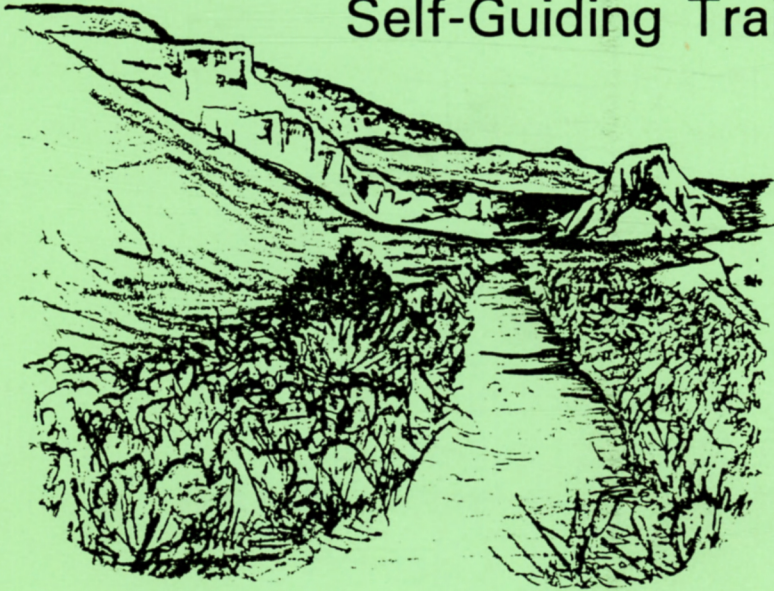


STORY IN STONE

Self-Guiding Trail



Fossils embedded in rock layers are like words on the pages of a book. With the discovery and study of each fossil a piece of a story is revealed and images of an ancient environment develop. Your walk will take you near scenic rock formations. These same formations hold a fascinating story

... a story in stone.

The trail, with four touchable exhibits, ends approximately 900 feet from the start. Over-all, there is a 30 foot increase in elevation. The trail has gradual slopes and a hardened surface, though visitors in wheelchairs may need assistance. Benches are spaced along the route.

Foot traffic damages fossils and rock exposures. Please stay on the trails. Digging or collecting is prohibited.

Stop 1 ... is an exhibit located 50 feet from the start of the trail. The rocks displayed are from neighboring slopes.

BASALT ... The top layers of the valley hills are dark, dense, iron-rich rock. They formed from lava floods occurring about 16,000,000 years ago. Each lava flow spread for miles, incinerating and burying the land.



Fossils are rarely found in rock formed from hot volcanic material.

CLAYSTONE ... Beneath the basalt flows are layers composed largely of volcanic ash deposited by air and water. These ash deposits, reworked by organisms and other processes, became clay-rich soils before they were buried and changed into rock. The claystone may be in shades of white, pale green, red, or brown.

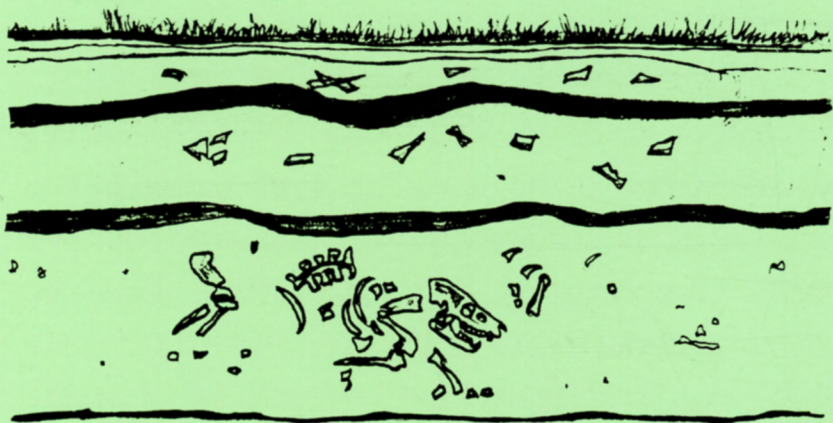
The colors are due to various minerals undergoing chemical and structural changes after burial.

"PICTURE GORGE IGNIMBRITE" ...

Sandwiched in the claystone, just above the trees before you, is a layer of red and tan welded tuff, called ignimbrite. During one moment in geologic time, a violent eruption, to the west, ejected massive amounts of hot gases and volcanic particles which traveled great distances across the land at high speed. This fiery torrent settled, welding into a glassy rock layer. It has been dated at 28,700,000 years old by measuring the decay of radioactive argon trapped within - a stone-bound clock.

"BLUE BASIN TUFF" ... Part of this layer, deposits of hot ash-fall, tops the pale green butte to the right. This tuff is hard, cemented together but not welded. It has been argon-dated at 28,900,000 years old.

STOP 2 ... simulates fossils in claystone. Find the 1/2 inch tall peg near the center of the exhibit. At ten o'clock from the peg, four adult finger widths away, is a fossil vertebra. At six o'clock and three fingers away are mouse-deer teeth, about 1/2 inch wide. At two o'clock, three fingers away, is a snail shell, 1/2 inch across. Others to find are vertebrae, teeth, and bone segments.



Fossils are evidence of prehistoric life. Many fossils started as buried bone, wood, shells, etc. The organic matter was then slowly replaced by minerals dissolved in ground water.

Fossils may also be molds or imprints, such as leaf prints or footprints originally left in soft earth. Fossils can be very large or microscopic. Large bones draw attention, but a single tooth can be used to identify a species, give clues to its diet, and reveal the age of the animal at its death. A pollen grain may reveal much about the parent plant. Root traces help suggest climates, and burrows and tracks can reveal animal behavior.

Scavengers devouring bones, long exposure to air, incineration, erosion, and earth movements may interfere with the fossilization process. Due to this interference, the chance of any single organism becoming a fossil, out of millions of its contemporary organisms, is rare.

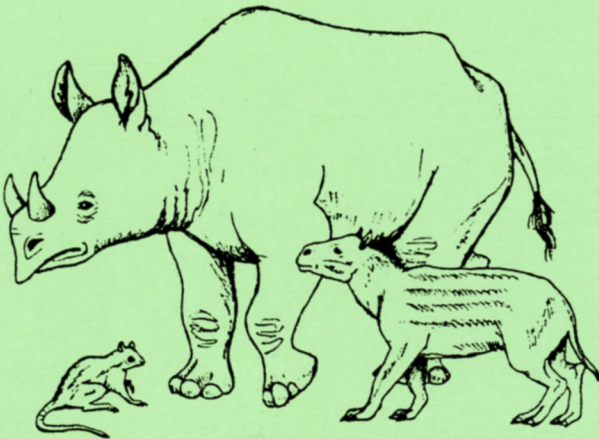
The trail crosses the foot bridge. At the overlook, stop at the post numbered "3."

STOP 3 ... Imagine a mouse eating into a book, the edges of the chewed pages revealing parts of letters and words - pieces of a story. Water acts as our mouse in the pale green rock below, the rains cutting into layers interspersed with fossils that paleontologists seek. To record the exact layer in which a fossil is found is vital in helping us read, in proper order, the complete story of the past. A fossil removed prematurely is like holding a numberless page ripped from some unread book.

STOP 4 ... About 5,000,000 years ago land-building processes, such as volcanic activity, diminished in this area. Water and wind carved deep into the land. Some soil and rock eroded faster than others. The nearby butte is capped by "Blue Basin tuff," a harder rock than the claystone below. The cap still protects the butte, though eventually

both will erode away. A layer of "Blue Basin tuff" is also in the high cliff-side to the left.

STOP 5 ... These replicas are a sample of over one hundred kinds of animal fossils discovered in the claystone. Compare the various-sized mammal femur (leg bone) and molar fossils on display. There are skeletal similarities. Regardless of size, each animal was well adapted to its "role" in the environment.



Rodent

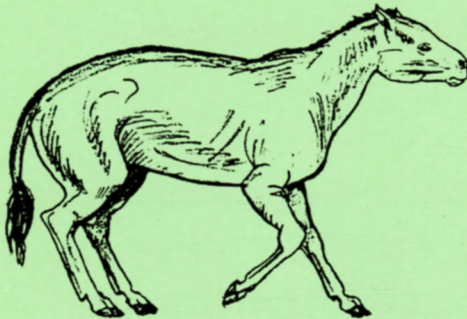
Rhinoceros

Oreodont

The upper femur and molar are from a **rhinoceros** (a lineage smaller than

current rhinos) which had two horns on its snout side-by-side. The middle elements are from a small **oreodont** (or-ee-oh-dawnt), a plant-eating mammal now extinct. Oreodonts weighed from 50 to 700 pounds. The lower femur and molar are from an adult **rodent**.

STOP 6 ... has four replicas of fossil skulls, found in the claystone.



Miohippus

Miohippus (my-oh-hip-pus) ... was a three-toed horse the size of a small deer. Miohippus roamed forests browsing on leaves and hiding from predators. Forests were gradually replaced by grasslands, with some

horse lineages adapting to the new and open environment. Over millennia, the teeth of grassland horses increased in length and strength to better grind silica-enriched grasses. Also (with an over-all increase in body size), the horse skull lengthened and the eye socket repositioned toward the rear, as teeth extended deeper into the skull. Today's single-toed Equus (all the world's horse species belong to this genus), is adapted to grazing the open range and racing from danger.

Eporeodon (epp-ore-ee-oh-don) ... is a kind of oreodont fossil found only in the Pacific Northwest. These browsers combined some features of pigs and deer. Oreodonts existed for 30,000,000 years before going extinct 5,000,000 years ago. Abundant, they were common prey to predators.

Mesocyon (mez-oh-sigh-on) ... was a short-faced mammal, with long neck, body, and legs; a member of the dog family (Canidae).



Mesocyon

They had meat-shearing teeth, pointed canines, and crushing molars, and could eat meat, bone, insects, and fruit. Worldwide, in the last 10,000,000 years, the number of canid genera has decreased from about 40 to 10. All domestic dogs are considered to be one genus. The genus Mesocyon did not survive.

Capacikala (chap-ah-cheek-ah-la) ... This beaver fossil was found in claystone above the ignimbrite layer that tops the nearby cliff. Beavers are members of the rodent order.

This order also includes squirrels, mice and rats. A feature of rodents is their ability to gnaw tough woody plants using front incisor teeth. A vegetarian, Capacikala probably lived in burrows, could not swim, nor cut down trees. Capacikala went extinct with no known living descendants.

At the last stop on the trail you will find a bench that overlooks an eroded basin of land, to the east.

STOP 7 ... How much of the story in stone do we know so far? This region's claystone layers have revealed evidence of an ancient, changing environment. Average annual temperatures were warmer than present with less variation season-to-season. Rainfall was about 40 inches per year, compared to 15 today. The climate gradually became cooler and dryer. At this spot, about 30,000,000 years ago, you would be

in a shallow, wide basin of forested land. Heavy thickets flourished beneath treetops of maple, alder, "dawn" redwood, elm, and beech. There were a few clearings.

For miles to the east, the land gently rose into the distance. Streams scored the forest floor, the water eventually flowing north. To the west, volcanic mountains reared up. The ancestral Cascade range grew, periodically erupting clouds of rhyolitic ash that fell like snow over the landscape. Plant and animal remains were buried.

Beneath the treetops and amidst the undergrowth crept and blundered a splendid assortment of animals. Rodents, rhinoceros, oreodonts, monkeys, cat-like nimravids, camels, giant pigs, deer-size horses, land snails, limbless lizards, and turtles abounded. Birds peered down as hungry bear-dogs and sabertooth

"cats" hunted prey. The environment was rich in mammal diversity, **more than the present**. Each lived, reproduced, and died, yet none of these ancient species exist today in their identical form.

What insights, then, have we learned from this story in stone?

Changes in the environment will occur over time; such as climate, prey and predator, and competitive changes. As a result, each living species is a mosaic of adaptations. Long-term survival of any species depends upon the potential to change, to adapt, perhaps giving rise to new species. The adaptation process is complex, and thousands of lifetimes may pass before bodily changes and abilities may evolve that enhance the survival of a lineage. Originations (new species) and extinctions are a significant part of evolution.



The ongoing study of geology and fossils at John Day Fossil Beds National Monument provides us clearer images of an ancient environment, of familiar and unusual plants and animals. Other areas of the monument reveal different chapters of the same story in stone. From images of near-tropical forests of the Clarno Formation 50,000,000 years ago, to the dryer and cooler grasslands of the Rattlesnake Formation 6,000,000 years ago, fossils are the physical evidence of this evolutionary change.

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