PITS IN INTERNAL MOLDS OF CEPHALOPODS

Davis, Richard A. [1], Mapes, Royal H. [2]

[1]College of Mount St. Joseph, Cincinnati, Ohio, USA. r_a_davis@mail.msj.edu; [2]Department of Geological Sciences, Ohio University, Athens, Ohio, 45701, USA. mapes@oak.cats.ohiou.edu

House, in 1960, described a number of Devonian ammonoids from the Emsian, Eifelian, and Givetian of the United Kingdom, North Africa, and Germany that have more-or-less regularly arranged pits in the internal molds. In 1983, Chlupác and Turek reported similar pits also in Devonian anarcestines, but from what then was called Czechoslovakia. We have observed comparable pits in some ammonoids and in a bactritoid from the Devonian of Morocco. In addition, we have observed pits in a bactritoid and in some goniatites from the Carboniferous. House concluded that the pits are the result of pearl-like mounds that formed on the interior surface of the body-chamber of the ammonoid in life. He attributed the pearl-like mounds to pathologic responses to foreign particles that entered between the body of the cephalopod and the conch and that the particles apparently were restricted in their adapical movement by an unknown soft-part structure, which also resulted in the configuration of the mounds (and, hence, of the pits). The individual pits in the Devonian ammonoids are somewhat similar to those in the internal molds of Toarcian (Early Jurassic) ammonoids of Germany attributed to pearl formation by Keupp (1986).

Other pits in internal molds of ammonoid cephalopods have been reported. Some of these seem to be normal features of the taxa involved (for example, the lateral pits in *Agathiceras suessi* from the Permian, those in *Dunbarites rectilateralis* from the Carboniferous, and those in adolescent individuals of the Permian genus *Popanoceras*). Davis (1972) described and figured small pits that occur in the internal molds of some mature representatives of the Permian genera *Adrianites*, *Texoceras*, and *Waagenoceras*.

As House and Chlupác & Turek clearly recognized, not all pits in the internal molds of cephalopods are the same. Interpretational evidence includes: the number, size, shape, and arrangement of the pits; the distribution of the pits with respect to one another and to the peristome, sutures, growth-lines, umbilicus, venter, plane of symmetry, and other features of the conch; the relationship of the pits to the ontogeny of the cephalopod; the presence and frequency of occurrence both within and among cephalopod taxa; the configuration of each pit with respect to the adjacent portions of the internal mold and to the overlying shell-wall, if preserved; and geologic and stratigraphic occurrence.

On the basis of analysis of a collection of some 20,000 hematite and calcite internal-molds of Lower through Upper Devonian cephalopods (mostly ammonoids) from Morocco, we conclude that biological pitting in internal molds is relatively uncommon in all units, with less than one percent of the specimens showing these features. However, some units in the Devonian of Morocco have yielded significantly more specimens with such pitting than have others. We agree with House that the pits were formed by pearl-like mounds on the inner surface of the conch. However, we conclude that some of these mounds are the product of parasite infestations and subsequent irritation of the mantle of the cephalopod during life. Different parasites seem to have produced different sizes, shapes, and arrangements of mound-structures, which vary among taxa of cephalopods and among specimens within a given taxon.