Is half enough? The validity of using single valves in studies of predation on brachiopods

SE Mendonca[a], MJ Pruden[a], and LR Leighton[a]

[a] *Earth and Atmospheric Sciences, University of Alberta, AB, Canada*

Predation on brachiopods in the Paleozoic can be studied using repair scars, which are formed when a brachiopod is attacked by a predator but survives to repair its shell (valve). Repair frequency (the proportion of scarred individuals out of total individuals in the assemblage) has been shown to be a proxy for predation pressure in living systems. Traditionally, in calculating these repair frequencies, both valves of the brachiopod are required because the valves are not symmetrical and predators therefore may prefer specific valves because of the relative strength of the valve or position of the internal organs relative to the valve. This would result in higher repair frequencies on the preferred valve and result in different apparent rates for the same assemblage.

There are many scenarios such as disarticulation, encrustation, spalling, sediment filling, and slab preservation in which only one valve can be observed. This leads to an underrepresentation in predation studies of specific brachiopod species and paleoenvironments that encourage these types of preservation. This study tests whether it is possible to use single valve samples in predation studies on brachiopods by using articulated specimens (both valves) but comparing the repair rates of the individual valves (pedicle vs brachial). The study examines 15 species from 10 units spanning the Ordovician to the Permian. If there is little variation in repair rates between valves or if valve preference is constant through time, single valves alone may be used to generate reliable repair rates.

This study found that the majority of repair frequencies on biconvex taxa varied little between valves, regardless of time or taxon, supporting that single valves can be used in repair scar studies of biconvex brachiopods. This study also found that, except for a single species, using the more convex valve of concavo-convex taxa can provide accurate repair rates. The exception in the Ordovician samples provided accurate repair frequencies on the concave valve instead. This may suggest a shift in predation strategies occurring between the Ordovician and the Devonian. However, even with this exception, regardless of which valves are used, the rank order of the samples' repair frequencies did not change between using convex single valves or both valves (Spearman's rho = 0.98, $p << 0.001$).

Corresponding author: smendonc@ualberta.ca