

An introduction to: Geology of the Rogue Valley



Presented by: North Mountain Park Nature Center

A division of the Ashland Parks and Recreation Department

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Geology and Geologists

Geology is the study of the earth's rocks and the processes that affect them. Geologists study the earth in many different ways. Some geologists locate new rock quarries and mineral deposits, while others study rocks in an effort to locate energy reserves including gas, oil, and coal. Another important area of study for today's geologists is to locate and tap into groundwater and springs. Still other geologists study rocks in an effort to better predict natural disasters including earthquakes, tsunamis, volcanic eruptions, landslides, and avalanches. Paleontologists study rocks (and fossils) in an effort to learn about the history of life on earth. In addition to the economic and scientific applications of geology, the study of rocks, minerals and earth processes are of interest to lay people for a variety of reasons. Along with their unending variety, beauty, and usefulness, rocks help tell the story of our landscape. People can use this information to prevent catastrophic erosion and flooding, help identify economic resources, and help protect and incorporate interesting features in city planning. Rocks and their associated minerals have been, and will always be, an integral part of our culture, technology, and daily existence.

About this booklet

This booklet is one piece of the North Mountain Park Nature Center's interpretation of our local natural and cultural history. The area represented by the term "local" includes the Rogue Valley of southwest Oregon, with an emphasis on the Ashland area.

While every attempt has been made to ensure accuracy, this booklet is not meant to be a formal work but is rather to be used by educators and others seeking an introduction to the topic of local geology. It is hoped that readers of this booklet will be inspired to use this information to help make decisions that will enhance the livability of the Rogue Valley for both its people and its wildlife now and into the future.

We invite any and all comments to this document, which will be updated periodically in an effort to reflect the most accurate information available.

Acknowledgements: This booklet was written and formatted by a team consisting of North Mountain Park staff members and volunteers. Artwork and extensive background material were contributed by local geologist Len Eisenberg.



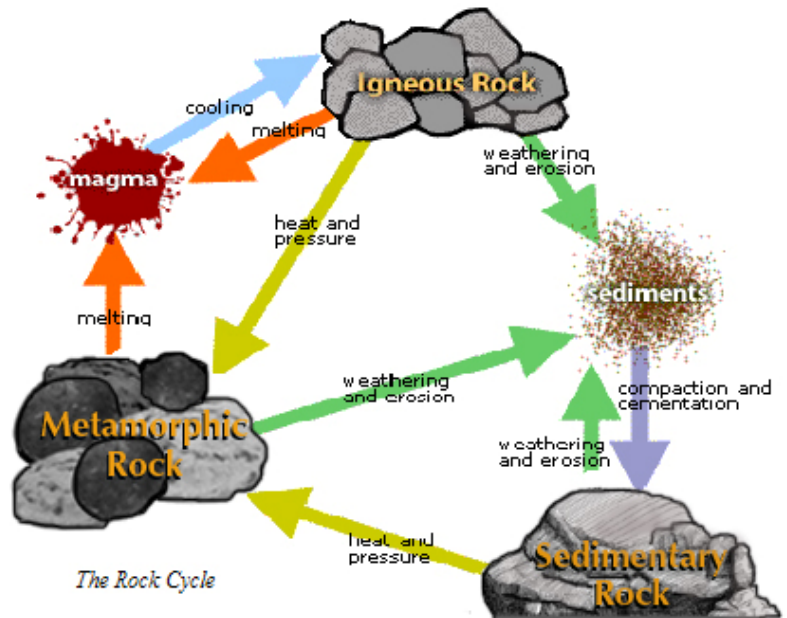
Table of Contents

Types of Rocks and How They Form	4
Plate Tectonics	6
Earth Time Walk	8
Major Events of the Phanerozoic Eon	9
Geologic History of the Rogue Valley	10
Formations of the Rogue Valley	12
Local Rock Types	15
Summary of Rocks and their Uses.....	16
Local Uses of Rocks and Minerals	18
Modern Uses of Rocks and Minerals.....	24
Plants and Animals Need Rocks Too!	26
Index.....	27
Learn More About Local Geology.....	28

Types of Rocks and How They Form

Most people think of rocks as solid, non-living bodies that we find beneath our feet. While they do originate from the hardened crust of the earth, they are not static. Instead, they have multiple “lives,” including being buried, melted, extruded from volcanoes, weathered and chemically changed over thousands and even millions of years. To understand how rocks are formed and how they are categorized, it is helpful to look at the rock cycle.

The **rock cycle** is a term used to describe the continual process whereby one type of rock is changed, through heat, pressure, or compaction, into another type of rock. The rock cycle transforms rocks by two different processes.

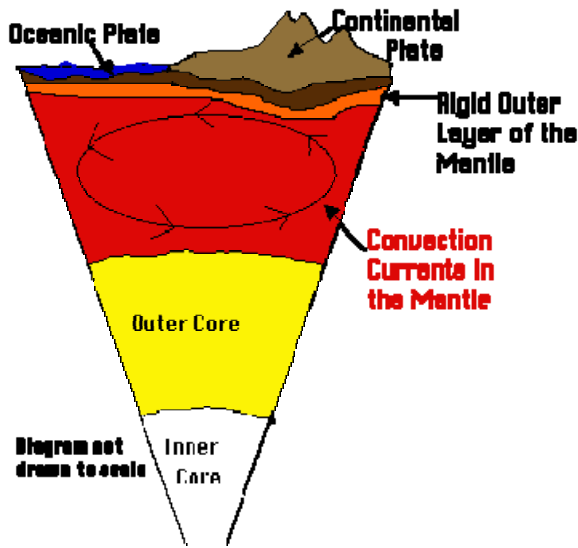


The first and most important process happens below the earth’s surface and is caused by the difference in temperature between the Earth’s surface and its center. Because the inner core (center) of the earth is the hottest part of the planet, heat radiates upward from the inner core toward the surface.

As it does so, it begins to move the mantle, the liquid layer of rock beneath the earth’s crust. These movements cause convection currents that move large chunks of the earth’s surface called tectonic plates.

As these plates bump into, slide past, and pull apart from each other, older rocks are buried and changed through heat and pressure into metamorphic rock. At the same time, new igneous rocks are formed as the internal magma, or molten rock, rises up, cools and solidifies.

The second process driving the rock cycle is caused by energy from the sun. The sun's energy causes all of the Earth's weather and drives the water cycle, which in turn "weathers" rocks and forms sediments that are later forged into rock. The sun also causes the wind, rain, ocean waves and flood events that bury **sediments** in a process that forms sedimentary rocks. Finally, the sun exposes these newly-formed sedimentary rocks by eroding the earth's surface with weather and water-driven events.



Three Rock Types

The names for the three rock types—igneous, sedimentary, and metamorphic—refer to the way each rock is formed.

Igneous rocks form when molten rock (melted by Earth's internal heat) cools. Extrusive igneous rock forms when molten lava cools quickly on the earth's surface after a volcanic eruption. Lava rock, pumice, obsidian, and basalt are all extrusive igneous rocks. Intrusive igneous rock is formed when the liquid rock slowly cools and crystallizes beneath the earth's surface (or within a volcano). The most well-known intrusive igneous rock is **granite**. Although they contain the same minerals, extrusive and intrusive igneous rocks look very different because they cool at different rates.

Sedimentary rocks are made from sediments (eroded pebbles, sand, silt, clay, and plant and animal remains) that have been deposited in layers and compacted under land or sea. Examples of sedimentary rocks include sandstone, conglomerate, mudstone, shale, chert, chalk, and limestone.

Metamorphic rocks are formed when igneous and sedimentary rocks beneath the earth's surface are subjected to enough heat and pressure to change their internal structure and mineralogy without melting. Colliding tectonic plates can create enough pressure to create metamorphic rocks. Two common metamorphic rocks are **marble** (formed from limestone) and **slate** (formed from shale).

Plate Tectonics

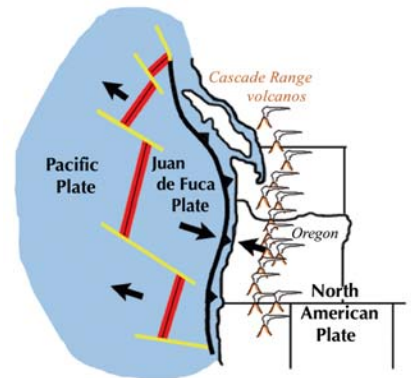


Plate tectonics is the basic theory of today's geology. It says that the earth's crust is made of a many plates which move across the globe. This movement is caused by actions deep within the earth, and as these plates move, many different outcomes are possible.

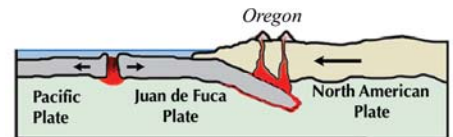
Movements of the earth's major tectonic plates.

When tectonic plates collide, the heavier plate slides beneath the lighter one, creating what geologists call a convergent boundary. This is believed to be happening just off the Oregon coast where a small oceanic Juan de Fuca Plate, is moving into the large continental North American Plate. As the plates converge, the heavier oceanic plate moves underneath the continental plate. As this rock material is forced under the earth's surface it enters the much hotter upper mantle and melts, forming magma. Under the right conditions, this magma will rise up to the surface in the form of volcanoes. This is the basic process that formed, and is still forming, the Cascade Mountains.

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Convergent boundaries can also force the two plates upward, forming mountains. Geologists believe the Himalayas and the Appalachian Mountains formed in this way.



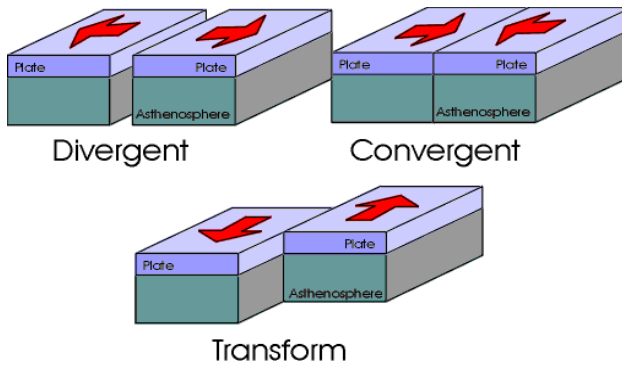
The converging North American and Juan de Fuca Plates.

Transform boundaries occur where two tectonic plates slide past each other horizontally. These boundaries can cause earthquakes, but do not create new crust.

When two plates diverge, or move away from each other, very different land masses form.

When tectonic plates move away from each other, a gap or “rift” forms, from which magma under the crust can seep up and form new crust.

Geologists believe divergent boundaries occur in several places in the ocean, including between the Juan de Fuca Plate off the Oregon coast, and the oceanic Pacific Plate to the west.



Tectonic plate movements create three different types of boundaries.

Potential Geologic Disasters

Because tectonic plates do not always move under one another in a regular manner, pressure can build up. Geologists believe that around 1700, the Juan de Fuca Plate was significantly submerged under the North American Plate so that enough pressure built up to create movement. There is evidence that this movement produced an earthquake along the Oregon coast that was large enough to produce significant tsunamis in Japan. It has been 300 years since this system has produced a large earthquake, and many geologists feel the area is overdue for an earthquake on the scale of 8 or greater. The threat of a superquake has led geologists to raise southern Oregon’s seismic rating to a 3. Areas with the highest risk of earthquake activity are given a 4. This change in rating has led to new regulations for construction; commercial buildings must now be built to withstand these large earthquakes, and many schools and bridges have been retrofitted, including Medford’s downtown I-5 overpass.

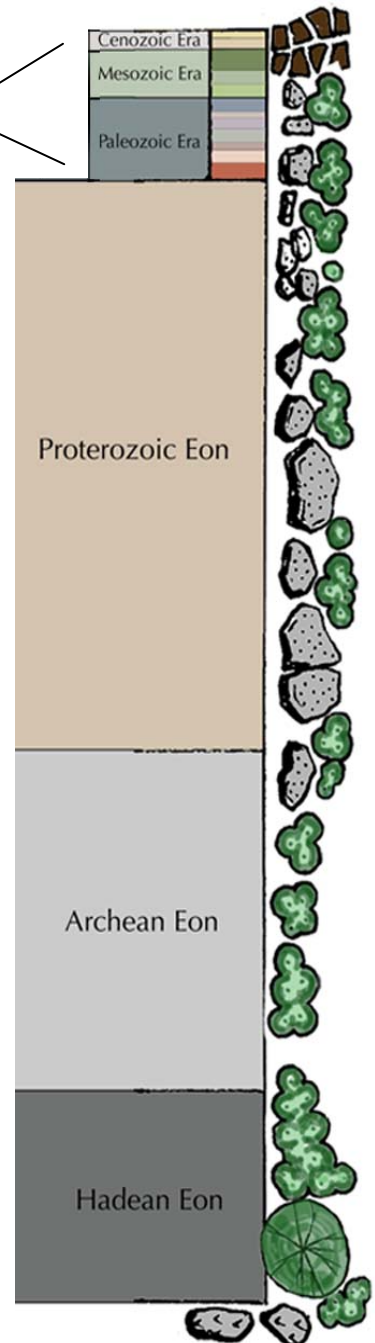
A lesser threat to southwest Oregon is volcanic eruption. The Cascade Mountains, which lie just east of the Bear Creek valley, but actually extend all the way from California to Canada, are volcanically active. While the Cascade volcanoes are relatively quiet right now, they have been more or less continuously active for at least the last 12 million years. Mt. McLoughlin is thought to be recently extinct but could possibly become active once again. If it erupted, mud flows and ash clouds racing west down Butte Creek and Little Butte Creek could threaten the towns of Shady Cove and Eagle Point. If Mt. Shasta erupted, it could have a large impact on the Bear Creek Valley, mostly from drifting ash. While there is a small amount of seismic activity occurring underneath Mt. Shasta, Mt. Rainier (near Seattle) and Three Sisters (near Bend) are showing much greater activity and are much more likely to become active in the near future.

Earth Time Walk

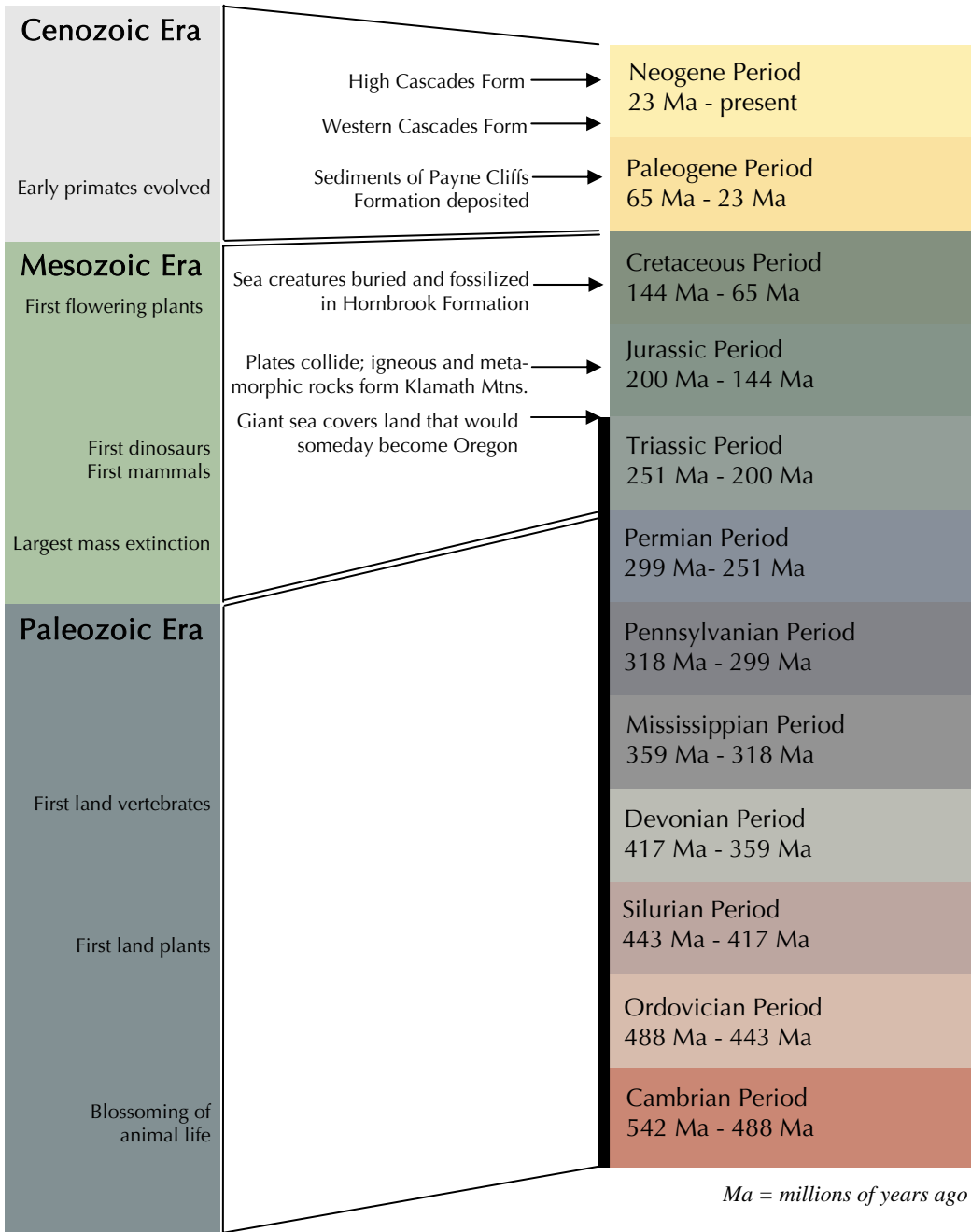
Geologists have divided the entire history of the Earth into four time periods known as Eons. During the earliest eon, which is named after the greek word 'hades' as a reference to the fiery underworld, the earth experienced intense volcanic activity and heavy bombardment by asteroids and comets. During the next eon, known as the Archean Eon, the first life appeared in the form of single-celled animals such as bacteria. The third and longest eon, the Proterozoic Eon, lasted for approximately 2 billion years. Within this time period single-celled organisms were busy photosynthesizing which resulted in the deposition of huge amounts of oxygen into the atmosphere. Finally, beginning about 500 million years ago, the current era began. Because this is when most of the geologic and evolutionary events occurred, the Phanerozoic Eon is further divided into three Eras. The longest and oldest era of the current eon, the Paleozoic, is further divided into seven periods, each of which lasted approximately 50 million years. It was during the Paleozoic Era that multicelled life evolved, the first land plants appeared, and animals came out of the ocean. The middle era, known as the Mesozoic, is divided into three periods, the most famous of which, the Jurassic Period, is known for the dominance of the large dinosaurs. The most recent Era, the Cenozoic Era, has been divided into two periods; the older Paleogene Period, which saw the evolution of the primates, and the current Neogene Period.

This picture is a feature of the Briscoe Geology Park in Ashland, Oregon. It represents the span of Earth's geologic history.

Phanerozoic Eon



Major Earth Events of the Phanerozoic Eon



Geologic History of the Rogue Valley

The Bear Creek valley of southwestern Oregon that we see today is the result of a variety of ancient and recent geologic processes.



Permian Period

300 million years ago, during the Paleozoic Era, the only animals living where southwestern Oregon is today were sea-dwelling animals such as nautiloids and early sharks. The North American continent, whose western shore was near present-day Montana, was home to a variety of land-dwelling animals including amphibians, reptiles, and giant flying insects. Rocks and sediments that became buried beneath the ocean were formed into metamorphic rocks that would later become part of the Klamath Mountains.

About 160 million years ago, during the early Mesozoic Era, an oceanic tectonic plate began to slowly crash into the North American continental tectonic plate from the west. The impact resulted in the pushing up of an enormous amount of material and caused the formation of a long chain of mountainous islands. Igneous and metamorphic rock from these ancient islands are today part of the Klamath Mountains.



Jurassic Period



Paleogene Period

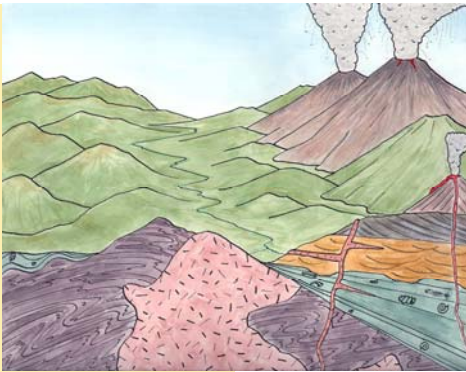
As soon as these island mountain ranges formed they began to erode. Over millions of years, so much sediment came down the mountains that eventually the east side of the sea filled in. The west side remained ocean. Sea creatures were buried and fossilized, or turned to stone. These fossils, formed in the sedimentary rocks of the Hornbrook Formation of the Bear Creek valley. About 40 million years ago, during the early Cenozoic Era, rivers began to flow.

These ancient rivers carried lots of sand and gravel. Sediments from these old rivers can be seen today in the foothills along the east side of the valley in the Payne Cliffs Formation.

35 million years ago, after a period of dormancy, tectonic plates began moving together again. As they collided, the heavier oceanic plate began sinking under the lighter North American plate. This action brought rocks down into the internal heat of the Earth and caused them to melt. This magma, or molten rock, eventually rose to the surface and erupted in a series of volcanoes. These volcanoes formed the Western Cascades which are made up of a variety of igneous rock including basalt and cinders. Remnants of these ancient volcanoes can be seen in Grizzly Peak and Pilot Rock.



Neogene Pe-



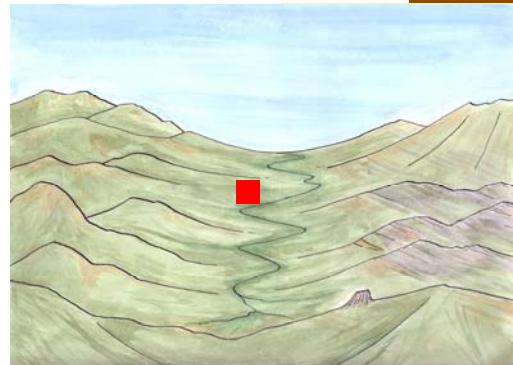
Neogene Pe-

For approximately 15 million years, there was very little volcanic activity in the area, just the eroding, or wearing down of the new mountains. But about 12 million years ago the volcanic activity in this area was renewed. This activity formed the High Cascades which are made up mostly igneous rock. One of the largest volcanoes of the High Cascades, Mt. Mazama, erupted 7,000 years ago, forming Crater Lake.

By this time, Native Americans were living in the valley hunting big game and gathering a variety of plant material.

After more than 200 million years of activity, this is what the Bear Creek Valley looks like today. No one knows what the Valley will look like a million years from now, but due to the processes of erosion, flooding, earthquakes, and volcanoes it is certain that it will look quite different than it does today.

The lowest point of the valley is Bear Creek. Looking north, the older Klamath Mountains are to the left and the Cascade Range is to the right. The red area is the approximate location of North Mountain Park in Ashland.



Neogene Pe-

Formations of the Rogue Valley

KLAMATH MOUNTAINS

The Klamath Mountains are a very old mountain chain, formed between 300 and 160 million years ago. They consist of sedimentary rock formed from sea creatures of the Paleozoic Era, and igneous and metamorphic rock from the Paleozoic Era.



Klamath
Mountains

Mount Ashland

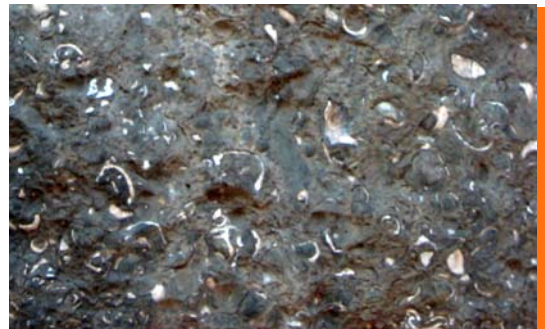
Granite, and other intrusive igneous rocks including diorite and granodiorite can be found all the way from the top of Mt. Ashland to the Bear Creek valley floor. Granite consists of pale-colored crystals which are quartz (white or gray) and feldspar (reddish, salmon, cream, or white) and darker colored crystals containing iron and magnesium.

Applegate Formation

An ancient sea deposited sediments in the area of the Applegate Formation, creating sedimentary rocks such as chert and limestone. Roughly 200 million years ago, the sediments of this ancient sea were deeply buried and compressed into tight folds. It was this high heat and extreme pressure which transformed these ancient sediments into marble. Gneiss and phyllite are two of the more common metamorphic rocks found the Applegate Formation, formed from the collision of the North American Plate and the oceanic tectonic plates.

HORN BROOK FORMATION

The Hornbrook Formation is a sedimentary rock formation deposited on the bottom of a Cretaceous sea roughly 90 million years ago. Many homes in Ashland are built on Hornbrook Formation bedrock. The bedrock consist mostly of sandstone, shale, and conglomerate. The bedrock beneath North Mountain Park is also Hornbrook Formation, specifically shale. Shale often forms an impervious surface and,



Hornbrook
Formation

during low stream flows, can be seen as the bedrock material in portions of Bear Creek. The Hornbrook Formation also contains fossils of ammonites, clams, snails and sharks' teeth.

PAYNE CLIFFS FORMATION

The Payne Cliffs Formation is made of conglomerate and sandstone. Roughly 40-50 million years ago the Payne Cliffs rocks were deposited from rivers flowing slowly across the land. There are no seashells in the formation, although petrified wood occurs sporadically and a coal layer occurs near Phoenix. Metamorphic quartzite is also found in the Payne Cliffs.



Payne Cliffs Formation



Western Cascades

WESTERN CASCADES

The Western Cascades are about 35 million years old, formed from volcanoes that erupted when the North American Plate crashed into an oceanic tectonic plate.

Grizzly Peak

The rocks that form Grizzly Peak are about 23 million years old.

These rocks, including extrusive igneous rhyolite and dacite, were formed as volcanoes produced lava containing a high amount of silica (the main component of quartz). These lava flows may show banding, such as

swirling layers of different colors and textures formed by the rapid cooling of the lava. Grizzly Peak formed by erosion of a larger, young volcano.

Pilot Rock

Pilot rock is a basalt plug of an eroded volcano. It was formed about 30 million years ago when magma broke through the earth's crust, but didn't erupt out of the volcano. Instead, the magma cooled inside the central vent of the volcano. Over millions of years, the outside of the volcano eroded away, leaving the prominent column of basalt.



Western Cascades

HIGH CASCADES

The High Cascades are the most recently formed mountains in the Bear Creek valley. They started forming 12 million years ago, and are still volcanically active today.



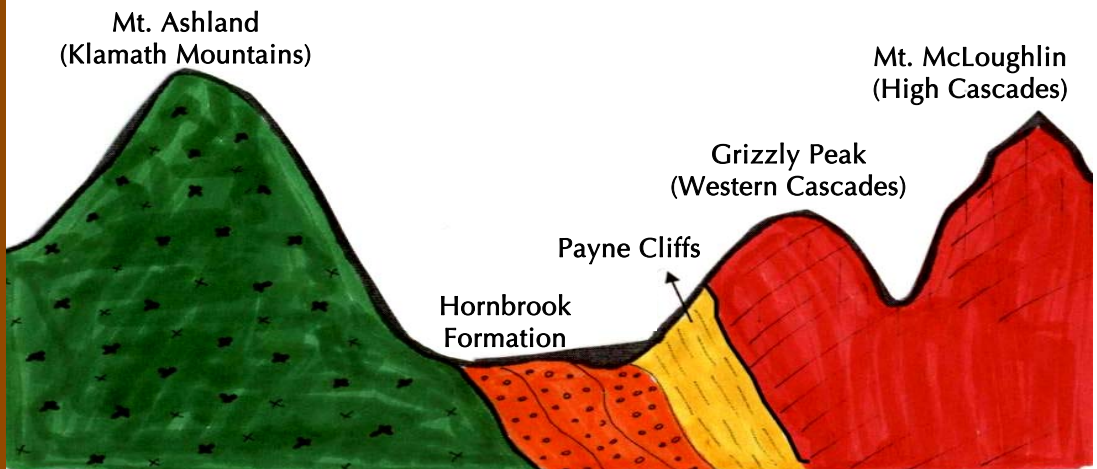
Table Rocks

One eruption of the Cascade Range poured down the Rogue River Valley and pooled in the Medford region about 7 million years ago, creating a layer of extrusive igneous rock up to 300 feet thick.

Slowly the Rogue River eroded the soft underlying Payne

High
Cascades

Cliffs Formation (sedimentary rock), but the hard andesite (extrusive igneous rock) caprock was resistant. The Table Rocks are all that remain.



Geographic origins of the Bear Creek valley

Local Rock Types

Rock Type	Rock Name	Found Locally	Description
Intrusive Igneous	Chert	Cascades	Compact & hard, made of micro-crystalline silica.
	Granite	Klamath Mtns.	Large, pale-colored crystals not in layers or bands.
	Diorite	Klamath Mtns.	Resembles granite but with more dark minerals.
	Granodiorite	Klamath Mtns.	Has a salt-pepper texture with dark crystals and mica.
Extrusive Igneous	Basalt	Cascades	Made of microscopic crystals with a dark appearance.
	Cinders	Cascades	A bubbly volcanic rock, can be red, brown, or black.
	Pumice	Cascades	Soft and spongy, light enough to float on water.
	Dacite	Cascades	Fine grained texture with microscopic crystals.
	Rhyolite	Cascades	Fine grained with colors ranging from gray to purple.
	Andesite	Cascades	Pale green or grey with microscopic crystals.
Sedimentary	Chert (Agate, Jasper)	Payne Cliffs	Compact & hard rocks made of micro-crystalline silica.
	Conglomerate	Hornbrook, Payne Cliffs	Made of cemented pebbles, cobbles, and sand.
	Limestone	Klamath Mtns.	Grayish in color and frequently contains fossil shells.
	Petrified Wood	Payne Cliffs	Fine crystals that have taken on a granular pattern.
	Sandstone	Hornbrook, Payne Cliffs	Made of small, rounded sand grains cemented together.
	Siltstone	Hornbrook	Composed of silt grains smaller than 62 micrometers.
	Shale	Hornbrook	Soft and layered, may appear black, grey, or tan.
Metamorphic	Quartzite	Hornbrook	Hard dark-colored shell with a sugary-looking core
	Marble	Klamath Mtns.	Whitish to dark gray with streaks of black color.
	Slate	Klamath Mtns.	Smooth and shiny, splits into flat sheets.

Summary of Rocks and their Uses

KLAMATH MOUNTAINS

Diorite: Diorite was used for inscription, as it is easier to carve in relief than in three-dimensional statuary. It eventually became more popular as a structural stone and was frequently used as pavement due to its durability. In later times, diorite was commonly used in the cobblestone streets of England and Scotland.



Gabbro: Gabbro often contains valuable amounts of chromium, nickel, cobalt, gold, silver, platinum and copper sulfides. Gabbro can be used as ornamental facing stones, paving stones, graveyard headstones and kitchen countertops. It is also known by the trade name of “black granite.”

Granite: Granite was commonly used to build foundations for homes in New England. Currently, in addition to flooring tiles, granite has begun to supplant marble as a monument material because it is much more durable and less susceptible to acid rain. Polished granite is a popular material for kitchen countertops due to its high durability and aesthetic qualities.



Quartzite: Crushed quartzite is often used as railway ballast because it is very hard. Quartzite is also used as the raw material for glass and ceramics.

HORN BROOK AND PAYNE CLIFFS (Valley Floor)

Siltstone: Siltstone is used in masonry, stone crafting and construction.



Conglomerate: Crushed conglomerate is used in construction as gravel or concrete.

Sandstone: Some sandstones are resistant to weathering, yet are easy to work, which makes them a common building and paving material. The hardness and uniformity of sandstone grains make it an excellent materials for grindstones and gritstones, used to grind various items from blades to grain.



CASCADE MOUNTAINS

Andesite: Andesite is a historic building stone.



Basalt: Basalt is crushed and used in concrete aggregate and railroad ballast. Basalt is also used to manufacture floor tiles, and indoor and outdoor decorative rock slabs.



Chert (Agate & Jasper):

In prehistoric times, chert was used for stone tools such as arrowheads. Flintlock firearms were historically made with common chert and flint. Chert is used as stream gravel, fieldstone, construction material and road surfacing.



Cinders: Cinders are used on track surfaces and roads for additional traction in winter conditions. Cinders are used in inorganic mulch and xeriscaping because it has excellent drainage properties and is resistant to erosion where they are frequently referred to as "lava rock".



Local Uses of Rocks & Minerals

Native Americans Found Many Uses for Rocks

The Shasta Indians occupied Ashland before white settlement. The Shasta used stones and rocks for knives, arrow points, scrapers, pipe-tips, pestles, grinding rocks, and vessels.



The Shasta used obsidian and jasper rocks for many of their tools and weapons. Jasper could be found locally, however they preferred obsidian for blades, arrowheads and scrapers because it was harder and sharper. Obsidian was not found locally, but it was available regionally and obtained by trading with other tribes.

Toolmakers used a variety of rocks and bones for flintknapping — the making of stone tools. Each rock in a tool kit had a different job helping to turn a single chunky piece of stone into a refined tool or weapon. For example, pieces of compact slate were used as stone anvils while agates (a type of chert) were used as chisels.

Pumice and sandstone were then used to smooth the arrows. Stone points were reserved for war or large game while hardwood arrow points were often used for small game. Once the animal was killed and its hide was soaked, the flesh was

removed with a red obsidian scraper. The hides were then smoked and sunned and finally the skins were whitened by rubbing them with white clay. Stones were also used as fishing weights, holding down brush or nets used in weirs and traps.

Large rocks were invaluable in preparing food. Women used mortars, pestles, and basalt grinding stones with hopper baskets to grind dried berries, acorns and other food items. In order to turn acorn flour into an edible mush, they heated small rocks in the fire and added them





Shasta grinding stone

to a water-tight basket containing the acorn flour and water. Camas bulbs were similarly roasted by burying them with hot rocks, allowing them to cook all night. The Shasta covered baskets on the ground with rocks, or dug storage pits below ground and lined them with rocks.

In Oregon, rock art is most frequently found along the Columbia River and in the Great Basin region. No rock paintings or carvings are known in the area occupied by the Shasta, with a few exceptions. Some art has been found along the Rogue River, and on the Klamath River there was formerly a large boulder on which many figures were cut or scratched. Some were said to resemble bear's feet and others were described as hieroglyphics. Other tribes in the Pacific Northwest made frequent use of rock art during spiritual vision quests or in preparation for important hunts or the fishing seasons.



There's Gold in Them Hills!

The discovery of gold in Oregon in 1850 would forever change the local landscape. Miners looked for gold in two types of deposits. A lode deposit is a gold vein in the original igneous rock. These "hard rock" mines were worked by chiseling a tunnel into the parent rock. When lode deposits are exposed to erosion and weathering, the gold is released from the rock and transported downstream, taking the form of dust, flakes, grains, or nuggets. The gold is now considered a placer deposit. Most of the early miners were searching in placer deposits by panning for gold in or near streams.





Local historic sluice box operation.
SOHS #755

These placer deposits in the streambeds were first mined with gold pans, but later entire stream banks were washed away with gravity-fed hydraulic pumps and sluice boxes. As gravel was washed through a sluice box, the heavier gold pieces would settle out. While gold is still mined in southwest Oregon, it is done

with hydraulic dredges, usually by hobbyists rather than commercial miners.

New Railroads spur Increase in Use of Glass Containers

In 1887, the golden spike was laid in Ashland heralding the completion of the railroad traveling from Portland and to San Francisco. Suddenly, pioneer settlers no longer had to rely solely on their gardens to stock their pantries. An influx of food from across the country meant variety on the table and a greater need for shipping containers. The glass industry saw many important improvements during this time. The primary ingredient of glass is silica which is found in quartz crystals and grains of sand. When silica is heated and allowed to cool, it becomes translucent, brittle, and hard. Glass is the resulting material. Glass sometimes occurs in nature, when silica-rich rocks or sand are super-heated by a lightning strike or volcanic eruption. Most bottles made before 1900 were blue or green because they were the least expensive to produce. Bottles dating back to the turn of the century were found during the excavation of the ponds at North Mountain Park.



A collection of bottles found while excavating the ponds at North Mountain Park.

After 1910 clear glass became the new standard. Colors are created by adding compounds to the basic glass mixture. For example adding chromium or copper will produce green glass while carbon or nickel will make brown glass. Since the invention of glass pressing machines in the 1920s, most modern pieces of glass are created using molds. Pressed glass is less labor intensive and allows for greater control of the glass density.



Molten glass is divided into small portions and then extruded into molds made of iron or brass and pressed until it fills the inside of the mold.



Recently, there has been a resurgence in the creation of glass art. Molten glass can be blown into countless beautiful or functional shapes.

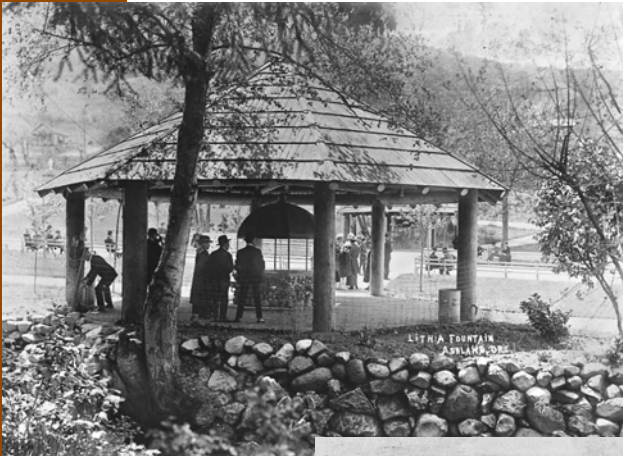
To blow glass, a blob of molten glass is gathered onto the end of a long, hollow blow pipe. A glass maker blows into the pipe causing

the thick glass to expand like a bubble filling with air. A piece of blown glass requires continuous blowing, re-heating and shaping to create the correct thickness before cutting or breaking it away from the tube.



The Story of our Local Mineral Waters

One of the most exciting finds during the pond excavations of North Mountain Park were rare bottles from historic mineral water operations right here in Ashland. The area in and around Ashland is home to 11 big mineral springs — the source of which is based in the volcanic faults that exist deep within the Cascade Range. These faults allow water to access heat from deeply buried rocks. As water travels through the rock layers, it attracts minerals such as boron, salt, arsenic and iron.



Above:
SOHS #2177

Right:
SOHS #9525



By the early 1900s, the area's hot and mineral springs were at their height of popularity. Big, colorful railroad posters described Ashland hot springs to the crowds of tourists, usually from Portland, who would scurry off the passenger trains to relax in the local pools.

In addition to hot springs, the area had numerous sources of mineral water including Colestine Natural Mineral Water, near the Siskiyou Summit and Siskiyou Soda Springs, located on Emigrant Creek.

Perhaps the most famous local water was Lithia Water, named for its unusually high content of lithium. This water contains a variety of minerals, acids, and dissolved salts including bicarbonate acid, calcium, and trace amounts

of arsenic among others. A few local businessmen made an attempt to parlay Ashland and its famous Lithia Water into an upscale resort town, but due to various reasons those dreams never materialized.

Today, visitors can still enjoy the unique carbonated elixir of Ashland's own Lithia Water at the Gazebo in Lithia Park near the bandshell and on the Ashland Plaza.

Local Aggregate Mining Provides Material for Sidewalks and Roads

In addition to gold, another ore that has been mined locally is silica (SiO_2). Although silica is very common (it is found in sand and actually makes up 70% of the earth's crust) it is not economically viable to mine unless it is found in concentrated veins. One such vein exists near the town of Gold Hill, Oregon and has been mined there since 1938. Over 3 million tons of silica have been extracted there for use in everything from glass and watch parts, to rocket engines and cast iron.



Today, the most economic mining is done in simple rock quarries which produce construction grade crushed rock known as aggregate. The aggregate is mined, sorted, and crushed before being used in concrete, asphalt, and other construction uses. Granite and basalt are both mined this way, but river rock and sand are also important sources.



Concrete is the final result of mixing gravel, sand, water, and cement. Cement is a binder made of common minerals including calcium oxide, silica, alumina, and iron. When water is added to cement, a series of chemical reactions occur, which cause the mixture to heat up, and then bind with the sand and gravel. Concrete is commonly used in

sidewalks, house foundations, bridges, and many other construction projects.

Roads and bike lanes are made of asphalt. Natural asphalt was used to make roads as early as 600 BC by the Babylonians. Since that time, inventors have found a way to make synthetic asphalt by combining aggregate rock with a petroleum based product. When heated, this mixture becomes a slurry that can easily be laid in a line. Dried, it provides a smooth, hard surface with very little cracking.



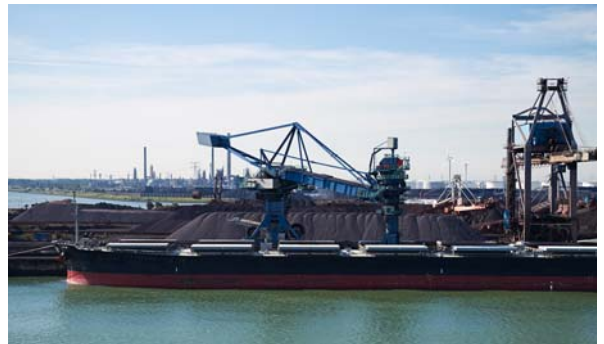
Modern Uses of Rocks and Minerals



Today, we use rocks and minerals in almost every aspect of daily life. Stones, sand, gravel and metals are used when traveling on roads and sidewalks, and when taking shelter in buildings. Salt and phosphate are important minerals used in agriculture. Lead and copper form the basis of many of today's electronics. In addition to the uses of rocks and minerals in most of the products that we rely on to perform normal everyday functions, there are rocks and minerals that are utilized for their beauty including gemstones, gold and silver which are used to make jewelry. Other types of rock, such as marble, granite and slate are used to create beautiful tiles and countertops.

Of all of the ways we use rocks and minerals today, one of the few materials obtained locally is construction aggregate. Just about all of the other materials used in the Rogue Valley are imported, many from great distance. For example, the United States imports 100% of its bauxite, the mineral that is used to make aluminum. Cars, even those made in the US, contain many minerals, including copper, gold, platinum and nickel that are mined in places as far away as South Africa, Russia, Chile and the Philippines.

Although coal, oil, and natural gas are not derived from minerals—they formed from long-dead plants and animals—they are extracted from the earth and provide the vital non-renewable resources upon which modern society depends. Over fifty percent of the petroleum used in the United States is imported, mostly from Arab nations.



The removal, transport, use and disposal of all of these rocks, minerals, and fossil fuels can cause great damage to the environment and so this is one of the areas geologists are working on to try to find more sustainable ways of utilizing and transporting these critical resources.

With the value of gold at an all-time high, there is a whole new generation of gold miners. The heightened competition to locate deposits has explorers getting creative on where and how they conduct their search. Typically, when you think of gold mining, an underground or open-pit hard rock mining operation comes to mind. These days, however, gold is acquired through dredging. Since the early days, this method has evolved tremendously, and is now successfully employed by both hobbyist prospectors and large miners alike. One or two individuals may now make up a mining operation and they utilize small suction machines known as gold dredges. On a commercial level, gold dredging can be found around the world including in Africa, Alaska, and New Zealand.



Suction dredgers are essentially underwater vacuum cleaners that draw up sediment and rocks from the bottom of a stream. The material is then run through a separation system that isolates the gold from the other materials. Suction dredging is typically done in a natural stream or river. Gold dredging, like many mining operations, is not without its

environmental concerns. Just as mining activities on land disrupt the surface, dredging operations disrupt the underwater environment. Fish-bearing streams are of particular concern. In many areas of the world, this concern is negated by only allowing dredging operations during certain times of the year when there will be minimal impact to fisheries.



Plants and Animals Need Rocks Too!

In general, most plants grow by absorbing nutrients from the soil. Their ability to do this depends on the nature of the soil. Depending on its location, soil contains some combination of sand, silt, clay, and organic matter. The make-up of a soil (soil texture) and its acidity (pH) determine the extent to which nutrients are



available to plants. Soil texture affects how well nutrients and water are retained in the soil. Clays and organic soils hold nutrients and water much better than sandy soils. As water drains from sandy soils, it often carries nutrients along with it. This condition is called leaching. When nutrients leach out of the soil, they are not available for plants to use. An ideal soil contains equivalent portions of sand, silt, clay, and organic matter.

Animals also make use of rocks for a variety of purposes. Reptiles, like snakes and lizards, use rocks for protection and also to warm their body temperature. The internal temperature of a reptile depends on the weather outside which is why you will often find them basking on a rock in the sun to soak up the heat. Likewise, turtles also utilize the tops of rocks to keep them warm. Bears, cougars, coyotes and many other larger mammals find protection in caves or dens made from rocks. These dens provide shelter and protection for the animal, especially during the time they raise their young. Many birds, such as hawks, eagles, and owls, build their nests up high on rocky cliff walls to protect their chicks. The height makes it difficult for other animals to reach their nest. Rocks also provide camouflage. For example, a mouse's fur helps it to blend in with the sand and pebbles.



Moles, ants, badgers, groundhogs and other burrowing animals build their underground homes and tunnels in dirt, which consists of small, weathered rocks. By living underground, they are protected from predators above ground. These underground homes often consist of many chambers, or rooms, each with a specific purpose, such as food storage, raising young, and even bathrooms.

Index

agate 17,24
aggregate 20,21
andesite 14,15,17,24
Applegate Formation 12
asphalt 23
basalt 5,11,15,17, 18, 21
Bear Creek valley 7,10,11,12,14
Cascade Mountains 6, 7, 9,11,14
Cenozoic Era 8,9,10
chert 5,12,15,17
cinders 11,15,17
clay 5
concrete 23
conglomerate 5,15,17
Crater Lake 11
dacite 13,15
diorite 12,15,16
fossil fuels 2
fossils 2,9,10,13,15
gabbro 16
geologic disasters 2,7,11
geologic time 8
glass 16,20,21
gold 16,19,20
granite 5,12,15,16
Grizzly Peak 11,13
High Cascades 9,11,14
Hornbrook Formation 9,10,12
igneous rock 4,5,11,12,13
jasper 15,17
Juan de Fuca Plate 6,7
Klamath Mountains 10,11,12,15,16
lava 5,13
limestone 5,12
lode deposit 19
magma 4,6,11
marble 5,12,15,16
Mesozoic Era 8,9,10
metamorphic rock 4,5,10,12,13
mineral water 22
mining 19,20
Mt. Ashland 12
Mt. McLoughlin 7,14
Mt. Mazama 11
Mt. Shasta 7
North American Plate 6,7,11,12
obsidian 5,18
Pacific Plate 6,7
Paleozoic Era 8,9,10,
Payne Cliffs Formation 9,10,13,14
petrified wood 13,15
Pilot Rock 11,13
placer deposits 19
plate tectonics 4,5,6,7,10,11,12
pumice 5,15,18
quartzite 12,13,15,16
rock art 19
rock cycle 4,5
sandstone 5,12,13,15,17,18
sedimentary rock 5,10,12,14
sediments 5,9,10,12
shale 5,12,15
silica 13,20
siltstone 15,17
silt 5
slate 5,15
Table Rocks 14
tsunamis 7
volcanoes 4,5,11
Western Cascades 9,11,13

Learn more about local geology

Briscoe Geology Park in Ashland.

Walk through three time walks to learn how the Earth has changed over the past 4.6 billion years. A selection of over 100 colorful tiles, interpretive signs and a visitor booklet will help to explain how plant and animal life has evolved and how local geology fits into the bigger picture.

Crater Rock Museum in Central Point.

The Crater Rock Museum is owned and operated by the Roxy Ann Gem and Mineral Society, Inc. It houses many collections of minerals, artifacts, fossils, agates, geodes, gems and much more. Contact: (541)664-6081 www.craterrock.com

Upper and Lower Table Rocks near Medford.

Hike to the top to view andesite lava flows that have capped softer sedimentary rocks. You will see an excellent view of the Rogue River and the rest of the Rogue Valley.

Lithia Park in Ashland.

Granite and diorite boulders that have eroded from the Mt. Ashland pluton can be seen all along Ashland Creek.



Outcrop near the junction of Oak Street and Eagle Mill Road in Ashland. This is a good location to observe sandstone and shale of the Hornbrook Formation.

Emigrant Lake Waterslide area

Sandstone and conglomerate of the Payne Cliffs Formation can be observed here. Check with Jackson County Parks about entry fees.



North Mountain Park Nature Center

620 N Mountain Ave ~ Ashland, OR 541.488.6606 www.northmountainpark.org

