

THE BIOGEOGRAPHIC NATURE OF PALEOZOIC NAUTILOID CEPHALOPODS

CRICK, Rex E., Department of Geology, The University of Texas at Arlington, Arlington, TX 76019

The historical and prevailing view regarding the distribution of nautiloid cephalopods is one of cosmopolitanism. There are several objections to such a sweeping view of this major group of marine invertebrates, but only the most significant are addressed here. First, unlike endemism, there is no clear agreement on the meaning of the term cosmopolitanism as used in biogeography. It is thus extremely difficult to gain a historical perspective without access to original data. I have found the term used for as few as four occurrences on four modern landmasses without reference to the paleogeographic relationships of these landmasses. Second, while a few nautiloid groups did compile impressive dispersal statistics, the fossil record clearly reveals that such periods of dispersal were generally brief in geological terms and that the group or groups involved did not colonize all available landmasses. Third, nautiloids were incapable of developing cosmopolitan distributions unless climatic constraints were removed by changes in the global system or by positioning all landmasses within the sub-tropical to tropical latitudes. Since there is no convincing evidence that either event occurred during the 520 million years of nautiloid evolution, it is perhaps more appropriate to view the distribution of nautiloids in terms of the number of landmasses colonized relative to the number of landmasses available for colonization. For nautiloids, the number of landmasses available for colonization was always fewer than the number of landmasses comprising the global paleogeography during any one slice of geologic time. Nautiloid genera restricted to one landmass are considered endemic, a condition exhibited by 65% of the Ordovician and Silurian genera and 81% of the Devonian genera. The maximum number of landmasses colonized by any one nautiloid genus for any one particular period of time was four, two fewer than the six available landmasses.

The basic biogeographic unit for nautiloid cephalopods is the genus. This is so because the dispersive potential of nautiloids was low when compared with true pelagic groups such as conodonts. Thus for nautiloid groups capable of dispersal among landmasses, the time needed to effect dispersal and insure permanence in the stratigraphic record was something greater than the longevity of the typical nautiloid species but less than the longevity of most genera. It seems reasonable that the best chance for the occurrence of cosmopolitan nautiloid genera would be at or near the zenith of those groups with attributes most suitable for dispersal. However, the fossil record for nautiloids shows that such periods rarely coincide with the peak intervals of total nautiloid diversity for the Lower and Middle Paleozoic (Arenig, Wenlock and Eifelian) occurring instead during succeeding intervals of time. Such events are generally confined to periods of modal diversity within each group. The lowest percentages of endemic genera and the intervals in which they occurred for the major nautiloid groups are: Ellesmerocerida (57%) and Endocerida (60%) for the Llanvirn, Actinocerida (36%) and Tarphycerida (45%) in the Llandeilo, Orthocerida (52%, 47%, 55%) and Oncocerida (66%, 66%, 75%) for the Caradoc, Ludlow, and Givetian, Discosorida (67%) in the Wenlock and Nautilida (62%) for the Givetian. While the low percentage of endemics for the Actinocerida and Tarphycerida translate into the highest percentages of genera found on more than three separate landmasses (20%), similar percentages of endemics for the Orthocerida do not. Nonendemic members of the Orthocerida are more common to two or three of the available landmasses with approximately 20% occurring in either of these configurations. The fossil record also shows that Devonian nautiloids were the most restricted with the majority occurring on no more than two landmasses.

These and other criteria indicate that the distributions of nautiloid cephalopods do not conform to the general perception of cosmopolitanism. At the generic level the group is largely endemic with reasonably large numbers of genera occurring on two or three landmasses with no genus occurring on all available landmasses during a given interval of time. Because of the type and manner of biogeographic barriers imposed on nautiloids, their distributions or patterns tend to have well defined limits with considerable predictive powers.