

John Day Fossil Beds

John Day Fossil Beds
National Monument
Oregon

National Park Service
U.S. Department of the Interior

A unique treasure is concealed in the sculpted exposures of sedimentary rock of the John Day River Valley in central Oregon. Here are some of the richest fossil beds in the world, and they contain a record of remarkable continuity. Fossil beds that span even 5 million years are rare. Yet these beds show an almost continuous 40-million-year record of diverse plant and animal life that existed here 54 million to 6 million years ago. R. W. Chaney, a paleobotanist, once wrote that "no region in the world shows more complete sequences of tertiary land populations, both plant and animal, than the John Day Basin." It is a record of such continuity and duration that scientists can test theories against the fossil record.

Fossil beds contain vestiges of actual soils, rivers, ponds, watering holes, mudslides, ashfalls, floodplains, middens, trackways, prairies, and forests. The rocks are rich with the evidence of ancient habitats and the dynamic processes that shaped them; they tell of sweeping changes in the John Day fossil basin. Great changes, too, have taken place in this area's landscape, climate, and the kinds of plants and animals that have inhabited it. And it is all recorded in the fossil record: The park's Fossil Research Study Collection contains more than 22,000 specimens; more than 2,100 species have been identified. Four of the major environmental periods are depicted below.



Clarno formations

54 to 37 million years ago

Tropical to subtropical forests mantled the local terrain some 54 to 37 million years ago. We know of these forests because of a splendid sample of fossil seeds, nuts, fruits, leaves, branches, and roots. The Clarno Nutbeds are among the finest fossil plant localities on the planet, with hundreds of species—many new to science—preserved. The conspicuous mammals were the browsing brontotheres and amynodonts—conspicuous because of their great size and ungainly appearance. Impressive, too, were the strong-jawed scavengers, hyaenadonts, and ruggedly framed predators such as *Patriofelis*. Although a few of these animals lived into the early Oligocene—34 million years ago—they have left no modern descendants.

However, some of their contemporaries—the equids, rhinos, tapirs, and cats—do have present-day descendants, most of which are no longer found in North America.



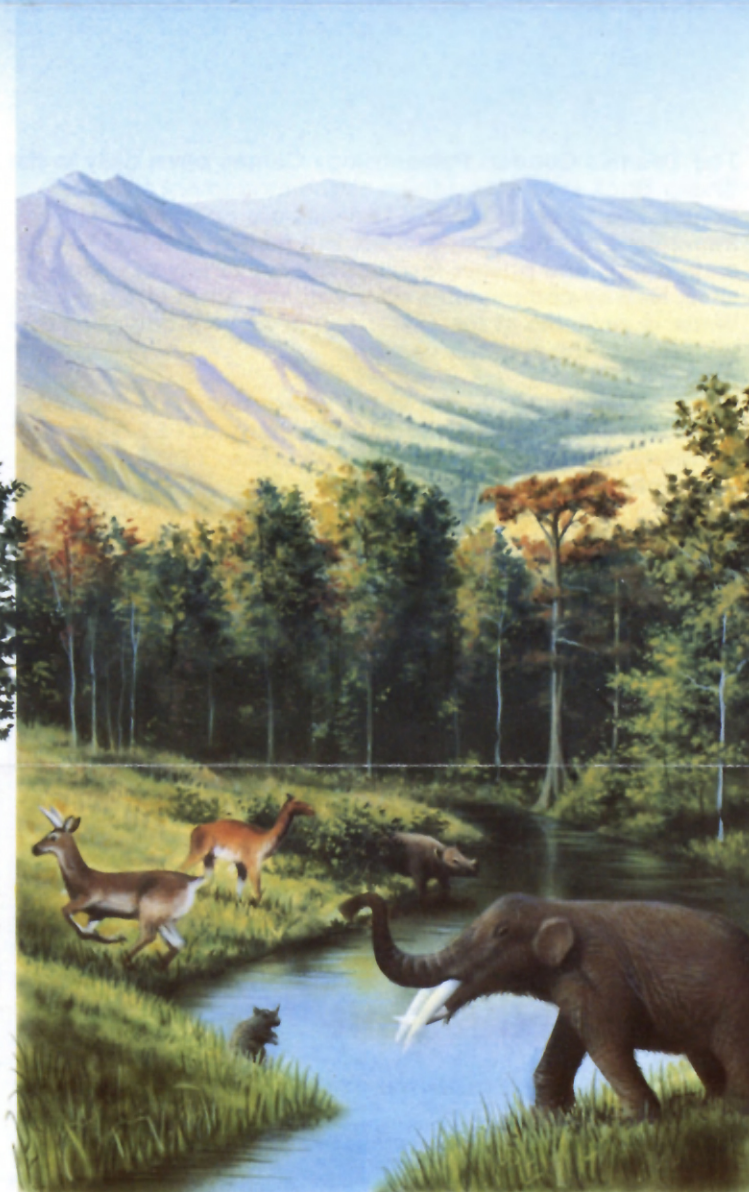
John Day formations

39 to 18 million years ago

The John Day formations span more than 20 million years. Even a cursory examination reveals that many types of environments existed in this landscape.

Deciduous forests replaced the earlier subtropical forests of the Clarno formations. Numerous fossil plant localities containing a great number of different species indicate the vast biological diversity of the early Miocene Epoch. More than 100 groups of mammals have been found in this formation as well, including dogs, cats, swine, oreodonts, horses, camels, rhinoceroses, and rodents.

Multiple volcanic events during the deposition of the formation produced large amounts of volcanic ash. The resulting tuff, interspersed throughout the fossil-bearing beds, allows determination of accurate radiometric dates. The chronology derived from the tuff helps scientists determine the rate at which plants and animals changed as they evolved.



Mascall Formation

16 to 12 million years ago

The interval between deposition of the John Day and Mascall times was marked by intermittent flows of basaltic lava that repeatedly leveled and denuded the region. By 15 million years ago these eruptions had ceased and the basalt was weathering into soil. A moderate climate, sufficient precipitation, periodic deposits of volcanic ash, and the basaltic parent material combined to produce highly fertile soils, and from these soils arose lush, nutritious grasses and mixed hardwood forests—much like those found today in the eastern United States.

The Mascall savanna was home to a great variety of animals that we might recognize as horses, camels, and deer, as well as bears, weasels, dogs, and cats. Some dwelt in the woodlands, while others adapted to the grasslands. At the same time large mammals made a resurgence. Among them were the gomphotheres (early elephants), as well as sizable rhinos and bear-dogs.



Rattlesnake formations

8 to 6 million years ago

Named for Rattlesnake Creek, a minor tributary of the John Day River, the coarse deposits of the Rattlesnake formations complete the paleontological story of the John Day Basin. Though they contain considerably fewer fossils than the Clarno, John Day, or Mascall formations, fragmented fossils have been found of horses, sloths, rhinoceroses, camels, peccaries, pronghorns, dogs, bears, and others. It is an interesting population, with some species resembling those of today and others, those of a distant past. A preponderance of grazing animals over browsers suggests a much dryer and cooler climate, dominated by grasslands. These strata represent the last major episode of deposition in the basin. Erosion then began and continues to sculpt the landscape of today.

Illustration by Rob Wood based on research and artwork by Doris Tischler

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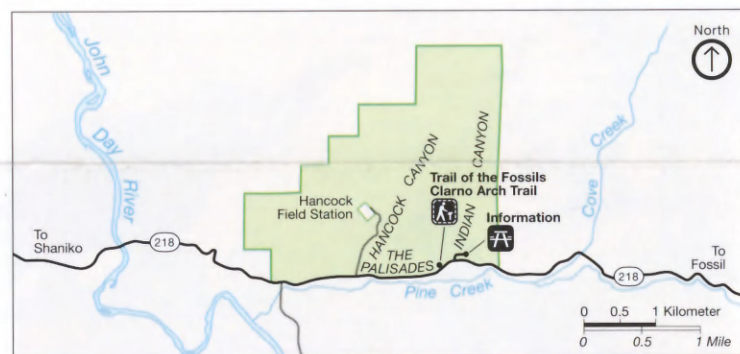


Cover photos: Ray Atkeson (left and right), Tom Algire (center)

Eastern Oregon holds many unexpected elements: pine-forested mountains, glades preserving tall native grasses and wildflowers, deep canyons, trout streams, and small coves of pinacled badlands. Intriguing, too, are its hidden landscapes—fossil remains of jungles, savannas, and woodlands that once flourished here. John Day Valley badlands are fossil beds whose sedimentary rocks preserve a 40-million-year record of plant and animal life. Congress established John Day Fossil Beds National Monument in 1975. It encompasses 14,000 acres in three separate units. You can follow trails into the badlands and examine fossils displayed at the visitor center, while scientists continue field investigations and the painstaking analysis of the monument's vast fossil record.

The Thomas Condon Paleontology Center, open daily in the Sheep Rock Unit, also serves as the monument's visitor center. The trails and picnic facilities are open all year. The monument has no campground, but nearby national forests, state parks, and private facilities offer a variety of campsites. Nearby communities offer lodging, food, and gasoline. Water is available at the visitor center all year and at all picnic areas in the summer season.

For more information stop at the visitor center or contact: John Day Fossil Beds National Monument, 32651 Hwy 19, Kimberly, OR 97848; 541-987-2333 voice/TTY; joda_interpretation@nps.gov; or www.nps.gov/joda.



Clarno Unit

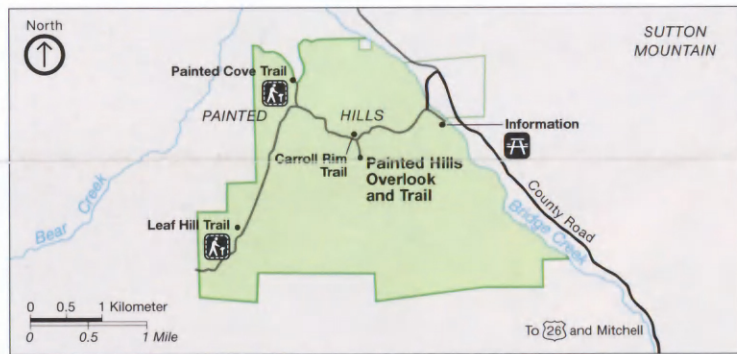
Palisades The cliffs of the Clarno Palisades were formed when a succession of ash-laden mudflows (lahars) inundated a forested landscape. Two trails begin at the base of the Palisades. Winding up through the lahars, they allow observation of embedded plant remains. Picnic facilities and water are available.

Within the boundaries are significant fossil sites not yet open to the public. In the Clarno Nut Beds, more than 300

plant species have been found. The Hancock Mammal Quarry has revealed an unusual ancient fauna still under investigation.

The **Hancock Field Station**, operated by the Oregon Museum of Science and Industry, offers several programs for those interested in the geology, paleontology, and ecology of central Oregon. For additional information, write: Hancock Field Station, Fossil, OR 97830.

Scenic Drives The routes between Clarno and Painted Hills and between Clarno and Sheep Rock pass through interesting geological features. Travelers may obtain road logs, which interpret the geology of these routes, at the visitor center.



Painted Hills Unit

Picnic Area This landscaped area provides restrooms, water, shaded picnic tables, and exhibits.

Painted Hills Overlook The color-splashed hummocks and hills are the eroded remnants of the lower John Day Formation. The weathering of volcanic ash under varying climatic regimes resulted in vividly-hued rock layers of red, pink, bronze, tan, and black.

Carroll Rim Trail A moderately strenuous 0.75-mile trail rewards the hiker with an outstanding view of the Painted Hills and Sutton Mountain.

Painted Cove Trail A short trail winds around a crimson hill, permitting a close view of the popcorn-textured claystones that distinguish the Painted Hills. A printed trail guide is available at the trailhead.

Leaf Hill Trail An exhibit describes the hill where large quantities of plant fossils have been removed for scientific study and where research continues. Much of what is now known about the ancient forests once growing in eastern Oregon was learned at this site. Walking on the hill is strictly prohibited.



Park Regulations and Safety Information John Day Fossil Beds National Monument is a unit of the National Park System, which consists of more than 350 parks representing important examples of our country's natural and cultural inheritance.

Collecting, digging, or disturbing fossils is prohibited. All plants, animals, fossils, rocks,

artifacts, and other natural and cultural features in the national monument are protected from removal, destruction, and injury.

Hiking trails are available to enable visitors to experience the area more closely. For protection of the landscape and for your safety, please remain on these trails. Since the trails are rocky and uneven, appropriate footwear is recommended. Trails are for foot

traffic only. Be sure to carry sufficient supplies of drinking water especially during the hot, dry summer months.

Rattlesnakes may be present anywhere in the monument. Give them plenty of room.

Pets must be kept under physical control.

Private lands are included within the monument. Please respect

Getting There The monument's three units are: Clarno, located 20 miles west of Fossil, Ore.; Painted Hills, 9 miles northwest of Mitchell, Ore.; and Sheep Rock, 6 miles west of Dayville, Ore. The visitor center is located in the Sheep Rock Unit. All three units provide a variety of opportunities for recreation and study.

property owners' rights; ask if in doubt about land ownership.

Hunting and other uses of firearms, traps, nets, and any other weapon are prohibited on all federal lands within the monument boundary.

Fishing is allowed within the monument; a valid state fishing license is required.

Sheep Rock Unit

Visitor Center This facility is the principal information center for the monument and includes museum exhibits of fossils recovered from the John Day Basin. The shaded lawn of the visitor center is a favored picnicking site.

Mascall Formation Overlook The view from this point takes in the John Day Valley and Strawberry Mountain range, Picture Gorge, and the Mascall and Rattlesnake formations.

Sheep Rock Overlook A short distance south of the visitor center is the viewpoint of Sheep Rock, a colorful exposure of the John Day Formation.

Blue Basin One way to experience the fossil beds is to walk along the Island in Time interpretive trail, extending 0.50-mile into blue-green canyons. The more strenuous 3-mile Overlook Trail climbs to

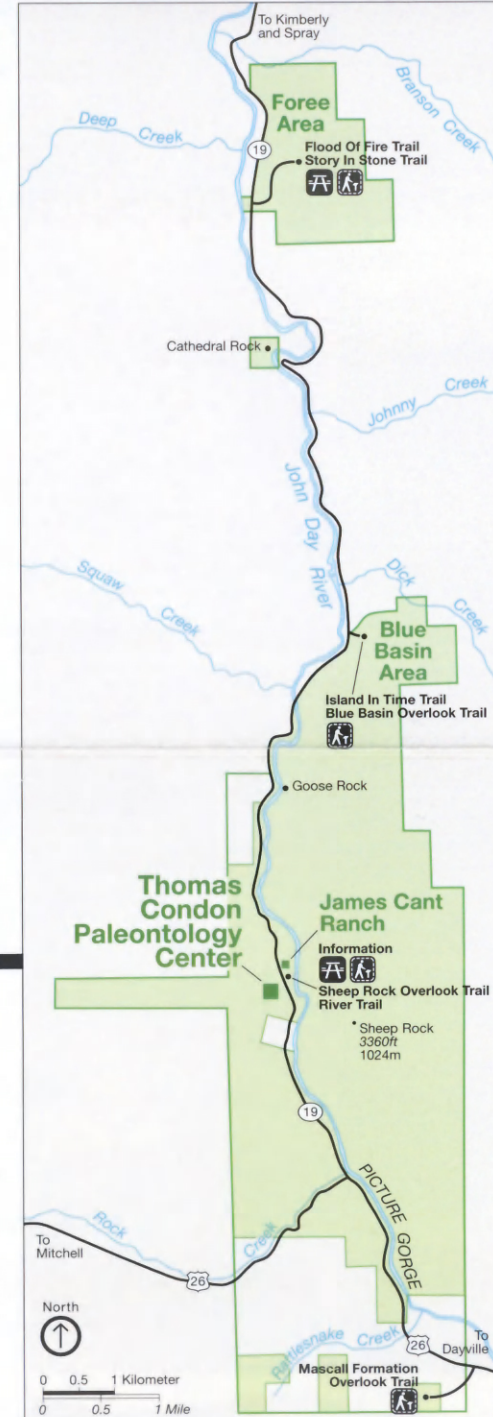
the rim of Blue Basin and provides spectacular views of the valley's badlands. Off-trail hiking in Blue Basin is strictly prohibited.

Cathedral Rock This large block of the John Day Formation slid down from the high bluff to the west. A geologically "recent" event, the slump caused a re-routing of the John Day River, which now forms a horseshoe bend around the base of Cathedral Rock.

Foree Area A picnic site and two short trails offer views of sculpted John Day Formation sediments capped by enormous flows of Picture Gorge Basalt.

River Access Pedestrian access to the John Day River is provided at several points along Ore. 19. Be careful when pulling off or on the road.

Goose Rock These cliffs are river-borne material that settled on the ocean bottom more than 100 million years ago.



University of California scientists John C. Merriam and Loye Miller work at an excavation site in 1899. They were among the earliest professionals to work in the John Day area.



Oregon Historical Society ORHI 55652

Left Thomas Condon gained much of his training through the study of Oregon's fossil sites and his contacts with professional scientists. He later became the first state geologist of Oregon. **Right** During excavation, an encapsulating plaster jacket is fashioned around the fossil, insuring its safe removal from the field.



Right In the laboratory, both the jacket and the matrix are gradually removed. Plastic consolidants are used to stabilize and strengthen the fossil bones. Hundreds of hours of preparation may be required before the specimen can be studied or exhibited.



The next phase, study and analysis, is never concluded. Information concerning the thousands of specimens collected in the monument is permanently maintained. With these data, paleontologists can analyze various aspects of a fossil population. Their research enables them, finally, to recreate scenes from the past.



Cynthia Tait

Reconstructing The Past The John Day Basin was first recognized as an important paleontological site in the 1860s, thanks to the ability of a young frontier minister, Thomas Condon, who recognized the fossil beds as a scientific treasure. At the time, paleontology, the study of ancient life, was still a new science. However, discoveries such as Condon's galvanized scientific interest. By the late-19th century, researchers at Yale, Princeton, and the

Smithsonian Institution had requested and received hundreds of specimens from the John Day Basin. They were then classified and described in the scientific literature. This early work set the stage for field paleontologists such as John C. Merriam, who, in 1899, began the task of placing the John Day fossils in their geological, chronological, and paleoecological context. His efforts were instrumental in the preservation of this area.

Exploration and study of the John Day fossil beds continues today. In many of the beds, the fossils are widely scattered, and their occurrence cannot be predicted. Many types of fossils deteriorate rapidly once erosion exposes them to the elements. Thus the fossil beds are continually canvassed by paleontologists.

Each year hundreds of specimens are added to the National Park Service collection. Many of

the items are mere fragments—a few teeth, for instance—but each specimen is accompanied by a wealth of field data: coordinates that pinpoint both its geographical location and the stratigraphic position, descriptions of features where it was deposited, and other data about its recovery. This information, as well as that gained as the fossils are stabilized, prepared, and studied, is entered into museum records for use by scholars now and in the future.

Such collection efforts have provided researchers with scientifically significant samples, which open up intriguing avenues for research. Paleontologists can now detect subtle shifts in the composition of ecosystems through time. Researchers have identified and studied some ancient soils preserved in the John Day Basin and, from a distance of millions of years, are able to gauge former climatic conditions such as temperature. Sedimentologists map the orien-

tation of bones in a Clarno Formation quarry, and thereby plot the eddies, backwaters, and gravel bars of a river that flowed 37 million years ago. Paleobotanists determine the rate at which plant communities evolved. A biostratigrapher dates the earliest known occurrence of fossil "elephants" in the Mascall Formation. Studies such as these combine to give us richly detailed pictures of the past.

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