

Paleontological Fieldwork on the Little Missouri Grassland with the United States Forest Service

by
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Management of paleontological resources on public lands in the United States has become a major concern for many federal agencies and state governments because of the scientific and educational importance of fossils. During the past three summers the North Dakota Geological Survey has been working closely with the United States Forest Service--Custer National Forest to identify, map, and assess the significance of fossil sites located in the Little Missouri Grassland area of North Dakota. Custer National Forest has management responsibilities for fossil resources on vast tracts of land in the Little Missouri Grassland, and in 1986 (reaffirmed in 1995) the Survey signed an agreement with Custer National Forest to cooperatively manage fossil resources on those lands. A cooperative field study program between the two agencies has resulted in the discovery of hundreds of fossil sites. Fossil resource information is being used in overall resource management planning for the Forest Service and the State of North Dakota. The following are a few of the most significant fossil discoveries.

Hell Creek Dinosaur Discoveries

The dinosaur fossil-bearing Hell Creek Formation is exposed in the southern portion of the Little Missouri Grassland area of North Dakota. The need to identify the locations of significant fossil sites in this area was in part prompted by the dramatic increase in petroleum exploration activities and the concern that these activities may impact significant fossil sites. Over two hundred fossil sites, most of which contained vertebrate fossils in the Late Cretaceous (about 65 million years old) Hell Creek Formation, were mapped during a two-week survey of fossil sites in Slope County. Three of the sites contained partial dinosaur skeletons. These fossils appear to all be ceratopsian remains, probably *Triceratops*. One of the *Triceratops* skulls has been excavated and restored. It is now on exhibit at the North Dakota Heritage Center in Bismarck. Excavations have begun on the other two dinosaur fossils near Marmarth and will continue during the summer of 1998.

Ash Coulee Turtle Fossil Site

The Ash Coulee turtle fossil site, located near Fairfield, Billings County, was discovered during a survey before this Forest Service land was turned over to the Clay Banyai family (Figure 1). Management responsibilities for fossil resources on lands exchanged by the Forest Service are retained by the Forest Service. At this badlands locality, the Paleocene age (about 59 million years old) Sentinel Butte Formation is exposed. Turtle fossils, including carapaces, plastrons, skulls, and other skeletal parts of the soft shell turtle *Plastomenus*, are found in a thin, carbonaceous layer in the formation (Figures 2 and 3). We estimate that perhaps hundreds of turtles died at this site in a mass-mortality event. Three excavations have been completed at this site. Glenn Kays, a graduate student in the Department of Geology and Geological Engineering at the University of North Dakota, is working with us on this project. In his Master's study, Glenn will describe the turtle fossils which may be a previously undescribed taxon and will try to determine the cause of death of these animals.

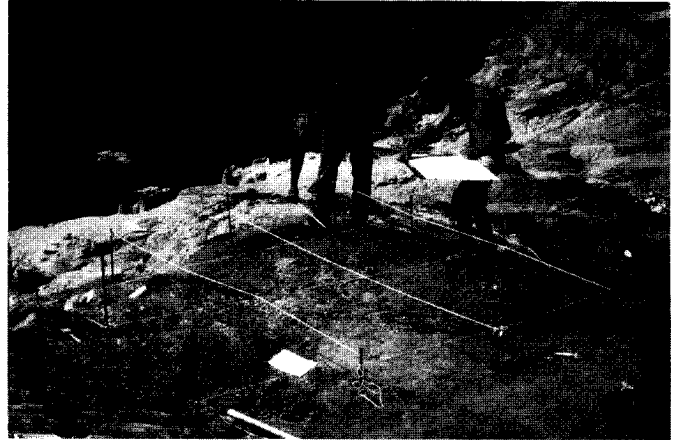


Figure 1. Dr. J. Mark Erickson (Professor of Geology, St. Lawrence University, Canton, New York) and Glenn Kays (geology graduate student, University of North Dakota) mapping the position of fossils in outcrop at the Ash Coulee turtle fossil site.

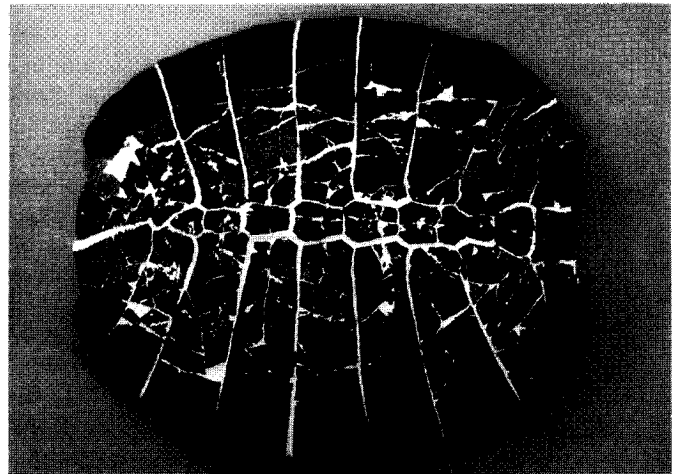


Figure 2. Carapace of one of the turtle fossil specimens identified as *Plastomenus* recovered from the Ash Coulee turtle fossil site.

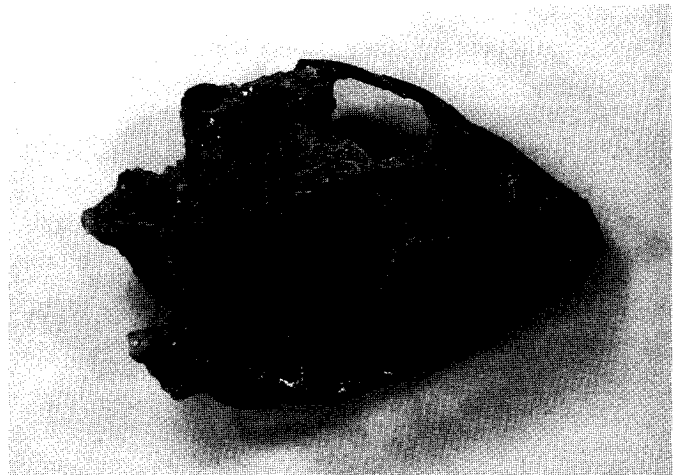


Figure 3. Dorsal view of a *Plastomenus* skull collected at the Ash Coulee turtle fossil site.

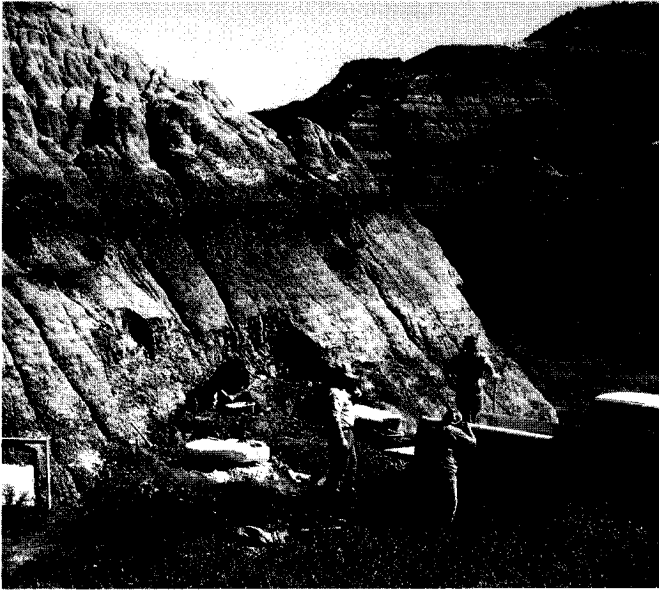


Figure 4. Plaster field packages containing crocodile fossils being removed from the Lone Butte crocodile fossil site by USFS and NDGS personnel.



Figure 5. Mike Matozevich (USFS) and Johnathan Campbell (NDGS) excavating the *Titanoides* specimen at the Poker Jim *Titanoides* site.



Figure 6. Prepared *Titanoides* skull and lower jaws from the Poker Jim *Titanoides* site.

Tracy Mountain Champsosaur Fossil Site

Mark Luther (formerly with the NDGS) and Chris Quinn (Dickinson) reported to us the occurrence of vertebrate fossils weathering out of an organic-rich layer in the Paleocene age (about 59 million years old) Sentinel Butte Formation at a locality near Fryburg, Billings County now called the Tracy Mountain champsosaur fossil site. Field work at the site, which will continue over the next few years, has already produced an extensive array of fossils including the remains of turtles, crocodiles, alligators, champsosaurs, giant salamanders, fish, mammals, freshwater snails, freshwater clams, and plants. The most significant finds so far have been the fairly complete skeletons of two champsosaurs. Champsosaurs were crocodile-like animals that lived in lakes and ponds in North Dakota during the Paleocene. One of these skeletons has been restored as a 3-dimensional skeletal mount and is now on exhibit at the North Dakota Heritage Center in Bismarck. The other skeleton has been restored and will be exhibited at the USFS National Headquarters in Washington, D.C. Funding for restoration of the Heritage Center specimen was provided by the USFS.

Lone Butte Crocodile Fossil Site

Another important Sentinel Butte Formation site was discovered during one of our fossil site inventories. This site is called the Lone Butte crocodile fossil site because of the occurrence of several partial crocodile skeletons in a Sentinel Butte mudstone near Lone Butte, McKenzie County. Fossil crocodile parts are often found in the Sentinel Butte Formation in North Dakota but partially articulated skeletons are extremely rare. We conducted an exploratory excavation at the site this summer and collected the partial skeletons of at least three crocodiles (Figure 4). These fossils are tentatively identified as remains of the common Paleocene crocodile, *Leidyosuchus*. We estimate that some of the crocodiles were twelve feet long, perhaps longer. Beautifully preserved leaf fossils, including the dawn redwood *Metasequoia*, are found with the crocodile bones. This site will be a focus of our research for quite some time because the bone bed is extensive. We feel confident that at least one of the skeletons will be complete enough to restore for exhibit at the Heritage Center in our continuing effort to provide exhibits of North Dakota's prehistoric life for the enjoyment and education of the public.

Poker Jim *Titanoides* Site

Mike Matozevich, USFS - Watford City, discovered an important mammal fossil site in the Paleocene age Sentinel Butte Formation this summer. Mike observed an upper jaw tooth row consisting of four mammal teeth exposed in the Sentinel Butte Formation at this McKenzie County site. Our excavation and preparation of the fossil exposed a complete skull and lower jaws of the pantodont *Titanoides* (Figures 5 and 6). The skull is flattened but all the teeth in the upper and lower jaws are present. Other *Titanoides* remains have been found in North Dakota but this specimen may be the most complete skull and lower jaws yet discovered. *Titanoides* was one of the largest mammals that lived during the Paleocene in North Dakota. These animals were about three feet tall at the shoulder and weighed perhaps 200 pounds. They were apparently herbivores and fed on roots and tubers. It is possible that more than one *Titanoides* lived in the site area. Fragments of large leg bones, presumed to be from that mammal, were found in another part of the butte exposure. Remains of crocodiles, champsosaurs, turtles, fish, freshwater snails, and freshwater clams are found with the mammalian remains. This important fossil site will require additional study.