

A NEW AULOSTEGID (BRACHIOPODA: AULOSTEGOIDEA)
FROM THE LOWER MISSISSIPPIAN OF
NORTHCENTRAL IOWA

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ABSTRACT

Archaiosteges harperi, n. gen. n. sp., is the earliest known representative of the superfamily Aulostegoidea. It occurs in the early Osagean (late Middle or early Upper Tournaisian) Gilmore City Formation ("Humboldt Oolite") of northcentral Iowa. Internal morphology of the dorsal valve permits referral of this genus to the subfamily Echinosteginae of the family Aulostegidae.

Although there is some suggestion of postmortem abrasion, most specimens are well preserved, which indicates moderate predepositional transport. The sedimentary environments of this formation at this locality range from high-intertidal beach deposits to lagoonal infilling, implying that this species probably was adapted to a shallow water environment. There is little evidence that *A. harperi* had an attached mode of live as an adult.

INTRODUCTION

This paper is an addendum to one describing new brachiopod taxa from the Gilmore City Formation (Carter, 1983). In that paper I misidentified a single ventral valve of an enigmatic productid as *Pustula* sp. because I lacked information concerning the dorsal interior (Carter, 1983: table 1). New material from the same locality, including a number of dorsal valves and another small ventral valve, now allows confident identification and description of a new taxon from the Lower Mississippian of North America.

The beds from which the specimens were collected have been assigned variously to the Gilmore City Formation (Woodson and Bunker, 1989:14) or to the "Humboldt Oolite" (Brenckle and Groves, 1987:562). The latter authors have suggested from foraminiferal evidence that these beds are Lower (but not lowest) Osagean in age. Also, Woodson and Bunker (1989:6) point out that the name "Humboldt Oolite" was never formally proposed as a stratigraphic unit. However, its informal usage is succinct and there is some paleontological evidence (Brenckle and Groves, 1987) that these beds are significantly younger than those at the type section of the Gilmore City Formation to the west.

All of the specimens came from the upper part of the section at the well known Hodge's P & M—Martin Marietta Quarry just northeast of the city of Humboldt, Humboldt County, Iowa. These beds may represent a high-intertidal environment (Brenckle and Groves, 1987:563) and backshore beach deposits (Gerk and Levorson, 1982). The entire section at Hodge's Quarry is interpreted by Glenister and Sixt (1982:9) as a single shallowing upward sequence, culminating in evaporitic collapse breccias.

At least some of the productid specimens described here were recovered from the backshore beach coquinas discussed by Gerk and Levorson (1982). Most of the specimens give some indication of abrasion or even decortication but the

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preservation is generally good. In any case, it is very unlikely that any of the specimens were found in life position.

Brunton and Mundy (1988) suggested that, in general, aulostegoideans were adapted to an attached mode of life. However, no mode of attachment is ascertainable for this new species and a *modus vivendi* is not obvious. A cicatrix is not preserved and was probably not present on either of the two ventral valves available for study, and creeping adherent spines also seem to be lacking. The preserved spines are directed toward all of the margins.

Furthermore, there is no indication of a hard substrate for an attachment site in these Humboldt oolite sediments. The most likely possibilities for a hard substrate here are probably 1) bioherms, 2) large clasts, or 3) hardgrounds. Lower Carboniferous bioherms in North America are restricted to the carbonate shelf edge (Lane, 1982), which occurs far from this part of Iowa. The largest clasts at this locality in the Gilmore City Formation are biogenic and consist of rare large mobile snails (Harper, 1977), solitary corals (Carlson, 1964), and a few medium-sized brachiopods (Carter, 1983). It seems unlikely that this new genus would have been attached to any of these organisms. Hardgrounds are evidence of a sedimentary stillstand, for which there is no documentation in this part of the Gilmore City sedimentary sequence, although one may have been formed after the topmost evaporitic beds were deposited and before the collapse breccias were formed. Therefore, it is possible that this genus was attached only in its juvenile stage and lived freely as an adult.

SYSTEMATIC PALEONTOLOGY

The specimens described herein are deposited in The Carnegie Museum of Natural History (CM), Section of Invertebrate Paleontology. The suprageneric classification used here follows that of Cooper and Grant (1975).

Order Strophomenida Öpik, 1934

Suborder Productidina Waagen, 1883

Superfamily Aulostegoidea Muir-Wood and Cooper, 1960

Family Aulostegidae Muir-Wood and Cooper, 1960

Subfamily Echinosteginae Muir-Wood and Cooper, 1960

Genus *Archaiosteges*, new genus

Type species.—*Archaiosteges harperi* n. sp.

Etymology.—From the Greek *archaios*, primitive, and *steges*, room (masculine).

Species assigned.—Type species only.

Diagnosis.—Small to medium-sized geniculate Echinosteginae with moderately developed trails and moderately thin body cavity; outline subquadrate; ears weakly produced; ventral interarea moderately short, apsacline; dorsal interarea short, anacline; elytridium not preserved, possibly absent; ventral valve ornament of concentric rugae and spine-bearing tubercles only; spines of one size only, probably suberect; dorsal interior with large quadrilobate cardinal process; marginal rim well developed.

Description.—Same as for the type species given below.

Age.—Lower Osagean (late Middle or early Upper Tournaisian).

Comparisons.—This new genus is not closely similar to any described genus of the Echinosteginae. It is most similar to the genera *Echinosteges* Muir-Wood and Cooper, 1960, and *Edriosteges* Muir-Wood and Cooper, 1960, both of Permian age. *Archaiosteges* differs from both of these genera in having a dorsal interarea,

a geniculate ventral valve, a modestly raised dorsal adductor platform, and in lacking a gutterlike flange around the ventral trail. In addition, it differs from *Echinosteges* in lacking a plicated trail. It also can be distinguished from *Edriosteges* in having a tuberculate rugose ornament.

Remarks.—Affinities of this new genus with the subfamily Echinosteginae are clearly indicated by the presence of a lophidium, quadrate cardinal process, non-spinose dimpled dorsal valve, and strongly dendritic posterior dorsal adductors raised on a low platform. It differs from all other members of this subfamily in having a short dorsal interarea, which is also well illustrated in the aulosteginine genus *Taeniothaerus* Whitehouse (Muir-Wood and Cooper, 1960: plate 11). Other workers (Cooper and Grant, 1975, and Brunton and Mundy, 1988) have suggested that a dorsal interarea was lacking in this superfamily. The presence of a dorsal interarea in two genera of this superfamily strengthens Cooper and Grant's (1975) assertion that the Aulostegoidea were derived from the Strophalosioidea, a group characterized by interareas in both valves.

The appearance of *Archaiosteges* in the late Middle or early Upper Tournaisian substantially extends the range of the superfamily Aulostegoidea. Previously, the earliest aulostegoideans were known only from the family Sinuatellidae (Brunton and Mundy, 1988) of Late Visean age. Extension of the ranges of the family Aulostegidae and subfamily Echinosteginae is even greater. The oldest previously known aulostegid, the echinosteginine genus *Limbella* Stehli, first appears in the latest Carboniferous (Virgilian) Gaptank Formation in West Texas.

Archaiosteges harperi, new species
(Fig. 1A–K)

v. 1983 *Pustula* sp., Carter, p. 60.

Holotype.—CM 34953, a large ventral valve from SL 612. Collected by Dr. John A. Harper.

Paratypes.—CM 34954–34958, a small ventral valve and four dorsal valves, all from the same locality as the holotype. All collected by Arthur Gerk of Mason City, Iowa.

Type locality.—SL 612. All of the specimens were collected from one or more of the several coquina beds that occur at various levels within the former west pit (now merged with the former east pit) at the former Hodge's P & M Quarry, Humboldt Co., Iowa (Center Sec. 32, T92N, R28W). This quarry is now owned by the Martin Marietta Corporation and has been greatly expanded. The highly fossiliferous coquinas have all been removed by recent quarrying activities and good fossil collecting is no longer possible (Arthur Gerk, personal communication, December 1990).

Referred material.—Several dorsal valves in the collections of the University of Iowa, Iowa City, also collected by Arthur Gerk from the type locality.

Description.—Ventral valve irregularly subquadrate in outline with straight hingeline; greatest width attained near midlength; visceral disc weakly convex, sloping gently toward margins; trail moderately geniculated, bent nearly normal to plane of visceral disc, and about as long; ears poorly produced, distinguished only by weakly concave flexures; venter slightly flattened but sulcus not developed; ventral interarea moderately short, flattened, strongly apsacline, teeth lacking; elytridium not observed; cicatrix apparently lacking; ornament consisting of numerous irregular rugae which extend onto at least part of trail, and numerous,

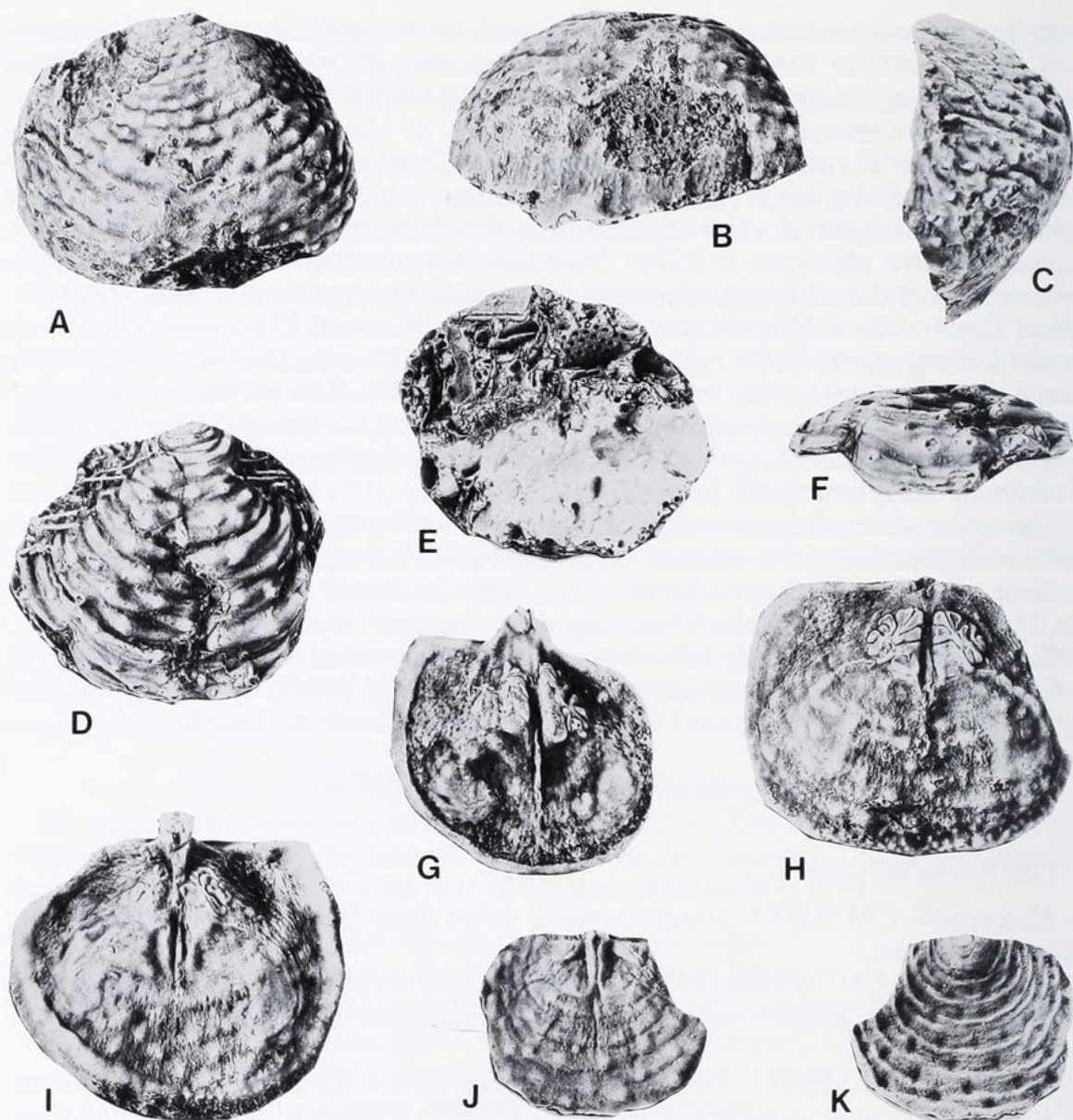


Fig. 1A-K.—*Archaiosteges harperi* n. gen., n. sp. A-C, ventral, anterior and lateral views of the holotype, a large ventral valve, CM 34953, $\times 2$; D-F, ventral, dorsal and anterior views of a small ventral valve paratype, CM 34954, $\times 3$ (note the posterolaterally and laterally directed spines); G-I, three large dorsal valve interiors, paratypes, CM 34955-34957, all $\times 2$; J, K, dorsal and ventral views of a small dorsal valve paratype, CM 34958, $\times 3$.

almost regularly spaced, spine-bearing tubercles; spines of one size, rather fine, directed towards all margins; interior not observed.

Dorsal valve with flattened visceral disc and sharply geniculate short trail; ears weakly delineated by slightly convex flexures; dorsal interarea invariably present, short and anacline, extending full width of hingeline; ornament of rugae and numerous dimples only; spines lacking; interior with large thick cardinal process with quadrilobate myophore and moderately extended shaft in adults; juveniles with erect bilobed cardinal process; lophidium moderately produced; alveolus shallow, accessory muscle scars not observed; median septum obscured by muscle

platform posteriorly, appearing as brevisseptum anterior to adductor muscle scars and extending forward about two-thirds length of visceral disc; adductor scars moderately raised on low platform; posterior pair strongly dendritic, anterior pair smooth; brachial ridges given off parallel to hingeline just anterior to adductor muscle platform, lobes extending forward almost to marginal rim; lateral ridges parallel to hingeline, merging with distinct marginal rim that surrounds visceral disc; endospines not observed.

Distinguishing characters.—See generic diagnosis above.

Comparisons.—There are no similar Lower Mississippian species described in North America.

Age.—Late Middle or early Upper Tournaisian or Lower Osagian.

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