THE TROPHIC CONTROL ON THE FUNCTION OF THE AULACOCERATID AND BELEMNOID GUARD AND PHRAGMOCONE

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The basic shape of the guard and phragmocone of aulacoceratids and belemnoids did not change for nearly 290 million years from the Upper Devonian to the end of the Cretaceous, showing the high efficiency of this combined buoy-ballast structure. It was suggested to balance the body. Calculations showed that the phragmocone balanced the gaurd (rostrum) in horizontally swimming belemnoids (Monks et al., 1996). However, the advantage of the buoy-ballast structure at the posterior end of the body was not clarified. Whereas the rostrum has a certain weight, the change in liquid content within the phragmocone enables it to change the relative weight of the posterior part of the body. This adjustable posterior ballast must have balanced a change in weight in the frontal part for maintaining a horizontal orientation while swimming.

Calcareous skeletal fragments in the stomach content of ammonoids and extant cephalopods (Jäger and Fraaye, 1997) may hint that the aulacoceratids and belemnoids likewise swallowed the whole prey on its crushed skeletal fragments. It is suggested that the rostrum-phragmocone coupled structure balanced the accumulated weight of the skeletal fragments in the stomach in the anterior part of the body. This enabled it to rapidly swallow great quantities of prey till the accumulated skeletal fragments had to be emitted. It also balanced the horizontally swimming creature while in its arms it was holding a prey which comprised of a heavy exoskeleton. The calcareous and chitinous rostrum of the Upper Paleozoic aulacoceratids became completely calcified (hence heavier) in the Mesozoic belemnoids, suggesting that the latter enriched their diet with prey comprising calcareous skeletons. The evolutionary diversification and increase in abundance of the Boreal belemnoids is associated with the appearance of the calcareous opercular aptychi in Late Liassic ammonoids in the same province. Since ammonoids consumed smaller ones (e.g. Jäger and Fraaye, 1997), belemnoids may have preyed upon ammonoids as well. This kind of food became scarce in latest Cretaceous times and disappeared in the Early Cenozoic. The belemnoids (or ancestral sepiids) had to change their diet to prey with a low (or no) content of calcareous components. The balancing function of the rostrum and phragmocone became useless with this new diet, and their disadvantageous presence in the posterior part of the body had to be eliminated. The Early Tertiary descendants of the belemnoids rapidly reduced the size and weight of the rostrum, and changed the shape of the phragmocone in two trends, as exhibited by the extant *Spirula* and *Sepia.* The bullet-like elongated shape of the rostrum and its pointed end provided secondary means of protection, and enabled the attachment of the muscles of the fins (Monks et al., 1996).

Jäger, M., and Fraaye, R., 1997. The diet of the Early Toarcian ammonite *Harpoceras falciferum.* Palaeontol. 40, 557-574.

Monks, N., Hardwick, D., and Gale, A.S., 1996. The function of the belemnite guard. Paläont. Z. 70, 425-431.