Olsen, P. E., 1986, Discovery of earliest Jurassic reptile assemblage from Nova Scotia implies catastrophic end to Triassic: Lamont (Newsletter), v. 12, p. 1-3.

Discovery of Earliest Jurassic Reptile Assemblages from Nova Scotia: Imply Catastrophic End to the Triassic

Late Triassic and Early Jurassic sediments record a crucial period in the evolution of the Earth's biota. Not only does this interval witness the origination of the dinosaurs, pterosaurs, mammals, turtles, lizards, crocodiles, and teleost fishes, but the Triassic-Jurassic boundary itself is the third most significant of the thirteen or so mass extinctions that punctuate the Phanerozoic record. Unfortunately, despite its crucial position, the Triassic-Jurassic transition has remained one of the most poorly documented successions of the Phanerozoic, especially for terrestrial vertebrates. In particular, the time-stratigraphic framework for continental rocks of Late Triassic and Early Jurassic age has been especially problematic, with well dated earliest Jurassic terrestrial skeletal assemblages being essentially unknown. A direct consequence of these stratigraphic difficulties is a proliferation of conflicting hypotheses on the nature of the faunal transition: from those suggesting a dramatic, catastrophic turnover, to those suggesting none.

Late Triassic and Early Jurassic continental sediments are well represented in eastern North America, where they comprise the Newark Supergroup (Fig. 1). These are the remnants of the basin fill of the rifting episode of the present Atlantic passive margin. Fossils, especially those of terrestrial vertebrates, have traditionally been regarded as very rare in the Newark Supergroup. Last summer, however, in collaboration with a team headed by developmental biologist Neil H. Shubin of Harvard and funded by the National Geographic Society, Lamont paleontologist Paul E. Olsen discovered a series of rich assemblages of well-preserved reptiles in the earliest Jurassic part of the Fundy Group of the Newark Supergroup. These assemblages apparently just postdate the mass extinction event, and thus they shed considerable light on what may prove to be one of the great biological catastrophes that helped shape the modern world.

The animal remains occur within the upper part of the early Mesozoic Fundy Group of the Newark Supergroup, a 1000-m-thick continental sequence consisting of red clastics, minor carbonates, and extrusive tholeiitic basalts (Fig. 3). Five formations spanning from the Anisian-Ladinian (Middle Triassic) to Hettangian (earliest Jurassic) are recognized (Table I). The new assemblages occur in basal beds of the youngest formation of the Fundy Group, the McCoy Brook Formation at Wasson's Bluff near Parrsboro, Nova Scotia. The upper flows of the underlying extrusive North Mountain Basalt are discontinuous in this area and the basal, bone-producing portions of the McCoy Brook Formation fill the highly irregular basalt topography where the two formations intertongue (Fig. 4).

So far, roughly three tons of bone-bearing matrix have been collected, containing perhaps 100,000 bones. Long-legged, fully terrestrial crocodiles and crocodile relatives are by far the most common animals, with at least 50 skulls and jaws uncovered. Second in abundance are small lizard-like sphenodontid rhynchocephalians represented by about 30 jaws and one nearly complete skull (Fig. 5). Third, and perhaps the most precious of all, are remains of highly advanced mammal-like reptiles. These are the trithelodonts, the reptile group thought to most closely relate to mammals. Over 13 trithelodont skulls and jaws have been recovered, with several forms being represented — including the *Pachygenelus* and *Diarthrognathus*. This is the first definitive record of these genera outside South Africa, and the first record of the reptile group closest to mammals in North America. Least common is a suite of ornithischian, theropod, and prosauropod dinosaur remains. This includes a partial prosauropod dinosaur skeleton (collected in collaboration with Donald Baird of Princeton). There is a massive residuum of unidentified material that remains to be sorted through. A faunal list is given in Table II.

The faunal assemblages occur in three distinct facies of the McCoy Brook Formation: 1) a brown fluvial sandstone dominated by sphenodontids, and crocodilomorphs (this is also the unit which produced the prosauropod dinosaur skeleton); 2) a basalt-bearing basalt agglomerate, a probable lahar, dominated by crocodilomorphs and the trithelodont mammal-like reptiles: and 3) a lacustrine muddy limestone and interbedded basalt agglomerate dominated by semionotid fishes and ornithischian dinosaurs.

The real value of these assemblages is that it

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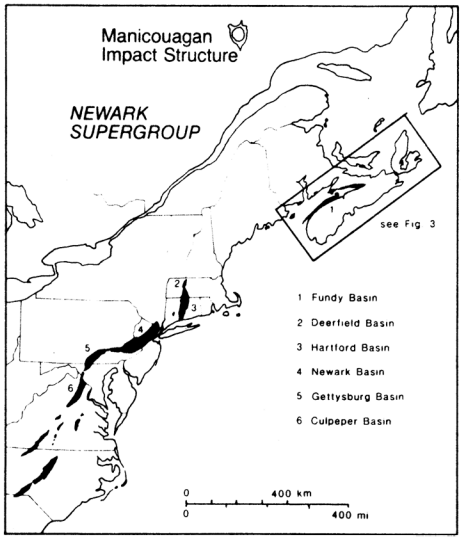

Fig. 1: Just prior to the Middle Jurassic separation of the North American and African continental plate, a series of elongate rift basins formed around the incipient rifting axis. In eastern North America, these basins parallel the grain of the Appalachian Orogen and were filled with thousands of meters of continental sediments and minor tholeiitic igneous rocks. The faulted, tilted, and deeply eroded remnants are exposed from Nova Scotia to South Carolina and are termed the Newark Supergroup. The Manicouagan impact structure, which dates from 210 ± 4 ma, very close to the Triassic-Jurassic boundary, and according to impact theory may have been responsible for a mass extinction event at the boundary.

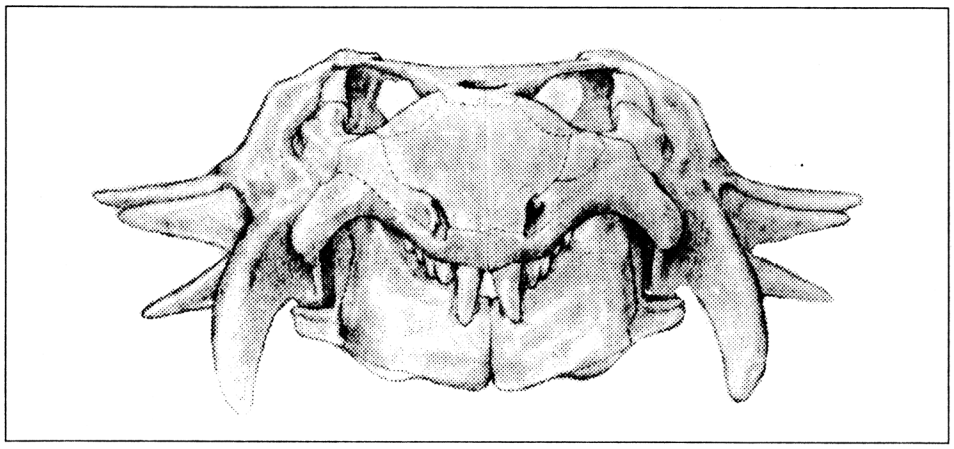

Fig. 2: Skull of the common primitive reptile Hypsognathus *found in latest Triassic Newark Supergroup red sandstones from the Fundy Basin in Nova Scotia, Hartford Basin, and Newark Basin. In Clifton, New Jersey, a skeleton has been found 100 m (<500,000 years) below the Triassic-Jurassic boundary.* Hypsognathus *represents one of the 13 families of terrestrial reptiles that went extinct at or near the boundary. (Drawing by Paul Olsen, twice actual size).*