Hydrodynamics and Feeding Posture in the Ordovician Paracrinoid Platycystites
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Paracrinoids are a small group of Middle to Late Ordovician sessile benthic echinoderms. Although temporally and geographically restricted, they could be locally abundant in relatively shallow, largely suspension feeding communities. Paracrinoids are characterized by aberrant morphologies (relative to other echinoderms), such as asymmetric placement of the stem and the mouth and dramatic shifts through the clade in terms of ambulacral symmetry. At the extreme, several genera including Platycystites have a narrow body with a reduced ambulacral system consisting of two ambulacra with brachioles (feeding appendages) arising from the top edge of the theca. Complete individuals are rarely preserved, and hence the feeding posture and functional morphology of the group is poorly known. To better understand the role of paracrinoids within Ordovician ecosystems and explore how feeding performance varied in concert with morphological changes, we constructed 3-D digital models of the paracrinoid Platycystites and used these in computer simulations of water flow. Keeping all other aspects of the theca consistent, we constructed four models that varied in the posture of the stem (straight versus curved) and the brachioles (splayed versus straight). We then examined how these models functioned in unidirectional currents perpendicular and parallel to the long axis of the body.

Our results suggest that an orientation parallel to the current was optimal for drag reduction in Platycystites. Moreover, this posture slowed flow velocity near the brachioles, which would have enabled more effective feeding on particles suspended in water. The posture of the stem had little to no effect on fluid flow surrounding the feeding structures. However, the posture of the brachioles did have an impact on flow patterns; models with straight brachioles dramatically slowed water on the upcurrent brachioles, producing an eddy that recirculated water on the downcurrent brachioles. Overall, recirculation was more uniformly distributed, thereby maximizing particle capture, in the model with straight brachioles oriented parallel to fluid flow. Based on the success of this method, we will explore how feeding posture changed with shifting morphology within this aberrant clade by constructing additional models of other paracrinoid species.