

# PALEONTOLOGICAL SURVEY OF GRAND TETON NATIONAL PARK



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## ♦ ABSTRACT

A comprehensive paleontological survey of Grand Teton National Park (GTNP) was completed during the 2002 and 2003 field seasons. A number of formations from within the park have yielded a variety of invertebrate, vertebrate, and plant fossils. The following formations (listed in stratigraphic sequence from oldest to youngest) were surveyed in this study: the Gros Ventre, Gallatin Limestone, Bighorn Dolomite, Darby, Madison Limestone, Amsden, Tensleep Sandstone, Phosphoria, Dinwoody, Chugwater, Gypsum Springs, Sundance, Morrison, Cloverly, Thermopolis, Mowry Shale, Frontier, Cody Shale, Bacon Ridge Sandstone, Sohare, Mesaverde, Meeteetse, Harebell, Pinyon Creek, Hominy Peak, Colter, Teewinot, and Huckleberry Ridge Tuff. Comments on the depositional environments of the various formations are based on field observations and analysis of voucher specimens. This study provides a greater understanding of the extensive paleontological resources present in the park.

## ♦ INTRODUCTION

The sedimentary rocks in the region of (GTNP) contain evidence of shallow seas that transgressed and regressed in this area during a time span of 535 million years resulting in the accumulation of over 8,000 meters of sedimentary deposits, many of which are fossil bearing. These fossil resources provide significant research value in reconstructing paleoenvironments as well as contributing to the overall knowledge of the geologic history of the area.

Previous research on the fossils of GTNP has been sporadic. Gregory et al., (1881) reported on the presence of fossil marine invertebrates and plants ranging from the Cambrian to the upper Miocene. Foster (1947) described many of the formations found within the park, adding to our knowledge of the geologic history of the area. J. D. Love contributed fifty years of field work and publications to our understanding of sedimentary geology in Grand Teton. Barnosky (1986) published

a thorough study of Miocene mammals from the Colter Formation in and near the park. A preliminary report on the fossil bearing rocks of Grand Teton National Park was published by Santucci and Wall (1999).

#### ✦ MATERIALS & METHODS

Field work for this study was carried out in GTNP over a period of several years beginning in 1999. A small collection of fossils housed at the Colter Bay Museum in the park was studied, however, the majority of information about the fossils of Grand Teton was obtained through field work during this survey. All localities were identified using G.P.S. readings as well as the geologic map of Teton County (Love et al., 1992). Descriptions of the geomorphology, lithology, and paleontology were made for each locality and formation surveyed. Voucher specimens, along with locality data, were collected for taxa requiring further study.

#### ✦ GEOLOGY & PALEONTOLOGY

Twenty-eight formations of sedimentary rocks are exposed in GTNP. Based on this survey, 13 of these formations are fossiliferous within park boundaries. The Teton Range was uplifted less than 10 million years ago and exhibits a total vertical displacement of 10,000 meters (Love and Reed, 1995). The peaks of the Teton Range are resistant Precambrian rocks including layered gneisses, granitic gneisses, granites, pegmatites, and diabase dikes from the Early Proterozoic (Harris et al., 1997). The peaks are flanked by younger sedimentary rocks. The lower lying sediments of Holocene age found in Jackson Hole are primarily alluvial and glacial till deposits.

Paleozoic rocks outcrop to the north, south, and west of the Teton Range. Every period from the Paleozoic is represented in GTNP with the possible exception of the Silurian (see discussion in Foster, 1947). The Paleozoic rocks are the most fossiliferous strata in the park. The Cambrian is represented by the Gros Ventre and Gallatin Limestone Formations which typically outcrop along canyon walls. The Gros Ventre Formation is of middle Cambrian age and is divided into two members: the Wolsey Shale Member and the Death Canyon Limestone Member. The Wolsey Shale Member is greenish-black, friable, and rich in glauconite. Outcroppings of this rock

contain numerous small bivalves. The Death Canyon Limestone Member is a massive cliff forming bed that contains abundant evidence of bioturbation. Fragmentary trilobites and worm borings are reported from the upper strata of this formation (Miller, 1936). Overlying the Cambrian rocks are the Bighorn Dolomite and Darby Formations of the Ordovician and Devonian respectively. The Darby Formation is a dolomitic siltstone with large pockets of calcite 2 cm in diameter and fine-grained sandstone which is friable in some places and is highly fossiliferous. *Theodossia* brachiopods, rugose and tabulate corals, bryozoans, and stromatolites were identified from the Darby during this survey. Just above the Darby is the Mississippian Madison Limestone Formation. This unit is the most fossiliferous formation in the park containing bivalves, brachiopods, crinoids, corals, nautiloids, and gastropods (Figure 1). The Madison Limestone forms large outcrops of light to dark gray biosparite which is dolomitic in the lower sections. The Permian is represented by the Phosphoria Formation which contains many marine fossils and ichnofossils. It is a gray fine-grained cherty limestone which is partly dolomitic in the upper parts and a fine-grained well sorted siltstone in the lower parts (Rubey et al., 1975). Near the base are phosphatic beds separated by clay and limestone layers (Foster, 1947). The Phosphoria is rich in trace fossils, in particular *Thalassinoides* (Figure 2) which is a dwelling and/or feeding burrow of a decapod crustacean (Savrda, 1992). Mollusks were found in the fine grained sandstone layers along with a possible denticle of a palaeoniscid or acanthodian fish.

Mesozoic rocks outcrop to the north, south, and east of the Teton Range. The depositional environments shifted from marine to terrestrial during the progression of the Mesozoic. The majority of formations in GTNP are Mesozoic in age. Of these, the Frontier, Harebell, Chugwater, Mowry Shale, Cody Shale, Sundance, and Gypsum Springs Formations are fossiliferous within the park. The Sundance Formation is a carbonate sequence that includes light gray oomicrite and biomicrite facies containing abundant marine fossils (Figure 3). The lithology and paleontology of the Sundance Formation suggests a shallow marine environment during the time of deposition of these beds in the Grand Teton region. The Cretaceous Frontier Formation is a white to orange fine grained silty-sandstone laid down during a period of rapid deposition. This formation contains two layers: a lower oyster layer called the Oyster Ridge Sandstone Member and an Upper Sandstone Member which contains abundant plant fossils (Figure 4).

A



B



C



D

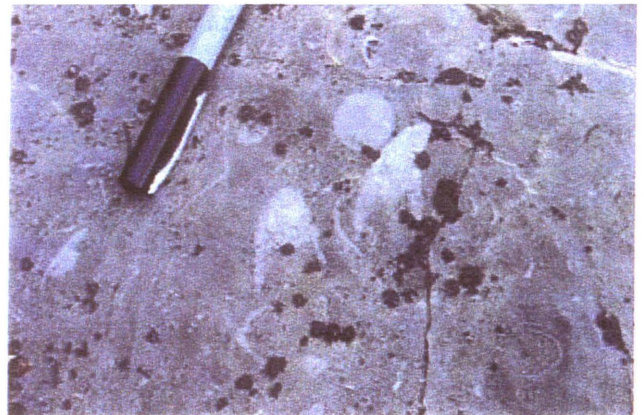
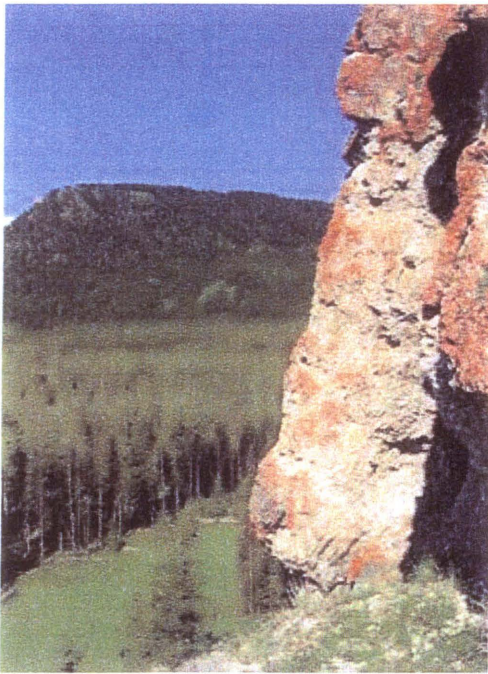


Figure 1. A. Talus slopes of the Madison Limestone Formation along Granite Canyon Trail, B. a nautiloid, C. a crinoid crown possibly *Pachylocrinus*, and D. horn coral all from the Madison.

A



B



C



D

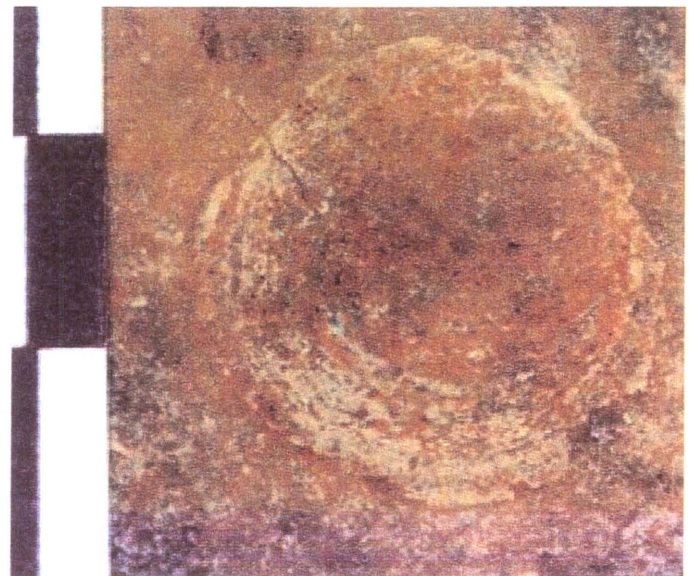


Figure 2. A. Exposed section of the Phosphoria Formation on the west side of Jackson Lake north of Berry Creek along the south side of Harem Hill. B. Ichnofossil exposed *in situ*. C. *Thalassanoides* and D. a bivalve both collected from the Phosphoria Formation near Berry Creek Trail in the northern region of the park.

A



B



C

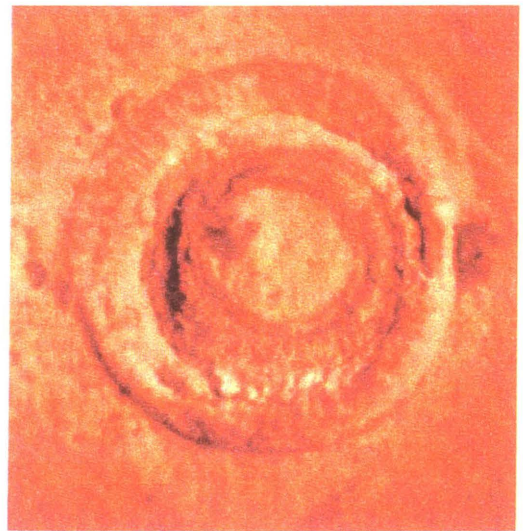


Figure 3. A. Sundance Formation along Berry Creek Tail on the west side of Harem Hill, B. *Unio felchi* and C. belemnoid collected from the Sundance Formation.

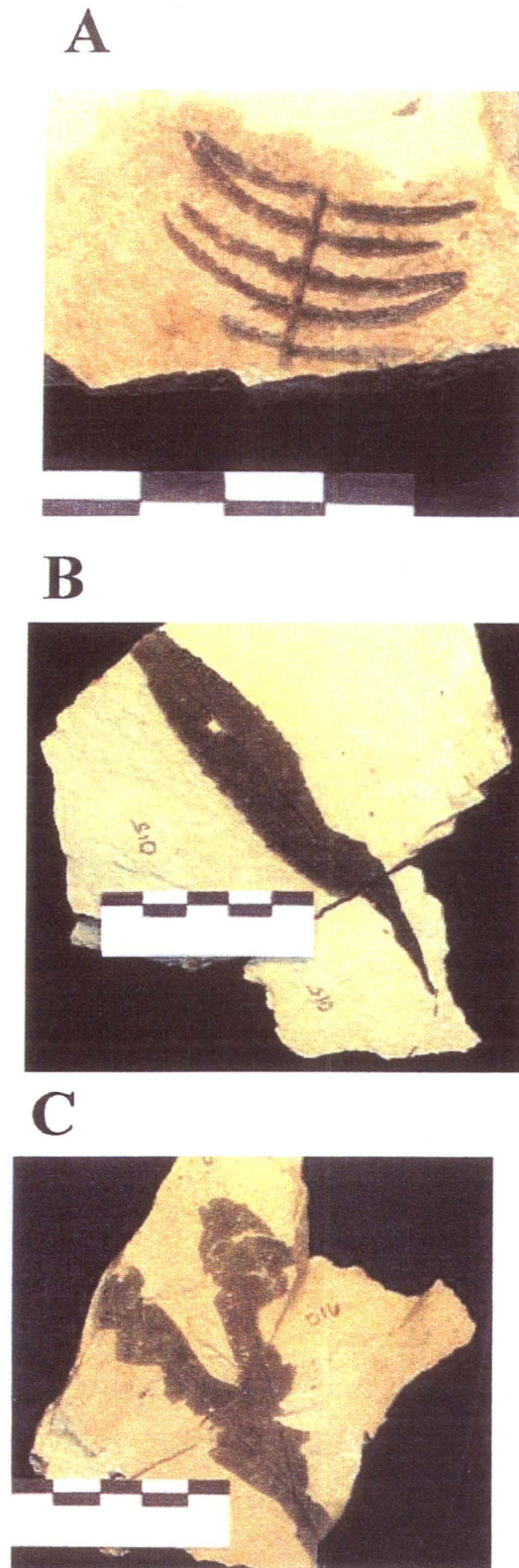


Figure 4. Fossil plants from the upper Cretaceous Frontier Formation collected along the eastern bank of Jackson Lake. A. *Anemia* B. *Dryophyllum* and C. *Aralia*

The Laramide Orogeny began during the end of the Cretaceous and continued through the early part of the Cenozoic. Volcanic activity to the north of GTNP resulted in the deposition of mudflow breccias, tuffs, and conglomerates (Love and Reed, 1995). The Cenozoic is represented within park boundaries by four formations: the Huckleberry Ridge Tuff, Teewinot, Colter, and Hominy Peak Formations. The Hominy Peak and Colter Formations are a result of nearby volcanic activity. During the Late Miocene the Teewinot Formation was deposited in a lake that covered most of the area known today as Jackson Hole. This formation is characterized by light gray limestone and contains many fossils associated with lacustrine environments. Barnosky (1986) reported mammal fossils from the early Miocene Colter Formation around Two Ocean Lake in the northeastern region of the park.

#### ◆ FURTHER STUDY

Several potentially significant localities remain to be surveyed. These sites include parts of the Gros Ventre Formation in the Southwest corner of the park, the Chugwater Formation near Two Ocean Lake, and Mesaverde, Sohare, and Bacon Ridge Sandstone at the eastern edge of the park. The most promising exposure for the Gros Ventre Formation is in Granite Canyon (at least a three day back country trip). The Chugwater Formation forms a large cliff wall high above Two Ocean Lake which may require climbing skill to reach. The Mesaverde Formation is exposed along Hwy 89/287 just north of Moran Junction along Pacific Creek (accessibility is dependent on the level of the creek). Sohare and Bacon Ridge Sandstone Formations flank one another just south of Hwy 89/287 near the boundary of the park. Permission may be needed to reach this locality since it is within the boundaries of a private ranch. Identification of repositories housing collections of GTNP specimens would also be of value.

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