such a subtle feature difficult. *Warthia americana* (Girty) (see Yochelson, 1960, for description and illustration of this and other North American Permian *Warthia*) is another similar species, but it differs in being slightly wider. Other North American species range from still wider to globose.

From the incomplete material available, the Brazilian specimens of *Warthia* cannot be referred with certainty to any described species. Additional material may show this to be a new species; it is clearly distinct from the common Australian species. *Warthia* is known from rocks

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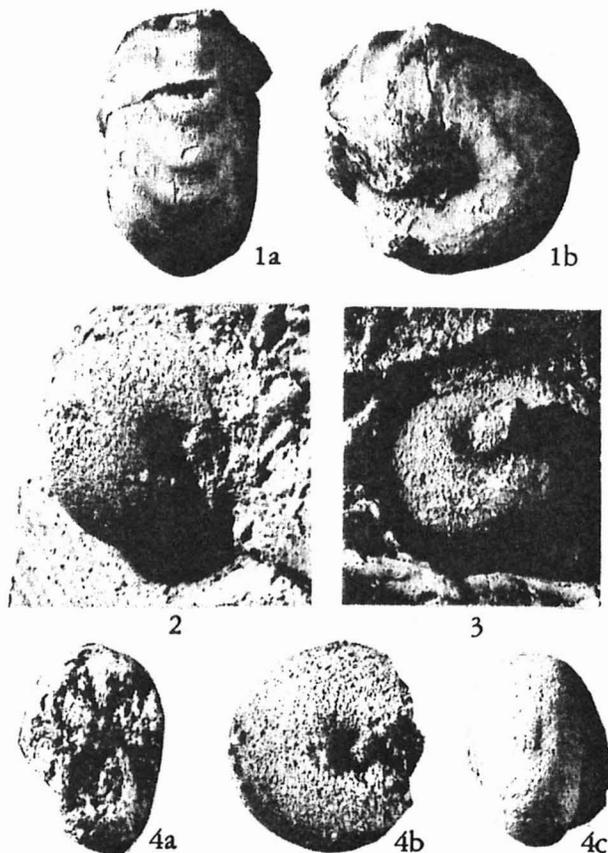
of Late Pennsylvanian (Virgil) age in Kansas but is characteristic of the Permian in both North America and Australia. A Permian age is not in conflict with that determined from the rest of the Taió faunule.

In Santa Catarina, *Warthia* is confined to a 50-cm light-gray marine sandstone just above the middle of the Rio Bonito Formation, Guatá Group. In the area studied by Rocha-Campos, the Rio Bonito is a sequence of about 230 meters of coarse to fine sandstone, bearing *Ctenacanthus* near the base. Rare intercalated siltstone and shale has yielded a *Glossopteris-Gangamopteris* flora. Specimens of *Warthia* occur at all 14 fossiliferous localities investigated by Rocha-Campos during geologic mapping. They are most abundant in a sandstone bench crossing the Taió-Passo Manso secondary road, 2 km N. 45° W. of Taió in a straight line, about 3 km by road.

At none of the outcrops does *Warthia* compose more than 3 percent of the faunule. So far as known, this is the only late Paleozoic gastropod from Santa Catarina. Gastropods are equally rare in the neighboring State of Paraná, though Gordon (1947, p. 4) reports *Euomphalus* in sandstones of the underlying Itararé Group, and Lange (1954) lists four other forms described or reported from the State.

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TEXT-FIG. 1—*Warthia micromphala* (Morris). Holotype of *Bellerophon undulatus* Dana, from the Carboniferous strata of Wollongong Point, Illawarra, New South Wales. USNM 3624. a, Dorsal view, b, left side view, both $\times 1\frac{1}{2}$.

2-4—*Warthia* sp. From near Taió, Brazil, all $\times 3$. 2, Side view of steinkern showing slight curvature of outer edge of aperture. Research Collection, no. 7-1008. 3, Oblique side view of latex impression of external mold, demonstrating that the umbilical areas are anomphalous. R. C. no. 7-1009. 4, Steinkern in a) aperture, b) right side, and c) dorsal views. R. C. no. 7-1010. The last view shows the right side of an elongate parallel-sided ridge, presumed to be the trace of a slit. The three figured specimens are deposited in the Coleção de Pesquisa (Research Collection), Departamento de Geologia e Paleontologia, Faculdade de Filosofia, Ciências e Petras da Universidade de São Paulo, Brazil.

paper is printed with facing pages in Portuguese and English; reference is to the Portuguese text).

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