USE OF EMBRYONIC CHARACTERS TO INVESTIGATE THE PHYLOGENY OF THE AMMONOIDEA

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Study of the embryonic features of ammonoids reveals a number of characters that are useful in phylogenetic analysis. The initial chamber of ammonoids varies in shape from globular (e.g., in the Agoniatitina) to spindle-shaped (e.g., in the Ammonitina). In ammonoids with a globular initial chamber, the succeeding whorls are loosely coiled or even straight, whereas in ammonoids with a spindle-shaped initial chamber, the succeeding whorls are tightly coiled. The distal end of the initial chamber is marked by either an abrupt narrowing of the shell (e.g., in the Bactritina) or a flattening along the venter (e.g., in the Ammonitina). In most ammonoids, the primary constriction appears as a groove in the shell wall, which is especially well expressed on the venter, although in the Bactritina, it appears as a gradual narrowing of the shell followed by a widening. In general, the diameter of the ammonitella (or length in straight ammonitellas) ranges from 0.5 to 1.5 mm except in the Agoniatitina (1.5-2.6 mm), Goniatitina (0.6-2.3 mm), and Lytoceratina (0.8-1.9 mm). The diameter of the initial chamber ranges from 0.25 to 1.60 mm, with most values occurring between 0.25 and 0.75 mm. The ammonitella angle ranges from a minimum of 240° in some Ceratitina and Ammonitina to a maximum of 410° in some Goniatitina. The surface of the ammonitella is either smooth (e.g., in the Gephuroceratina) or covered with a micro-ornamentation consisting of either lirae (e.g., in the Agoniatitina and Tornoceratina) or tubercles (e.g., in the Lytoceratina, Phylloceratina, Ammonitina, and Ancyloceratina). The wall of the ammonitella is constructed of several prismatic layers although the variation in microstructure among suborders has not yet been well established. The most marked change in microstructure occurs at the primary constriction where a large pad of nacre develops on the inside of the shell wall. The prosuture varies in shape from asellate (e.g., in the Agoniatitina) to latisellate (e.g., in the Ceratitina) to angustisellate (e.g., in the Ammonitina). The second suture (primary suture) varies in complexity and attains as many as six lobes in some Lytoceratina. The caecum varies in shape in median cross-section from elliptical (e.g., in the Ancyloceratina) to hemicircular (e.g., in the Lytoceratina) to rectangular (e.g., in the Prolecanitina). In most ammonoids, the prosiphon is short and curved but it is long and straight in most Ammonitina and Ancyloceratina. The initial position of the siphuncle varies from marginal to central. The use of the above data in a phylogenetic analysis helps clarify some of the relationships among ammonoid suborders that have previously been difficult to resolve.