Frequently Asked Questions

National Park Service
U.S. Department of the Interior

John Day Fossil Beds
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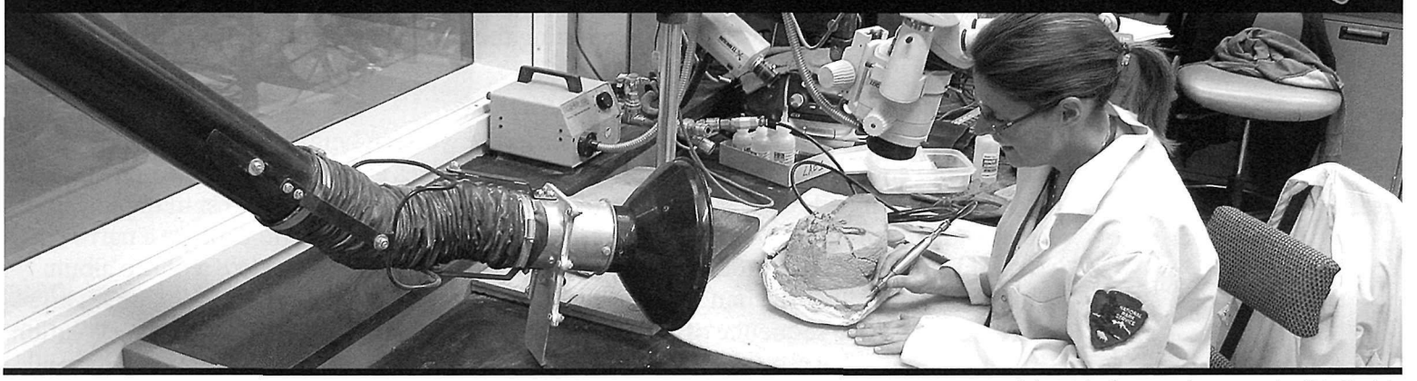

Paleontologist preparing a new fossil in the lab

Fossils

Where is the best place to see fossils?

The Thomas Condon Paleontology Center at the Sheep Rock Unit has over 500 fossils on display along with exhibits that explain the incredible fossil history of eastern Oregon.

Where can I see fossils on trails?

The Clarno Unit is the only place in the monument where visitors can see fossils in the ground. Along the three Clarno trails are multiple leaf fossils and pieces of fossilized wood. In the Painted Hills and Sheep Rock Units, any fossil that weather out of the clay can be destroyed by sun, rain, ice, and wind, so it is quickly collected by park staff for preservation in the lab. In the Sheep Rock Unit, replica fossils were placed along the Island in Time trail in Blue Basin to show examples of fossils that were found there.

Where can I dig for fossils?

No fossil collecting is allowed in the monument. Fossils are protected by strict federal laws and only park-approved scientists may pick up or remove fossils. The nearest place for the public to legally collect plant and insect fossils is the Wheeler County High School in Fossil, OR. Contact the State of Oregon, the Bureau of Land Management, or the National Forest Service for regulations about collecting fossils on those lands.

What should I do if I see a fossil?

Do not pick it up. These fossils are very fragile, they can break, and they are protected by law. If you are in the Sheep Rock or Painted Hills Units, inform a ranger and the park staff will remove it carefully. If you see plant fossils along trails in the Clarno Unit, those are already known and do not need to be reported.

Can I see dinosaur fossils here?

No. The oldest fossils in the monument are about 45 million years old. Dinosaurs went extinct 20 million years earlier. Most of the surface rocks in eastern Oregon are too young to contain dinosaur fossils. There are areas in eastern Oregon with sedimentary rocks from the age of dinosaurs, but most of these are oceanic or offshore island deposits. They contain shelled ammonites, marine reptiles like ichthyosaurs, a plesiosaur, crocodiles, and a flying reptile called a pterosaur. However, as plate tectonics and earthquakes jostle Oregon and erosion reveals older rocks, the answer to this question may change.

Geology

Where did all the volcanic material that built up this area come from?

Ongoing volcanism here is the result of heat generated by subduction of the Juan de Fuca plate under the North American plate, and perhaps even activity from the hot spot currently under Yellowstone National Park. Over time these eruptions built up the land resulting in many different rock and clay types, colors, and textures. The Clarno formation was formed by ashfalls, lava flows, and volcanic mudslides from a broad arc of volcanoes throughout the region. Most of the ash that forms the John Day Formation came from three volcanic calderas in eastern and central Oregon. Massive basalt lava flows issued from enormous fissures near the Steens Mountains about 16 million years ago, covering the older ash layers with the Picture Gorge Basalts. The Mascall and Rattlesnake layers were formed by eruptions from a number of different volcanoes scattered around eastern and central Oregon. About 5 million years ago, these volcanic forces diminished. Erosion from water and wind became the dominant geologic force, exposing fossils once buried beneath millions of years of volcanic debris.

Why are some of the rock layers green?

The green mineral celadonite present in the volcaniclastic claystones give some layers a distinctive green color. There is no copper in these rocks, despite the visual similarity to copper patina.

Paleontology

What is the difference between paleontology, geology, and archaeology?

Paleontology is the study of ancient life, usually by examining the fossilized remains of plants and animals and comparing them to living species. Geology is the study of minerals (rocks) themselves including how they form and change over time. Archaeology is the study of past human life usually by examining the cultural artifacts people leave behind.

What makes these fossil beds noteworthy?

The John Day Fossil Beds are the only place in the western hemisphere where tens of millions of years of evolutionary and ecosystem changes are preserved in just one area. The oldest fossil beds at Clarno are 45 million years old and the youngest in the Sheep Rock Unit are 5 million years old. Most fossil sites around the world capture a narrow span of time, like a snapshot, whereas John Day Fossil Beds is more like a photo album chronicling how life has changed over 40 million years. These fossil beds document an incredibly valuable sequence of changes in geology, geography, climate, and the evolution of living things. This record is mostly continuous, allowing scientists to examine how all these factors interacted to create the world we inhabit today.

How can scientists say how old a fossil is?

The fossils found here are far too old to be dated by carbon dating. However, ancient volcanic ash can be dated by other radiometric methods. Paleontologists look for ash layers above and below a fossil in the rock strata to infer a relative age. For example, if an oreodont fossil is found between the Blue Basin Tuff and the Picture Gorge Ignimbrite, it is determined to be between 28.8 and 28.7 million years old. If an oreodont fossil is found loose on a hillside on top of the Tin Roof Tuff (25.9 million years old), it could have fallen down from a higher (and more recent) rock layer, so it is determined to be up to 25.9 million years old.

How does radiometric dating work?

Several methods of dating volcanic ash are used here. In the case of potassium/argon dating, the isotope potassium-40 decays into argon-40. Both elements are found in magma. When ash is ejected during a volcanic eruption, the stable argon gas escapes into the atmosphere. This leaves only the isotopic potassium in the ash. As the ash cools, sanidine crystals form and trap potassium inside the crystals. Over time some of the potassium decays in the crystal and turns into argon. The argon gas is sealed inside the crystal and cannot escape. Scientists crush the crystal in a lab and capture and measure the ratio of potassium to argon. Formulas based on the nuclear physics of radioactive decay determine the approximate age.

Isotope	Decays into	Half-life	Effective Range of Dating
Carbon 14	Nitrogen 14	5715 years	0-80,000 years
Uranium 235	Lead 207	700 million years	> 100 million years
Potassium 40	Argon 40	1.26 billion years	> 100,000 years
Uranium 238	Lead 206	4.5 billion years	>100 million years
Thorium 232	Lead 208	14 billion years	>200 million years

Please note: > = older than

People

Who was John Day?

John Day was a member of an 1810-12 overland expedition sent to establish a fur trading post at the mouth of the Columbia River. While camped at the mouth of the Mah-hah River along the Columbia, John Day and Ramsey Crooks were robbed of everything they had, including their clothes. Following this incident, people traveling along the Columbia River would point out the mouth of the river where they were robbed. By the 1850's, the Mah-hah River had been renamed and mapped as the John Day River. The fossil beds, discovered in the 1860s, were named after the river. As far as historians can tell, John Day never found a fossil nor came within 100 miles of the monument that bears his name.

Who was Thomas Condon?

Thomas Condon was the first scientist to recognize the significance of these fossil beds. Originally from Ireland, Condon emigrated to New York as a child and Oregon as an adult, where he became a congregationalist minister. After working for nearly a decade in western Oregon, he and his family moved to The Dalles. In the early 1860s, soldiers who knew of his interest in geology brought him fossils from the John Day region. He traveled to the fossil beds and found an amazing array of specimens. He sent many fossils to well-known eastern paleontologists like Edward Drinker Cope and Othniel C. Marsh, who made these fossil beds world famous. Because of his work here and in other regions of Oregon, he became the first Oregon State Geologist, and later the first professor of geology at the University of Oregon. He continued to study the John Day Fossil Beds until his death in 1907. To recognize his contribution to the fossil beds, the monument's state of the art paleontology research center was named in his honor.