

STORMY RELATIONS: GROUP SPAWNING AND MASS MORTALITY OF NAUTILOIDS RECORDED IN MIDDLE DEVONIAN TEMPESTITES, ALASKA

SOJA*, Constance M., GOBETZ, Katrina E., THIBEAU, Jennifer, ZAVALA, Erika, Department of Geology, Colgate University, Hamilton, NY 13346, U.S.A.; WHITE, Brian, Department of Geology, Smith College, Northampton, MA 01063, U.S.A.

Nautiloid cephalopods, like most other molluscs including ammonites, are well represented in the fossil record. However despite their taxonomic diversity, range in trophic habits and environmental preferences, and their evolutionary longevity, nautiloids typically do not occur in abundance in most sedimentary deposits and consequently appear to represent numerically subordinate members of Phanerozoic benthic or nekto-benthic communities. Exceptions include storm-related accumulations of the modern *Nautilus* on beaches in the southwestern Pacific and concentrations of Paleozoic nautiloids, such as those in the Ordovician Maquoketa coquina, Iowa; in the classic "*Orthoceras*" limestones of Greenland, Scandinavia, and central and southern Europe; and in foreslope environments of Devonian reefs and mud mounds.

Until recently, a full appreciation of nautiloid paleobiology has been hindered partly because of misconceptions about the paleoecology of extinct nautiloids and their shell hydrodynamics but also because the life habits of the only living representative of this group, *Nautilus*, appear to be unique among all other modern cephalopods (e.g., coleoids). Significant accumulations of microscopic nautiloids in Devonian carbonate grainstones from Alaska are reported for the first time from the fossil record and yield important clues about the paleobiology of some extinct nautiloids. Small-sized nautiloids belonging to three or four taxa (orthoconic and breviconic nautiloids associated with rare coiled nautiloids and goniatite ammonoids) are the predominant components in a 25 m-thick sequence of skeletal grainstones and interbedded stromatoporoid boundstones. The nautiloids overall are well preserved or partly silicified, and they constitute as much as 80% of the volume and 99% of the skeletal material in meter-thick limestone coquinas. The nautiloids have an average length < 6 mm and an average diameter < 2 mm, are densely packed, and moderately well sorted with rare evidence of grading, imbrication, or alignment. Association with abundant massive stromatoporoids and colonial corals indicates that the nautiloid communities inhabited a shallow-marine reefal environment.

The exceptional nature of these deposits, which is reflected in the extraordinary numbers and density of small-sized nautiloids and in the thickness and frequency of the nautiloid concentrates in the reefal sequence, suggests that special circumstances were associated with the production, concentration, and preservation of an unusually high abundance of nautiloid skeletons. A combination of biological (successive group spawning and mass mortality events) and physical (storm-related) processes is inferred, with preservation of small, delicate shells of juvenile and adult nautiloids enhanced by rapid burial nearshore in homogenized, amalgamated storm deposits. These nautiloid coquinas record behaviors (social gregariness) and life history strategies involving selective spawning grounds within shelf reefal habitats that are comparable to those expressed by belemnites, shallow-marine ammonoids, and modern coleoids. Thus these deposits corroborate the hypothesis that as a "living fossil" *Nautilus* has a unique life history among extant cephalopods and exhibits behaviors not representative of many of its extinct ancestors.