Bryce Canyon informational paleontological handout for the general public and interpreters
Bryce Canyon National Park
Cory Redman

This document, created by a National Park Service (NPS) volunteer, was made possible by the Geoscientists-In-the-Parks (GIP) Program and its partners. Documents created through the GIP Program are intended to address a variety of park-identified needs including: resource management, education and outreach, interpretation, inventory and monitoring, and research. Documents are not generally peer-reviewed. Quality may vary significantly, and the product may not be finalized. Specific information may have been redacted to protect proprietary information regarding cultural or paleontological resources, and locations of threatened and endangered species.

Views and conclusions in this report are those of the authors and do not necessarily reflect the views or policies of the National Park Service, the NPS-Geologic Resources Division, and its partners. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the National Park Service.

Documents and related materials are filed with the National Park Service-Geologic Resources Division, and with Bryce Canyon National Park. Contact Bryce Canyon National Park for additional information. Cite this document as:

> Redman, Cory. Bryce Canyon informational paleontological handout for the general public and interpreters. Geoscientists-In-the-Parks document, 2007-BRCA. National Park Service, Denver, Colorado.

Please be aware that products produced under the GIP Program do not authorize the collection of, or damage to park resources. The NPS specifically prohibits the damaging or collecting of natural, cultural, and archeological resources on federal lands under its regulations at 36 CFR §2.1.

Bryce Canyon Informational Paleontological Handout for the General Public and Interpreters:

While Bryce Canyon National Park is famous for its hoodoos, spires, and pinnacles formed from the weathering of the Claron Formation, there are many other rock units (i.e. formations- mappable rock units) found within the park that have as interesting and scientifically significant geological history.

Bryce Canyon National Park is located on the eastern margin of the Paunsaugunt Plateau. The Paunsaugunt Plateau is bound to the east by the Paunsaugunt fault system and bound to the west by the Sand Pass Fault and Sevier Fault Zone. The Kaiparowits Plateau is immediately east of the Paunsaugunt Plateau and extends east to the Straight Cliffs (i.e. Escalante region). The Paunsaugunt and Kaiparowits Plateaus are part of a much larger plateau called the Colorado Plateau. The Colorado Plateau is a huge plateau centered on the four corners area (i.e. Colorado, Wyoming, Utah, New Mexico) that began uplifting 5-10 million years ago. The uplift of the Colorado Plateau and the erosional down-cutting of the Colorado River and its associated tributaries have exposed spectacular geological outcrops that are seen within Bryce Canyon, Zion, Grand Canyon, Escalante National Monument, Arches, and Capital Reef. The rocks exposed in these areas have allowed scientists to develop a better understanding of the biological, environmental, and tectonic changes that have occurred in western North America for the last 2 billion years (i.e. since the Precambrian).

The rocks exposed in Bryce Canyon National Park and the immediate surrounding area contains the most complete fossiliferous, Upper Cretaceous terrestrial sequence of rocks known in the world. The Late Cretaceous is an interval of time designated for the range of time in earth history between 100 and 65 million years (m.y.) ago. The Late Cretaceous is subsequently broken down into a series of stages: Cenomanian (99-93.5 m.y.), Turonian (93.5-89 m.y.), Coniacian (89-85.8 m.y.), Santonian (85.8-83.5 m.y.), Campanian (83.5-71.3 m.y.), and Maastrichtian (71.3-65.0 m.y.).

The oldest (i.e. basal) rock unit of this renowned Cretaceous section is called the Dakota Formation. The age of the Dakota is middle-late Cenomanian in age and has yielded the most diverse Cenomanian terrestrial vertebrate record in the world. Fossil remains of fish, sharks, rays, lizards, amphibians, dinosaurs, crocodilians, turtles, and mammals have all been recovered from the Dakota. Most of the fossils have been recovered from the sediments deposited by rivers (i.e. fluvial) or lakes (i.e. lacustrine). The Dakota Formation is found just outside the park's boundary, but is included here for stratigraphic (i.e. sequence of rock units) completeness.

The Tropic Shale is the next Late Cretaceous formation that was deposited as a result of a rise in sea-level (i.e. transgression) flooding the continental interior of North America creating a seaway connecting the Gulf of Mexico to the Arctic Ocean. This seaway is called the Greenhorn Sea. The interior of the North American continent has been flooded many times over the course of Earth's history, especially during the Cretaceous when sea-level was 50-100 meters higher. The Tropic Shale is a dark marine shale (i.e. fine-grain deposit of clay, mud, and silt) and represents the height of the Greenhorn Sea. Marine water from the Greenhorn Sea began encroaching on this area (i.e. western margin of the Kaiparowits Plateaus) in the upper member (i.e. subdivision of a rock formation) of the Dakota Formation and didn't withdraw until after the deposition of the Tibbet Canyon Member of the Straight Cliffs Formation. Fossil remains of plesiosaurs, ammonites, and host of other marine invertebrates have been recovered from this formation.

The Straight Cliffs Formation is divided into four members: Tibbet Canyon, Smoky Hollow, John Henry, and Drip Tank. The Tibbet Canyon is middle Turonian in age and is dominated by sandstones that were deposited on a shore line (i.e. shore face/shore zone) during the retreat (i.e. regression) of the Greenhorn Sea. Shark teeth are the most common fossil recovered from this member, but fish, crocodiles, and mammalian teeth have been recovered from the delta deposits.

Smoky Hollow is the next member of the Straight Cliffs Formation. The upper part of this member has yielded turtles, crocodilians, dinosaurs, lizards, amphibians, and mammals from floodplain and lake deposits. The Smoky Hollow has yielded the only known Turonian aged mammals in this hemisphere. There is only one other Turonian terrestrial locality known in the world and that is located in the country of Uzbekistan in Central Asia.

The sediment of the John Henry Member is primarily brackish to nonmarine along the western margin of the Kaiparowits Plateau, but is dominated by marine deposits on the east side of the plateau, since the Greenhorn Sea was still present in the area around Escalante. Minor sea-level fluctuations occurred throughout the deposit of the John Henry causing brackish fauna (i.e. fish, sharks, and rays) to be the largest component of fossil recovered from this member. The John Henry Member ranges in age from Coniacian to late Santonian. The John Henry Member has also produced the only Santonian age terrestrial locality known in this hemisphere. Remains of dinosaurs, turtles, crocodiles, lizards, amphibians, and mammals have all been recovered from the John Henry Member.

The last member of the Straight Cliffs Formation is the Drip Tank. The Drip Tank is probably late Santonian in age and is dominated by sandstone and pebble conglomerates (i.e. poorly-sorted rock composed of fragments larger than 2 mm) deposited by braided and meandering streams. Gar scales, turtle and crocodile fragments have been recovered from thin mudstone layers (i.e. lenses) in the upper part of the member.

The sediments of the Wahweap Formation consist of almost equal portions of mudstone and sandstone and was predominately deposited by meandering streams during the early part of the Campanian. Fossil localities have been found through out the formation, yielding fresh water molluscs, sharks, turtles, fish, crocodilians, dinosaurs, mammals, and rare crab claws. The Wahweap Formation exposed within Campbell Canyon of Bryce Canyon National Park has one of the most productive fossil localities known from this formation on the Paunsaugunt and Kaiparowits plateaus.

The Kaiparowits Formation is not exposed within Bryce's park boundary, but is included here for stratigraphic completeness. The Kaiparowits Formation is the most fossiliferous Cretaceous unit on the Kaiparowits Plateau. Fossils are most common in the lower half of the formation. Fossil localities occur in sandstones associated with rivers and mudstones associated with floodplain and lake environments. All types of taxa have been recovered from the Kaiparowits Formation: sharks, ray, fish, amphibians, turtles, crocodilians, lizards, dinosaurs, birds, and mammals. This formation has produced the greatest diversity and abundance of Late Cretaceous taxa in this region.

The Kaiparowits Formation is capped by the Canaan Peak Formation. The Canaan Peak Formation is a conglomeratic unit in which only palynomorphs (i.e. fossil pollens) have been recovered. The basal part of the Canaan Peak is Late Campanian based on the palynomorphs

On the Paunsaugunt Plateau the Wahweap Fomration is overlain by the Claron Formation which is divided into two members, a white limestone member and a pink limestone member. The white limestone member is more resistant to erosion and forms a resistant cap on the pink limestone allowing the formation of hoodoos, spires, and pinnacles. The Claron is dominated by lake deposited sediment, but also includes sediments deposited in mudflats, floodplains, and rivers. The Claron is largely absent of fossils, only invertebrate trace fossils (i.e. sedimentary structure resulting from the life activity of an animal, e.g. tracks/trackways/burrows), gastropods and bivalves have been found within. To date, no vertebrate fossils have been found within the Claron.

For more information see: Eaton, J.G., 1991, Biostratigraphic framework for the Upper Cretaceous rocks of the Kaiparowits Plateau, southern Utah. *in* Nations, J.D. and Eaton, J.G., eds., Stratigraphy, depositional environments, and sedimentary tectonics of the western margin, Cretaceous Western Interior Seaway: Geological Society of America Special Paper 260.