STATOLITH SHAPE AS AN INDICATOR OF THE LIFE STYLE IN RECENT AND EXTINCT DECAPOD CEPHALOPODS

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Squids and sepioids are decapod cephalopods having the unique jet propulsive locomotion which is characterized by a rhythmic change of linear acceleration. We have found that under acceleration, the statolith (gravity stone) may deviate around the three mutually perpendicular axes running through its rotation center and therefore may induce endolymph flows within the cavity of the equilibrium organs (statocysts). This finding re-considers the theory of the statocyst function in decapods. As the statoliths play an important role in detection of various types of accelerations, their general morphology is different in pelagic and demersal decapods (Fig.1). Pelagic squids (both nektonic and planktonic species) live in an environment without physical obstacles, and therefore have mainly 'rocket-like' movement. Demersal sepioids and near-bottom squids either have to land on or to take off from the bottom, and negotiate bottom obstacles. Peculiarities in the statolith shape and size of demersal decapods (their relative total statolith length is considerably greater than that of pelagic species) make their statoliths more movable around the transversal axis than those of pelagic squids. Such a mobility provides a greater sensitivity to accelerations of the animal during both gliding and pitching. The oar-like rostrum of the demersal decapod statolith provides a greater sensitivity during rolling at low accelerations. Distinct separation of the statolith body into dorsal and lateral domes provides separation of endolymph flows in the corresponding channels during pitching and yaw, respectively. Thus, peculiarities of the statolith shape in demersal decapods give them greater sensitivity to low angular accelerations in all possible planes compared to those of pelagic species. Peculiarities of the statolith shape in pelagic species (especially long and wide wing achieving the rostrum tip and short sharpened rostrum) make these statoliths hardly movable around both longitudinal and transversal axes that considerably diminish the sensitivity of these animals to angular accelerations in pitching and rolling planes. In pelagic squids, the statolith monitors mainly the strength and frequency of jet propulsions during linear movement. Thus, our findings make it possible to re-construct the life style and movement patterns of recent and (most important) extinct decapods using statolith shape features, and to re-consider evolutionary connections between different decapod groups.

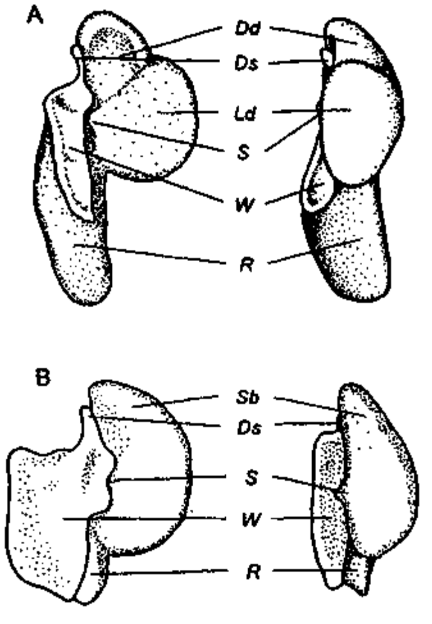

Fig.1. Statoliths of the near-bottom squid *Berryteuthis magister* (A) and pelagic squid *Moroteuthis robusta* (B). Lateral (left) and anterior (right) views. Dorsal (Dd) and lateral (Ld) domes, dorsal spur (Ds), statolith body (Sb), spur (S), wing (W) and rostrum (R).