

IMPACT OF REPRODUCTIVE STRATEGY ON CEPHALOPOD EVOLUTION

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Ammonoid "mean total diversity" is roughly 4 to 5 times greater than for nautiloids. Approximately 212 ammonoid families evolved during ~330 million years, corresponding to an average of 0.64 family-level originations per million years. For "nautiloids" (all non-ammonoids and non-coleoids), there were 83 families during >500 m.y., which is about 0.17 originations/m.y.; using a more contemporary Nautiloidea taxonomic concept, 57 nautiloid families evolved during ~475 m.y., which corresponds to 0.12 family-level originations/m.y. Thus, the ammonoids were by far the most rapidly evolving and species-rich of cephalopod groups in the fossil record, and the cause of that disparity has puzzled paleontologists for years.

One possible solution to the mystery of cephalopod diversity is that taxa in clades characterized by short stratigraphic ranges and high total diversity had a semelparous reproductive strategy (parental mortality follows mass spawning event), whereas taxa in clades with long stratigraphic ranges and low total diversity had an iteroparous reproductive strategy (repeated, isolated breeding events). It has been noted that r-selected species tend to be semelparous, with little parental care provided for the many offspring that are of relatively small size at birth/hatching; conversely, K-selected species tend to be iteroparous and some degree of parental care is commonly provided for the few, relatively large offspring. Although the correlation between reproductive strategy and r versus K population dynamics is not without exception, it has been hypothesized that the size of the cephalopod embryo correlates with reproductive strategy, small embryos indicating semelparity and large embryos indicating iteroparity.

Preliminary results from the Carboniferous of the southern mid-continent, USA, support these hypotheses. The ammonoid taxa studied include 7 reticuloceratid, gastrioceratid, and schistoceratid species; nautiloid taxa include the orthoconic *Reticycloceras croneisi* and the planispiral *Aphelaeceras arkansanum*. Specimens were collected from Upper Mississippian (Chesterian) and Lower Pennsylvanian (Morrowan) units of northern Arkansas. Lithologies are diverse and include concretionary black shales and high energy, calcareous, conglomeratic sandstones. These cephalopod occurrences have been interpreted previously as reflecting mass mortality of populations of sexually mature individuals, possibly as a result of reproduction. Representative specimens were sectioned longitudinally and ground carefully in order to observe the maximum dimension. Mean ammonitella diameter was very similar within families (approximately 0.8 mm), and little variation was seen within species (s.d. <0.05 mm); nautas were typically 3 to 5 times larger than ammonitellas. These results are consistent with data from at least some extant semelparous and iteroparous cephalopods (e.g., *Loligo pealei* and *Nautilus pompilius*, respectively) but are in marked contrast with some recently published accounts of Cretaceous Lytoceratina species (e.g., *Tetragonites glabrus*).

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