New discoveries in North America's Great Plains bring ammonites to life

October 13 2010

This is a fossiliferous concretion containing a large macroconch of *Hoploscaphites brevis*, *Inoceramus nebrascensis* and *Baculites cuneatus* . This fossil, collected as AMNH 63467, was found in the *Baculites cuneatus* Zone, Pierre Shale, Meade County, South Dakota. Credit: S. Thurston/AMNH

New research on ammonites, a group of previously common marine invertebrates that went extinct after the Chicxuluxb impact 65 million years ago, is filling in details about the biology of these organisms.

Although ammonites have been extinct for 65 million years, newly published data based on 35 years of field work and analysis is providing

invaluable insights into their paleobiology. Ammonites, shelled mollusks closely related to modern day nautilus and squids, inhabited the oceans for nearly 350 million years. Specimens found in the rock record of the ancient seaway that covered North America during the Cretaceous Period demonstrate that these animals thrived at cold methane seeps at the bottom of the sea, consumed small prey, and often survived predation attempts.

"Our field work has resulted in the discovery of exceptionally well preserved ammonites at ancient methane seeps, which permit new insights into the mode of life and habitat of these organisms," says Neil Landman, curator in the Division of Paleontology at the American Museum of Natural History. "The picture that emerges is that these ammonites had little in common ecologically with either modern nautilus or most modern coleoids. This forces us to reexamine our thinking about the ecology of ancient marine systems and how the extinction of ammonites ultimately impacted the modern marine biota."

About 70 million years ago, dinosaurs roamed the continents, the Atlantic Ocean was much narrower than today, and what is now North America was divided in half by a broad inland sea that covered much of the continent. This epicontinental sea was, according to new discoveries, partly covered by cold methane seeps of gas bubbling up from sediments below. These seeps were like underwater oases that attracted a host of organisms—bacteria, sponges, gastropods, bivalves, sea urchins, and even sea lilies that attached to the veneer of calcite that formed on the bottom at the seep sites. Ammonites were also abundant at the seeps.

"What astonishes me is that I have walked over these fossil deposits for years without ever realizing that they were the sites of cold methane seeps," says Landman.

At one locality in South Dakota, the fossilized methane seeps are

exposed on the side of a steep cliff of black rock. Landman and his team criss-crossed the cliff with bright white ropes, forming a grid-like pattern onto which the team mapped the distribution of fossils.

"The result looked like an enormous Christo installation," says Landman. "You have to imagine the underwater scene 70 million years ago: a cloud of zooplankton, with ammonites flocking to the vents, forming isolated communities surrounded by the muddy sea floor. Because the sedimentation rates in the seaway were so rapid, the ammonites and other organisms were buried quickly after death, preserving exquisite details of their morphology."

The new research, published in the *Bulletin of the American Museum of Natural History*, redescribes the type specimens (holotypes) of two of the most common ammonite species that lived at the time: *Hoploscaphites nodosus* and *H. brevis*. The original specimens were collected over 150 years ago from what is probably South Dakota. *Hoploscaphites nodosus*, previously *Jeletzkytes nodosus*, is reassigned to *Hoploscaphites* because new, large fossil collections show that the traditional separation of robust, coarsely ornamented specimens from more slender, finely ornamented specimens is arbitrary. The paper also helps reconstruct the paleogeography of the epicontinetal sea that covered North America at the time as well as other seaways that covered parts of Europe.

Landman and colleagues argue that these ammonites were probably not fast swimmers. They lacked strong muscles which would have been required for strong propulsion. In addition, their jaws could only accommodate small prey and, as a result, they were probably sluggish filter feeders. Many of the ammonites also show injuries. Some of the injuries were healed during life but others resulted in death. Landman argues that the predators were probably fish, reptiles, crustaceans, and other cephalopods.

"There were probably millions of individuals in the seaway, which gives you an idea of the importance of ammonites in the marine ecosystem," says Landman.

Provided by American Museum of Natural History