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SHELL BORINGS IN PERMIAN BRACHIOPODS FROM SOUTHEASTERN ALASKA

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Abstract—Shell borings in brachiopods are uncommon in the Permian. Two specimens are illustrated from an unnamed carbonate unit in southeastern Alaska. Two cylindrical boreholes are probably due to predators or parasitic organisms, while one horizontal excavation may have been formed by sponges or an unknown organism. The brachiopods occur in a cool-water, cherty carbonate with abundant sponge spicules.

INTRODUCTION

Predatory boreholes in brachiopods are known from throughout the Paleozoic but are variable in abundance and rare in the Permian (Kowalewski et al., 1998). Hoffmeister et al. (2004) examined 7597 specimens from the extensive Permian Glass Mountains (West Texas) collections of G.A. Cooper and R.E. Grant at the National Museum of Natural History and observed only 1.07 percent of the brachiopods were drilled. The less abundant Alaskan brachiopods are drilled with about the same frequency, but many of the shells are fragmentary.

Silicified brachiopods occur in a coastal outcrop section of an unnamed Permian limestone on Suemez Island (56°16.1' N, 133° 13.8' W) in the Alexander terrane in southeastern Alaska, Craig B-4 USGS quadrangle (Fig. 1). The first mention of the unit appears in Buddington and Chapin (1929), but Eberlein and Churkin (1970) did not include it on their map. Karl et al. (2010) correlated it to the Pybus Formation, 200 km to the north. The Permian unit is a slightly-folded, blue to gray limestone with cool-water origins that has undergone pervasive silicification. Macrofossils include bryozoans, echinoderms, brachiopods, solitary corals, and siliceous sponges, but warm-water components such as ooids, oncoids, peloids, green algae, and calcareous sponges are absent. Such microfacies are associated with cool-water (less than 20° C) carbonates (Beauchamp and Desrochers, 1994; Flügel, 2004).

The bedding in the unit may indicate seasonal storm events, where macrofossils are concentrated in beds with a chaotic orientation and a possible mixing zone of both siliceous and carbonate materials from the shelf slope (May, 2016). Illustrated specimens are deposited in the UAMES University of Alaska Museum Earth Sciences Collection.

FIGURE 1. Brachiopod specimens are from an unnamed Permian limestone unit exposed along the shoreline on eastern Suemez Island (arrow) in southeastern Alaska.

DESCRIPTION

Several hundred complete and fragmentary silicified brachiopods were collected by Mitchell May in July, 2015, and they were etched in hydrochloric acid. Circular, cylindrical boreholes occur in only two of the brachiopods. The specimens are disarticulated valves of an athyridid, probably *Pinegathyris* and the spiriferoid genus *Spiriferella,* and are 354 and 324 ft, respectively, above the base of the unit. The Permian brachiopod fauna from Suemez Island is typical for the high-latitude Permian Boreal (or "Arctic Permian") fauna (Blodgett and Boucot, 2012). The holes are untapered, normal to the surface of the shell and 2.5 mm in diameter. The inside of the athyridid shell is filled with matrix, and the interior surface is not exposed. The borehole in *Spiriferella* (Fig. 2D-F) is near the beak and penetrates the interior just adjacent to the hinge line.

The drilled athyridid brachiopod (Fig. 2A-C) shell also displays sinuous, branching, horizontal excavations of uncertain origin. The excavations vary from 0.5 to 1.0 mm in width and are about 0.5 mm deep. The trough-like excavations are flat-bottomed and wider at the bottom than top. They are branching and may have formed a rosette pattern, but the shell is broken at that point. Teichert (1945) noted that if the borings are in the form of straight or curved tubes they are probably of worms, while more irregular excavations are thought to be due to boring sponges. Permian borings on brachiopod and bivalve shells illustrated by Teichert (1945) are tubular, smaller and more abundant. Furlong and McRoberts (2014) concluded that the simple differentiation between sponge and worm borings by Teichert (1945) is not valid for all ichnotaxa, and they reviewed the previous confusing nomenclature using examples from the Devonian of New York.

CONCLUSIONS

The two cylindrical boreholes may be due to predators or parasites. The presence of only a single hole penetrating each shell, and the location on the spririferid near the hinge line, suggests predators (see Boucot, 1981, for examples). Since the shells are disarticulated, it is not known if the holes penetrated both valves. Cenozoic boreholes are mostly made by predaceous gastropods (naticids or muricids), but none are known in the Paleozoic. Platyceratid gastropods drilled during the Paleozoic (Baumiller and Gahn, 2002), but none were observed in the Alaskan Permian unit.

The single set of horizontal excavations differs from the Devonian forms of Furlong and McRoberts (2014), but appears to be closest to *Clionoides* Fenton and Fenton, 1932. The boring occurs within the early growth margins of the shell, suggesting a commensal relationship. The origin of the boring is uncertain, although sponges were abundant in the Permian formation.

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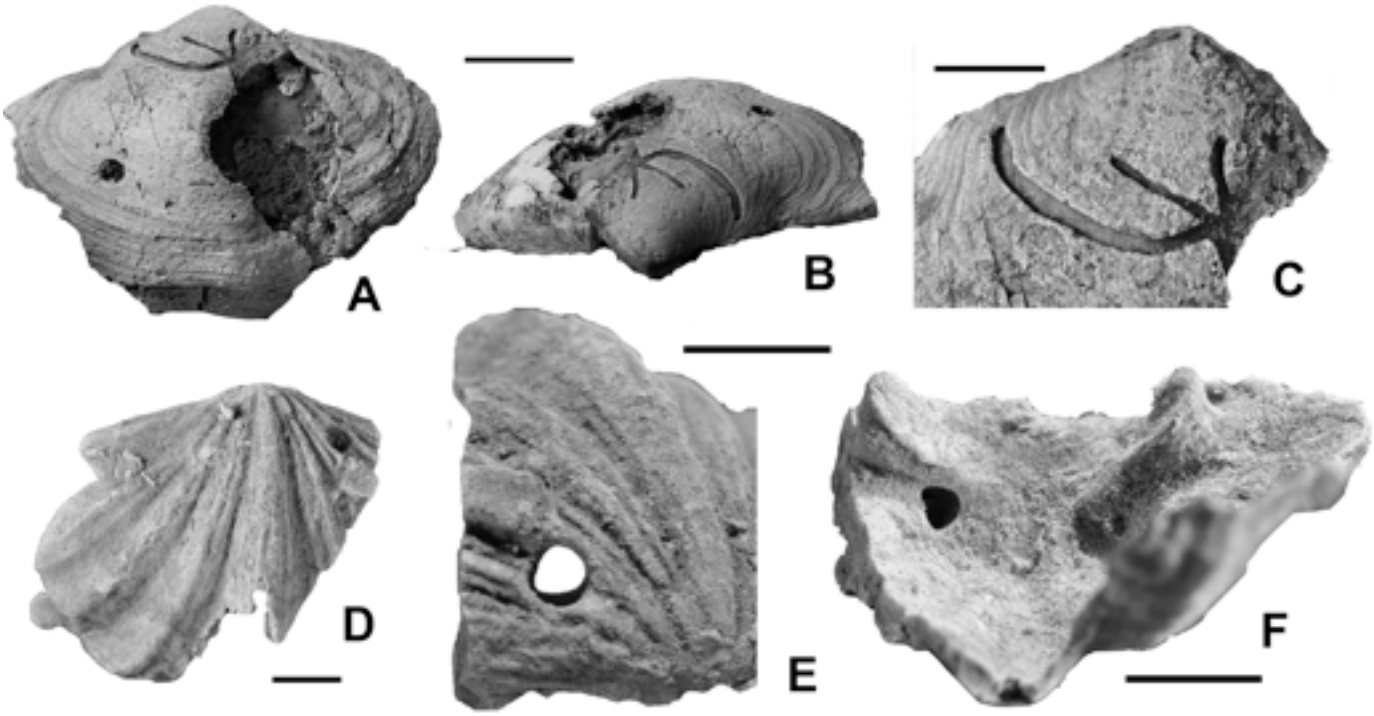

FIGURE 2. **A-C**, athyridid brachiopod, probably *Pinegathyris* UAMES 38062: **A**, exterior with two types of traces, fine lineations on the shell are post-depositional cracks, bar scale is 1 cm; **B**, side view with circular and horizontal borings, scale bar is 1 cm.; **C**, detail of boring, bar scale is 5 mm. **D-F**, *Spiriferella* UAMES 38063; **D**, exterior with cylindrical boring; **E**, detail of borehole on exterior; and **F**, slightly oblique detail of shell interior with borehole near hinge. Bar scales are 5 mm.

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