THE ADAPTIVE VALUE OF HETEROMORPHY IN AMMONOID CEPHALOPODS (Invited Presentation)

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Heteromorph ammonoids are characterized by their unique modes of conch coiling that deviate from "typical" planispiral forms. Some morphologies are quite bizarre, obscuring their modes of life and ecology. These seemingly aberrant forms have even been used as examples of typolysis (pre-programmed degeneration) by early researchers. While the concept of typolysis is no longer accepted, the adaptive value of many heteromorphs has remained elusive. However, recent advances in computer modeling, simulation, and model fabrication provide new context for the functional morphology of heteromorphs. A broad range of examined morphotypes have the capacity for neutral buoyancy (or nearly so). Hydrostatic simulations demonstrate that most heteromorphs were more stable than extant *Nautilus* (a frequently used, but imperfect modern analogue to ammonoids). Under these conditions, the static orientation assumed by living heteromorphs would have been somewhat fixed, which strongly influences interactions with their surroundings and the directional efficiency of propulsive locomotion. Many heteromorphs (e.g., nostoceratids, scaphitids, ancyloceratids, and others) exhibit a final stage of coiling that resembles a U-shaped hook. This common adult modification consistently produces upward-facing postures and increased hydrostatic stability while simultaneously aligning the thrust direction for efficient horizontal movement at maturity. Furthermore, certain modes of coiling (e.g., helical; vermiconic) improve rotational capabilities about the vertical axis. Most heteromorphs are poorly streamlined, suggesting they were not well suited for rapid movement (with a few exceptions, like orthocones). Instead, hydrostatics were likely primary selective drivers behind these bizarre conch morphologies, which manage or change certain physical properties throughout ontogeny.